Invasive Animals CRC

ANNUAL REPORT

2011-12

An Australian Government Initiative

CRC AUSTRALIA

Invasive Animals Cooperative Research Centre Annual Report 2011–12 for the period 1 July 2011 to 30 June 2012 as per the Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE) annual reporting requirements.

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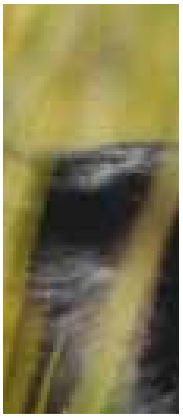
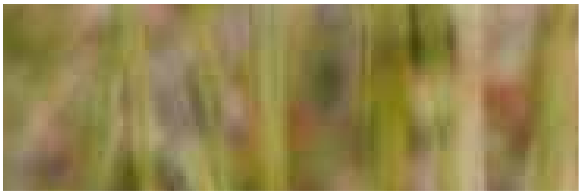
Dr Ben Smith, South Australian Research and Development Institute, with a haul from a carp separation cage.





Front Cover photographs
Top left of front cover – Dr Tanja Strive and Dr Brian Cooke conducting rabbit research.
Front cover: Fox profile by Gary Tate.
Middle right of front cover – David Lord, Chair of Australian Wool Innovation Rabbit Research Advisory Group, on his property 'Thackaringa' near Broken Hill.
Bottom left of front cover – Invasive Animals CRC PhD candidate Crystal Kelehear researching cane toads.

Back Cover photographs
Top right of back cover – Professor John Aitken is researching non-surgical sterilisation of pest animals, using laboratory mice and rats.
Bottom left of back cover – Invasive Animals CRC PhD candidate Kate Grarock researching Indian Mynas.

Photograph credits
Miscellaneous invasive animals images from the Invasive Animals CRC photo archives.
Chair, Board Directors and CEO Images by ANU Photographer Stuart Hay.
Page 20: Mark Lonsdale image from CSIRO.

Disclaimer: The views and opinions expressed in this report reflect those of the authors and do not necessarily reflect those of the Australian Government or the Invasive Animals Cooperative Research Centre. The material presented in this report is based on sources that are believed to be reliable. Whilst every care has been taken in the preparation of the report, the authors give no warranty that the said sources are correct and accept no responsibility for any resultant errors contained herein, any damages or loss whatsoever caused or suffered by any individual or corporation.

This document should be cited as: Invasive Animals CRC (2012) Annual Report 2011-2012. Invasive Animals Cooperative Research Centre, Canberra.

Erratum
This Indian Myna image by Mat and Cathy Gilfedder was used without proper acknowledgement to Mat and Cathy Gilfedder in the Invasive Animals CRC publications:

- Annual Report 2008–09 p10 (p18/69)
- Annual Report 2009–10 p10 (p20/78)

. . . threat to Australia's food and fibre security, our globally significant biodiversity and social wellbeing.

OUR PURPOSE

To counteract the impact of invasive animals through the application of new technologies and by integrating approaches across agencies and jurisdictions.

Dr Peter Fleming, NSW Primary Industries, presenting at PestSmart Roadshow.

OUR PARTICIPANTS

Core Participants

Third Party Participants

During the reporting period The Kangaroo Island Natural Resources Management Board provided significant in-kind contributions to the Kangaroo Island Demonstration Site project. Contributions were also received from the US Department of Agriculture who have generally supported and collaborated with the CRC for several years in areas of shared interest including pig control solutions and fertility control developments.

Changes to Participants

Nil

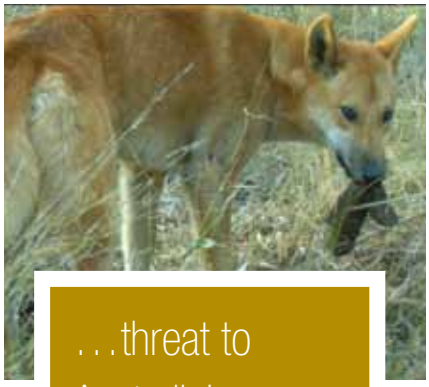
Supporting Participants

PARTICIPANTS CURRENTLY PARTIES TO THE INVASIVE ANIMALS CRC

Participant Name	Participant Type	Organisation Type
Animal Control Technologies (Australia) Pty Ltd	Core	SME
Australian Veterinary Association	Core	Industry/Private Sector
CSIRO	Core	Australian Government
Environment ACT	Core	State Government
Department of Agriculture, Fisheries and Forestry QUEENSLAND	Core	State Government
Department of Environment & Conservation WA	Core	State Government
Department of Environment, Climate Change & Water NSW	Core	State Government
Department of Primary Industries Victoria	Core	State Government
Murray-Darling Basin Authority	Core	Australian Government
NSW Department of Primary industries	Core	State Government
Parasitech Pty Ltd	Core	SME
Pestat Pty Ltd	Core	SME
SA Department of Primary Industries (SARDI and NRM Biosecurity Departments)	Core	State Government
University of Canberra	Core	University
University of Newcastle	Core	University
University of Queensland	Core	University
University of Sydney	Core	University
Valuemetrics Australia	Core	SME
Australian National University	Supporting	University
Australian Wildlife Conservancy	Supporting	Industry/Private Sector
Australian Wool Innovation	Supporting	Industry/Private Sector
ABARES	Supporting	Australian Government
Carpbusters	Supporting	Industry/Private Sector
Cattle Council of Australia	Supporting	Industry/Private Sector
Connovation Ltd (NZ)	Supporting	International
Grains Research & Development Corporation	Supporting	Industry/Private Sector
K&C Fisheries Global PL	Supporting	SME
Meat & Livestock Australia	Supporting	Industry/Private Sector
NZ Department of Conservation	Supporting	International
New Zealand Landcare Research	Supporting	International
State Management Council of NSW Livestock, Health and Pest Authorities	Supporting	State Government
Tasmanian Department of Primary Industries, Water & Environment	Supporting	State Government
UK Central Science Laboratory (FERA)	Supporting	International
University of Minnesota	Supporting	International
University of York	Supporting	International
Victorian Department of Sustainability and Environment	Supporting	State Government
WA Department of Agriculture and Food	Supporting	State Government
WWF Australia	Supporting	Industry/Private Sector

During the year some formal amendments were recognised through a deed of Variation to the Commonwealth Agreement, to reflect changes to the names of some State Departments and Statutory Authorities.

NATIONAL CHALLENGE



…threat to Australia's food and fibre security, our globally significant biodiversity and social wellbeing.

Rabbits, foxes, wild dogs, carp, feral pigs and other invasive animals are a serious threat to Australia's food and fibre security, our globally significant biodiversity and social wellbeing. Around the turn of this century, in the midst of a severe prolonged drought, invasive animals cost Australia at least $740 million per year in lost agricultural production and control costs.

Invasive animals are also among the biggest threats to the conservation of Australia's wildlife and the environment. Foxes, feral cats, rabbits and rats have contributed to numerous mammal and bird extinctions and impact on hundreds of threatened plant and animal species. The rabbit, for example, impacts 156 threatened species and native vegetation over two-thirds of Australia.

New and emerging pests, combined with new challenges posed by established pests, have created a dynamic and constantly changing situation. This is all compounded by the nature of the challenge. It is chronic and diffuse, and it lacks clear ownership and responsibilities, factors that have often led to market failure of commercial efforts to control invasive animals. The situation has stymied innovation in many areas of invasive animal management, particularly in the development of new control technologies.

Furthermore, the reduced effectiveness of rabbit biocontrol technologies, societal demand for more humane controls and the global trend to restrict or withdraw available control products underscores the imperative for ongoing innovation. The response to this national challenge: Phase One — the Invasive Animals CRC and Phase Two — the Invasive Animals CRC Extension.

CONTENTS

Greg Mifsud, National Wild Dog Facilitator, at PestSmart roadshow.

01 CHAIR'S FOREWORD

2005 – 2012 has changed the face of pest animal management and control opportunities in Australia. The Invasive Animals CRC's diverse team of participants, scientists, communicators, students, management and Board has successfully combined to deliver new technologies, methods, literature publications and an international collaborative network that is setting the scene for the future.

To all the members of our team, as you read through the Annual Review and Research Portfolio, congratulate yourself and your colleagues on the achievements recorded here. We started out with enormous enthusiasm and dedication to "together create and apply solutions" and we have arrived through hard work and determination, delivered on our commitments, and won the opportunity to evolve into an ongoing entity to tackle the growing and relentless problem of invasive animals in Australia.

Congratulations and thank you to everyone who put their shoulders to the wheel of the extension bid – the thinking, writing, endless rewriting and interviews all fine-tuned a good bid into a great winning bid.

We have achieved 87% of our projected outputs and gathered along the way an additional $10 million in cash and in-kind funding to deliver on new projects.

For all those who pushed the boundaries gaining extra dollars, extra projects, never giving up, despite seesawing fortunes that tested your resolve, this is a great outcome.

The game changing factors include new products and technologies on the market: collaborative landscape scale control: the use of social media communication tools Facebook, Twitter and YouTube as well as feral.org.au: the Australia-wide PestSmart Roadshows engaging the broader community with a host of research speakers: an extensive set of some 69 PestSmart communication products and aids to the adoption of research findings: new educational opportunities with the Balanced Scientist Program and Pest Management Diplomas: and a better-established public understanding and profile of invasive animal impact across all landscapes. In fact, one out of every two media stories on invasive animals across Australia in 2011–12 specifically mentions the Invasive Animals CRC.

From the Daintree to Tasmania, from the United States Department of Agriculture (USDA) to Animal Control Technologies (Australia) Pty Ltd (ACTA), the Research Portfolio tells the stories of dedicated science research teams brought together by the IA CRC, carefully and thoroughly applying their knowledge and exploring hypotheses drawn from end user needs, under the guidance and encouragement of our exceptional Program Leaders, communicated through the creative energy of Keryn Lapidge, Alex Bagnara and team and commercialised with the expertise of Simon Humphrys.

The Participants are an integral part of these successes through their genuine dedication to make a difference as well as continuing the valuable investment of their resources. Additionally, the collaborative network with international Participants has been an important and growing part of IA CRC research business, as exampled by the USDA and IA CRC's joint hog control R&D and its implementation.

This final Annual Report records the last chapter of seven years of outstanding work by the management team.

CEO Dr Tony Peacock's energy and entrepreneurial 'gutsy call' to 41 participants set the challenge to all of us to perform above expectation, continuing with Andreas Glanznig progressing the development of the IA CRC and setting us up for a successful extension bid, demonstrating tremendous leadership and foresight for the IA CRC.

Our business manager Chris Buller guided and set up the successful business structure, followed by Susan Duson who finessed and perfected the management system compiling the 'Complete Duson Manual' containing the IA CRC management and governance procedures. Susan consistently achieved perfect audit results enhancing the reputation of the IA CRC. Then add Betty Ferguson to the mix, bringing her strong and varied background in tax accounting, risk analysis and experience establishing new business systems.

Finishing with the invaluable input from the Executive Committee of our esteemed program leaders Dr Glen Saunders, who became the IA CRC sage, Assoc Prof Steve Lapidge created global business opportunities becoming its advocate and ambassador, Dr Elaine Murphy transformed detection and prevention of invasive animals despite the ongoing earthquake impact, Wayne Fulton's leadership created strategic fish options for the future, Prof Stephen Sarre expanded invasive education to all – primary through to tertiary to PhD students, and all complemented by great support staff in Canberra, Adelaide, Orange and Snobs Creek.

During the course of the IA CRC the Board has drawn on its extensive experience and skills to build a solid governance base and develop the future strategic direction always cognisant of balancing the present with the long-term Institute goal.

Thank you to all past and present governing Board directors whose insightful debate has always been constructive and probing. A special thanks to Prof Arthur Georges for his valuable contribution to our discussions and who leaves the Board to continue in a research role detecting the presence of invasive tilapia fish from water samples using e-DNA technology. Welcome to our new Director, Manfred Claasz, who is passionate about enabling scientists to grow their research base through industry interaction and brings to the Board a wealth of international and national corporate business knowledge. Also, my personal thanks to Deputy Chair Dr Dedee Woodside who has been a valuable mentor and provided excellent counsel throughout my term as Chair.

To the members of the IA CRC team who have moved on to other opportunities, thank you for the important role you played in this achievement and I look forward to our paths crossing again. I will also take this opportunity to make a special mention and thank you to Di Holloway who established the great camaraderie throughout the IA CRC that we enjoy today.

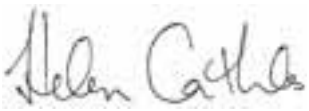
The IA CRC is now looking to a proactive future role, building on and honouring the achievements of the last seven+ years, albeit with a smaller team and a smaller budget. We have a heightened excitement around the long-term vision of the original IA CRC, to establish an ongoing

Helen Cathles, Chair.

Centre of excellence to continue to discover and improve technologies and methods for the control and management of invasive species through robust R&D science and international collaboration.

The entire IA CRC has contributed to this growing legacy for future generations, the opportunity to enjoy an Australian environment where native species survival is improving, agriculture is increasingly productive and invasive animals are being controlled and managed with more humane and intelligent technologies and methods.

With sincere thanks from the Board to the whole IA CRC team.



Helen Cathles
Chair
Invasive Animals CRC

02 CEO'S FOREWORD

Andreas Glanznig, CEO.

This is a special time in the trajectory of the Invasive Animals Cooperative Research Centre – a time to look back and celebrate our achievements so far and to look forward to see how these achievements will be built on for our successful five-year extension to 2017.

The report outlines the impressive suite of new pest animal products and techniques that have recently come into the market place or have been submitted for regulatory assessment. Together they and other best practice technologies form the basis of our PestSmart approach. An important part of our adoption program was to finish this CRC with a major cooperative venture with our industry and government partners to promote the PestSmart approach nationally. Our national wild dog and NRM facilitators, as well as scientists involved in our PestSmart Roadshow, took the PestSmart approach across Australia from Katherine to Charleville and Bourke to Naracoorte. This was supported with a wealth of new knowledge that has been distilled in our PestSmart information toolkit.

To get to this point, our technology trajectory has enabled researchers to breakthrough various knowledge blocks that have impeded effective pest animal control. Take the rabbit for example. At the start of this CRC, the rabbit biocontrol agent, rabbit haemorrhagic disease virus (RHDV), worked well in dry areas but was less effective in cool/wet areas. In addition, moving the virus around the country in liquid form to release in new areas was costly given it needed to be stored on dry ice and as such is classed as a dangerous good.

Invasive Animals CRC and CSIRO scientists soon unravelled the problem of patchy RHDV performance by discovering and characterising a new native benign rabbit calicivirus known as RCV-A1 that was providing partial protection to rabbits. This unlocked 'RHD Boost', a major new project to import and evaluate a range of new RHDV strains to improve the performance of the existing single strain. If successful, the agricultural and environmental benefits are estimated to be some $1.4 billion over 15 years.

The final piece to this story is that in tandem, NSW Department of Primary Industries scientists have developed a freeze-dried form of RHDV that can be easily transported around the country. This holistic approach to a national challenge that costs farmers over $200 million per annum and causes immense environmental damage is what our CRC is about.

Finding enduring solutions requires new top-calibre scientists. A proud achievement since the early 2000s through to today has been the ability of our CRC to help stabilise the loss of research scientists. Our lauded Balanced Scientist Program has produced a group of fine PhD graduates that have moved into research positions in industry, government research agencies and universities. Rebuilding this capability, particularly given many pest animal research scientists are nearing retirement age, is a significant legacy of this CRC.

Looking forward, the Invasive Animals CRC extension will focus its research program to ensure delivery of long-lasting, high-impact solutions. It includes the largest strategic rabbit R&D program in nearly 20 years, a major wild dog research effort, a new strategic community engagement research program to focus on the social and institutional aspects of pest animal control, and continuing efforts to develop new and humane mice, rat and bird toxins, and to also take them into new international markets.

As we transition to our extension phase, a number of our team are moving on to new challenges. Susan Duson ensured that our CRC administrative engine was finely tuned through her exceptional efforts as Business Manager. And four Program Leaders and their Coordinators have also moved on or are changing roles. Assoc. Prof Steve Lapidge, Program Leader Uptake, helped position the CRC to be a global leader in new pest animal control product innovation. Wayne Fulton, Program Leader Freshwater Pest Fish, provided the leadership to deliver a strategic, integrated package of carp control products. Dr Elaine Murphy, Program Leader Detection and Prevention, ensured high-quality outputs that strengthened knowledge in risk assessment and incursions response and established a new standard in pest animal impact baselines. Finally, Prof Stephen Sarre, Program Leader Education, built a concept into our leading Balanced Scientist PhD program that others are now following. You all made outstanding contributions and I thank you.

I hope you enjoy finding out more about our achievements and the people behind them in the pages that follow.

Andreas Glanznig
Chief Executive
Invasive Animals CRC

03 EXECUTIVE SUMMARY

The Invasive Animals CRC's seven-year innovation program leaves an important legacy of new techniques, products, validated management strategies and enhanced national research capability that together will result in a sustained reduction in pest animal impacts.

Our CRC has made impressive inroads in the development and uptake of new genetic and camera detection techniques to underpin pest animal eradication and monitoring programs.

In addition to the already launched world's first factory manufactured feral pig bait – PIGOUT® – and bait delivery system – HOGHOPPER™ – a range of new products will be widely available over the next several years. These will include DOGABATE®, FOXECUTE® and HOGGONE® baits whose action can be reversed with our Blue Healer® antidote. Together, they will assist to deliver more effective regional-scale management approaches. Our demonstration sites have been integral to this effort.

A critical legacy has been building the nation's research capability in this area. It is heartening that so many of our PhD graduates have moved into directly relevant research positions in State agencies, universities and the private sector.

RESEARCH HIGHLIGHTS

Genetic techniques vital to Tasmanian fox eradication program

Cutting-edge DNA technology developed by the University of Canberra continues to play a vital role in detecting the presence of foxes in Tasmania. These recent invaders have the potential to cause major environmental and agricultural damage if they establish and are being tackled through the Tasmanian Government's fox eradication program.

The screening of thousands of scats for fox DNA and identification of many positive fox scats has significantly increased knowledge of where foxes are currently found in our island State.

DOGABATE® and FOXECUTE®: new wild dog and fox baits with antidote

All additional studies were completed to enable Australian Pesticides and Veterinary Medicines Authority (APVMA) full regulatory assessment of new DOGABATE® and FOXECUTE® products. This project represents a nine-year process of collaborative effort between Australian Wool Innovation, Animal Control Technologies (Australia) Pty Ltd, and the Invasive Animals CRC to register a new active predator pesticide for the first time in Australia in the last 50 years. A registration application for an intravenous treatment and oral formulation use of the toxins' antidote – Blue Healer® has also been submitted. When used together, these products have the potential to increase the comprehensiveness and effectiveness of 1080-based regional baiting programs.

Research Rolls Out to 2017

It was a team effort by participants, researchers and the Invasive Animals CRC management team that resulted in our $72 million, 27 partner research collaboration being successful. The investment by our partners, including the Australian Government, will focus on four research programs: Land Pests, Land Pests (Commercial products), Inland Water Pests and Community Engagement. The Invasive Animals CRC extension bid presentation team (back row to front row left to right) Dr Jim Thompson - Chief Biosecurity Officer, Biosecurity Qld; Robert Anderson - Chair, Meat and Livestock Australia Board; Professor Paul Martin – University of New England; Professor Frances Shannon - Deputy Vice-Chancellor Research, University of Canberra; Lisa Thomas - Senior Ranger, Central West Livestock Health and Pest Authority; Dr Glen Saunders - Terrestrial Program Leader; Professor Linton Staples – Managing Director, Animal Control Technologies (Australia) Pty Ltd; Assoc Professor Steve Lapidge - Uptake Program Leader; Helen Cathles - Chair, Invasive Animals CRC Board and Andreas Glanznig - CEO, Invasive Animals CRC.

HOGGONE® and HOGHOPPER™: New feral pig bait and delivery system

The past year has seen the growth in HOGHOPPER™ usage throughout Australia. More than 250 units have now been sold to all corners of the country and reports back have been promising. The simple yet effective design of the HOGHOPPER™ saw it become a finalist in the Agriculture division of the inaugural 'The Australian Innovation Challenge' in November, 2011. The device was also awarded the 'Best Australian Made Machine' at the Toowoomba Agshow in September 2011.

Ongoing trials with the United States Department of Agriculture in six states in America have further proven the utility of the HOGHOPPER™ with all non-target species except a couple of large racoons excluded from the device.

With additional financial support from Meat & Livestock Australia, the project team is now embarking on the development of a nitrite concentrate that can be added to other bait substrates. Through the potential utilisation of an Emergency Use Permit in Texas, this powerful combination of HOGHOPPER™ and a nitrite concentrate could be in use in Texas before it is even registered in Australia.

Teak, banana and horticulture industries benefit from MOUSEOFF® ZP and RATTOFF® ZP

Throughout the last 12 months, the research project led by Animal Control Technologies (Australia) P/L in partnership with the Centre has resulted in the registration of RODEMISE® Bromadiolone Rodent Block and approval (subject to stability data) of their RODEMISE® Difenacoum Rodent Block.

(above) Jason Wishart and prototype HogHopper™.

(right) Feral pigs feeding from the commercially-available HogHopper™ in the Macquarie Marshes, NSW. Note the HogHopper™ is set to the free-feed position (doors partially open) to allow pigs to get used to feeding before the doors are fully closed during toxic baiting.

The ACTA team will shortly submit the Use Extension registration packages so MOUSEOFF® ZP can be used in horticulture and RATTOFF® ZP used for the teak and banana industries.

Daughterless platform technology found to be inheritable

Daughterless platform technology was demonstrated to be inheritable and a prototype female–lethal (daughterless) construct was successfully tested during the year. The prototype was tested through four generations of zebrafish, with marked effects on offspring sex ratios. A prototype female–lethal carp construct, built wholly of native carp genetic material, was also successfully tested using a transient assay.

Trials on feasibility of new fox and cat post

The Invasive Animals CRC focus during 2011–12 on improved feral cat (and fox) management has been concentrated on the novel spray tunnel and/or post concept. Working with Ecological Horizons P/L and Connovation Ltd (NZ), with financial support from Meat & Livestock Australia Ltd, the project team will shortly pen and field test non-toxic then live prototypes to obtain proof-of-concept. The spray units contain infra-red sensors that can detect the presence of feral cats and foxes. Their fur is then sprayed with a lethal dose of PAPP, which cats and foxes fastidiously groom off and then ingest the toxin.

Feral Cat by Andrew Bengsen.

Invasive Animals CRC researched novel technology that automatically administers a toxin specifically to feral cats and foxes.

To smoothly implement conservation policies related to cats across the urban and semi-urban interface, it is necessary to understand the attitudes of people to fauna conservation, control of feral and stray cats and containment of domestic cats. The responsible cat ownership project involved a representative and statistically robust, random telephone survey of ACT residents to gain an understanding of community attitudes to a range of policies and management strategies for domestic, stray and feral cats and more specifically on cat containment.

The outcomes of this research have informed the development of future policy making and cat management approaches in the ACT, and have provided relevant information to other jurisdictions across Australia considering a range of cat management policies.

Rabbit biocontrol research to select new RHDV strain progressing well

As part of the RHD Boost Project, strains of RHDV have been selected and imported from France, Spain and South Korea. Preparations are also well advanced on the import of a new RHDV strain from China. In addition, competitive advantage studies have started to examine the interaction of the existing Czech strain of RHDV and one of the new RHDV strains imported through the RHD Boost project.

EDUCATION AND TRAINING SUMMARY

The Invasive Animals CRC education program more than meet its 24 PhD students target, achieving 29 PhD students, two Masters students and two Honours students enrolled. Sixteen PhD students have now had their awards conferred, four have submitted their theses and are awaiting acceptance and eight are still in progress. During 2011–12, six PhD theses were submitted. All Masters level students have had their award conferred and both honours degrees have been conferred.

Major PestSmart information Toolkit and Roadshow to promote new Invasive Animals CRC products

The PestSmart Toolkit is a wealth of glovebox guides, manuals, case studies, fact sheets, and scientific reports, along with its own Facebook, Twitter and YouTube pages. The year also saw a PestSmart presence at many industry conferences, as well as agricultural shows and field days. PestSmart has gone live at www.feral.org.au/pestsmart.

On 30 January 2012, the PestSmart Roadshow was launched in Queanbeyan (near Canberra). Since then, an additional 21 PestSmart events have occurred in all states and territories, with 1,500 government staff, farmers, natural resource managers and scientists attending the events. Reports from attendees have been positive.

The Roadshow was generously sponsored by Australian Wool Innovation, Meat & Livestock Australia and the Murray-Darling Basin Authority. A case study appears on the following pages.

PAVING THE WAY FOR RESEARCH ADOPTION:

PESTSMART ROADSHOW

"The PestSmart Roadshow set a new standard in the area of adoption of research results, targeting as it did, not primarily the end users, but the consultants, advisors and extension officers who would carry the message further."

Dr Johann Schröder,
Meat & Livestock Australia

The PestSmart toolkit consolidates and packages information from the Invasive Animals CRC's seven-year research program findings into practical planning and control information to improve pest animal control and reduce pest impacts both at the property and regional levels.

PestSmart Roadshows between January and June 2012 introduced the PestSmart toolkit to extension and advisory staff from every State and Territory government invasive species management section. These are the people who disseminate the information on the products and techniques to public and private land managers.

Australian Wool Innovation, Meat and Livestock Australia and the Murray Darling Basin Authority were partners with the Invasive Animals CRC in presenting the PestSmart Roadshows. An Adoption Steering Group of key players and advisors was established to guide key aspects of planning the Roadshows and met several times prior to the Roadshows commencing. A Roadshow Project Officer was employed to organise the Roadshows and make daily operational decisions whilst on the road.

The PestSmart Roadshow format and content was road tested at the 2011 AWMS Conference in November 2011 ahead of its 30 January 2012 launch in Queanbeyan. After the first few Roadshows, schedules had to be changed due to major flooding throughout Queensland and NSW.

Top photo – Chris Lane at Carnarvon WA PestSmart Roadshow, February 2012 at the Camel Lane Theatre.

Welcome address being provided by Blair Brice (Meat & Livestock Australia) at the Toowoomba PestSmart Roadshow, March 2012.

The Roadshows visited 20 regional venues during the reporting year across all States and Territories in Australia between February and June, ending 14 June in Campbell Town, Tasmania. Inbetween, Roadshows were staged at Forbes NSW, Albury NSW, Naracoorte SA, Horsham Vic, Mildura Vic, Port Augusta SA, Port Lincoln SA, Carnarvon WA, Kojonup WA, Esperance WA, Bairnsdale Vic, Toowoomba QLD, Armidale NSW, Townsville QLD, Alice Springs NT, Katherine NT, Charleville QLD and Bourke NSW. Two national pest fish Forums on European carp and tilapia were also held.

Approximately 1,500 people attended PestSmart Roadshows, with thousands more seeing, hearing or reading about the events in associated radio, television and newspaper articles. The locations for the Roadshows were decided by the Adoption Steering Group as the best fit for access, populations, varying landscapes, strong bases for AWI, MLA or the MDBA and areas where landholders could benefit from the implementation of the new Invasive Animals CRC products and innovations.

The majority of attendees were extension and advisory staff, practical land managers along with indigenous groups, zoos, consultants, landcare groups, fisheries, conservation hunters, pest control contractors, researchers, students and members of the general public.

The fact that some individuals travelled to multiple Roadshows (up to five for one individual), travelled 10 hours to attend the Roadshows, drove or flew more than 1,200km each way to attend and that multiple NRM Boards offered to pay $20,000 for the Roadshow to visit their town indicates the strong public support for the PestSmart Roadshow extension effort.

PestSmart Roadshow Presentations

Roadshow presenters were drawn from key experts from within the Invasive Animals CRC and its partners but also interspersed with local experts. Particular thanks needs to be given to all of the presenters for their enthusiastic and informative presentations and then answering many questions and mingling with the participants.

During and subsequent to the Roadshows, demand for PestSmart Toolkit publications has been strong and publications have also been distributed at Catchment Management Agency and Natural Resource Management (NRM) forums, agricultural field days and direct mail upon request with very strong positive feedback. Demand has been strong with some materials re-printed up to three times. Several requests have been received for bulk quantities of PestSmart toolkit materials. Landcare and NRM groups have ordered publications for participants in their own pest control programs.

Whether indicated through increasing usage of the PestSmart Toolkit website and You Tube channel, direct attendee feedback at Roadshow events, community support, increased product sales or calls for more Roadshow events, the PestSmart project has been a resounding success. This is in part due to the financial and physical support received for the project from Meat & Livestock Australia Ltd, Australia Wool Innovation Ltd, the Australian Bureau of Agricultural and Resource Economics and Sciences, the Murray Darling Basin Authority and Animal Control Technologies (Australia) Pty Ltd. For this the Invasive Animals CRC is sincerely grateful.

PUBLICATIONS SUMMARY

During 2011–12, the Invasive Animals CRC published:

- One formal book
- One formal book chapter
- 34 formal articles in scholarly-refereed journals
- Seven formal full written conference papers - refereed proceedings
- Nine conference abstracts in a non-refereed proceedings publication
- Seven Invasive Animals CRC technical reports
- 29 PestSmart reports/factsheets/ brochures
- Nine PestSmart case studies
- Nine other agency reports

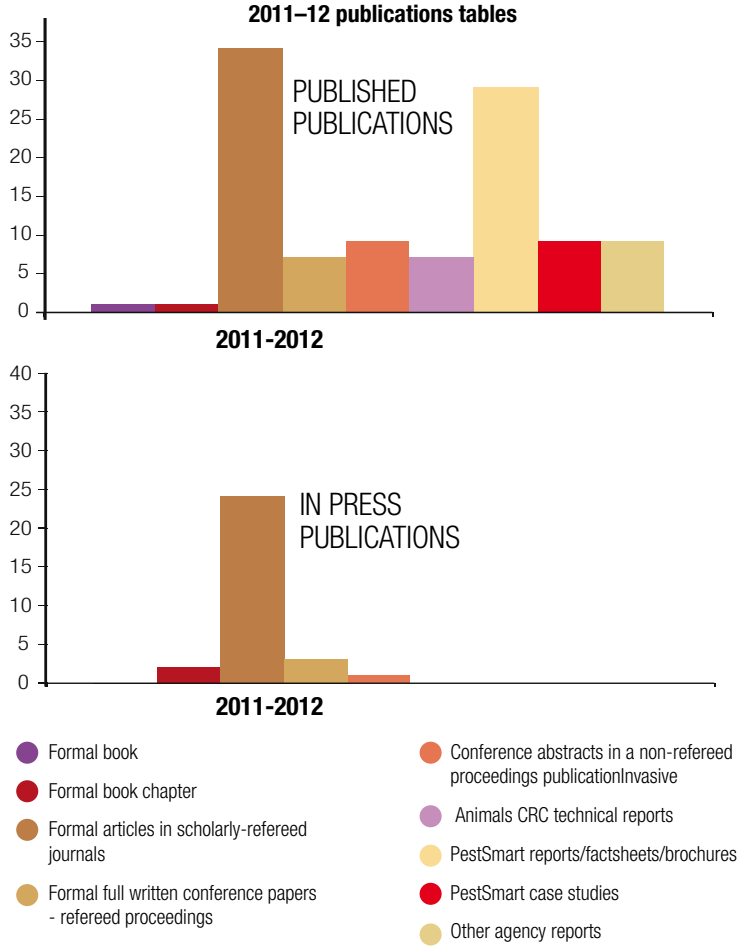
A high portion of the formal Invasive Animals CRC articles were published in Science Citation Index journals (25 articles or 90%), which attests to the science excellence inherent in our program.

The publications achievement culminates a solid publishing record for this CRC from 2005 to 30 June 2012

- 2 formal books
- 15 formal book chapters
- 150 formal articles in scholarly-refereed journals
- 82 formal full written conference papers - refereed proceedings
- 32 conference abstracts in a non-refereed proceedings publication
- 13 Invasive Animals CRC technical reports
- 29 PestSmart reports / factsheets / brochures
- 9 PestSmart case studies
- 54 other agency reports
- In press publications 2011-12: summary mentioned in Publications Table Two, a total of 30 publications in press at the time of this Annual Report.

The above totals from 2005 to 2012 are summarised in Publications Graph One (right).

2011–12 publications tables



Publications Graph One

Since 2005, the Invasive Animals CRC has published:

	2005–2006	2006–07	2007–08	2008–09	2009–10	2011–12	2011-12 In Press
2.1.1 Formal books	-	-	1	-	-	1	-
2.1.2 Formal book chapter	-	5	2	3	2	1	2
2.1.3 Formal articles in scholarly-refereed journals	7	19	25	38	27	34	24
2.1.4 Conference papers in refereed proceedings	2	4	36	19	14	7	3
2.2.1 Conference abstracts in a non-refereed proceedings publication	5	-	-	18	-	9	1
2.2.2 Invasive Animals CRC technical reports	2	-	-	4	-	7	-
2.2.3 PestSmart reports / factsheets / brochures	-	-	-	-	-	29	-
2.2.4 PestSmart case studies	-	-	-	-	-	9	-
2.2.5 Other agency reports	13	25	-	7	-	9	-

04 END-USER ENVIRONMENT

The continued wet weather cycle since 2010 has resulted in the rapid growth in pest animal numbers causing increased impacts on the environment and agricultural productivity. Initially, smaller and highly-fertile pests responded quickly to favourable conditions producing mouse plagues in addition to surging rabbit and carp numbers. Over the past two years, the carnivores have followed with growing fox and wild dog numbers and impacts.

Increasing wild dog and fox populations will be controlled with a new generation of human toxins which are presently in the appraisal part of the registration process. We are expecting good news on that front in the year ahead. Feral pigs can be controlled with two different types of toxins based on 1080 or sodium nitrite (which surprisingly is also used in the bacon curing process). PIGOUT® (1080 based) is already available.

The Invasive Animals CRC Economic Impact Assessment, undertaken by the Centre for International Economics, used an economy-wide approach to estimate the national economic benefit terms for nine of the 40 key technologies for which value could be sensibly monetised. The assessment covered:

Invasive Animals CRC outputs will deliver benefits to the community worth around $142 million over 30 years.

Outcomes

The Invasive Animals CRC has 12 Outcomes that aim to be delivered through 40 key technologies.

Outcome 1: A benefit of $29 million per annum by reducing the impacts of fox and wild dogs by 10%

Outcome 2: A national benefit of $16 million per annum by reducing feral pig damage by 15%

Outcome 3: A benefit of $7 million per annum by reducing rodent damage by 20%

Outcome 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

Outcome 5: Deliver innovative, practical control measures against cane toads

Outcome 6: Reduced impact of feral cats over five million hectares

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

Outcome 8: Deliver improved and humane approaches to reduce the production and biodiversity impacts of expanding or other overabundant and widespread species

Outcome 9: Reduced risks of economic losses, environmental damage and social stress by forecasting and responding to potential, new or emerging invasive animal problems

Outcome 10: Growth in Australian invasive animal pest control industries. Through industry collaboration on the registration, marketing, export and community uptake of new products the CRC will enhance control of problem species

Outcome 11: Increased professional and practical skills base in invasive animal management through education, training and community awareness

Outcome 12: Established national and local benchmarks for invasive animal impact, density and distribution from which performance on delivery of all outcomes can be assessed.

- fox and wild dog control activities, in particular the development of a new more humane and target-specific toxin, the effects of which can be reversed with an antidote
- feral pig control activities, in particular the development of more target-specific pig baits, that again have the added safety of an antidote
- rabbit control activities, in particular the development of a new freeze-dried rabbit haemorrhagic disease (RHD) product
- rodent control activities, in particular the new application of a mouse bait that can be legally and safely used in brassica and root vegetable crops
- early warning detection technologies, in particular the enhancement of a DNA-based species identification test to detect new invasive animal incursions.

Based on the economy-wide analysis and despite the omission of many of the benefits from the quantitative analysis, the assessment estimated that Invasive Animals CRC outputs will deliver benefits to the community worth around $142 million in present value terms over 30 years (in 2007 dollars, using a discount rate of 5%). This exceeds the Australian Government's investment in the Invasive Animals CRC of around $24.9 million in comparable terms, by around $117 million. This equates to $5.70 value to the community for every dollar invested by the Australian Government. The internal rate of return on the Government's investment is estimated at 32.4%.

When all funding sources are considered, the new technologies developed by the Invasive Animals CRC are estimated to generate net benefits of $58 million over the 30-year period (in 2007 dollars, using a discount rate of 5%). The benefit-cost ratio is estimated at 1.7:1, with an internal rate of return of 10.5%.

Carp by Chris Wisniewski.

> . . .the new technologies developed by the Invasive Animals CRC result in $5.70 value to the community for every dollar invested by the Australian Government.

The environmental benefits, although not estimated, are also expected to be significant. This includes the environmental benefits to be delivered through the potential release of Australia's first carp biocontrol agent – Cyprinid herpes virus 3 – which has devastated common carp populations overseas with no non-target species impacts. In Indonesia for example, common carp numbers were reduced by 80 to 95% within two years of the accidental introduction of the virus. Environmental benefits will include improved water quality and ecological health over most of the 1 million sq. km Murray-Darling Basin.

Other environmental benefits include the avoided conservation impacts to 78 native species that are vulnerable to fox impacts if this pest establishes in Tasmania. The Invasive Animals CRC has developed the DNA detection technology that underpins the Tasmanian Government's fox eradication campaign. On the mainland, the impact of Invasive Animals CRC technologies will also contribute to the conservation of many nationally listed threatened species, including the 156 threatened by rabbits and 76 threatened by foxes.

The social impacts of invasive animals, particularly wild dogs, are considerable and will be reduced through the Invasive Animals CRC's new control products and its validation and promotion of regional nil-tenure wild dog management.

To secure these outcomes, the Invasive Animals CRC has increased its capacity to develop the product registration packages needed to enable the APVMA to assess and register our new control products, and develop robust exit plans for uncompleted key technologies (particularly daughterless platform technology and Cyprinid herpes virus 3) as part of our wind-up process and seek additional funds through the Invasive Animals CRC's extension bid to allow the finalisation of the scientific research to enable a robust registration package to be submitted for Cyprinid herpes virus 3 that will facilitate its assessment, approval and release within the lifetime of the proposed extended Invasive Animals CRC.

05 NATIONAL RESEARCH PRIORITIES

The Invasive Animals CRC aims to create new tools and strategies to assist partners and the Australian community at large to manage invasive animals. However, the development of tools is not sufficient. The Invasive Animals CRC must ensure that any outcomes are:

- socially acceptable
- ecologically effective
- commercially viable.

Most of our activities address the National Research Priority 'Safeguarding Australia'. Under this Priority, the Invasive Animals CRC works directly towards the outcome of 'Protecting Australia from invasive diseases and pests'. About 20% of our activities also contribute to the outcome of achieving 'Sustainable use of Australia's biodiversity'.

National Research Priorities	CRC Research 2010–11
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%

The Invasive Animals CRC's broad membership comprises 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 Invasive Animals 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.

Thomas Newsome – Research Success

Recipient of an Invasive Animals CRC PhD Thomas Newsome (pictured right), with Guy Ballard (left) and Adam, researched the ecology and behaviour of the dingo in the Tanami Desert, NT. His study site included a mining and pastoral operation where there had been a long history of negative human-dingo interactions. The project involved a wide range of stakeholders and scientific collaborators. The work resulted in novel and groundbreaking research and strategies for how to better manage interactions between dingoes, humans, co-occurring predators and prey. It led to the development of long-term dingo management plans, education and awareness programs for mining and pastoral workers and employment and training of indigenous rangers through nationally-accredited programs.

06 STRUCTURE & GOVERNANCE


Helen Cathles

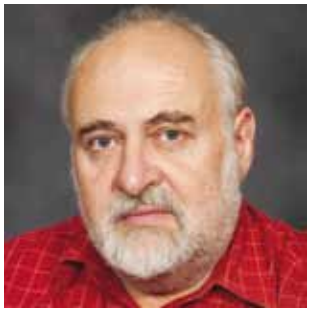

Dedee Woodside


Helen Scott-Orr


Mark Lonsdale


Phil Cowan


Manfred Claasz


Arthur Georges (until 20 March 2012)

The structure and governance of the Invasive Animals CRC provides strong support to its operations. The CRC is led by a Board of skills-based Directors, the majority of whom are independent from the participants of the CRC. The Governing Board meets at least four times a year and is committed to compliance with the Australian Securities Exchange (ASX) Corporate Governance Principles and Recommendations.

In carrying out its governance role, the main task of the Board is to drive the CRC strategy, to develop policies and monitor and review performance to ensure that the CRC achieves its research and adoption/utilisation goals. The Board also approves the CRC budget and ensures the Company complies with its contractual, statutory and other obligations.

Board Members

Name	Role	Key Skills	Independent/ Organisation
Helen Cathles	Chair	Corporate Governance, Primary Production, Pest Animal Control	Independent
Dedee Woodside	Deputy Chair	Conservation, Social Sciences, Business & Commercial	Independent
Helen Scott-Orr	Director	Primary Production, Pest Animal Control, R&D Management	Independent
Mark Lonsdale (until 27 October 2011)	Director	Corporate Governance, R&D Management, Risk Analysis	CSIRO
Phil Cowan	Director	Corporate Governance, Pest Animal Control, R&D Management	Landcare Research NZ
Manfred Claasz	Director	Communication, Business and Commercial, Risk Analysis	Independent
Arthur Georges (until 20 March 2012)	Director	Conservation, Pest Animal Control, R&D Management	University of Canberra

Committee Members

The Audit & Risk Committee has a documented charter approved by the Board. The Audit & Risk Committee has responsibility for the oversight of fiscal and legal matters and ensuring appropriate procedures and internal controls are in place. The Committee is responsible for the independence of the external auditors and also manages the internal audit program.

The Remuneration & Nominations Committee has responsibility for remuneration policy and facilitating the Director nominations process.

Audit & Risk Committee Members

Name	Role	Key Skills	Independent/ Organisation
Dedee Woodside	Chair	Conservation, Social Sciences, Business & Commercial	Independent
Mark Lonsdale (until 27 October 2011)	Director	Corporate Governance, R&D Management, Risk Analysis	CSIRO
Helen Scott-Orr	Director	Primary Production, Pest Animal Control, R&D Management	Independent
Manfred Claasz (from 7 February 2012)	Director	Communication, Business and Commercial, Risk Analysis	Independent

Ms Betty Ferguson, Certified Public Accountant (CPA), is engaged as an independent external advisor to the Board and the Audit & Risk Committee in the fields of Finance and Risk.

Remuneration & Nominations Committee Members

Name	Role	Key Skills	Independent/ Organisation
Helen Scott-Orr	Committee Chair	Primary Production, Pest Animal Control, R&D Management	Independent
Helen Cathles	Chair	Corporate governance, Primary Production, Pest Animal Control	Independent
Phil Cowan	Director	Corporate Governance, Pest Animal Control, R&D Management	Landcare Research NZ

Director's Meetings

The number of Director's meetings and number of meetings attended by each of the Directors of the Company during the financial year are presented in the table opposite.

A: Number of meetings held during the time the Director held office during the year

B: Number of meetings attended.

Director's Meetings

	Board Meetings		Audit Committee		Remuneration & Nominations Committee	
Director	A	B	A	B	A	B
Helen Cathles	5	5	-	-	2	2
Manfred Claasz	5	4	1	1	-	-
Phil Cowan	5	5	-	-	2	2
Arthur Georges	4	3	-	-	-	-
Mark Lonsdale	2	2	2	-	-	-
Helen Scott-Orr	5	5	4	4	2	2
Deedee Woodside	5	5	4	4	-	-

Key Staff

Key staff* sit on the Executive Committee. This committee continually assesses the activities and performance of the CRC and provides management information to support the decision making of the Governing Board.

Invasive Animals CRC Staff

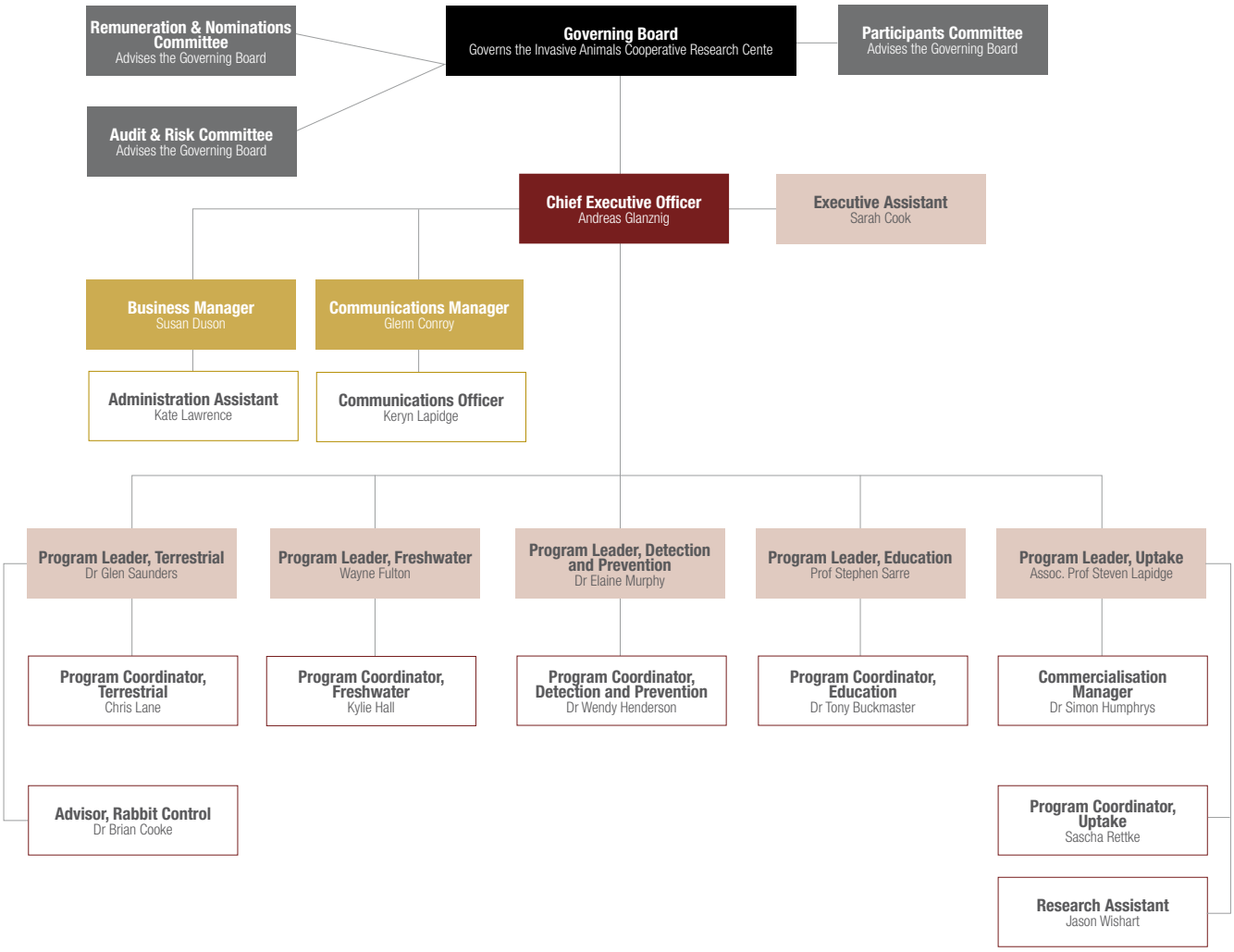
Name	Organisation	CRC Position/Role	Time Committed
Mr Andreas Glanznig*	Invasive Animals Ltd	CEO	100%
Ms Susan Duson*	Invasive Animals Ltd	Business Manager/Company Secretary	100%
Mr Glenn Conroy*	Invasive Animals Ltd	Communications Manager	100%
Dr Glen Saunders*	NSW Primary Industries	Program Leader, Terrestrial	60%
Mr Chris Lane	NSW Primary Industries	Program Coordinator, Terrestrial	100%
Mr Wayne Fulton*	Invasive Animals Ltd	Program Leader, Freshwater	50%
Ms Kylie Hall	Invasive Animals Ltd	Program Coordinator, Freshwater	100%
Dr Elaine Murphy*	NZ Department of Conservation	Program Leader, Detection & Prevention	30%
Dr Wendy Henderson	Invasive Animals Ltd	Program Coordinator, Detection & Prevention	80%
Assoc. Prof Steven Lapidge*	Invasive Animals Ltd	Program Leader, Uptake	100%
Dr Simon Humphrys*	Invasive Animals Ltd	Commercialisation Manager	100%
Ms Sascha Rettke	Invasive Animals Ltd	Program Coordinator, Uptake	100%
Prof Stephen Sarre*	University of Canberra	Program Leader, Education	30%
Dr Tony Buckmaster	Invasive Animals Ltd	Program Coordinator, Education	40%
Ms Keryn Lapidge	Invasive Animals Ltd	Communications Officer	60%
Ms Kate Lawrence	Invasive Animals Ltd	Office Manager	60%
Ms Sarah Cook	Invasive Animals Ltd	Executive Assistant	100%

Staff Changes

Ms Melanie Allan — resigned 19 August 2011.
Ms Diane Holloway — retired 7 February 2012.
Dr Wendy Henderson — resigned 9 April 2012.

Structure

The Invasive Animals CRC is a joint venture arrangement between the Participants, which includes the Managing Company, Invasive Animals Ltd. Invasive Animals Ltd is a public company limited by guarantee. It has been endorsed by the Australian Taxation Office as a tax concession charity and is exempt from income tax.



07 RESEARCH ACHIEVEMENTS

The following is a summary of the research achievements obtained during the reporting year under relevant activity outcomes. Activity outcomes that relate to commercialisation and utilisation (Outcome 10) and education and training (Outcome 11) are detailed under their own sections.

For further information on the CRC's research activities, refer to the Invasive Animals CRC Research Portfolio Summary (October 2012), which provides more detailed information on project progress aligning with the CRC's goals and milestones.

Download the full research portfolio from: http://www.invasiveanimals.com/publications/research/

OUTCOME 1: A BENEFIT OF $29 MILLION PER ANNUM BY REDUCING THE IMPACTS OF FOX AND WILD DOGS BY 10%

The strategy to achieve this outcome is based on:

- strengthening strategic knowledge on fox and wild dog biology, ecology and ecological interactions at landscape scales
- developing a new fox and wild dog toxin (PAPP) and bait that includes an antidote (Blue Healer®) to increase the effectiveness of 1080-based regional fox and wild dog control programs
- validating and promoting regional nil–tenure control approaches
- developing and promoting best–practice management strategies and tools.

2011–12 Highlights

- Registration package for the new fox toxin (PAPP) and bait — FOXECUTE® — submitted to the APVMA in March 2012.
- Registration package for the new wild dog toxin (PAPP) and bait — DOGABATE® — submitted to the APVMA in June 2012.
- Minor use permit that allows PAPP antidote Blue Healer® to be intravenously administered by vets was submitted to the APVMA in June 2012.
- Comprehensive fox and wild dog PestSmart toolkit products completed and widely available through PestSmart roadshows and www.feral.org.au website. This included very strong demand (more than 5,000 copies distributed) of the Invasive Animals CRC wild dog trapping DVD.

This strategy is based on new control tools and regional planning.

Remote Camera – Wild Dogs by Richard Ali.

OUTCOME 2: A NATIONAL BENEFIT OF $16 MILLION PER ANNUM BY REDUCING FERAL PIG DAMAGE BY 15%

The strategy to achieve this outcome is based on:

- strengthening strategic knowledge on feral pig biology, ecology and ecological interactions at landscape scales to identify vulnerabilities that can be exploited in feral pig management
- developing a first-generation 1080-based feral pig bait (PIGOUT®)
- developing a new second generation feral pig toxin and bait (HOGGONE®) based on sodium nitrite that includes an antidote (Blue Healer®)
- developing efficient and target-species delivery systems (HogHopper™)
- developing and promoting best–practice management strategies and tools.

2011–12 Highlights

- With additional financial support from Meat & Livestock Australia, the project team is embarking on field trials of a new bite-sized HOGGONE® Econobait for use in HogHopper™ in Australia and the USA, as well as a nitrite concentrate that can be added to other bait substrates.
- Through the potential utilisation of an Emergency Use Permit in Texas, this powerful combination could be available in Texas before it is registered in Australia.
- The past financial year has seen the growth in HogHopper™ usage throughout Australia since going on sale in March 2011. More than 250 units have now been sold to all corners of the country and reports back have been promising. The simple-yet-effective HogHopper™ design saw it become a finalist in the Agriculture division of the inaugural 'Australian Innovation Challenge' in November 2011. It was also awarded the 'Best Australian Made Machine' at the Toowoomba Agshow in September 2011.
- Ongoing trials with the United States Department of Agriculture in six states in America have proven the utility of the HogHopper™ with non-target species, except for a couple of large racoons excluded from the device. The USDA has collected sufficient field safety data to apply for a US Environmental Protection Agency Experimental Use Permit to conduct live field trials in multiple states/habitats.
- Comprehensive feral pig PestSmart toolkit products were completed and are widely available through PestSmart roadshows and www.feral.org.au website.

OUTCOME 3: A BENEFIT OF $7 MILLION PER ANNUM BY REDUCING RODENT DAMAGE BY 20%

The strategy to achieve this outcome is based on:

- developing a mouse immuno-contraceptive virus that can be transmitted naturally (project ceased)
- broadening the legal use of the existing zinc phosphide toxin to brassica, forestry plantation and industrial situations.

This outcome has been constrained by the cessation of the mouse immuno–contraceptive project, which would have been able to significantly reduce the impacts of mouse plagues.

2011–12 Highlights

- Animal Control Technologies (Australia) P/L, with financial support from the Invasive Animals CRC, achieved the registration of RODEMISE® Bromadiolone Rodent Block and approval (subject to stability data) of their RODEMISE® Difenacoum Rodent Block. The Animal Control Technologies Australia Pty Ltd (ACTA) team will shortly submit the use extension registration packages so MOUSEOFF® ZP can be applied in horticulture and RATTOFF® ZP can be used in the teak and banana industries.

OUTCOME 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

The strategy to achieve this outcome is based on developing an integrated carp and pest fish management approach, comprising the following:

- Strengthening strategic knowledge on carp and tilapia biology, ecology and ecological interactions to identify vulnerabilities that can be exploited in integrated carp and/or tilapia management programs.
- Developing and/or determining the potential of two strategic control technologies: daughterless carp platform technology and Cyprinid herpes virus 3 (Australia's first potential carp biocontrol agent).
- Validating tactical control technologies, such as carp separation cages and fish-down methods. A report is being published on previous investigations into the potential of various fish-specific biocides for use in Australia.
- Developing and/or determining the potential of carp sex, environmental and acoustic attractants and acoustic repellents.
- Developing a freshwater fish incursion decision support tool.

Inland Fisheries Service staff Paul Donkers (left) and Alasdair Macdonald (right) with carp captured in traps during pheromone trials (Lake Crescent, Tasmania). Photo by Chris Wisniewski.

2011–12 Highlights

- Daughterless platform technology demonstrated to be inheritable. A prototype female–lethal (daughterless) construct was successfully tested. The prototype was tested through four generations of zebrafish, with marked effects on offspring sex ratios. Testing of a prototype female–lethal carp construct, built wholly of native carp genetic material, also proved successful using a transient assay.
- The scientific study of Cyprinid herpes virus 3 has been continued into the extended Invasive Animals Cooperative Research Centre research program.
- Two plants have been shown to have attractant properties for juvenile carp. As part of a PhD study, these plant–based attractants have been chemically isolated and identified.
- Control strategies for tilapia in Queensland have been developed based on an integrated management 2008 to 2012 Herberton Weir experiment. The experiment proved successful in reducing tilapia numbers.
- A major report on tilapia, 'Development of management strategies for the control and eradication of feral tilapia populations in Australia', was published.
- Targeted carp control continued in Lakes Sorell and Crescent, Tasmania, with carp believed to have been eradicated from Lake Crescent (no carp have been found in monitoring surveys since 2007). A manual of carp control methodologies based on the Tasmanian model was published.
- A national forum on carp management was held at Preston, Victoria in June 2012.
- A forum on the state of knowledge of tilapia in Australia was held in Brisbane in May 2012.
- A toolkit of resource factsheets and case studies on both carp and tilapia has been written and is progressively coming online as completed on www.feral.org.au.
- Comprehensive carp and tilapia PestSmart toolkit products completed and widely available through PestSmart roadshows and www.feral.org.au website.

OUTCOME 5: DELIVER INNOVATIVE, PRACTICAL CONTROL MEASURES AGAINST CANE TOADS

The strategy to achieve this outcome is based on:

- strengthening strategic knowledge of cane toad ecology and control, particularly through parasites
- investigating the potential of applying daughterless platform technology to cane toads
- assessing cane toad impacts and developing a national action plan.

2011–12 Highlights

- Crystal Kelehear's PhD dissertation 'Host-parasite interactions during a biological invasion: the potential of a lungworm Rhabdias as a biocontrol against cane toads' has been submitted and accepted.

OUTCOME 6: REDUCED IMPACT OF FERAL CATS OVER FIVE MILLION HECTARES

The strategy to achieve this outcome is based on:

- strengthening strategic knowledge of regional feral cat control by obtaining the field data essential for the registration of the Curiosity PAPP feral cat bait and investigating the relationships between introduced predators (mainly fox and cat), their control and sustained fauna recovery in southern Western Australia
- investigating the potential of Spray Tunnel technology as a feral cat control tool.

2011–12 Highlights

- In previous financial years of the Invasive Animals CRC, the CURIOSITY® feral cat bait has been tested at Scotia Sanctuary in NSW and on Kangaroo Island in SA. The product has been successfully used for island eradications of feral cats and in the WA rangelands. However, target specificity was deemed to be sufficiently lacking in the NSW, SA and southern WA trials (northern jarrah forest demonstration site) to warrant the use of the product. As a consequence, the Invasive Animals CRC is no longer involved in CURIOSITY® feral cat bait trials and has shifted its research focus in a future attempt to meet this outcome.
- The Invasive Animals CRC focus during 2011–12 on improved feral cat (and fox) management has been concentrated on the novel spray tunnel and/or post concept. Working with Ecological Horizons P/L and Connovation Ltd (NZ), with financial support from Meat & Livestock Australia Ltd, the project team will shortly pen and field test non-toxic then live prototypes to obtain proof-of-concept. The spray units contain an array of infra-red sensors that can detect the presence of long-legged cats and foxes and spray their fur with a lethal dose of PAPP, which cats and foxes fastidiously groom off and ingest.

Increased knowledge on cane toads will be a vital weapon against the pest.

OUTCOME 7: INCREASED AGRICULTURAL PROFITABILITY THROUGH IMPROVED INTEGRATION OF EXISTING BIOLOGICAL, CONVENTIONAL AND NEWLY DEVELOPED CONTROL OPTIONS FOR RABBITS

The strategy to achieve this outcome is based on:

- strengthening strategic knowledge on the biodiversity impacts caused by rabbits, as well as the mechanisms behind the lack of effectiveness of rabbit haemorrhagic disease
- enabling the rabbit haemorrhagic disease virus (RHDV) suspension product to be available to end–users
- investigating the potential of new RHDV strains to boost biocontrol of wild rabbits in Australia
- developing a freeze–dried RHDV bait-delivered product
- developing a tactical rabbit warren pressure carbon monoxide fumigator
- developing strategies for optimal use of RHDV and conventional controls.

2011–12 Highlights

- Large-scale infection experiments were conducted to determine the degree of cross protection that the non-pathogenic Australian lagovirus RCV-A1 can convey to lethal RHDV challenge. Unexpectedly, the study revealed that the protection rates are not dependant on serum antibody titres but on a variety of other factors, most importantly the time between RCV-A1 and RHDV infection. The dose and route of RHDV challenge infection may very likely also play a role. More studies are needed to confirm this finding.

  In our studies, a recent RCV-A1 infection (up to three months before the RHDV challenge) followed by a moderate oral challenge dose of RHDV, resulted in average protection rates of 32%.

- A set of serological tools that allow discrimination between antibodies to RHDV and RCV-A1 was developed. This involved the production of reagents and antibodies and the development of six different Enzyme-Linked-Immuno-Sorbent-Assays (ELISAs) for RCV-A1.

- A similar set of reagents were developed to conduct serological analysis for the pathogenic RHDV.

  Subsequently, the new RCV-A1 ELISAs were used to study the continent-wide distribution of RCV-A1. This analysis is ongoing, but so far samples from 60 sites across Australia confirm the presence of RCV-A1 in the south-east and south-west of the continent.

- The data generated in this study will be used to feed into a CLIMEX model for RCV-A1 to map its likely distribution. Such models will be valuable tools to aid the development of improved rabbit management strategies.

- The enhancing RHDV effectiveness project has generated five high-impact peer-reviewed journal publications (three more are in preparation), six national and international conference presentations and several invited lectures at the national and international level. The results generated in RHDV study have been included in two book chapters and received a large amount of media attention, including an episode on the national science television program ABC Catalyst.

- Data arising from the RHDV genetic diversity project and the long-standing Turretfield SA site has become the basis of collaborative research initiatives in the new Invasive Animals CRC extension between Biosecurity SA and University of Adelaide to study co-evolution between rabbits and RHDV.

- As part of the RHD Boost Project, strains of RHDV have been selected and imported from France, Spain, China and South Korea. Genetic and

Rabbits cause widespread and dramatic damage.

antigenic comparisons of these imported RHDV strains have been conducted and five candidate strains have been selected for further evaluation. Master virus stocks for the candidate strains have been produced and a regime for testing for freedom from adventitious agents is under negotiation with Biosecurity Australia and Australian Quarantine and Inspection Service (AQIS). Real-time Polymerase Chain Reaction (PCR) assays for determining virulent and benign rabbit caliciviruses have also been produced.

In the past 12 months, the projects' supply of rabbits has been decimated by myxomatosis. Many producers have left the industry and two other producers reported recent mass mortalities consistent with myxomatosis infection. This delay means that the titration experiments of the candidate viruses have not yet commenced.

- All information for formal registration package and product label associated the RHDV virus disease suspension product has been collated and is currently being finalised for submission to the Australian Pesticides and Veterinary Medicines Authority (APVMA) in September 2012.
- A practical Rabbit PestSmart toolkit has been developed from the seven years of pest animal research in Australia by the Invasive Animals CRC and its partners. Primarily aimed at landholders and land managers, the Rabbit PestSmart toolkit includes 'how-to' guides (including YouTube footage), case studies, fact sheets, guidelines and technical reports focusing on strategic planning, management and control of rabbits. All this information is freely available, accessible and downloadable from one website. Go to: www.feral.org.au/pestsmart

OUTCOME 8: DELIVER IMPROVED AND HUMANE APPROACHES TO REDUCE THE PRODUCTION AND BIODIVERSITY IMPACTS OF EXPANDING OR OTHER OVERABUNDANT AND WIDESPREAD SPECIES

The strategy to achieve this outcome is based on:

- providing leadership in implementing welfare-based invasive animal control practices
- strengthening strategic knowledge of the social impacts of invasive animals
- developing management packages to reduce pest bird impacts and improve herbivore management.

2011–12 Highlights

- The existing Codes of Practice (COPs) and Standard Operating Procedures (SOPs) by Sharp & Saunders, 2005 were reviewed in 2011, new COPs and SOPs have been written for a range of species including cane toads, rodents, camels and donkeys. The revised COPs and SOPs along with the new documents will be published on the feral.org.au website by December 2012. In addition, 'A Model for Assessing the Relative Humaneness of Pest Animal Control Methods' publication was updated.
- The original COPs have met the requirements of the regulatory impact assessment process of the Commonwealth Office of Best Practice Regulation (OBPR) and subsequently been endorsed by Vertebrate Pests Committee (VPC), Australian Animal Welfare Committee (AusAWC) and its (then) parent committee the Animal Welfare and Product Integrity Taskforce (AWPIT). The COPs are currently with the Department of Agriculture, Fisheries and Forestry (DAFF) en route to the Primary Industries Standing Committee (PISC) and from there to the Standing Council on Primary Industries (SCoPI) for ultimate endorsement by Ministers and adoption by all jurisdictions. However, they remain at this stage as guiding documents only – they are not written into any legislation.

These documents fulfilled an obligation that animal welfare issues be recognised in controlling pest animals and as such have been widely accepted and applauded for their content and detail. They have been acknowledged by key animal welfare agencies such as the RSPCA.

Fertility control trials to reduce kangaroo and wallaby fertility continue to progress well.

- Adult female wallabies vaccinated once or twice with GonaCon® in March 2007 remain infertile to July 2012.
- Eastern grey kangaroos vaccinated intramuscularly with a single shot of GonaCon® (15 kangaroos) in May 2008 have not produced a pouch young in the breeding seasons of 2009,

2010 or 2011. All control females (nine kangaroos) have produced young since 2010.

- New trials assessing the efficacy of silica nanoparticles as carriers for oral delivery of immunogenic proteins have been undertaken. Variable immune responses after oral delivery of a non-reproductive immunogen (tetanus toxoid) using these particles have been observed in mice.
- As part of the feasibility of humane management project, extensive screening of chemical libraries has succeeded in isolating a cohort of chemicals that are selectively cytotoxic towards our target cell types. All of these chemicals have demonstrated selective cytotoxity in-vitro and some have had their activity confirmed in-vivo. These results herald a new chapter in the development of highly selective reagents for the non-surgical sterilisation of pest animal species. This work will be carried on in the new Invasive Animals CRC extension (2012–2017).

Minister Tony Burke, Minister for Sustainability, Environment, Water, Population and Communities launched the publication 'Economic Impacts of Vertebrate Pests in Australia' for the Invasive Animals CRC in 2009.

OUTCOME 9: REDUCED RISKS OF ECONOMIC LOSSES, ENVIRONMENTAL DAMAGE AND SOCIAL STRESS BY FORECASTING AND RESPONDING TO POTENTIAL, NEW OR EMERGING INVASIVE ANIMAL PROBLEMS

The strategy to achieve this outcome is based on:

- validating risk models, systems and assessments
- developing cost–effective early warning detection and response options to restrict introductions or the range of invasive animals
- developing packages for managing invasive animal species that are hosts for pathogens that threaten humans, livestock or native fauna.

2011–12 Highlights

- First national official record of previous vertebrate incursions and interceptions and identification of high–risk species to target for future biosecurity action. The study was prepared in close consultation with the National Vertebrate Pests Committee Incursions Working Group.
- A better understanding of the fox incursion in Tasmania was formed along with the government and community response to the incursion (through social and genetic analysis).
- International collaboration assisted in the development of recommendations for best practice in relation to rabbit eradication on islands such as Macquarie Island.
- A web–based-freshwater fish incursion decision support tool was developed and is now online on www.feral.org.au with user manuals for scientific and community users.

OUTCOME 10: GROWTH IN AUSTRALIAN INVASIVE ANIMAL PEST CONTROL INDUSTRIES. THROUGH INDUSTRY COLLABORATION ON THE REGISTRATION, MARKETING, EXPORT AND COMMUNITY UPTAKE OF NEW PRODUCTS THE CRC WILL ENHANCE CONTROL OF PROBLEM SPECIES

SEE COMMERCIALISATION AND UTILISATION PAGES 45-47.

OUTCOME 11: INCREASED PROFESSIONAL AND PRACTICAL SKILLS BASE IN INVASIVE ANIMAL MANAGEMENT THROUGH EDUCATION, TRAINING AND COMMUNITY AWARENESS

SEE EDUCATION AND TRAINING PAGES 39-44.

OUTCOME 12: ESTABLISHED NATIONAL AND LOCAL BENCHMARKS FOR INVASIVE ANIMAL IMPACT, DENSITY AND DISTRIBUTION FROM WHICH PERFORMANCE ON DELIVERY OF ALL OUTCOMES CAN BE ASSESSED

The strategy to achieve this outcome is based on:

- establishing biophysical and economic benchmarks of invasive animal impacts
- assessing the impact of Invasive Animals CRC technologies and adoption.

2011–12 Highlights

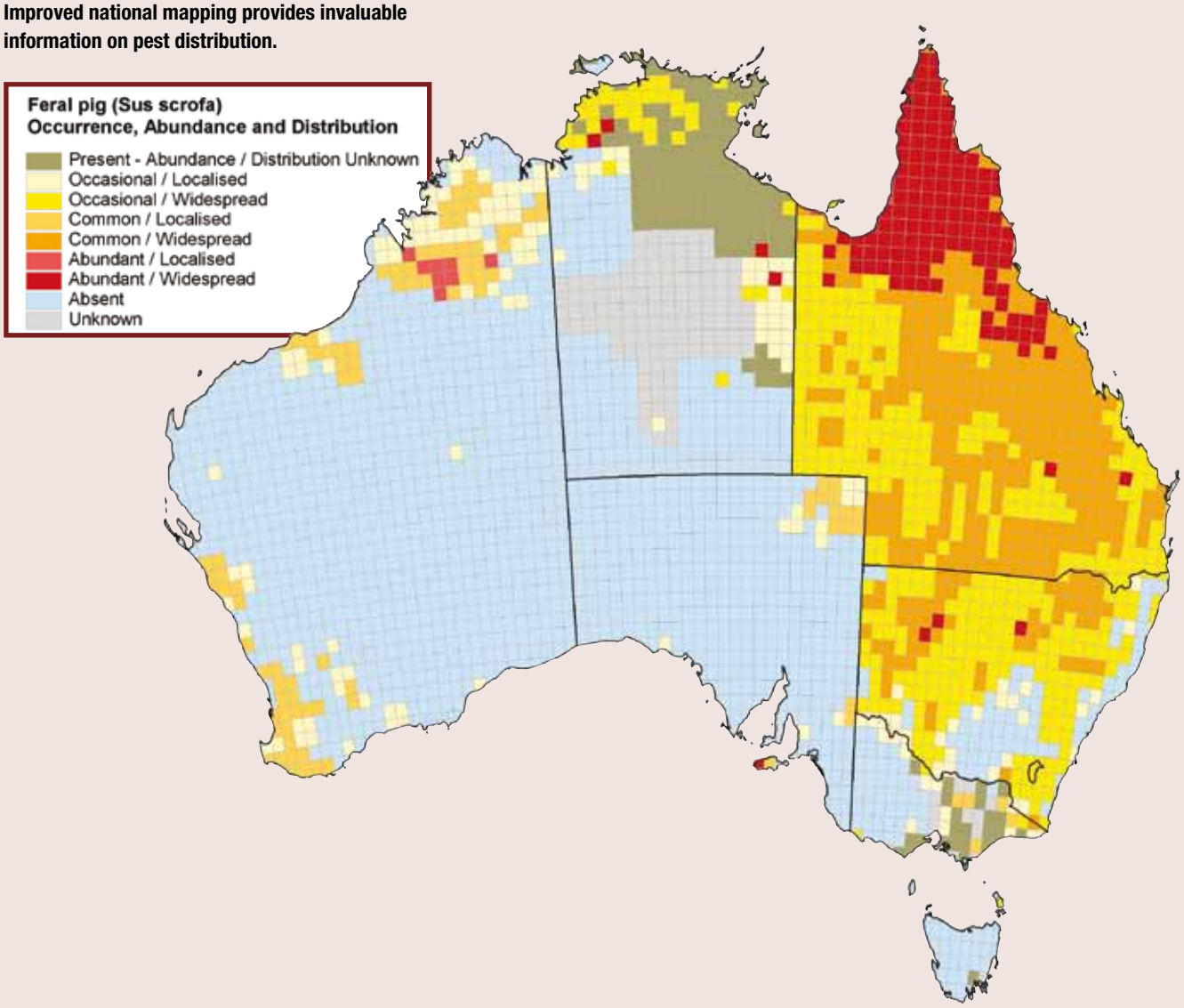
The mapping invasive animals project:

- improved procedures for monitoring, evaluation and reporting at regional, state and national levels for significant invasive animals
- provided nationally consistent national-scale datasets for species occurrence, distribution and abundance
- produced a series of pest species mapping information products for relevant stakeholders including NRM regional groups, local government, state/territory pest management authorities and VPC. Pest animal information resources for decision support were also delivered for respective jurisdictional management authorities.
- FeralScan websites for rabbits, foxes, feral camels, feral pigs, wild dogs, cane toads, feral goats, common starlings, feral deer and common mynas were developed and launched. The facility offers site users a range of options and tools including bulk data importing, year and month filtering, data exporting, map creation and printing, image uploading and real-time reporting of species sightings, damage and control data developed. Independent datasets defining the known extent of species (eg known max range of pest) were also integrated.
- Research to better understand the factors that might influence the adoption of baits containing a new humane poison, para-aminopropiophenone (PAPP) for wild canid control, was undertaken by ABARES for the Invasive Animals CRC. This research identified the complex variables influencing individual stakeholder decisions about the adoption of baits containing PAPP.

Survey responses from public and private land managers suggested that baits containing PAPP and its antidote Blue Healer® will appeal to those who do not participate in wild canid management due to concerns over accidental poisoning of non-target species. Increasing the adoption of products containing PAPP will be achieved by not only promoting their benefits but also through increased landholder/manager participation in wild canid management programs, which would result from encouraging coordinated landscape scale wild canid management practices.

Feral Pig by Andrew Bengsen.

Improved national mapping provides invaluable information on pest distribution.



08 RESEARCH COLLABORATIONS

Collaborative links across the Invasive Animals CRC are a major focus of activities given the very large number of parties involved. A compulsory investment criterion for every project funded is that at least two Invasive Animals CRC participants are involved in the project and at least one of these participants must be a technology end-user. Even when projects have a relatively long time frame and are close to the 'research' end of the 'research and development' spectrum, the Invasive Animals CRC's approach is that the direct involvement of end-users is invaluable to achieving outcomes.

More than half the participants in the Invasive Animals CRC are end-users of research. In setting up the Invasive Animals CRC, the Board took the view that the CRC would have low entry requirements (for example no entry fees) to encourage participation. Thus, our end-users are generally directly involved in many of the projects of interest to them, in an attempt to have a technology transfer process that is as seamless as possible. We believe the end-users improve the research process as well, so that technology or processes developed are more likely to be adopted. Key national and international collaborators beyond the collaboration between our CRC partners are outlined in this section.

Australian collaborations:

Agforce Queensland	Development of Codes of Practice (COPs) and Standard Operating Procedures (SOPs) for the humane control of invasive animals; and National Wild Dog Advisory Group Membership.
Agrifood Skills	Training agenda for capacity building in the area of pest animal management.
Desert Recovery (Roxby Downs)	Fox and feral cat control using spray tunnel.
James Cook University	Investigation into appropriate control strategies for feral pigs in rainforest terrain.
Kangaroo Island NRM Board	Field trial sites.
Lachlan and Central West CMAs	Integrated carp and wild dog management plans.
National Wild Dog Management Advisory Group	Development of wild dog management plans.
Rabbit Free Australia	RHD Boost Rabbit control Project.
RSPCA	Establishment of local trials.
South Australian Arid Lands NRM	Development of Codes of Practice (COPs) and Standard Operating Procedures (SOPs) for the humane control of invasive animals, regional dog control.
South Australian Farmers Federation	Development of Codes of Practice (COPs) and Standard Operating Procedures (SOPs) for the humane control of invasive animals; and National Wild Dog Advisory Group Membership.
Vertebrate Pest Committee	Training agenda for capacity building in the area of pest animal management, policy advice in relation to rabbit biocontrol.
Victorian Farmers Federation	Development of Codes of Practice (COPs) and Standard Operating Procedures (SOPs) for the humane control of invasive animals; and National Wild Dog Advisory Group Membership.
WA Farmers Federation	Development of Codes of Practice (COPs) and Standard Operating Procedures (SOPs) for the humane control of invasive animals.
WA Pastoral and Grazing Association	Development of Codes of Practice (COPs) and Standard Operating Procedures (SOPs) for the humane control of invasive animals.

International collaborations:

Auburn University	Collaboration on gene manipulation technologies to control invasive freshwater fish.
Instituto Zooprofilattico Sperimentale (IZS)	Supply of monocional antibodies for ELISAs to confirm indigenous RABBIT lagovirus.
Israel National Parks	Improving tools for wild pig control.
Michigan University	Collaboration on carp attractant technologies to assist control of invasive freshwater fish.
Texas Parks and Wildlife Association	Trial of pig control products.
United States Department of Agriculture	Trials of pig control products.
University of Notre Dame	Collaboration on gene manipulation technologies to detect invasive freshwater fish.
University of York	PhD Student supervision.

OUTCOME 1: A BENEFIT OF $29 MILLION PER ANNUM BY REDUCING THE IMPACTS OF FOX AND WILD DOGS BY 10%

- 56 NRMs and CMAs across Australia
- ACT Department of Territory and Municipal Services
- AgForce Queensland
- Animal Control Technologies (Australia) Pty Ltd
- Australia Bureau of Agricultural Resource Economics and Sciences
- Australian Wool Innovation
- Border Rivers-Gwydir Catchment Management Authority
- Bioquiv
- Biosecurity Queensland
- Cattle Council of Australia
- Caring For Our Country — Department of Agriculture, Fisheries and Forestry
- Charles Sturt University
- Department of Agriculture and Food WA
- Forests NSW
- Gippsland Wild Dog Advisory Group
- James Cook University
- Low Ecological Services
- Meat & Livestock Australia
- NSW Livestock Health and Pest Authorities
- NSW Management Council for Livestock Health and Pest Authorities
- NSW Department of Primary Industries
- NSW Office of Environment and Heritage (National Parks & Wildlife Service)
- NSW Wild Dog Advisory Committee
- Pestat Pty Ltd
- Phillip Island Nature Park (Vic)
- Queensland Department of Environment and Resource Management
- Queensland Department of Agriculture, Fisheries and Forestry (Biosecurity Queensland)
- Rangelands NRM Coordinating Group (WA)
- South Australian Arid Lands NRM
- South Australian Department of Water, Land and Biodiversity Conservation
- South Australian Farmers Federation
- Tasmanian Department of Primary Industries, Parks, Water and Environment
- Connovation Ltd (NZ)
- Victorian Department of Primary Industries
- Victorian Department of Sustainability and Environment
- Victorian Farmers Federation
- Victorian North-East Wild Dog Advisory Group
- WA Department of Environment and Conservation
- Western Australia Farmers Federation
- WA Pastoralists and Graziers Association
- Wild Dog Advisory Group
- Wool Producers Australia
- University of Canberra
- University of Sydney
- University of Western Australia

OUTCOME 2: A BENEFIT OF $16 MILLION PER ANNUM BY REDUCING FERAL PIG DAMAGE BY 15%

- ACT Department of Territory and Municipal Services
- Animal Control Technologies (Australia) P/L
- Australian Bureau of Agricultural and Resource Economics and Sciences
- Biosecurity Queensland
- Central West CMA
- Connovation Ltd (NZ)
- CSIRO
- Department of Sustainability, Environment, Water, Population and Communities
- James Cook University
- Kangaroo Island Landholders
- Kangaroo Island NRM Board
- Lachlan CMA
- Landcare Research (NZ)
- Meat & Livestock Australia
- NSW Department of Primary Industries
- NSW Livestock Health and Pest Authorities
- Queensland Murray-Darling Committee
- SA Department of Environment and Heritage
- SA Department of Water, Land and Biodiversity Conservation
- SA Department of Environment and Heritage
- SA Department of Water, Land and Biodiversity Conservation
- University of Queensland
- US Department of Agriculture National Wildlife Research Center and Wildlife Services

OUTCOME 3: A BENEFIT OF $7 MILLION PER ANNUM BY REDUCING RODENT DAMAGE BY 20%

- Animal Control Technologies (Australia) P/L
- CSIRO
- Grains Research & Development Corporation
- Indonesian Centre for Rice Research
- Northern Arizona University (under contract to SenesTech)
- NZ Department of Conservation
- University of Queensland
- University of Western Australia

Ben Allen is a dingo researcher working with the NSW Department of Primary Industries, supported through funds from the Invasive Animals CRC. Over the last five years, Ben has been investigating the ecological roles of dingoes in arid and semi-arid areas. Through collaboration with Invasive Animals CRC partners and others, Ben has published extensively on his findings related to beef cattle predation, risks to threatened fauna, dingo diet, scavenging behaviour and movements. Ben has also published the results of critical reviews of evidence for the dingo's ecological roles, has delivered a series of public workshops on dingo and wild dog management, and has developed the PestSmart Toolkit for wild dogs (available at www.feral.org.au). Some of Ben's dingo research will feature in a soon-to-be broadcast ABC Television documentary 'Dingoes - wild dogs at war'.

OUTCOME 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

- Auburn University Alabama
- Australian National University
- CSIRO Marine
- Deakin University
- Inland Fisheries Service, Tasmania
- K&C Fisheries
- Kingfisher Research Pty Ltd
- Lachlan Catchment Management Authority and local community representatives
- Michigan State University
- Murray-Darling Association
- Murray-Darling Basin Authority
- National Vertebrate Pests Committee
- NSW Department of Primary Industries
- NSW State Water
- Queensland Department of Agriculture, Fisheries and Forestry
- Queensland Department of Employment, Economic Development and Innovation, Biosecurity Queensland
- SA Research and Development Institute
- University of Adelaide
- University of Minnesota
- University of Notre Dame, Indiana
- University of NSW
- University of Queensland
- University of Tasmania
- US Geological Survey
- Victorian Department of Primary Industries
- Victorian Department of Sustainability and Environment

OUTCOME 5: DELIVER INNOVATIVE, PRACTICAL CONTROL MEASURES AGAINST CANE TOADS

- Australian Pest Animal Strategy
- Department of Agriculture, Fisheries and Forestry—Biosecurity Queensland
- Department of Primary Industries and Regions SA
- Department of Sustainability, Environment, Water, Population and Communities
- James Cook University
- National Cane Toad Advisory Group
- NSW Office of Environment and Heritage (National Parks & Wildlife Service)
- NSW Department of Primary Industries
- NT Department of Natural Resources, Environment, the Arts and Sport
- University of Sydney
- University of Queensland
- University of Wollongong
- WA Department of Environment and Conservation

Invasive Animals CRC PhD Dr Peter Elsworth and research assistant Dallas Powell checking on a rabbit used in RHDV challenge trials.

OUTCOME 6: REDUCED IMPACT OF FERAL CATS OVER FIVE MILLION HECTARES

- ABARES
- ACT Government: Conservation Planning and Research, Parks and Conservation Service, Environment and Sustainable Development Directorate (ESDD), Land Development Agency (LDA) and Economic Development Directorate (EDD).
- ACT RSPCA
- Alcoa World Alumina Australia
- Animal Control Technologies (Australia) P/L
- Australian Wildlife Conservancy
- Connovation Ltd (NZ)
- Desert Recovery (Roxby Downs)
- Department of Sustainability, Environment, Water, Population and Communities
- Ecological Horizons
- General Dogs Body Pty Ltd
- Kangaroo Island NRM Board
- Meat & Livestock Australia
- Murdoch University
- RSPCA Australia
- University of Sydney
- University of Western Australia
- Victorian Department of Sustainability and Environment
- Victorian Department of Primary Industries
- WA Department of Environment and Conservation
- Worsley Alumina

OUTCOME 7: INCREASED AGRICULTURAL PROFITABILITY THROUGH IMPROVED INTEGRATION OF EXISTING BIOLOGICAL, CONVENTIONAL AND NEWLY DEVELOPED CONTROL OPTIONS FOR RABBITS

- Animal and Plant Control Group, SA Department of Land, Water and Biodiversity Conservation
- Agriculture Services Victoria P/L
- Australia Bureau of Agricultural Resource Economics and Sciences
- Australian Wool Innovation
- CSIRO Entomology
- Foundation for a Rabbit Free Australia
- INSERM, Nantes, France
- IZS of Brescia, Italy
- Meat & Livestock Australia
- NSW Department of Primary Industries
- Parks Victoria
- Queensland Department of Employment, Economic Development and Innovation, Biosecurity Queensland
- SA Arid Lands Natural Resource Management Board
- Victorian Department of Primary Industries
- Victorian Department of Sustainability and Environment
- Western Australian Department of Agriculture

Our research has strengthened integrated control programs to manage wild rabbit populations.

OUTCOME 8: DELIVER IMPROVED AND HUMANE APPROACHES TO REDUCE THE PRODUCTION AND BIODIVERSITY IMPACTS OF EXPANDING OR OTHER OVER-ABUNDANT AND WIDESPREAD PEST SPECIES

- ACIL Tasman
- ACT Government: Planning, Conservation and Land, Environment and Sustainable Development Directorate, Land Development Agency and Economic Development Directorate
- ACT RSPCA
- Animal and Plant Group, SA Department of Water, Land and Biodiversity Conservation
- Australian Animal Welfare Strategy
- Australian Bureau of Agricultural and Resource Economics and Sciences
- Australian National University
- Canberra Indian Myna Action Group
- CSIRO
- Department of Sustainability, Environment, Water, Population and Communities
- Economic and Social Research Council (United Kingdom)
- Lord Howe Island Board
- National Vertebrate Pests Committee
- NSW Department of Primary Industries
- Pestat Pty Ltd
- RSPCA Australia
- University of Newcastle
- University of Queensland
- University of Sydney
- University of York
- USDA National Wildlife Research Centre

Invasive Animals CRC PhD Eve-McDonald-Madden.
Image: L'Oréal Australia/sdpmedia.com.au

Decision Theory helps PhD student investigate better decision making strategies

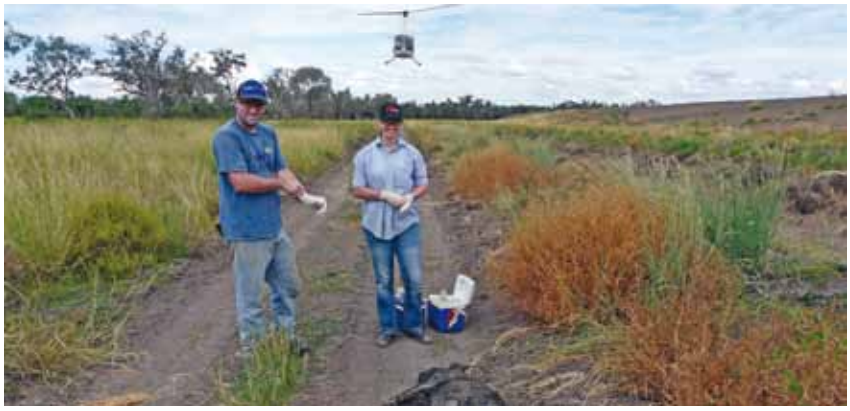
Throughout my career, including my PhD within the CRC for Invasive Animals, I have worked at the cross-roads of statistical and mathematical analysis and ecology. My research focus to date has been determining how conservation management decisions are made (ie funding decisions, strategy development and adoption). To aid better decision making, my research has involved a suite of analysis techniques novel to conservation and pest control.

OUTCOME 9: REDUCED RISKS OF ECONOMIC LOSSES, ENVIRONMENTAL DAMAGE AND SOCIAL STRESS BY FORECASTING AND RESPONDING TO POTENTIAL, NEW, EXPANDING OR EMERGING INVASIVE ANIMAL PROBLEMS

- ABARES
- Australian Capital Territory Department of the Environment, Climate Change, Energy and Water
- Australian Capital Territory Department of Territory and Municipal Services
- Australian Customs and Border Protection Service
- Australian Government Department of Agriculture, Fisheries and Forestry (including Australian Quarantine and Inspection Service), Wildlife Exotic Disease Preparedness Program
- Australian Government Department of Sustainability, Environment, Water, Population and Communities
- Australian Pork Limited
- Department of Primary Industries and Regions SA (Biosecurity SA)
- National Vertebrate Pests Committee
- Northern Territory Department of Natural Resources, Environment, the Arts and Sport
- NSW Department of Environment, Climate Change and Water
- NSW Department of Primary Industries
- NZ Department of Conservation
- Primary Industries and Resources of South Australia
- Queensland Department of Agriculture, Fisheries and Forestry (Biosecurity Queensland)
- State and Territory agencies
- Tasmania Department of Primary industries, Parks, Water and Environment
- University of Adelaide
- University of Auckland
- University of Canberra
- University of Queensland
- University of Sydney
- University of Western Australia
- Victorian Department of Sustainability and Environment
- Victorian Department of Primary Industries (Biosecurity Victoria)
- Western Australian Department of Agriculture and Food
- Zoo and Aquarium Association

OUTCOME 10: GROWTH IN AUSTRALIAN INVASIVE ANIMAL PEST CONTROL INDUSTRIES. THROUGH INDUSTRY COLLABORATION ON THE REGISTRATION, MARKETING, EXPORT AND COMMUNITY UPTAKE OF NEW PRODUCTS THE CRC WILL ENHANCE CONTROL OF PROBLEM SPECIES

- Animal Control Technologies (Australia) P/L
- Aquapower
- Aromacoat
- Australian Bureau of Agricultural and Resource Economics and Sciences
- Australian Wool Innovation
- Bioquiv
- Connovation Ltd (NZ)
- CSIRO
- Food and Environmental Research Agency (UK)
- Grains R&D Corporation
- Meat & Livestock Australia
- NSW Department of Primary Industries
- NSW Livestock Health and Pest Authorities
- Pestat Pty Ltd
- Queensland Department of Agriculture, Fisheries and Forestry
- SenesTech
- Texas Parks and Wildlife
- United States Department of Agriculture
- University of Newcastle
- University of Sydney
- Victorian Department of Primary Industries
- Victorian Department of Sustainability and Environment



Hayley Pearson – Research success

Darren Marshall (left) of Queensland Murray-Darling Committee and recently completed Invasive Animals CRC PhD student, Hayley Pearson (right), collect samples from feral pigs for disease and stomach content analysis.

The extent to which wild animals are contributing to endemic disease in livestock in Australia is largely unknown. In a PhD project jointly funded by the Invasive Animals CRC and Australian Pork Limited, invasive animals captured in and around piggeries were sampled for various pathogens of importance to the pork industry. Pathogens were detected in European starlings in South Australia, rats in Victoria and South Australia, and feral pigs in Queensland. The project involved a number of additional funding bodies and collaborators. A quantitative risk assessment determined the risk of exposure of the domestic pigs to the pathogens carried by the invasive animals. As this risk of exposure was not negligible, key areas to mitigate this risk were identified.

OUTCOME 11: INCREASED PROFESSIONAL AND PRACTICAL SKILLS BASE IN INVASIVE ANIMAL MANAGEMENT THROUGH EDUCATION, TRAINING AND COMMUNITY AWARENESS

- AgriFood Skills Australia
- Animal Control Technologies (Australia) P/L
- Australian Bureau of Agricultural and Resource Economics and Sciences
- Australian Wool Innovation
- Border Rivers-Gwydir Catchment Management Authority
- Department of Agriculture, Fisheries and Forestry, Caring For Our Country
- Meat & Livestock Australia
- Murray-Darling Basin Authority
- National Vertebrate Pests Committee
- NRMs and CMAs across Australia
- NSW Department of Primary Industries
- NSW Livestock Health and Pest Authorities
- Pestat Pty Ltd / Australian Pest Animal Strategy
- University of Canberra
- University of Canberra College
- University of Canberra (Institute for Applied Ecology)
- University of Newcastle
- University of Queensland
- University of Sydney
- University of Western Australia
- Victorian Department of Primary Industries

OUTCOME 12: ESTABLISHED NATIONAL AND LOCAL BENCHMARKS FOR INVASIVE ANIMAL IMPACT, DENSITY AND DISTRIBUTION FROM WHICH PERFORMANCE ON DELIVERY OF ALL OUTCOMES CAN BE ASSESSED

- Australian Broadcasting Commission
- Australian Bureau of Agricultural and Resource Economics and Sciences
- Australian Capital Territory Department of Territory and Municipal Services
- Australian Capital Territory Department of the Environment, Climate Change, Energy and Water
- Australia Feral Camel Management Project
- Canberra Indian Myna Action Group
- CSIRO
- Department of Agriculture, Fisheries and Forestry
- Department of Primary Industries and Regions SA (Biosecurity SA)
- Department of Sustainability, Environment, Water, Population and Communities
- Fitzgerald Applied Sociology
- Julian Cribb and Associates
- Landcare Australia
- National Vertebrate Pests Committee
- NSW Office of Environment and Heritage (National Parks & Wildlife Service)
- NSW Department of Primary Industries
- Northern Territory Department of Natural Resources, Environment, the Arts and Sport
- NZ Department of Conservation
- Primary Industries and Resources of South Australia
- Queensland Department of Agriculture, Fisheries and Forestry (Biosecurity Queensland)
- South Australian Arid Lands NRM
- South Australian Department of Environment and Heritage
- State and Territory government agencies
- Tasmania Department of Primary industries, Parks, Water and Environment
- Toshiba
- University of New England
- ValueMetrics
- Victorian Department of Primary Industries (Biosecurity Victoria)
- Victorian Department of Sustainability and Environment and Parks Victoria
- Western Australian Department of Agriculture and Food
- Western Australian Department of Environment & Conservation
- Western CMA (NSW)
- Woolworths

Developing safe and effective feral pig baiting tools for the Wet Tropics

The suite of pest control tools available for any given pest animal management program is often limited by the risks that some tools can pose to non-target species. *Andrew Bengsen's PhD project 'Controlling feral pigs in tropical rainforests' developed a method for identifying ways to improve the target specificity of pest control tools and applied the method to the problem of developing safe and effective baiting practices for feral pigs in the Wet Tropics World Heritage Area.

Andrew Bengsen, as a member of a research team, identified and evaluated new baiting materials and methods that should allow consideration of baiting to reduce the impacts of pigs in the World Heritage Area. These new baiting materials and methods hold the potential to improve the target specificity of pig baiting in adjacent agricultural lands. The team also developed new and efficient methods for assessing the impacts of pig control operations on pig populations.

*Since Andrew Bengsen completed his PhD through the Invasive Animals CRC four-year Balanced Scientist Program, he has worked on pest animals in two different organisations. At present, Andrew is working for the NSW Department of Primary Industries as a Meat & Livestock Australia Postdoctoral Fellow, with the specific purpose of ensuring continued capacity within vertebrate pest research. This is a good example of the Invasive Animals CRC's investment directly contributing to in-the-field succession and capacity building.

Caption: Andrew Bengsen servicing a remote camera being used to monitor interactions between animals and feral pig baits in the rainforest of the Wet Tropics World Heritage Area in far North Queensland.

09 EDUCATION & TRAINING

OUTCOME 11: INCREASED PROFESSIONAL AND PRACTICAL SKILLS BASE IN INVASIVE ANIMAL MANAGEMENT THROUGH EDUCATION, TRAINING AND COMMUNITY AWARENESS.

This segment of the annual report focuses on key areas of education and training research and student involvement during 2011–12 as they relate to Outcome 11.

Education has four main initiatives to extend information and interactive opportunities that evolve from this CRC. Initiatives include: Balanced Scientist Program, a Vocational Education and Training Diploma in Conservation and Land Management, an educational website (www.feralorg.au) including Feral Focus and Pest Tales and the PestSmart toolkit.

Pictured above is Invasive Animals CRC PhD student Katie Doyle who said this Murray Cod was a lovely fish and it was soon released back into the river. Field work is pretty fun when you catch fish like that. (Left) Murray-Cod with small carp in its mouth.

My PhD research examined the potential to stock native predatory fish species to control carp through predation. The fish species included the Australian bass from the east coast of Australia, and the Murray Cod, golden perch and trout cod located in the Murray-Darling Basin. Throughout the project I conducted tank-based experiments, pond experiments and field work. The results from my research revealed that Australia bass, golden perch and trout cod are unlikely to control carp populations due to their mouth gape limitations and habitat preferences.

Objectives

Education objectives include:

- Produce market-ready, balanced and exceptional graduates, who in addition to their specialised PhD research experience, also emerge with broad skills in areas such as research leadership and management, stakeholder and community engagement, project management, innovation and development, effective communication and media awareness.
- Train graduates that are better prepared for the workforce and have developed collaborations and industry based networks prior to graduation and who are able to match their research efforts with the priorities of their chosen industry.
- Increase the capacity of land managers to plan and undertake strategic invasive animals management through the development of a Vocational Education and Training level course.
- Develop and maintain a centralised, publicly accessible repository of invasive animal resources and management information.
- Provide curriculum-based teaching resources to primary and secondary schools based on invasive animal education activities and resources.

The Balanced Scientist Program is a hands-on approach that supports the Invasive Animals CRC's PhD, Masters and Honours level students through scholarship funding and additional training that students would not normally receive while enrolled in standard award courses.

The program includes a fully-funded eighth semester for PhD students to enable additional training to take place without adversely impacting on a student's capacity to undertake cutting-edge research.

The Vocational Education and Training Diploma in Conservation and Land Management (Strategic Pest Management) employs innovative on-line learning techniques. The delivery of the course content on-line through Moodle allows participants to study remotely and facilitates the effective delivery of the course to students across Australia.

The Diploma course is offered through the University of Canberra College. Six students were enrolled for the 2010 academic year and seven for 2011. Student enrolments came from across the country with all students attending the intensive residential components of the course in Canberra. This facilitated networking and collaborations between the students.

During the reporting year, the on-line information and learning site www.feral.org.au continued to provide a one-stop shop for information on invasive animals for teachers and community alike. The site includes an extensive image gallery and more than 8,000 accessible records such as report, manuals, guides, grey literature and web-links to external resources.

The website also hosts school- and community-based education packages – Feral Focus and Pest Tales. These packages are designed in accordance with school science curriculum and allow teachers to deliver lessons on common pest animal problems to primary and secondary level students.

Feral Focus (www.feralfocus.org.au) uses real-life situations involving invasive animals to enhance the understanding of these issue and problem solving capacity of secondary school students, specifically years 8, 9 and 10 in the areas of Science, Studies of Society and Environment (SOSE) and Geography. Sixteen packages are available, including five on-line scenarios, together with teacher instructions and plans.

Pest Tales (www.pestales.org.au) contains nine educational packages for primary school and includes lesson plans for teachers, activities and interactive scenarios for students that have strong links to curriculum profiles including the new Australian curriculum. These packages utilise real-life situations to engage students and guide them through problem solving activities.

The PestSmart toolkit and training programs facilitate delivery of the acquired knowledge of the Invasive Animals CRC to end users. Provision of this content on-line is enhanced through targeted face-to-face education.

Student Progress

Postgraduate Research Education

The Invasive Animals CRC had 13 PhD students and one Masters student actively engaged in research during 2011–2012 across all of the CRC's programs. Of these, six PhD students and one Masters student submitted their thesis for marking. In total 20 PhD students have completed their research and submitted theses. Sixteen of the 20 theses have been accepted while the remaining four are in review.

The completion rate for Cohort 1 of 100% (see KEY ACHIEVEMENTS LIST) is far above the reported national average (64% overall and 75% in Natural Sciences; Sinclair 2004*). Doctors of Philosophy have been conferred on 92% of those students. The thesis of the remaining student is currently being marked.

The postgraduate program is ahead of the expected targets in student numbers with a total of 29 PhD students, two Masters and two Honours students either currently supported or who have graduated with their awards.

KEY ACHIEVEMENTS LISTING

As of 30 June 2012, 16 of the 29 PhD students have had their awards conferred, four have submitted their theses and are awaiting acceptance and eight are still in progress. All Masters level students have had their award conferred and both honours degrees have been conferred.

...100% completion rate for first PhD intake compared to 75% national average.

Key achievements PhD Cohort 1

All (100%) C1 PhDs have submitted their theses for marking.

11 out of 12 (92%) C1 submitted PhDs accepted (remaining one still being marked).

Key achievements PhD Cohort 2

Six out of 11 (55%) C2 PhD students have submitted their thesis with the balance making strong progress towards completion and submission.

Four out of six (66%) C2 these submitted have been accepted.

Key achievements PhD Cohort 3

Two of six (33%) C3 PhD students have submitted their thesis for marking.

One of those two theses has been accepted and the award conferred. The remaining four C3 students are making strong progress with two expected to submit theses for marking during August 2012 and two before the end of 2012.

Key achievements Masters Cohort

All Masters students have submitted their thesis and have had it accepted.

Key achievements Publications

Invasive Animals CRC students have submitted 48 manuscripts, based on Invasive Animals CRC-funded research, for publication in peer reviewed journals or conference proceedings in 2011–2012. Of these, 27 have been accepted for publication and the remaining 21 are in review pending a determination on publication. A further 15 articles based on students research have been published in non-peer reviewed conference proceedings or in the popular media.

*Sinclair, M (2004) The pedagogy of 'good' PhD supervision: A national cross-disciplinary investigation of PhD supervision. Report to the Department of Education, Science and Training, Canberra.

Completed Invasive Animals CRC students

Name	Cohort and year	Award	Activity Output	Title of Thesis	Employment on graduation	
Jennyffer Cruz-Bernal	Cohort 1 Submitted 2011	PhD	1.1	Ecology of the koomal (*Trichosurus vulpecula hypoleucus*) in the northern jarrah forest in relation to predation and resource availability	Landcare New Zealand	International research
Eve McDonald-Madden	Cohort 1 Conferred 2009	PhD	9.1	Optimal decision-making in conservation: management, uncertainty and monitoring	University of Queensland	Australian research
Gwilym Haynes	Cohort 1 Conferred 2009	PhD	4.1	Population genetics of common carp (*Cyprinus carpio* L.) in the Murray-Darling Basin	University of Wisconsin, USA	International research
Alex Diment	Cohort 1 Conferred 2010	PhD	1.1	Monitoring the ecological impacts of invasive predator control	Flora and Fauna International, Cambridge UK	International industry
Andrew Bengsen	Cohort 1 Conferred 2010	PhD	2.1	Target-specific vertebrate pest control in complex faunal communities: feral pig baiting in the wet tropics of Queensland, Australia	Kangaroo Island Natural Resources Management Board	Australian industry
John Abramyan	Cohort 1 Conferred 2010	PhD	5.1	Biology of sex determination and sexual development in the cane toad (*Bufo marinus*)	University of California Riverside	International research
Maija Marsh	Cohort 1 Conferred 2010	PhD	7.2	Transmission and effectiveness of RHDV infections in rabbit populations at different spatial scales	Natural England, UK	International industry
Megan Barney	Cohort 1 Conferred 2010	PhD	4.2	Sex determination and differentiation in carp, (*Cyprinus carpio*)	CSIRO, Hobart	Australian research
Tarnya Cox	Cohort 1 Conferred 2010	PhD	8.4	Predator faecal odours as repellents to manage feral goats and kangaroos	NSW Department of Primary Industries, Orange	Australian industry
Amanda Elledge	Cohort 1 Conferred 2011	PhD	2.1	Habitat preferences and environmental impacts of feral pigs (*Sus scrofa*) in lowland tropical rainforests of north-eastern Australia	Department of Environment and Resource Management Queensland	Australian industry
Carla Meurk	Cohort 1 Conferred 2011	PhD	2.6	Loving nature, killing nature, and the crises of caring: An anthropological investigation of conflicts affecting feral pig management in Queensland, Australia	University of Queensland	Australian research
Tony Buckmaster	Cohort 1 Conferred 2011	PhD	6.1	Ecology of the feral cat (*Felis catus*) in the tall forests of Far East Gippsland	University of Canberra and Invasive Animals CRC	Australian academia
Peter Elsworth	Cohort 2 Submitted 2011 Thesis accepted with minor emendations	PhD	7.2	Development of genetic resistance to Rabbit haemorrhagic disease in wild rabbits (*Oryctolagus cuniculus*)	Department of Agriculture, Fisheries and Forestry Queensland	Australian research
Danielle Stephens	Cohort 2 Conferral July 2012	PhD	1.1	Developing DNA-based monitoring techniques for improved management of wild dog	Helix Genetics Solutions, Western Australia	Australian Research
Jessica King	Cohort 2 Conferred 2011	PhD	9.4	Investigating the life cycle and transmission of Neospora caninum in Australia	University of Sydney	Australian research
Tom Newsome	Cohort 2 Conferred 2011	PhD	1.1	Ecology of the dingo (*Canis lupus dingo*) in the Tanami Desert in relation to human-resource subsidies	Low Ecological Services Pty Ltd, Alice Springs	Australian industry
Scott van Barneveld	Cohort 2 Conferred 2012	PhD	9.2	Invasive Species, endemic species and geographic distributions	Mining & Energy Technical Services Pty Ltd (MET Serve), Brisbane	Australian industry
Paul de Tores	Cohort 2 Submitted 2011	PhD	1.1	Native fauna response to large scale fox control in the northern Jarrah forest of south-west Western Australia: Operation Foxglove	Department of Environment and Conservation Western Australia	Australian industry

Name	Cohort and year	Award	Activity Output	Title of Thesis	Employment on graduation	
Hayley Pearson	Cohort 2, Submitted 2012 Thesis accepted with minor emendations	PhD	9.4	Understanding and mitigating domestic pig and wildlife interactions	University of Sydney	Australian research
Adriana Ford-Thompson	Cohort 3 Conferred 2012	PhD	8.2	People, pests and conflict: community participation in invasive deer management in Australia	University of York, UK	International academia
Crystal Kelehear	Cohort 3, Submitted 2012 Thesis accepted with minor changes	PhD	5.1	Host-parasite interactions during a biological invasion: the potential of a lungworm Rhabdias as a biocontrol against cane toads	University of Sydney	Australia research
Melissa Snape	Cohort 3 Submitted August 2012	PhD	8.4	Effects of vaccination against gonadotrophin releasing hormone (GnRH) on the behaviour and fertility of macropods	Not yet employed	
Ian McDonald	Cohort 3 Submitted August 2012	PhD	2.1	GnRH constructs for oral delivery: affects on immune responses and reproductive function	CSIRO Discovery Centre, Canberra	Australian industry
Ben Allen	Honours Completed 2006	Hon	9.4	The spatial ecology and zoonoses of urban dingoes – a preliminary investigation	NSW Department of Primary Industries	Australian industry
Melissa Snape	Honours Completed 2007	Hon	8.4	Traits for baits: an analysis of factors influencing bait acceptance in urban brushtail possums	Continued to PhD project with Invasive Animals CRC	Australian research
Marlene Jahnke	Masters Conferred 2010	Masters	7.2	Genetic diversity and evolution of a non-pathogenic calicivirus in wild rabbit populations in Australia	University of East Anglia, UK	International research
Kana Koichi	Masters Conferred 2012	Masters	2.1	Socio-economic and ecological costs and benefits of feral pigs in the Wet Tropics	Invasive Animals CRC	Australian industry

Continuing Invasive Animals CRC students

Name	Cohort and year	Award	Activity Output	Prospective Title of Thesis	University and Invasive Animals CRC program		Expected submission
Katie Doyle	Cohort 2 Commenced 2007	PhD	4.1	Impact of increased predator presence through stocking on carp populations and the implications for management	University of Queensland (Australian Postgraduate Award)	Freshwater	August 2012
Aaron Elkins	Cohort 2 Commenced 2007	PhD	4.4	Environmental attractants for carp	Australian National University (University Postgraduate Award)	Freshwater	August 2012
Penelope Marshall	Cohort 2 Commenced 2007	PhD	8.2	The social impacts on Australian farm families of wild dog predation on agricultural stock	Australian National University	Terrestrial	Unknown
Lindsey McFarlane	Cohort 2 Commenced 2007	PhD	4.2	Characterisation of RNA silencing pathways in the common carp (*Cyprinus carpio* L.)	University of Queensland (Australian Postgraduate Award)	Freshwater	Unlikely to submit
Kate Grarock	Cohort 3 Commenced 2007	PhD	8.3	Removal of the pest bird – Indian Myna (*Acridotheres tristis*) and its impacts and implications for native Australian birds	Australian National University (University Postgraduate Award)	Terrestrial	August 2012
John Tracey	Cohort 3 Commenced 2008	PhD	8.3	Evaluating management strategies for pest birds of horticulture	University of York	Terrestrial	September 2012
Jason Wishart	Masters Commenced 2010	21		An evaluation of feral pigs and their management in the Macquarie Marshes, NSW	University of Canberra	Terrestrial	December 2012

Perception and reality: managing feral pigs' environmental and socio-economic impacts

Most stakeholder groups in the Wet Tropics World Heritage Area, north Queensland, believe feral pigs cause damage to the rainforest. Kana Koichi, who completed her masters through the Invasive Animals CRC, said their perceptions varied considerably as to whether pigs had socio-economic values.

Pigs were a significant agricultural pest for a minority of sugarcane farmers but were a recreational resource for hunters and a food source for remote Aboriginal communities. Conversely, some local residents and the majority of visitors did not view pigs as either a pest or a resource, owing to their lack of concern and/or familiarity with feral pig issues.

Such varying perceptions meant that feral pig management efforts were inconsistent across the landscape and that pig management was often seen as the government's responsibility. Additionally, those not involved in pig management and Aboriginal communities strongly opposed 1080 baiting.

Kana's research showed that if pig management merely focused on mitigating the negative impacts of pigs without consideration of their positive values, or the controversial methods used, then it would cause conflicts and was likely to fail.

Instead, specific needs and aspirations of a particular stakeholder group should be considered first, followed by the assessment of whether and/how those needs and aspirations can be met. Since completing her masters, she has been working for the Invasive Animals CRC and Kana hopes to bridge the gap between scientific communities and the public through focused scientific communication.

Photograph caption: Masters student Kana Koichi is pictured alongside a cane farm in North Queensland.

10 COMMERCIALISATION & UTILISATION

OUTCOME 10: GROWTH IN AUSTRALIAN INVASIVE ANIMAL PEST CONTROL INDUSTRIES. THROUGH INDUSTRY COLLABORATION ON THE REGISTRATION, MARKETING, EXPORT AND COMMUNITY UPTAKE OF NEW PRODUCTS THE CRC WILL ENHANCE CONTROL OF PROBLEM SPECIES

Strategy

Since 2010, higher-than-average rainfall across much of the Australian mainland has resulted in an escalation of predation pressure from wild dogs, foxes, feral pigs and feral cats at the same time that rabbits and other herbivores have increased competition pressures.

Mitigating these dual shocks to agricultural production and biodiversity will require innovation in pest animal management so that the benefits of best practice outstrip the cost of the control measure, the environmental damage, and the negative impacts on agricultural productivity caused by invasive animals. To this end, the Invasive Animals CRC's commercialisation strategy is to invest expertise and dollars into innovation gaps that would otherwise not be bridged and prevent the development and adoption of new animal management tools and techniques.

Our strategy is not to bridge these gaps alone, but to partner with Invasive Animals CRC commercial and end-user participants to create innovation clusters that can more successfully engage local communities and work with them to implement cost-effective management programs.

The advantages of this strategy are listed below.

- Front-end costs of product/practice development are shared such that small to medium enterprise (SME) investment risks are lowered.
- The path-to-market and business plans are formulated and agreed upon in early-stage development.
- Commercialisers are active participants in the development of products/practices and work hand-in-hand with individuals/organisations that are end-users or will be key influencers of end-users, which is a driver of innovation adoption.
- The network that is built around the development/commercialisation opportunity creates critical mass that adds value and credibility to the innovation outputs and outcomes.

The strong new product/practice innovation track record of the Invasive Animals CRC is testament to its investment in human capital with commercialisation, technology transfer, negotiation, project management, regulatory and product delivery expertise and experience.

The value of this expertise supported by the greater Invasive Animals CRC management and participant fraternity is acknowledged to be a key national resource by Australian and overseas agencies/organisations involved in pest animal management. The strong focus and appropriate resourcing of utilisation and commercialisation by our CRC also underscores its commitment to successfully achieving the CRC operational goals and contracted milestones, many of which are achieved in collaboration with CRC SMEs.

SME Engagement

Due diligence on our projects led Invasive Animals CRC management to adopt a research development model which is strongly aligned with that of our key CRC SMEs, in particular – Animal Control Technologies Australia (ACTA) Pty Ltd.

The commercialisation management project within our CRC ensured that research and development had an industry/market pull and was well integrated and aligned with SME core businesses and competencies.

Dr Simon Humphrys and Associate Professor Steven Lapidge also fostered transparent and collaborative relationships with SME management and staff so that technology transfer was streamlined and end-users were embedded within product development and onground testing.

This approach to commercialisation and utilisation also has the advantage of consolidating SME commercial participants in the market compared to an approach that relies on spinning out intellectual property (IP) into start-

up companies that would effectively spread critical mass and further fragment the market participants, undermining key SME viability.

The Invasive Animals CRC acknowledges that this approach is tailored specifically to this market segment, which generally lacks critical mass and this approach maximises the probability that value can be captured from centre IP through the benefit to Australian enterprises.

Australia-focused research with international scope

To achieve our goals and milestones, the Invasive Animals CRC has engaged in excellent Australia-focused science since our inception through to the current reporting period. Where applicable, this science excellence is framed in the context of global research initiatives in the field of wildlife management.

This encompasses an understanding of how research in Australia and on Australian wildlife can have utility in overseas markets and how innovation and intellectual property generated in Australia might by valued overseas and used to generate greater economies of scale for Australian SMEs.

The value of this approach was in evidence during the reporting period where more than $3 million of in-kind resources was committed by the United States Department of Agriculture (USDA) in support of the Invasive Animals CRC's extension application.

This research collaboration was underpinned by Invasive Animals CRC patented IP and has created a foundation of networks that the CRC aims to build on in future collaborations. This investment from the USDA also highlighted the value that the commercialisation management project has added to the CRC's future through the management of IP that is used strategically to create value.

Intellectual property management

The Invasive Animals CRC's management of IP encompasses a balanced strategy based on:

- resources and the probability of significant return on investment
- maximising value of the Invasive Animals CRC to Participants
- benchmarking background IP and maximising the added value to centre IP
- enhancing commercial awareness of our CRC staff and students
- minimising the risk of inappropriate IP disclosure.

IP Management adheres to the Invasive Animals CRC Board-approved plan that 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 in this field commonly saw little prospect of their outputs being used to create value dependent on IP protection.

Effectively managing the IP of the Invasive Animals 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 Invasive Animals CRC Board and Executive recognise this key dynamic of value-adding to Participant background IP in creating centre IP that is valued by its Participants by resourcing the Uptake Program to effectively plan for and manage the IP encompassed within all projects.

Effective management of IP in our CRC has relied on managing internal and external IP. Administering Internal IP (Centre and Background IP) encompassed IP audits, assessment, development, and protection. External (non-CRC related) IP management encompassed all activities required to identify, evaluate and interpret the relevance of non-participant and non-centre IP.

Analysing internal Invasive Animals CRC IP readily pinpointed research and development strengths and weaknesses in the context of global Invasive species R&D. Using these approaches, our CRC could be confident that the investment risk it took in adding value to Participant IP was not unacceptably high and that we could confidently establish a research footprint on which an internationally renowned wildlife management cluster could be built.

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

The rights to commercialise the results of pivotal studies that facilitated the submission of two new product applications to the Australian Pesticides and Veterinary Medicines Authority (APVMA) for the use of a new active constituent and baits containing the new active as predacides.

The rights to commercialise the results of pivotal studies that facilitated the launch of a new product HOGHOPPER™ for use in best-current practice feral pig management.

The rights to commercialise the results of pivotal studies that facilitated the submission of a new product application to the APVMA for the use of Econobait™ containing 1080 for use in HOGHOPPER™ for feral pig management.

Impact: Benefits to Australia of IP arrangements

Royalty revenues for the previous 12 months were derived from HOGHOPPER™ and PIGOUT® sales.

- HOGHOPPER™ $10,869 (2011–2012 financial yr)
- PIGOUT® was commercialised using IP developed by the Pest Animal Control CRC (PAC CRC) the predecessor to Invasive Animals CRC and novated to the Invasive Animals CRC. All royalty proceeds from PIGOUT® are distributed to PAC CRC participants.

These two products are the first of eight new products and two approvals for product use in new markets, which will commercialised using Invasive Animals CRC project IP. This royalty stream is forecast to grow to approximately $240,000 p.a. by the time all the products are launched into the market place and integrated into pest animal management programs.

Patents

The Patent application, Cowled, BD, Lapidge, SJ, Humphrys, S, Staples, L (2008) 'Nitrite Salts as Poisons in Baits for Omnivores'. International Patent WO/2008/104028 http://www.wipo.int/patentscope/search/en/WO2008104028 has continued to progress through the examination process in the USA, EU, Canada, China and India.

UTILISATION

End-User Engagement

The Invasive Animals CRC has effectively planned for three phases of end-user engagement that address early and late stages of the product development pipeline and are aimed at fostering technology transfer and greater adoption of CRC innovations.

The first phase of end-user engagement has been achieved via end-user direct involvement in the onground testing of Invasive Animals CRC products that are required for the regulatory approval of new pesticide products.

End-users participating in product testing results in greater product familiarity, acceptance and credibility and importantly establishes local product champions who are more likely to be early adopters and whose testimonials generally influence later adopters such that adoption of innovation dynamics are positively affected.

The second phase of end-user engagement was via a series of promotional events collectively branded as the 'PestSmart Roadshow (see pages 14-15 where the Invasive Animals CRC could promote the new PestSmart Toolkit – a series of factsheets and case-studies that practically explain integrated pest animal management for each species and how new products can be integrated into conventional management practice.

PestSmart Roadshow events were planned and supported by end-user organisations: the Murray-Darling Basin Authority, Meat & Livestock Australia, Australian Wool Innovation, Animal Control Technologies (Australia) Pty Ltd, the Australian Pest Animal Strategy National Coordinator, the National Wild Dog Facilitator and the Invasive Animals CRC Natural Resources Management Facilitator.

This end-user engagement strategy was important because the bulk of the Invasive Animals CRC's innovations require APVMA approval and this assessment process takes anywhere from six to eight months, eg ejector capsule containing 1080, right-up to 18-20 months for products containing new chemical actives, eg baits containing a new poison.

These timeframes mean that many of the products co-developed by the Invasive Animals CRC will only be launched into markets during the Invasive Animals CRC extension (2012–2017). Therefore it was critical that our CRC had a strategy to enhance end-user awareness of the key pest animals in Australia and how new CRC-developed products can best be used in an integrated management program in what was potentially its last six months in order to assist the future promotion of products by our CRC SMEs.

The third phase of end-user engagement was aimed at reducing the barriers and increasing the drivers for adoption. The most effective way of enhancing adoption of new management practices is through community-led initiatives. Initiating and establishing community-led integrated pest management is more successful when local champions have a dedicated resource to call upon for support.

The Invasive Animals CRC and its industry participants acknowledge the value in providing this key resource and have committed to a National Natural Resource Management Facilitator and a National Wild Dog Facilitator. These individuals provide a point of reference for information, integrated pest animal management planning and are armed with the knowledge about the best tools and approaches to achieve desired outcomes at local, regional and landscape scales.

11 COMMUNICATIONS

Communications activities are undertaken in accordance with the Invasive Animals Strategic Communications Plan.

ACHIEVEMENTS

The aim of Communications is to establish the Invasive Animals CRC's credibility as a solutions-oriented, effective and accountable organisation and to increase awareness and knowledge of invasive animal impacts and the strategies being researched and developed to reduce them.

The following summary outlines communications activities and outcomes during 2011–2012 and features some of the year's communication highlights.

The Invasive Animals CRC's messages are based on the four 'P's:

PROMISE

the promise of good science

PEOPLE

synergies among and between participants, end-users and public policy makers — the team is definitely greater than the sum of its parts

PROCESSES

new processes including education, interagency and landscape management

PESTS

reduced pest impacts leading to better farm productivity and more secure wildlife populations and landscapes.

MEDIA COMMUNICATIONS ACHIEVES BROAD COVERAGE

One out of every two media stories on invasive animals across Australia during 2011–12 mentioned the Invasive Animals CRC. Media engagement continued to play a vital role during the year with a broad cross-section of coverage achieved across the Invasive Animals CRC's key research areas. Following is a summary of media publicity achieved during the reporting period.

Story coverage by topics

	Number stories on topic in general from all sources	Total number of IA CRC stories (% of all sources)	Press	Radio	Television
			Number of stories specifically naming Invasive Animals CRC		
Wild dogs / dingoes	369	117 (32%)	55	55	7
Invasive Animals CRC in general eg funding, PestSmart Roadshows, Detection & Prevention, PhD call and feral animals photo competition	195	195 (100%)	186	9	-
Rabbits	129	16 (12%)	11	4	1
Carp and Tilapia	86	20 (23%)	33	16	1
Mice	80	47 (59%)	25	19	3
Foxes	77	20 (26%)	7	13	-
Feral pigs	53	16 (30%)	13	3	-
FeralScan - feral population boom	35	35 (100%)	19	16	-
Feral cats	26	5 (19%)	-	5	-
Total	1052	501 (48%)	349	140	12

MEDIA RELEASES

To help gain media coverage throughout 2011-12, the following media releases were issued by the Invasive Animals CRC.

1. Major national pest animal R&D initiative through to final assessment stage – 1 September 2011
2. Wild dog trapping DVD captures attention of landholders – 16 September 2011
3. Carp are Coming – 22 September 2011
4. Wave of exotic invaders stopped, more to come: new report – 6 October 2011
5. WWW catches cane toads and feral pigs – 13 October 2011
6. The Koala – saving our national icon from wild dogs – 18 October 2011
7. PestSmart Roadshow coming to a town near you – 10 January 2012
8. National website pinpoints pest animals – 21 February 2012
9. Community attitudes guide pest animal research – 18 May 2012

Previous media monitoring by the Invasive Animals CRC since 2005 has shown a steadily-increasing media profile to invasive animals issues:

Media monitoring statistics by year (number of invasive animals stories)

2007–08	2008–09	2009–10	2010–11	2011–12
274	742	885	1,507	501

Note re table above:

1. *Media monitoring 2007–08 over three quarter-periods.*
2. *Media monitoring 2008–09 over four quarter-periods.*
3. *Media monitoring 2009–10 over two quarter-periods.*
4. *Media monitoring 2010–11 over two quarter-periods.*
5. *Media monitoring 2011–12 only counts specific Invasive Animals CRC mentions over an 11-month period out of total 1,052 stories on topics of invasive animals.*

Invasive Animals CRC Online 2011–12

The Invasive Animals CRC and the PestSmart brand continued to build a strong online presence during 2011–12. The pest animal portal www.feral.org.au continues to be popular with an average 10,000 visitors per month. Both visitor traffic and pages viewed have increased 10-15% on the previous year. The www.invasiveanimals.com website has also enjoyed an increase in traffic over the reporting period with visitor activity and pages viewed up 45% and 58% respectively. This is the corporate website of the Invasive Animals CRC and averages around 3,800 visitors per month over the 2011–12 year.

The PestSmart YouTube channel (www.youtube.com/PestSmart) was established in March 2012 and contains all the video clips from the two PestSmart DVDs (Introduction to using foot hold traps for the capture of wild dogs and foxes and DVD Guide to practical pest animal management). Other video clips on feral pigs and cats produced as part of the PestSmart toolkit can also be found on the YouTube channel. The channel received more than 9,400 views in its first four months of operation to the end of the reporting period.

Social media has also become a valuable way to communicate with, engage and inform our digital audience in 2011–12. Followers on our Facebook page (www.facebook.com/PestSmart) increased 423% from 30 to 127 during the reporting period and come from 20 different countries.

A twitter account (https://twitter.com/PestSmartCRC) was also created in March 2012 and had 166 followers by the end of June. Engagement with the audience across both platforms has been steadily increasing and has been valuable in promoting PestSmart Roadshow events, publications and activities of the Invasive Animals CRC.

One out of every two media stories on invasive animals across Australia during 2011–12 mentioned the Invasive Animals CRC.

12 FINANCIAL PERFORMANCE

The Invasive Animals CRC has completed its original seven-year funding term comfortably exceeding the cash staff full-time Equivalent (FTE) and non-staff in-kind contributions that were required under the Commonwealth Agreement. Overall, 319.30 FTE were dedicated to the activities of the CRC which exceeded the target of 296.50 FTE by a surplus of 22.8 FTE. In total, $19,972,000 of non-staff in-kind contributions were also received, well exceeding the target of $14,435,000 by a surplus of $5,537,000.

The target total cash receipts for the CRC was set at $45,867,000 (inclusive of the Commonwealth Grant). However, over the seven-year period, this was considerably bolstered with more than $51 million of cash invested in the pursuit of our goals and objectives. Participants, including Australian Wool Innovation, Meat & Livestock Australia and the Murray-Darling Basin Authority, made generous additional cash contributions to the CRC to enhance National PestSmart Roadshow activities during 2011–12.

At the end of June 2012, the CRC maintained an accumulated equity position of $839,960. A portion of this has been set aside to cover some final financial commitments towards research projects. DIISRTE have formally approved that residual funds may be retained by the CRC and applied to:

1. The promotion and roll-out of products which are due to be available in the market place over the next five years. These products include our sodium nitrite-based feral pig bait (HOGGONE®, PAPP-based wild dog and fox baits (DOGABATE® and FOXECUTE®) and our carbon monoxide-based rabbit warren fumigator.

2. Enhancing our rabbit research program by allocating additional funds to a rollout monitoring and evaluation program and to appoint an addition PhD student to deepen understanding of rabbit resistance to RHDV.

The complete Audited Financial Statements and Tables of Participant Contributions are available for download from www.invasiveanimals.com

These statements include other Commonwealth Grants to the Invasive Animals CRC (currently the RHD Boost Project) which cannot be included in reporting under the Contract Agreement with DIISRTE.

13 ADDITIONAL ACTIVITIES & GRANTS

The Invasive Animals CRC is involved in a significant activity outside those specified in the Commonwealth Agreement. This activity is funded through the Commonwealth Governments Caring for Our Country Initiative.

RHD BOOST: IMPORT AND EVALUATE NEW RHD VIRUS STRAINS TO STRENGTHEN RABBIT BIOCONTROL

The objective of the RHD Boost project is to identify new RHDV strains with high lethality to rabbits immune to endemic Australian Rabbit Calicivirus (RCV-A1) and rabbits resistant to infection with Czech 351 derived RHDV strains. Research is being conducted by CSIRO and the NSW Department of Primary Industries. Funding is being provided by the Commonwealth, Australian Wool Innovation, Meat & Livestock Australia and the Foundation for Rabbit Free Australia.

GRANT SOURCES

The Invasive Animals CRC did not receive any new competitive grants during the reporting period.

14 GLOSSARY

adventitious	coming from another source and not inherent or innate
annulus	Latin for 'ring — in fish research refers to annual rings that form in fish scales or bone sections (otoliths)
antibodies	an immunoglobulin, a specialised immune protein produced because of the introduction of an antigen into the body and which combines with the very antigen that triggered its production either destroying the antigen directly or facilitating the white blood cells to destroy it
avirulent	not virulent — refers to an infectious agent that does not produce pathological (disease manifestation) 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
canid	members of the family Canidae (carnivorous mammals) which includes the foxes, wolves, dogs, jackals and coyotes
calicivirus	a genus in the family Caliciviridae, a family of RNA viruses. They possess a characteristic six-pointed starlike shape whose surfaces have cup-shaped (chalice) indentions. Caliciviruses include the hepatitis E virus a form of swine virus, feline calicivirus and RHDV. We refer to the latter.
CIP	Centre Intellectual Property
cohort (student)	an organisational group defined to facilitate the analysis of student progression comprising programmes commencing in a particular academic year
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
EPBC	Environmental Protection Biodiversity Conservation
eutherian	mammals having a placenta
exotic	introduced — not native to Australia
felid	members of the family Felidae (carnivorous mammals) which includes the big cats and domesticated cat
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
IA	short form of 'Invasive Animals'
hybrid	something of mixed origin or composition. (Genetics) the offspring of genetically dissimilar parents or stock especially the offspring produced by breeding plants or animals of different species or races
judas	captive animal used to attract others or which is fitted with a transmitter and release leading researchers or hunters to a herd
KHV	koi herpes virus
KTP	Key Threatening Process
macropod	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
mesopredator	a medium-sized predator which often increases in abundance when larger predators are eliminated; eg. raccoons, skunks, snakes, cats, foxes.
monoclonal	of forming or derived from a sincle clone

Wild dogs cost the livestock industries, particularly the lamb industry, almost $50 million* in lost agricultural productivity each year.

Wild Dog by Lee Allen.

myxomatosis	a virus specific to rabbits causes by the myxoma virus otolith structure in the inner ear (see annulus above)
PAPP	para-aminopropiophenone
pathogenic	capable of causing originating or producing disease
pathological	of or relating to causing disease
PCR	polymerase chain reaction
pheromone	chemical that triggers an innate behavioural response in another member of the same species
RHD	rabbit haemorrhagic disease (see caliciviruses)
RHDV	rabbit haemorrhagic disease Virus
RSPCA	Royal Society for the Prevention of Cruelty to Animals
scat	faeces, droppings
shelf-stable	(non formal) a product that has been altered so it can be safely stored and sold in sealed containers at room temperature while still having a useful shelf life (quality for a suitable time)
SMEs	small to medium enterprises
spawning	production or depositing of large quantities of eggs in water
specificity	intended for applying to or acting on a particular thing (species)
sylvatic	referring to diseases or pathogens affecting only wild animals terrestrial land based
threatened	at risk of becoming endangered (plant or animal)
toxin	poisonous substance produced by living cells or organisms
virulence	a. extremely infectious malignant or poisonous. Used of a disease or toxin.
	b. capable of causing disease by breaking down protective mechanisms of the host. Used of a pathogen.

*Gong, W, Sinden, J, Braysher, M and Jones, R (2009) The economic impacts of vertebrate pests in Australia. Invasive Animals Cooperative Research Centre, Canberra.

15 APPENDICES

ANNUAL REPORT

2011-12

APPENDIX A
Milestone Report

Progress against revised Commonwealth Agreement Schedule 1 milestones due in FY 2011–12

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
1 Outcome	**A benefit of $29 million p.a. by reducing the impacts of fox and wild dogs by 10%.**				
1.1 Output	New knowledge on fox and wild dog biology, ecology, impact, management and the ecological interactions of control methods.	2011	Yes	The Uptake demonstration sites – 10.U.1 (WA), 10.U.3 (Tas) and 10.U.4 (Vic) -that involved foxes and wild dogs have all been completed successfully. Key new knowledge from the sites is insights into the interplay between foxes and feral cats in WA, the indicative distribution and minimum abundance of foxes in Tasmania, and the ecology and control options for foxes and cats in the tall forests of Victoria.	
1.1.2	Ecological experiments and large-scale demonstration projects completed.	30 June 2011	Yes	All large-scale Uptake Program demonstration site projects are complete, with many of the project final reports received. Three of four WA 'Feral Predator Control' sub-project draft final reports have been received and both 'Detecting foxes in Tasmania' and 'Southern Ark' project final reports are in preparation. Draft final project reports for Terrestrial Program projects 'Facilitating Strategic Management of Wild Dogs Throughout Australia' and 'Towards Best Practice for Wild Canid and Felid Management' are in preparation.	
1.2 Output	New humane fox and wild dog toxin and antidote.	2011	Yes	The Invasive Animals CRC and Animal Control Technologies (Australia) Pty Ltd (ACTA) jointly submitted the PAPP new active application and the FOXECUTE® PAPP bait registration application to the Australian Pesticides and Veterinary Medicines Authority (APVMA) in March 2012. The follow-up DOGABATE® Overview, Manufacturing and Chemistry, Toxicology, Environment and Efficacy Sections of the APVMA submission were submitted by ACTA on 18 June 2012.	
1.2.4	Laboratory experiments and pen trials completed for new antidote to methaemglobin-inducers.	31 December 2010	Yes/In progress	Minor use permit that allows an intravenously administered sterile aqueous methylene blue product and recommended treatment regime to be promoted to vets was submitted in June 2012. The capacity of a non-sterile methylene blue gel administered via buccal cavity to safely elevate methylene blue levels in the general circulation of healthy dogs was assessed in a good clinical practice study in June 2012.	Efficacy of the non-sterile methylene blue gel administered via buccal cavity route as an antidote to accidental poisoning by products containing para-aminopropiophenone or sodium nitrite will be completed early in the extension Invasive Animals CRC.
1.2.5	National APVMA registration package submitted for new toxin for foxes.	30 September 2010	Yes	FOXECUTE® registration package submitted to the APVMA in March, 2012. Final field trial reports received late 2011 enabling application to be submitted.	
1.2.6	National APVMA registration package submitted for new toxin for wild dogs.	30 September 2010	Yes	DOGABATE® registration package submitted to the APVMA in June, 2012. Final field trial reports received late 2011 enabling application to be submitted.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
1.2.7	New product registration applications and new registration applications of existing toxins submitted to the APVMA. One new chemical toxicant registration application submitted. One synergist to 1080 tested and assessed for registration. If the new chemical toxicant is successfully registered, the market for the synergist may be reduced, as the new active will reduce demand for products with the1080 toxin.	31 October 2010	Yes	Full Toxicity and Chemistry and Manufacturing data packages for the assessment of DOGABATE® and FOXECUTE® now with the APVMA.	
1.2.8	National APVMA registration package submitted for [antidote for] working and pet dogs.	31 December 2010	Yes	Additional Chemistry and Manufacturing data was supplied by the manufacturer of the sterile, aqueous methylene blue product to the regulatory consultant for completion of the minor use permit registration application in May, 2012. The minor use permit registration application was submitted to the APVMA in June, 2012.	
1.3 Output	New approved fox and wild dog lures and new toxin delivery methods.	2011	Yes	Funds were secured from Australian Wool Innovation to develop, test and register lethal trap devices. Currently the project is still in the prototype field testing stage. A minor use permit application for the use of ejectors and capsules containing sodium cyanide powder prepared by the Queensland Department of Agriculture, Fisheries and Forestry approximately nine years ago was used as the basis for a national registration application.	Lethal trap devices and mechanical ejectors will be delivered through the extension Invasive Animals CRC.
1.3.3 (b)	National APVMA registration package submitted (if necessary) for delivery systems and multiple canid lure devices that will increase canid detection and bait uptake.	30 June 2011	Yes	The Queensland Department of Agriculture, Fisheries and Forestry minor permit application prepared some nine years ago was re-drafted and added to in order to satisfy current APVMA registration requirements. This process necessitated incorporating significantly more information than was present in the original application from manufacturers of the cyanide technical active and polymer/wax capsules and detailing the training requirements used to accredit licensed operators prior to submitting the application to the APVMA. These deficiencies have been addressed and the application was submitted to the APVMA in September 2012.	
1.4 Output	Fox and wild dog management packages that include new and existing toxins, application strategies and end-user training.	2012	In Progress	Fox and wild dog PestSmart Toolkit content completed and live on Feral.org.au and promoted through the national PestSmart Roadshow, CMA/NRM forums, agricultural field days and direct mail upon request. FOXECUTE®, DOGABATE® and antidote are currently being assessed by the APVMA.The lethal trap project is well underway and three non-toxic prototypes were tested in the field during the last year. Prototype design improvements were required after each field trial to overcome faults that were observed.	Lethal trap device testing will continue in the extension Invasive Animals CRC. A registration package will be completed and submitted to the APVMA once in-field efficacy and OH&S studies of toxic prototypes has been completed.
1.4.2 (c)	Education and training package linked to demonstration sites developed for end-users.	30 June 2011	Yes	All PestSmart Toolkit publications and additional information from demonstration sites being written up as scientific publications on foxes and wild dogs were completed / submitted by end of June 2012. Due to overwhelming demand, a second print (5,000 copies – total produced now 9,500) of the canid trapping instructional DVD has been done and distributed across Australia.	
1.4.4	Education and training packages for new fox and wild dog strategies completed.	30 June 2011	Yes	All PestSmart Toolkit publications regarding foxes and wild dogs were completed by 30 June 2012.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
1.4.5	Final management and education/ training packages released and marketed nationally.	30 December 2011	Yes	All PestSmart Toolkit publications regarding foxes and wild dogs were completed by 30 June 2012. Final management and education/training packages have been promoted nationally through national PestSmart Roadshow, CMA/NRM forums, agricultural field days and direct mail upon request.	
1.4.6 (c)	National recommendations for improved fox and wild dog control practices produced.	30 June 2011	Yes	COPs and SOPs are completed and will be placed on www.feral.org.au website in the latter half of 2012. 'Glovebox guide for Managing wild dogs' and 'Best Practice' wild dog and fox PestSmart Toolkit factsheets and case studies completed and published. Working plan to manage wild dogs updated and published. 'Guardian Dogs: Best Practice manual' published.	
2 Outcome	**A benefit of $16 million p.a. by reducing feral pig damage by 15%.**				
2.1 Output	New knowledge on feral pig ecology and impacts.	2011	Yes	Three projects have gathered new knowledge on feral pigs - 10.U.2 on Kangaroo Island, 10.U.6 in the Daintree NP and 2.U.1 feral pig control tools. Advances from all three sites have related to an understanding of the molecular ecology of feral pigs, their environmental and social impacts in various settings, the socio-economic setting in which they are managed and refinement of the control options available in different habitats.	
2.1.3	Large-scale ecological experiments and demonstration projects completed.	30 June 2011	Yes	The two Uptake Program demonstration sites that involved feral pig research – 'Repel the Invaders' on Kangaroo Island, SA and the 'Controlling feral pigs in tropical rainforest', Queensland have been completed. All new Invasive Animals CRC feral pig management innovations were tested on Kangaroo Island and a feral pig management plan was produced. The Wet Tropics demonstration site has produced three PhDs, one MSc and an Honours student, with 20+ journal articles expected (eight published or in press).	
2.3 Output	HOGGONE® – Second generation feral pig toxin with improved humaneness profile.	2012	Yes	HOGGONE® is in the final stages of research and development. Registration has been delayed due to formulation stability issues, which will hopefully shortly be overcome. The product should be in for registration by the end of 2012 and at this stage will be used in Texas, USA during 2013 under an emergency use permit.	
2.3.4	National registration package submitted to APVMA for HOGGONE® feral pig baits.	30 June 2011	Yes/ In progress	The submission of the national registration package has been delayed until late 2012, hopefully leading to national registration by 2014.	
2.3.5	Adoption of new baits through demonstration sites and publicity.	30 June 2012	Yes	HOGGONE® trialled on Kangaroo Island 'Repel the Invaders' demonstration site and adoption will be accelerated once registration accepted.	
2.5 Output	Feral pig baits with capacity to carry contraceptives and/or vaccines (in collaboration with USA and UK scientists).	2012	No	PIGOUT® bait matrix and modifications thereof were tested for compatibility with currently available contraceptive vaccine formulations.	Bait matrices tested reduced the viability of contraceptive vaccine formulations making the vaccines ineffective.
2.5.2	Feral pig contraceptive and/or vaccine baits promoted for regions/countries that do not allow broadscale lethal control, if PIGOUT® proves suitable.	30 June 2011	No	USDA has made a multi-million dollar in-kind commitment to registering HOGGONE® feral pig bait and the HogHopper™ in the USA in the extended IACRC. This is due to USDA abandoning contraceptive/vaccine approach in favour of lethal bait. This is a better outcome for the Invasive Animals CRC and its commercial partner, ACTA, than the output originally proposed.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
2.5.3	International use of PIGOUT® / HOGGONE® re-assessed in relation to fulfilling market potential for an Australian SME.	30 June 2012	Yes	USA, New Zealand and Israel are all currently interested in HOGGONE®. Active pursuit of other potential international markets is continuing.	
2.6 Output	Feral pig management packages that include new and existing toxins, application strategies and end-user training.	2012	Yes	The feral pig PestSmart Toolkit content has been completed and is predominantly live on www.feral.org.au and was promoted through the national PestSmart Roadshow, CMA/NRM forums, agricultural field days and direct mail upon request. Feral pig products, PIGOUT® and HogHopper™, are commercially available and have seen steady growth in sales in recent times.	
2.6.3	Education and training packages for new feral pig strategies completed.	31 December 2011	Yes	The feral pig PestSmart Toolkit has been completed and promoted through the national PestSmart Roadshow.	
2.6.4	Education and management packages released and marketed nationally and internationally.	30 January 2012	Yes	Feral pig education and management packages have been established and promoted nationally through national PestSmart Roadshow, national and international conferences, CMA/NRM forums, agricultural field days and direct mail upon request. The package will continue to evolve over the coming years as more fact sheets and products come on-line.	
2.6.5 (b)	National recommendation for improved practices for feral pig control drafted and finalised.	30 June 2010	Yes	National recommendations – in the form of PestSmart Toolkit documents – have been published.	
2.6.5 (c)	National recommendations for improved feral pig control practices produced.	31 December 2011	Yes	National recommendations – in the form of PestSmart Toolkit documents – have been published and promoted through national PestSmart Roadshows in early 2012.	
3 Outcome	**A benefit of $7 million p.a. by reducing rodent damage by 20%.**				
3.3 Output	New and improved rodent control methods.	2012	Yes	New rodenticide block product application submitted to the APVMA. Currently approved rodenticide product use extended by the APVMA to include new horticultural markets.	
3.3.4	Pen trials to test novel baits (subject to any necessary approval from State and Federal authorities) commenced.	31 July 2011	Yes	Original Terrestrial Program project 'Control of Rodent Infestations' completed and data used to extend product registration of zinc phosphide within 2nd phase project 'Control of Rodent Infestations and Commercialisation of new rodenticides'.	
3.3.5	National recommendations for improved practices or alternatives to current methods of rodent control completed.	30 June 2012	Yes	COP and SOP completed and have been sent to VPC for comment and endorsement where appropriate. COP and SOP will be placed on www.feral.org.au website in the latter half of 2012.	
3.5 Output	Improved and/or new rodent control options to protect produce in agricultural areas.	2012	Yes	RODEMISE® Bromadiolone bait block registered RODEMISE® Difenacoum application has been submitted to the APVMA and has progressed to full assessment. MOUSEOFF® ZP Hort. and RATOFF® ZP Hort. use extension applications required additional data but will be submitted to the APVMA by the end of October 2012.	
3.5.3	Applications to the APVMA submitted for the commercial use of MOUSEOFF-ZP and RATTOFF to extend their use and current label claims.	30 June 2010	Yes	RODEMISE® Bromadiolone bait block registered. RODEMISE® Difenacoum application has been submitted to the APVMA and has progressed to full assessment. MOUSEOFF® ZP Hort. and RATOFF® ZP Hort. use extension applications required additional data but will be submitted to the APVMA by the end of October 2012.	
3.5.5	A business plan showing economic viability and strategic uses for new and improved rodent control methods.	30 June 2011	Yes	Market research that details the global rodenticide market segments, products and companies was used to populate a business plan.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
3.5.6	National recommendations for improved practices or alternatives to current methods of rodent control in agricultural areas produced.	30 June 2012	Yes	Uptake project 'Extending approved use patterns of zinc phosphide products for in crop mouse control' new recommendations for improved practices were communicated to grain producers via the GRDC.	
4 Outcome	**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.**				
4.1 Output	New knowledge on carp and tilapia biology and/or ecological interactions and control options.	2012	Yes	Achieved through the combined research of Freshwater Program carp and tilapia projects, as well as the Carp population genetics PhD and the Environmental attractants PhD.	
4.1.5	Information on carp population dynamics and vulnerability consolidated.	30 June 2010	Yes	In progress by December 2012, Synthesis report Gherig, S, Smith, B and Thwaites, L (2012) 'Exploitable' Biological Vulnerabilities of Common Carp. Invasive Animals CRC PestSmart Toolkit Publication, Invasive Animals Cooperative Research Centre, Canberra, Australia.	
4.2 Output	Knowledge of the potential of daughterless platform technology.	2012	Yes	A successful female lethal construct has been developed and trialed through four generations of a laboratory fish species and verified as effective in carp. Predictive models were updated to assess alternative management options and the framework for a robust risk analysis framework established.	
4.2.3	Experiments completed to examine whether daughterless technology works to drive a model fish population to extinction.	31 December 2010	Yes	Experiments undertaken using daughterless Zebrafish, but time taken to show effect over multiple generations will mean results not available by June 2012.	
4.2.5	Analysis of the international, national and State policy and regulatory frameworks regarding the use of control technologies against invasive fish undertaken to guide and enable the implementation of various control options, particularly daughterless technology and CyHV-3.	31 December 2010	Yes	Project was undertaken within the auspices of the NSW Fisheries project 'Identifying and implementing targeted carp control options for the lower Lachlan River catchment'. Information from the daughterless and KHV projects was integrated into this project, which outlines all issues for the development and release of a daughterless carp construct and KHV.	
4.3 Output	Knowledge on the potential of Cyprinid herpes virus 3 (CyHV-3) as a biocontrol agent for carp in Australia.	2012	Yes	The Fish Diseases Laboratory at the high-security CSIRO Australian Animal Health Laboratory examined the potential of KHV as a biological control agent for carp in Australia, undertaking a rigorous assessment of KHV. The project included screening of wild Australian carp for cyprinid herpes viruses and has demonstrated that only carp would be affected.	
4.3.2	Complete carp susceptibility trials to CyHV-3 to determine the most vulnerable carp stages.	31 December 2010	Yes	All stages except very small fish tested and known to be susceptible, particularly smaller carp.	
4.3.3	Complete screening of a range of non-target native species for susceptibility to CyHV-3.	30 June 2012	Yes	Molecular and histopathological data demonstrate that Murray cod, silver perch, golden perch, a galaxiid and rainbow trout are not susceptible to infection with KHV.	
4.4 Output	Improved technologies and cost-effective responses to management of new freshwater fish invasions and reduced rates of spread of existing pests.	2012	Yes	Achieved through the combined progress of Freshwater and Detection and Prevention Program projects. Results summarised in PestSmart Toolkit publication: Gherig, S, Smith, B and Thwaites, L (2012) 'Exploitable' Biological Vulnerabilities of Common Carp and other publications in draft form, pending editing and publication in late 2012.	
4.4.2 (b)	Risk and hazard analyses for new pest fish and significant range extensions of existing pests completed.	30 June 2012	Yes	Completed through the Detection and Prevention Program project 'Mapping invasive animals in Australia'.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
4.4.4	First generation tilapia population simulation model completed and released.	30 June 2012	Yes	Since mid–2007, CarpSim 2.0 software has been extensively modified to improve its utility and its capacity to be used for other fish species, including tilapia. The CarpSim model now allows for the simulation of a number of management interventions, including fishing, poisoning, recruitment sabotage, predation (on juveniles and adults) and removal of females through the use of 'daughterless technology'. Simultaneous use of some of these management interventions can also be modelled. Results of tilapia population modelling completed and published in PestSmart tilapia report 2012.	
4.4.8	Develop a range of techniques incorporating attractants and repellents for use in an integrated pest fish management program.	30 June 2012	Yes	All projects have contributed to the knowledge of available options for an integrated pest fish management program. Information extended to managers through focused extension – Pest fish management forums held for tilapia in May 2012 and carp in June 2012.	
4.5 Output	Adaptive management framework for assessing national control options for pest fish.	2012	Yes	Options explored through Freshwater Program demonstration site projects 'Carp control in the Logan-Albert Catchment', 'River Revival – Lachlan River Carp Cleanup' and 'Integrated Carp Eradication Demonstration Site – Lakes Sorell and Crescent, Tasmania' as well as the Predator presence PhD and the 'Decision-support tool for management of freshwater fish incursions' project. Information extended via pest fish management forums.	
4.5.7	Produce practical manual for carp control using sustained fishdown methods.	30 June 2011	Yes	PestSmart toolkit publication entitled 'A manual of carp control methodologies based on the Tasmanian model' was launched at the PestSmart carp management forum in June 2012. Thwaites, LA (2011) Proof of Concept of a Novel Wetland Carp Harvesting Set-up at Lake Bonney, South Australia. A Summary Report for the Invasive Animals Cooperative Research Centre and the South Australian Murray-Darling Basin Natural Resources Management Board. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, 38 pp.	
4.5.8	Produce practical manual for carp control using barrier traps.	30 June 2011	Yes	Thwaites, L.A. (2011) Proof of Concept of a Novel Wetland Carp Harvesting Set-up at Lake Bonney, South Australia. A Summary Report for the Invasive Animals Cooperative Research Centre and the South Australian Murray-Darling Basin Natural Resources Management Board. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, 38 pp.	
4.7 Output	Integrated pest fish management package.	2012	Yes	PestSmart pest fish toolkits summarise the findings of all of the research projects and provide advice on use of techniques in an integrated manner, complimented by the PestSmart fish forums for tilapia and carp. Invasive Animals CRC PestSmart toolkit publication entitled 'A Manual of Carp Control Methodologies Based on the Tasmanian Model'.	
4.7.2	Risk analyses, community consultation and management strategy evaluation of control options selected from scoping studies for detailed evaluation and development completed.	30 June 2011	Yes	Part of the reporting from the Lachlan demonstration site project included a preliminary application to the APVMA for assessment of a trial protocol for the release of KHV.	
4.7.4 (g)	Annual consultations with VPC fish working group, Australian Fisheries Management Forum, and MDBA pest fish working group, held to facilitate development of the policy and legislative frameworks required to make management package operational.	30 June 2012	Yes and ongoing	Annual consultations have been held to update stakeholders on the latest developments in carp management. In the final year of the program, in addition to the PestSmart Roadshows, specific carp and tilapia forums collaboratively hosted by Invasive Animals CRC and MDBA were held for fisheries managers.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
4.7.5 (c)	Input into the MDBA Basin Alien Fish Plan.	30 June 2012	Yes	In addition to the consultation mentioned above (milestone 4.7.4 (g)) the Freshwater Program Leader has had input into, and provided review comments on a Draft Basin Alien Fish Plan for the MDBA.	
4.7.6	Pest fish education and management package completed.	1 January 2012	Yes	PestSmart pest fish toolkit completed and online.	
4.7.8 (b)	National recommendations on the key elements of a national policy and legislative framework to enable effective management of aquatic pest animals, and suggested further development and implementation pathway options for daughterless technology and Cyprinid herpes virus 3 (CyHV3) produced.	1 January 2012	Yes	Reporting from the Lachlan demonstration site project also includes a review of existing national and state policy frameworks for the use of biological control options for carp and a pathway to adoption for these tools.	
6 Outcome	**Reduced impact of feral cats over five million hectares.**				
6.1 Output	New knowledge on feral cat ecology, and ecological interactions of control methods.	2012	Yes	A great deal on new knowledge has been developed on feral cats throughout the Invasive Animals CRC, whether on effectively controlling cats in the rangelands or seeing their devastating effects on woylies post fox baiting in WA (10.U.1), to understanding their movements, genetics and how best to get population estimates on Kangaroo Island and the tall forests in Victoria.	
6.1.4	Continental survey of cat genetic variation completed.	31 December 2011	In progress	Data collected and preliminary data analysis has been completed. Full analysis is in progress. Collaboration through the University of Canberra postdoctoral fellowship on the spatial analysis of genetic data.	
6.2 Output	Tools and strategies for reducing the impact of feral cats.	2012	Yes	Existing control methods (Eradicat and Curiosity baits) have been tested in multiple environments at the 10.U.1 (WA), 10.U.2 (SA- Kangaroo Island) and 10.U.4 (Southern Ark) demonstration sites. New control methods (spray apparatus) have been design to help improve feral cat control in Australia.	
6.2.2	Complementary feral cat products investigated and developed.	30 June 2012	Yes	Complementary feral cat control products such as lures and cat tunnels were tested on Kangaroo Island, SA in 2011. These included Connovation and Ecological Horizons cat tunnels and novel lures. Last post cat tunnels are currently undergoing investigation.	
6.4 Output	Education and management package.	2012	Yes	The feral cat ecology and management education package is now well advanced, with numerous fact sheets and videos now in the PestSmart toolkit and on the PestSmart YouTube channel.	
6.4.2 (b)	Education and training package linked to demonstration sites launched for end-users.	30 June 2011	Yes	General feral cats PestSmart Toolkit factsheet completed and Feral.org.au and promoted through the national PestSmart Roadshow, CMA/NRM forums, agricultural field days and direct mail upon request. WA 'feral predator control' project, 'Repel the Invaders: a management program for deer, pigs, goats and cats on Kangaroo Island' project and 'Southern Ark', Vic, project case studies and additional information from demonstration sites written up as scientific publications.	''
6.4.3	National recommendations for improved cat control practices produced.	31 January 2012	Yes	General feral cat PestSmart Toolkit factsheets have been completed and are live on www.feral.org.au and promoted through the national PestSmart Roadshow, CMA/NRM forums, agricultural field days and direct mail upon request. The Denny and Dickman (2010) report published by the Invasive Animals CRC is an excellent addition resource that reviews feral cat impacts and management in Australia and provides recommendations for the future.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
7 Outcome	**Increased agricultural profitability through improved integration of existing biological, conventional and newly-developed control options for rabbits.**				
7.4 Output	Freeze-dried Rabbit Haemorrhagic Disease bait delivered product made available to end users.	2011	In progress	The registration application for this new product that is "closely similar" to the currently approved RHDV suspension was submitted to the APVMA in September 2012. Once approval is granted (six-month assessment) the new freeze-dried product will be available for end-users to purchase from the NSW Department of Primary Industries.	This new product will be made available and promoted through the Invasive Animals CRC extension (2012–17).
7.4.2	National APVMA registration package submitted.	30 December 2010	Yes	The registration application for a freeze-dried RHDV product assessment was submitted to the APVMA in June, 2012.	
7.5 Output	Rabbit warren pressure CO fumigator.	2012	In progress	Continued engineering challenges have prevented the finalisation of working prototypes for field trials.	This project will continue into the extension Invasive Animals CRC.
7.5.1	Operational performance of fumigator determined under field simulated conditions.	30 June 2011	In progress	Continued engineering challenges have prevented the finalisation of working prototypes for field trials.	This project will continue into the extension Invasive Animals CRC.
7.5.2	National APVMA registration package submitted.	31 December 2011	In progress	This milestone will be achieved as soon as field trials have been completed (within the CRC extension).	This project will continue into the extension Invasive Animals CRC.
7.6 Output	Optimal strategy for bait delivered RHD Virus.	2012	Yes	Dose rates that optimise the efficacy of reconstituted freeze-dried RHDV delivered on carrot and oat bait were determined in pen studies.	
7.6.2	Results of field trials analysed and built into an optimal RHD bait delivery strategy.	30 June 2011	Yes	Optimal RHDV bait delivery was reviewed by a panel of experts and recommendations were incorporated into the proposed product label instructions that are included in the registration application.	
7.7 Output	Optimal strategies for conventional rabbit control.	2012	Yes	Optimal strategies updated through the outputs of a number of collaborative projects. Information from results disseminated widely across Australia. Strategies will be further refined as new products are approved by the AVPMA in the future.	This project will continue into the extension Invasive Animals CRC.
7.7.1	Optimal use of conventional rabbit control techniques determined through field evaluations and demonstration sites, and newly-developed techniques incorporated into an overall rabbit management strategy.	30 June 2012	Yes	Terrestrial Program project 'Biodiversity Impact of Rabbits' has determined specific rabbit density-damage relationships in relation to native vegetation and subsequently resulted in a rabbit management extension guide for landholders published in 2008. Continued engineering challenges have prevented the finalisation of working prototypes of the carbon monoxide pressure fumigator for field trials.	This project will continue into the extension Invasive Animals CRC.
7.8 Output	Strategies for optimal use of Rabbit Haemorrhagic Disease (RHD) and conventional controls.	2012	Yes	Optimal strategies updated through the outputs of a number of collaborative projects. Information from results disseminated widely across Australia. Strategies will be further refined as new products are approved by the AVPMA in the future.	
7.8.3	Optimal control strategies incorporating natural outbreaks of Rabbit Haemorrhagic Disease (RHD) and bait delivery of RHD delivered to end users.	30 June 2011	Yes	All PestSmart Toolkit publications regarding rabbits completed. Publications completed to date are live on Feral.org.au and promoted through the national PestSmart Roadshow, CMA/NRM forums, agricultural field days and direct mail upon request.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
8 Outcome	**Deliver improved and humane approaches to reduce the production and biodiversity impacts of expanding or other overabundant and widespread pest species.**		**Yes**	**Achieved through the development of Codes of Practice (COPs) and Standard Operating Procedures (SOPs) in pest animal management, stakeholder analysis and the roll out of the Invasive Animals CRC PestSmart Toolkits and National PestSmart Roadshow events.**	
8.1 Output	Leadership role in implementing welfare-based invasive animal control practices demonstrated.	2012	Yes	Review, update and development of new Codes of Practice and Standard Operating Procedures completed. More than 70 Codes of Practice and Standard Operating Procedures now in existence which will be considered by the National Vertebrate Pests Committee and adopted as required. All COPs and SOPs to be made available on www.feral.org.au in the latter half of 2012.	
8.1.1	Leadership role in the development of aspects of the Australian Animal Welfare Strategy (Animals in the Wild theme) adopted.	30 June 2012	Yes	Review, update and development of new Codes of Practice and Standard Operating Procedures completed. More than 70 Codes of Practice and Standard Operating Procedures now in existence which will be considered by the National Vertebrate Pests Committee and adopted as required. All COPs and SOPs to be made available on www.feral.org.au in the latter half of 2012.	
8.1.4	New welfare based control strategies developed.	31 December 2011	Yes	Review, update and development of new Codes of Practice and Standard Operating Procedures completed, in conjunction with the future registration of HOGGONE®, freeze-dried RHDV, FOXECUTE®, DOGABATE® and Blue Healer®. PIGOUT® and the HogHopper™ delivery vehicle have also been developed.	
8.1.5	National acceptance of standard operating procedures.	30 November 2011	Yes	More than 70 Codes of Practice and Standard Operating Procedures now in existence which will be considered by the National Vertebrate Pests Committee and adopted as required.	
Output 8.4	Management packages for improved herbivore management.	2012	Yes	Combination of PestSmart toolkit and FeralScan development (rabbit, feral deer and other species)	
8.4.7 (g)	National workshops held to describe pest problems, share knowledge, recommend gaps and agree on coordinated actions.	30 June 2012	Yes	National PestSmart Roadshows were held during the first half of 2012 across 20 locations with more than 1,500 attendees.	
9 Outcome	**Reduced risks of economic losses, environmental damage and social stress by forecasting and responding to potential, new or emerging invasive animal problems.**				
9.1 Output	The development of information systems that improve coordination and evaluation of effort on a national, regional and local level.	2012	Yes	Delivered through the National Mapping and FeralScan projects: National Mapping project involving state agency staff and FeralScan being the web-based community reporting, mapping, education and extension tool. Mapping and monitoring tools developed specifically for NRM regional groups. Decision support resources developed for managers and decision makers.	
9.1.5 (c)	Data-capture tools for occurrence, distribution and abundance of invasive animals developed, tested and implemented, and web-based information systems for invasive species evaluated.	30 June 2012	Yes	Delivered through the National Mapping and FeralScan projects: National Mapping project involving state agency staff and FeralScan being the web-based community reporting, mapping, education and extension tool. Mapping and monitoring tools developed specifically for NRM regional groups. Decision support resources developed for managers and decision makers.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
9.3 Output	Cost-effective early warning detection and response options to restrict introductions or the range of invasive animals.	2011		Key elements of the response to the fox incursion in Tasmania that have improved or held back the program have been identified and a toolbox of approaches for future incursions in other locations has been developed. Technical support was also given to the Tasmanian fox eradication project - more than 5,000 scats have been screened for DNA.	
9.3.2 (e)	A national pest animal genotyping facility developed and reviewed annually.	30 June 2012	Yes	Ongoing support was given to the Tasmanian fox eradication project through technical advice, DNA analysis, project direction and sample storage.	
9.3.4	A 'Toolbox' of early detection and rapid response options for new or spreading pest invasions developed and delivered to national Vertebrate Pest Committee and State agencies.	31 May 2012	Yes	Delivered through the 'Early detection toolbox – Tasmania case study.	
9.4 Output	Delivery of improved technical and strategic packages for managing invasive species that are hosts for endemic/ exotic pathogens that threaten humans, livestock or native fauna.	2012	Yes	Recommendations for research and some govt strategies (eg AUSVETPLAN) published from WEDPP disease preparedness workshop. AUSVETPLAN updated - this will form major strategy for mitigating risks of disease spread. Literature review of endemic disease in invasive animals in Australia provided high-level recommendations for mitigating disease spread by controlling feral populations. 2T1 Rollout of Pig Control Solutions. 12D1 National Mapping, Honours Urban dingoes and zoonotic diseases (Ben Allen). PhD Are wildlife and particularly wild canids associated with Neospora abortion in cattle? (King). PhD Understanding and mitigating domestic pig and wildlife interactions (Pearson)	
9.4.3 (c)	Strategies, including products and procedures, for defining, detecting and mitigating the risk of disease spreading from invasive species to humans, livestock and native fauna developed.	30 June 2012	Yes	Recommendations for research and some govt strategies (eg AUSVETPLAN) published from WEDPP disease preparedness workshop. AUSVETPLAN to be updated- this will form major strategy for mitigating risks of disease spread. 2nd phase lit review of endemic disease in invasive animals in Australia will also provide high-level recommendations for mitigating disease spread by controlling feral populations. A study trialling different cyanide formulations for pigs to monitor for disease was completed.	
11 Outcome	**Increased professional and practical skills-base in invasive animal management through education, training and community awareness.**				
11.1 Output	Postgraduate training: 24 PhD candidatures completed in support of CRC outcomes and fully integrated with a Certificate of Achievement in Research Leadership and Management.	2012	Yes	21 PhD students, two Masters students and two Honours students have submitted theses for marking. Four further PhD students are expected to submit before 30 June 2012, while two are not due to complete their studies until September 2012. 27 of 29 PhD students have fully completed the Balanced Scientist Program and have been awarded a Certificate of Achievement in Research Leadership and Management.	
11.1.1	An appropriate mix of subjects, delivery modes and industry placements provided from the education providers of the CRC for PhD students. (The PhD cohorts will commence in 2006, 2007 and 2008).	December 2012	Yes	The Balanced Scientist Program has delivered on this milestone through the Preparedness through Education program projects 'Postgraduate Training and Development' and 'Development of Post Graduate Courses'.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
11.1.2 (c)	A four-year, instead of the typical three-year, PhD program implemented for each student to enable scholars to complete their parallel Research Leadership and Management Certificate of Achievement without disadvantaging their research studies. Completion date for each cohort of PhD students expected: June 2010, June 2011, June 2012	30 June 2012	Yes	Three cohorts of PhD students have enrolled in the Balanced Scientist Program where they benefited from the four year research program and the additional 80 days of training, including industry placement. Twenty-seven PhD students (93%) completed this additional training receiving a Certificate of Achievement in Research Leadership and Management.	
11.1.3 (c)	Students placed in industry at a time best suited to the research program of the student and the timetable of the most appropriate industry partner. Each fulltime PhD cohort to have undertaken their industry placement by December of their final year: December 2009, December 2010, December 2011.	31 December 2011	Yes	Twenty-seven students have completed their industry placement. Appropriate industry placement was determined through consultation between the Education program, the individual student and their supervisors and was based on the future career aspirations of the students.	
11.2 Output	Manager and field officer training: Graduates of PESTPLAN – new diploma level training course in strategic invasive animal management and Conservation and Land Management Level 2-4 course.	2012	Yes	The Diploma in Conservation and Land Management (specialising in invasive pests) commenced in 2007 and has successfully trained a cohort of students each year. The Diploma program is well supported each year with students giving positive feedback on both the course content and the value of the course to their employment in the pest management field. The program was upgraded from the VET certificate 4 level to a Diploma level course in 2009 following feedback from students and industry.	
11.2.1 (g)	Consultation with partners to develop training courses and management packages to ensure rapid and correct uptake of products delivered to national and international stakeholders and end-users, as new IA CRC products, technologies, techniques and strategies are developed (in conjunction with each programme and demonstration sites).	30 June 2012	Yes	Course developed in consultation with State agencies and pest managers and accredited nationally. Currently in fifth year of delivery. Employer and student evaluations have been extremely positive.	
11.2.4 (e)	A series of five 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.	30 June 2012	Yes	The Graduate Certificate program is on-going with positive feedback from the participating students as to the value of the course and the impact that it is having on the decisions they are making in the field of pest management. A Graduate Diploma and Masters level course has been developed and is available for uptake through the University of Canberra.	
11.3 Output	Enhanced professional and skill development for partner agencies to produce benefits through reduced onground costs and increased productivity from invasive animal control.	2012	Yes	The provision of training opportunities through the Diploma in Conservation and Land Management (specialising in invasive pests) and the Graduate Certificate in strategic pest management have enhanced professional skills for partner and non-partner agencies in pest animal management. The on-going nature of these courses means that the effect will be enduring. Education packages have also been developed for primary and secondary level schools. These education packages comply with State and national curricula in the areas of science and HSIE.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
11.3.1 (f)	Appropriate education and training packages produced.	31 January 2012	Yes	Education packages have been prepared at a number of levels. The Graduate Certificate in Wildlife Management targets middle and senior managers in partner and non-partner organisations and provides management level training in best practice strategic pest management. The VET level Diploma targets base level managers and on-ground staff and provides training in the principles and practices of strategic pest management at a level appropriate for those positions. Education packages have been produced targeting primary and secondary school students. The Pest Tales package is suitable for primary age students while the Feral Focus package is aimed at secondary school students. These packages were designed to comply with all State and National curricula and are available as a complete teaching package including notes for teachers, learning outcomes reflecting key areas in the science and HSIE curricula. All are freely available for use by teachers either as an in class exercise or as student homework. All of these training packages are available online from www.feralfocus.org.au and www.pestales.org.au Other training packages associated with PestSmart have also contributed to training in this area.	
11.4 Output	End-user capacity-building: increased knowledge and skills.	2012	Yes	The education packages that have been developed at the primary, secondary, Vocational Education and Training and Graduate level have, and will continue to, increase the knowledge base and skill levels of end users. These are supported through end user courses that the Invasive Animals CRC supports such as the Vertebrate Pest Management Training course facilitated by NSW DPI. Additionally, the comprehensive range of publications that have been prepared under the PestSmart banner have been designed to increase the knowledge and skill set of end users without the need for them to attend training courses.	
11.4.3 (b)	Extension materials produced to enhance skills and knowledge to effectively deliver strategic best practice invasive animal management strategies.	31 December 2011	Yes	A comprehensive range of publications under the PestSmart banner have been produced to ensure that all end users have access to the best available knowledge on best practice, codes of practice and effective strategic pest management strategies. These are freely available on the www.feral.org.au website and are actively promoted at Invasive Animals CRC Roadshows, functions, workshops and meetings. The awareness of the availability of these publications is also being promoted through the strategic use of social media such as Facebook and Twitter. The use of these media has enhanced the knowledge and awareness of these publications.	
11.4.5 (c)	Development and maintenance of online educational and practical resources through www.feral.org.au for schools, managers and landholders.	30 June 2012	Yes and ongoing	A comprehensive range of brochures, guides, instructional and research literature is available for students, teachers, managers and landholders on the www.feral.org.au website. The website and the range of information available for download is continually updated to ensure that the most current literature is available.	

Output/ Milestone Number	Description	Contracted Achievement date	Achieved	Reason / Details	Strategies to achieve unmet milestone
11.5 Output	Increased stakeholder and community awareness.	2012	Yes		
11.5.1 (c)	Mass media coverage of invasive animal issues, impacts and solutions obtained.	30 June 2012	Yes	Media coverage of Invasive Animals CRC research and activities has been consistently good with a strong trend of increasing media coverage achieved.	
11.5.2	Awareness of strategic invasive animal issues by key stakeholder groups increased.	31 January 2012	Yes	The Invasive animals CRC toured the PestSmart Roadshows across Australia in the first half of 2012 reaching many hundreds of stakeholders with information to assist people to better control invasive animals.	
12 Outcome	**Established national and local benchmarks for invasive animal impact, density and distribution from which performance on delivery of all outcomes can be assessed.**				
12.1 Output	Assessment of the overall impact of the Invasive Animal CRC throughout its life and recommended directions and requirements into the future.	2012	Yes	This output has been delivered through the 2008 3rd Year Review Economic Impact Assessment, and the national policy recommendations that have been incorporated into the 2012-2017 research plan for the new extension Invasive Animals CRC.	

APPENDIX B
Published Publications Listing

The full publication listing follows.

2.1 Formal publications

2.1.1 Formal books

2.1.2 Formal book chapters

2.1.3 Formal articles in scholarly refereed journals

2.1.4 Formal full written conference paper – refereed proceedings

2.2 Publications and reports for industry and other end users

2.2.1 Conference abstract in a non-refereed proceedings publication

2.2.2 Invasive Animals CRC technical report

2.2.3 PestSmart report / factsheet / brochure

2.2.4 PestSmart case study

2.2.5 Other agency report

PUBLICATIONS SUMMARY

During 2011–12, the Invasive Animals CRC published:

- One formal book
- One formal book chapter
- 34 formal articles in scholarly-refereed journals
- Seven formal full written conference papers - refereed proceedings
- Nine conference abstracts in a non-refereed proceedings publication
- Seven Invasive Animals CRC technical reports
- 29 PestSmart reports / factsheets / brochures
- Nine PestSmart case studies
- Nine other agency reports

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
OUTCOME 1: A BENEFIT OF $29 MILLION P.A. BY REDUCING THE IMPACTS OF FOX AND WILD DOGS BY 10%					
2.1.3 – Formal articles in Scholarly-Refereed Journals	May 2012	Genetic tagging reveals a significant impact of poison baiting on an invasive species	*Journal of Wildlife Management* Volume 76, Issue 4, Pages 729-739	Berry, OD, Algar, J, Angus, N, Hamilton, Hilmer, S and Sutherland, DR	10.U.21b
2.1.3 – Formal articles in Scholarly-Refereed Journals	Online December 2011	Oocysts and high seroprevalence of *Neospora caninum* in dogs living in remote Aboriginal communities and wild dogs in Australia	*Veterinary Parasitology*, Volume 187, Issues 1–2, 8 June 2012, Pages 85-92	King, JS, Brown, GK, Jenkins, DJ, Ellis, JT, Fleming, PJS, Windsor, PA and Šlapeta, J	10.T.5
2.2.1 – Conference abstract in a non-refereed proceedings publication	November 2011	When does wild dog predation upon native species move from natural to a threatening process? Observations from wild dog control programs and the potential impacts on Koala populations from Western and South-East Queensland	24th Australasian Wildlife Management Society Conference Book of Abstracts — Non-Refereed	Mifsud, G and Tabart, D	1.T.2
2.2.3 – Publications and reports for industry and other end users — PestSmart factsheet	August 2011	Wild dog risks to threatened wildlife	Factsheet		10.T.5
2.2.3 – Publications and reports for industry and other end users — PestSmart factsheet	October 2011	Fox shooting and hunting	Factsheet		1.T.1
2.2.3 – Publications and reports for industry and other end users – PestSmart factsheet	November 2011	Introduction to using foot hold traps for the capture of wild dogs and foxes	Instructional DVD	Mifsud, G and Invasive Animals CRC	1.T.2
2.2.3 – Publications and reports for industry and other end users — PestSmart factsheet	March 2012	Have you got wild dogs?	Factsheet		1.T.1

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
2.2.3 – Publications and reports for industry and other end users — PestSmart factsheet	March 2012	Wild dog policy and legislation considerations	Factsheet		10.T.5
2.2.3 – Publications and reports for industry and other end users — PestSmart factsheet	March 2012	Tools and strategies for wild dog management	Factsheet		10.T.5
2.2.4 – Publications and reports for industry and other end users — PestSmart case study	March 2012	Glovebox Guide for Managing Wild Dogs	A5 booklet		10.T.5
2.2.4 – Publications and reports for industry and other end users — PestSmart case study	September 2011	Coordinated fox shooting program	Case study		1.T.1
2.2.5 – Other agency report	September 2011	Efficacy of Para-aminopropiophenone (PAPP) to control dingoes (*Canis lupus* spp.) in the Strzelecki Desert of South Australia: Quinyambie field trial	Final report, commercial in confidence	Allen, BL	1.T.7e
2.2.5 – Other agency report	November 2011	Potential benefits and risks of aerial baiting using PAPP to reduce the impacts of foxes in eastern Australia	Confidential report	Bengsen, A. and Saunders, G	1.T.7e
2.2.5 – Other agency report	July 2011	Facilitating the Strategic Management of Wild Dogs in Australia Report	Confidential Australian Wool Innovation Report	Mifsud, G	1.T.2
2.2.5 – Other agency report	November 2011	Facilitating the Strategic Management of Wild Dogs in Australia Report	Confidential ABARES Report	Mifsud, G	1.T.2
OUTCOME 2: A BENEFIT OF $16 MILLION P.A. BY REDUCING FERAL PIG DAMAGE BY 15%					
2.1.3 – Formal Articles in Scholarly-Refereed Journals	July 2011	Using a general index approach to analyse camera-trap abundance indices	*Journal of Wildlife Management* 75 (5): 1222-1227	Bengsen, AJ, Leung, LK, Lapidge, SJ and Gordon, IJ	10.U.6b
2.1.3 – Formal Articles in Scholarly-Refereed Journals	July 2011	Target-specificity of feral pig baits under different conditions in a tropical rainforest	*Wildlife Research* 38: 370-379	Bengsen, A, Leung, L, Lapidge, SJ and Gordon, I	10.U.6b
2.1.3 – Formal Articles in Scholarly-Refereed Journals	December 2011	Testing target-specific bait delivery for controlling feral pigs in a tropical rainforest	*Ecological Management & Restoration* 12 (3): 226-229	Bengsen, AJ, Leung, LK, Lapidge, SJ and Gordon, IJ	10.U.6b
2.1.3 – Formal articles in Scholarly-Refereed Journals	Published Summer 2011	Managing an invasion: effective measures to control wild pigs	*The Wildlife Professional* Summer 2011: 41-42	Hamrick, B, Campbell, T, Higginbotham, B, and Lapidge, SJ	2.U.5e
2.1.4 – Formal Full Written Conference Paper – Refereed Proceedings	Published electronically	Development of a humane feral pig toxicant and its potential for other vertebrate pests	The Wildlife Society — 17th Annual Conference Proceedings and Abstract — Refereed	Lapidge, S.	2.U.5e
2.1.4 – Formal Full Written Conference Paper – Refereed Proceedings	2012	What has the Invasive Animals CRC feral pig research program achieved?	Proceedings of the International Wild Pig Conference, Texas. Page 20.	Lapidge, SJ, Wishart, J, Arms, E and Staples L	2.U.5e
2.2.1 – Conference abstract in a non-refereed proceedings publication	In review 2012	The development of HOGGONE®, a new lethal control option for the management of feral pigs in Australia.	Queensland Pest Animal Symposium Proceedings and Abstract — Non-Refereed	Smith, M, Lapidge, S, Wishart, J and Staples, L	2.U.5e
2.2.3 – Publications and reports for industry and other end users — PestSmart factsheet	August 2011	Feral pig (*Sus scrofa*)	Factsheet		11.U.3
OUTCOME 3: A BENEFIT OF $7 MILLION P.A. BY REDUCING RODENT DAMAGE BY 20%					
2.1.3 – Formal articles in Scholarly-Refereed Journals	June 2012	Fertility control of rodent pests: a review of the inhibitory effects of plant extracts on ovarian function.	*Pest Management Science* DOI 10.1002/ps.3354	Tran, TT and Hinds, LA	9.T.1

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
OUTCOME 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					
2.1.3 – Formal article in Scholarly-Refereed Journals	2012	Variation in native micro-predator abundance explains recruitment of a mobile invasive fish, the common carp, in a naturally unstable environment.	*Biological Invasions* 14:1919–1929	Bajer, PG, Chizinski, CJ, Silbernagel, JJ and Sorensen, PW	4.F.4
2.1.3 – Formal article in Scholarly-Refereed Journals	July 2011	Polar metabolites synergise the activity of prostaglandin F2α in a species-specific hormonal sex pheromone released by ovulated common carp.	*Journal of Chemical Ecology* 37:695–704.	Lim, HK and Sorensen, P	4.F.4
2.1.3 – Formal article in Scholarly-Refereed Journals	October 2011	Effects of lifetime chemical inhibition of aromatase on the sexual differentiation, sperm characteristics and fertility of medaka (*Oryzias latipes*) and zebrafish (*Danio rerio*).	*Aquatic Toxicology*, 105:355–360	Thresher, RE, Gurney, R and Canning, M	4.F.3
2.1.3 – Formal article in Scholarly-Refereed Journals	February 2012	Common carp implanted with prostaglandin F2α release a sex pheromone complex that attracts conspecific males in both the laboratory and field.	*Journal of Chemical Ecology* 38:127–134.	Lim, HK and Sorensen, P	04.F.4
2.1.3 – Formal article in Scholarly-Refereed Journals	May 2012	Reproductive strategies of two invasive tilapia species Oreochromis mossambicus and *Tilapia mariae* in northern Australia.	*Journal of Fish Biology* 80(6):2176–2197 doi:10.1111/j.1095-8649.2012.03267.x,	Russell, DJ, Thuesen, PA and Thomson, FE	4.F.10
2.1.3 – Formal article in Scholarly-Refereed Journals	29 June 2012	Exploiting seasonal habitat use of the common carp *Cyprinus carpio* in a lacustrine system for management and eradication.	*Marine and Freshwater Research* 63:587–597.	Taylor, AH, Tracey, SR, Hartmann, K and Patil JG	4.F.16
2.2.2 – Invasive Animals CRC technical report	May 2012	Tilapia in Australia: Development of management strategies for the control and eradication of feral tilapia populations in Australia.	Technical report	Russell, DJ, Thuesen, PA and Small, FE	4.F.10
2.2.2 – Invasive Animals CRC technical report	May 2012	Validating the age of carp from the northern Murray-Darling Basin.	Technical report	Hutchison, M, McLennan, M, Chilcott, K, Norris, A and Stewart, D	4.F.11
2.2.2 – Invasive Animals CRC technical report	2012	Guidelines for carp management at wetland inlets. A test case for South Australia.	Technical report	Smith, B, Thwaites, L and Conallin, A	4.F.11
2.2.2 – Invasive Animals CRC technical report	2012	Management of Freshwater Fish incursions.	Technical report	Ayres, R and Clunie, P	4.F.11
2.2.2 – Invasive Animals CRC technical report	2012	Towards a national emergency response system for freshwater fish incursions.	Technical report	Ayres, R and Clunie, P	4.F.11
2.2.3 – Publications and reports for industry and other end users — PestSmart report / factsheet / brochure	November 2011	Carp (*Cyprinus carpio*)	Factsheet		4.F.22
2.2.3 – Publications and reports for industry and other end users — PestSmart report / factsheet / brochure	February 2012	Black mangrove cichlid (*Tilapia mariae*)	Factsheet		4.F.22
2.2.3 – Publications and reports for industry and other end users — PestSmart report / factsheet / brochure	February 2012	Mozambique tilapia (*Oreochromis mossambicus*) distribution in Australia.	Factsheet		4.F.22

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
2.2.3 – Publications and reports for industry and other end users — PestSmart report / factsheet / brochure	February 2012	Biology and ecology of Mozambique tilapia.	Factsheet		4.F.22
2.2.3 – Publications and reports for industry and other end users — PestSmart report / factsheet / brochure	February 2012	Impacts of introduced tilapia— Australia and overseas.	Factsheet		4.F.22
2.2.3 – Publications and reports for industry and other end users — PestSmart report / factsheet / brochure	March 2012	Fishing as a carp control method.	Factsheet		10.F.8
2.2.3 – Publications and reports for industry and other end users — PestSmart report / factsheet / brochure	March 2012	Impacts of Carp in Australia.	Factsheet		4.F.22
2.2.3 – Publications and reports for industry and other end users — PestSmart report / factsheet / brochure	March 2012	Introduction and distribution of carp in Australia.	Factsheet		4.F.22
2.2.3 – Publications and reports for industry and other end users — PestSmart report / factsheet / brochure	March 2012	Koi herpesvirus as a biological control method for carp.	Factsheet		4.F.7
2.2.3 – Publications and reports for industry and other end users — PestSmart report / factsheet / brochure	March 2012	Use of chemicals as poisons for pest fish control.	Factsheet		4.F.9
2.2.3 – Publications and reports for industry and other end users — PestSmart report / factsheet / brochure	March 2012	Containment as a method for pest fish control (originally CPFS3).	Factsheet		4.F.22
2.2.3 – Publications and reports for industry and other end users — PestSmart report / factsheet / brochure	March 2012	The importance of public consultation for pest fish management.	Factsheet		4.F.22
2.2.4 – Publications and reports for industry and other end users — PestSmart case study	March 2012	Carp spawning hotspots.	Case study		4.F.5
2.2.4 – Publications and reports for industry and other end users — PestSmart case study	2012	Decision support tool users manual - Incidental.	Manual		4.F.11
2.2.4 – Publications and reports for industry and other end users — PestSmart case study	2012	Decision support tool users manual - Scientific.	Manual		4.F.11
OUTCOME 5: DELIVER INNOVATIVE, PRACTICAL CONTROL MEASURES AGAINST CANE TOADS					
2.1.3 – Formal articles in Scholarly-Refereed Journals	August 2011	Effects of seasonal aridity on the ecology and behaviour of invasive cane toads (*Rhinella marina*) in the Australian wet-dry tropics.	*Functional Ecology* 25: 1339-1347	Brown, GP, Kelehear, C and Shine, R	5.T.1

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
2.1.3 – Formal articles in Scholarly-Refereed Journals	September 2011	Using combined morphological, allometric and molecular approaches to identify species of the genus *Raillietiella* (Pentastomida).	PLoS ONE 6: e24936	Kelehear, C, Spratt, DM, Dubey, S, Brown, GP and Shine, R	5.T.1
2.1.3 – Formal articles in Scholarly-Refereed Journals	November 2011	Rapid evolution of parasite life history traits at an expanding range-edge.	Annual Meeting of the Australian Society of Herpetologists	Kelehear, C, Brown, GP and Shine, R	5.T.1
2.1.3 –Formal articles in Scholarly-Refereed Journals	February 2012	Rapid evolution of parasite life history traits on an expanding range edge.	*Ecology Letters* Volume 15, Issue 4, pp 329-337	Kelehear, C, Brown, GP and Shine, R	5.T.1
2.1.3 –Formal articles in Scholarly-Refereed Journals	April 2012	Size and sex matter: infection dynamics of an invading parasite (*Raillietiella frenatus*) in an invading host (*Rhinella marina*).	*Parasitology* 139: in press. DOI: 10.1017/S0031182012000832	Kelehear, C, Brown, GP and Shine, R	5.T.1
2.1.3 –Formal articles in Scholarly-Refereed Journals	14 June 2012	Inadvertent consequences of community-based efforts to control invasive species.	*Conservation Letters* DOI: 10.1111/j.1755-263X.2012.00251.x	Kelehear, C, Cabrera-Guzmán, E and Shine, R	5.T.1
2.1.3 –Formal articles in Scholarly-Refereed Journals	16 June 2012	Corticosterone-immune interactions during captive stress in invading Australian cane toads (*Rhinella marina*).	*Hormones and Behaviour* DOI: 10.1016/j.yhbeh.2012.06.001	Graham, SP, Kelehear, C, Brown, GP and Shine, R	5.T.1
2.2.3 – Publications and reports for industry and other end users – PestSmart factsheet	March 2012	Cane toad (*Bufo marinus*, also *Rhinella marina*).	Factsheet		5.T.1
2.2.4 – Publications and reports for industry and other end users — PestSmart case study	March 2012	Introduction of the cane toad to Australia.	Case study		5.T.1
2.2.5 – Other agency report	January 2012	Methods for the field euthanasia of cane toads (Standard Operating Procedure Guideline).	Australian Government Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) website	Sharp, T, Lothian, A, Munn, A and Saunders, G	5.T.6e
OUTCOME 6: REDUCED IMPACT OF FERAL CATS OVER FIVE MILLION HECTARES					
2.1.3 – Formal articles in Scholarly-Refereed Journals	December 2011	Estimating and indexing feral cat population abundances using camera traps.	*Wildlife Research* 38: 732-739	Bengsen, A. J., Butler, J. A. and Masters, P.	10.U.2c
2.1.3 – Formal articles in Scholarly-Refereed Journals	2011	Assessment of risks to non-target species from an encapsulated toxin in a bait proposed for control of feral cats.	*Wildlife Research* 38: 39-50	de Tores, PJ., Sutherland, DR., Clarke, JR, Hill, RF, Garretson, SW, Bloomfield, L, Strümpher, L, Glen, AS and Cruz, J	10.U.1b
2.1.3 – Formal articles in Scholarly-Refereed Journals	April 2012	Applying home-range and landscape-use data to design effective feral-cat control programs.	*Wildlife Research* 39: 258-265	Bengsen, AJ, Butler, JA and Masters, P	10.U.2c
2.1.4 – Formal full written conference paper – refereed proceedings	March 2012	Feral cats in the tall forests of Far East Gippsland, Australia.	Proceedings of the Vertebrate Pest Conference Monterey, California	Buckmaster T	10.U.4
2.2.1 – Conference abstract in a non-refereed proceedings publication	March 2012	Feral cats in the tall forests of Far East Gippsland, Australia.	Published abstracts for the Vertebrate Pest Conference Monterey, California	Buckmaster T	10.U.4
2.2.1 – Conference abstract in a non-refereed proceedings publication	June 2012	Feral cats in the tall forests of Far East Gippsland, Australia.	Proceedings of the Vertebrate Pest Conference Sydney, NSW	Buckmaster T	10.U.4
OUTCOME 7: INCREASED AGRICULTURAL PROFITABILITY THROUGH IMPROVED INTEGRATION OF EXISTING BIOLOGICAL, CONVENTIONAL AND NEWLY DEVELOPED CONTROL OPTIONS FOR RABBITS					
2.1.2 – Formal book chapters	2011	Biological control of vertebrates.	*Encyclopedia of environmental management*. 2011	Kerr, P and Strive, T	7.T.1
2.1.3 – Formal articles in Scholarly-Refereed Journals	August 2011	Histo-Blood Group Antigens act as attachment factors of Rabbit Hemorrhagic Disease Virus infection in a virus strain-dependent manner.	*PLoS Pathog*. 2011 Aug;7(8):e1002188. Epub 2011 Aug 25.	Nyström, K, Le Gall-Reculé, G, Grassi, P, Abrantes, J, Ruvoën-Clouet, N, Le Moullac-Vaidye B, Lopes, A. Esteves, PJ, Strive, T, Marchandeau, S, Dell, A, Haslam, S. and Le Pendu, J.	7.T.1
2.1.3 – Formal articles in Scholarly-Refereed Journals	January 2012	Rabbit haemorrhagic disease: Are Australian rabbits (*Oryctolagus cuniculus*) evolving resistance to infection with Czech CAPM 351 RHDV?	*Epidemiology and Infection* Volume 39, Issue 4, pp 279-289 http://dx.doi.org/10.1017/S0950268811002743	Elsworth, PG, Kovaliski, J and Cooke, BD	7.T.4, 7.T.5, 7.T.9

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
2.1.3 – Formal articles in Scholarly-Refereed Journals	March 2012	Rabbit haemorrhagic disease: Applying Occam's razor to competing hypotheses.	*Molecular Ecology*, Volume 21, Issue 5, March 2012, Pages: 1038–1041 doi: 10.1111/j.1365-294X.2011.05466.x	Peacock, D, Mutze, G. Sinclair, R, Kovaliski, J and Cooke, B	7.T.4
2.1.3 – Formal articles in Scholarly-Refereed Journals	2012	Rabbits: Manageable environmental pests or participants in new Australian ecosystems?	*Wildlife Research* http://dx.doi.org/10.1071/WR11166	Cooke, BD	7.T.4, 7.T.9
2.1.3 – Formal articles in Scholarly-Refereed Journals	2012	European rabbit survival and recruitment are linked to epidemiological and environmental conditions in their exotic range.	*Austral Ecology* doi: 10.1111/j.1442-9993.2011.02354.x	Fordham, DA, Sinclair, RG, Peacock, DE, Mutze, GJ, Kovaliski, J, Cassey, P, Capucci, L and Brook, BW	7.T.9
2.2.3 – Publications and reports for industry and other end users — PestSmart factsheet	February 2012	Using RHDV for rabbit control.	Factsheet		7.T.9
2.2.3 – Publications and reports for industry and other end users — PestSmart factsheet	February 2012	Economic and environmental impacts of rabbits in Australia.	Factsheet		7.T.6-7
2.2.3 – Publications and reports for industry and other end users — PestSmart factsheet	February 2012	Rabbit legislation in Australia.	Factsheet		11.U.1
2.2.4 – Publications and reports for industry and other end users — PestSmart case study	September 2011	Effective rabbit control in pine-buloke woodlands.	Case study		11.U.1
2.2.4 – Publications and reports for industry and other end users — PestSmart case study	November 2011	Warren ripping on Thackaringa Station, NSW.	Case study		11.U.1
2.2.4 – Publications and reports for industry and other end users — PestSmart case study	November 2011	Bounceback - Rabbit control in the Flinders Ranges.	Case study		11.U.1
OUTCOME 8: DELIVER IMPROVED AND HUMAN APPROACHES TO REDUCE THE PRODUCTION AND BIODIVERSITY IMPACTS OF EXPANDING OR OTHER OVER-ABUNDANT AND WIDESPREAD PEST SPECIES.					
2.1.3 – Formal articles in Scholarly-Refereed Journals	March-2012	Stakeholder Participation in Management of Invasive Vertebrates.	*Conservation Biology* 26(2):345-356	Ford-Thompson, AES, Snell, C, Saunders, G and White, PCL	PhD
2.2.1 – Conference abstract in a non-refereed proceedings publication	1 July 2011	Technologies of belonging: The phenomenological consequences of feral pig control technologies and their implications for conflict mitigation in management.	Australian Anthropological Society Conference, Perth WA.	Meurk, CS	10.U.6
2.2.1 – Conference abstract in a non-refereed proceedings publication	22 May 2012	Deviant Natures: Rights, Responsibilities and Relationships in Human-Environment Relationships in Far North Queensland.	Global Knowledge and Local Identities Workshop UQ/UWA, Perth WA	Meurk, CS	10.U.6
2.2.5 Other agency report	1 March 2012	Babes, Boars, Bullets and the Puzzles of Pig Hunting	Australian Anthropological Society Newsletter	Meurk, CS	10.U.6
OUTCOME 9: REDUCED RISKS OF ECONOMIC LOSSES, ENVIRONMENTAL DAMAGE AND SOCIAL STRESS BY FORECASTING AND RESPONDING TO POTENTIAL, NEW, EXPANDING OR EMERGING INVASIVE ANIMAL PROBLEMS					
2.1.3 – Formal articles in Scholarly-Refereed Journals	12 July 2012	The invasion process: stages and tailored management actions. A case study reconstructing the invasion process of the Common Myna.	*Diversity and Distributions*	Grarock, K, Lindenmayer, DB, Wood, J and Tidemann CR	PhD
2.1.3 – Formal articles in Scholarly-Refereed Journals	July 2012	Formulation and delivery of vaccines: Ongoing challenges for animal management.	*Journal of Pharmacy and Bio-Allied Sciences* (Invited review) Volume 4 Issue 3 (July-September 2012)	Sharma, S and Hinds, LA	9T1
2.2.2 – Invasive Animals CRC technical report	October 2011	Detecting and preventing new incursions of exotic animals in Australia.	Technical report	Henderson, W and Bomford. M	9.D.96b

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
OUTCOME 10: GROWTH IN AUSTRALIAN INVASIVE ANIMAL PEST CONTROL INDUSTRIES. THROUGH INDUSTRY COLLABORATION ON THE REGISTRATION, MARKETING, EXPORT AND COMMUNITY UPTAKE OF NEW PRODUCTS THE CRC WILL ENHANCE CONTROL OF PROBLEM SPECIES					
2.1.4 – Formal full written conference paper – refereed proceedings	2012	The global future of vertebrate pest management.	(2012). Vertebrate Pest Conference 25: http://www.vpconference.org/Proceedings	Lapidge, SJ	10.U.14
OUTCOME 11: INCREASED PROFESSIONAL AND PRACTICAL SKILLS BASE IN INVASIVE ANIMAL MANAGEMENT THROUGH EDUCATION, TRAINING AND COMMUNITY AWARENESS					
2.1.1 – Formal books – authored research (unweighted)	October 2011	Guidelines for the Balanced Scientist Program.	Other CRCs, CSIRO, research institutions and universities	Dimond, W and Sarre S	11.E.4
2.1.4 – Formal full written conference paper – refereed proceedings	2012	PestSmart: An information toolkit for practical pest animal control.	(2012). Vertebrate Pest Conference 25: Monterey, California	Lapidge, SJ, Balogh, S and Lapidge, KL	11.U.1-5
2.1.4 – Formal full written conference paper – refereed proceedings	2012	Strategic vertebrate pest management training in Australia.	Proceedings of the Vertebrate Pest Conference 25, Monterey, California	Buckmaster T and Braysher M	11.E.6, 10
2.1.4 – Formal full written conference paper – refereed proceedings	2012	The Balanced Scientist Program - Training PhD candidates beyond research.	Proceedings of the Vertebrate Pest Conference 25, Monterey, California	Sarre, S, Buckmaster, T and Dimond, W	11.E.1-5, 9
2.2.1 – Conference abstract in a non-refereed proceedings publication	June 2011	Strategic vertebrate pest management training.	Proceedings of the Vertebrate Pest Conference Sydney, NSW	Buckmaster, T and Braysher, M	11.E.6, 10
2.2.1 – Conference abstract in a non-refereed proceedings publication	March 2012	Strategic vertebrate pest management training in Australia.	Publication of abstracts for the Vertebrate Pest Conference 25, Monterey, California	Buckmaster T and Braysher, M	11.E.6, 10
2.2.1 – Conference abstract in a non-refereed proceedings publication	March 2012	The Balanced Scientist Program - Training PhD candidates beyond research.	Publication of abstracts for the Vertebrate Pest Conference 25, Monterey, California	Sarre, S, Buckmaster, T and Dimond, W	11.E.6, 10
2.2.5 – Other agency report	2012	Churchill Fellowship Report: Refining and Improving the Use of Camera Trap Technology for Wildlife Management and Research in Australia and New Zealand.	Final Report available for download from The Winston Churchill Memorial Trust http://www.churchilltrust.com.au/fellows/detail/3558/paul+meek	Meek. P	11.T.4
2.2.5 – Other agency report	June 2011, September 2011, December 2011, March 2012, June 2012	NRM Notes Newsletter Issues 6-10.	Published E-Newsletter available to download from www.Invasiveanimals.com under Media Centre/Newsletters and Online Media	Marsh, J	11.T.1
2.2.5 – Other agency report	September 2011	Strategic vertebrate pest management training in Australia.	Australasian Wildlife Management Society newsletter available to download from www.awms.org.au	Buckmaster, T and Braysher, M	11.E.6, 10
OUTCOME 12. ESTABLISHED NATIONAL AND LOCAL BENCHMARKS FOR INVASIVE ANIMAL IMPACT, DENSITY AND DISTRIBUTION FROM WHICH PERFORMANCE ON DELIVERY OF ALL OUTCOMES CAN BE ASSESSED					
Nil					
OTHER					
2.1.3 – Formal article in Scholarly-Refereed Journals	June 2011	Extensive production of *Neospora caninum* tissue cysts in a carnivorous marsupial succumbing to experimental neosporosis.	*Veterinary Research* 42: 75	King, JS, McAllan, B, Spielman, DS, Lindsay, SA, Hurková-Hofmannová, L, Hartigan, A, Al-Qassab, S, Ellis, JT and Šlapeta, J.	PhD
2.1.3 – Formal article in Scholarly-Refereed Journals	27 March 2012	Seasonal field metabolic rate and water influx of captive-bred re-introduced yellow-footed rock-wallabies (*Petrogale xanthopus celeris*).	*Australian Journal of Zoology* 59(6) 400-406 http://dx.doi.org/10.1071/ZO11049	Lapidge, SJ and Munn, AJ	
2.1.3 – Formal article in Scholarly-Refereed Journals	Online and In Press	Are smaller subspecies of common brushtail possums more omnivorous that larger ones?	*Austral Ecology* DOI: 10.1111/j.1442-9993.2011.02346.x.	Cruz, J, Sutherland, DR, Martin, GR and Leung, LK.-P	10.U.1
2.2.3 – Publications and reports for industry and other end users – PestSmart factsheet	January 2012	DVD Guide to Practical Pest Animal Management.	Instructional DVD	Meek, P. and IA CRC	11.T.4

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
2.2.3 – Publications and reports for industry and other end users – PestSmart factsheet	2012	PestSmart. Tools for pest management.	DL Brochure		11.U.1
2.2.3 – Publications and reports for industry and other end users – PestSmart factsheet	January 2012	Balanced Scientist Program Video Clips.	YouTube Clips	Meek, P. and IA CRC	11.T.4
2.2.3 – Publications and reports for industry and other end users – PestSmart factsheet	2012	PestSmart DL postcard flyer.	DL postcard		11.U.1
2.2.3 – Publications and reports for industry and other end users – PestSmart factsheet	January 2012	Invasive Animals CRC Product Pipeline.	Factsheet		11.U.1
2.2.3 – Publications and reports for industry and other end users – PestSmart factsheet	January 2012	Roadshow Calendar.	Dates Flyer		11.U.2

APPENDIX C
In Press Publications Listing

The full publication listing follows.

2.1.2 Formal book chapters

2.1.3 Formal articles in scholarly refereed journals

2.1.4 Formal full written conference paper – refereed proceedings

2.2.1 Conference abstract in a non-refereed proceedings publication

IN PRESS SUMMARY

At the end of the 2011–12 financial year, the Invasive Animals CRC had the following publications in press or submitted:

- Two formal book chapters
- 24 formal articles in scholarly-refereed journals
- Three formal full written conference papers - refereed proceedings
- One conference abstracts in a non-refereed proceedings publication

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
OUTCOME 1: A BENEFIT OF $29 MILLION P.A. BY REDUCING THE IMPACTS OF FOX AND WILD DOGS BY 10%					
2.1.2 – Formal book chapters	In Press	Management of wild canids in Australia: Free-ranging dogs and red foxes	Chapter 6 in Carnivores of Australia: Past, Present and Future (Ed. Glen, A and Dickman, C) CSIRO Publishing, Collingwood)	Fleming, PJS, Allen, BL, Allen, LR, Ballard, G, Bengsen, A, Gentle, MN, McLeod, LJ, Meek, PD and Saunders, GR	10.T.5
2.1.2 – Formal book chapters	In Press	When is a dingo not a dingo? Hybridisation with domestic dogs	Chapter 7 in Carnivores of Australia: Past, Present and Future (Ed. Glen, A and Dickman, C) CSIRO Publishing, Collingwood	Claridge, AW, Spencer, RJ, Wilton, AN, Jenkins, DJ, Dall, D and Lapidge, SJ	13.U.1
OUTCOME 2: A BENEFIT OF $16 MILLION P.A. BY REDUCING FERAL PIG DAMAGE BY 15%					
2.1.3 – Formal Articles in Scholarly-Refereed Journals	In press	Aboriginal rangers' perspectives on feral pigs: Are they a pest or a resource? A case study in the Wet Tropics World Heritage Area of Northern Queensland	*Journal of Australian Indigenous Issues*	Koichi, K, Kaur, K, Cottrell, A, and Gordon, IJ	10.U.6b
2.1.3 – Formal Articles in Scholarly-Refereed Journals	Submitted	Cost-effectiveness of control methods commonly used for feral pigs – a comparison of trapping, dogging and shooting	*Wildlife Research*	Koichi, K, Mayer, B, Kaur, K, Cottrell, A and Gordon, IJ	10.U.6
2.1.3 – Formal articles in Scholarly-Refereed Journals	Revision stage	Are feral pigs (*Sus scrofa*) a pest to rainforest tourism?	*Journal of Ecotourism*	Koichi, K, Kaur, K, Cottrell, A and Gordon, IJ	2.U.5e
2.1.3 – Formal articles in Scholarly-Refereed Journals	Revision stage	What determines acceptability of wildlife control methods? Australian case	*Human Dimensions of Wildlife*	Koichi, K, Kaur, K, Cottrell, A and Gordon, IJ	2.U.5e
2.1.3 – Formal articles in Scholarly-Refereed Journals	Revision stage	The management implications of dual values of feral pigs (*Sus scrofa*) for Aboriginal communities	*Australian Journal of Environmental Management*	Koichi, K, Kaur, K, Cottrell, A and Gordon, IJ	2.U.5e
2.1.4 – Formal Full Written Conference Paper – Refereed Proceedings	In press	Development of a Feral Swine Toxic Bait (HOGGONE®) and bait hopper (HOGHOPPER™) in Australia and the USA	14th Wildlife Damage Management Conference (2011), Nebraska City, Nebraska, USA	Lapidge, SJ, Wishart, J, Staples, L, Fagerstone, K, Campbell, T and Eisemann, J	2.U.5e
2.2.1 – Conference abstract in a non-refereed proceedings publication	In review 2012	The development of HOGGONE®, a new lethal control option for the management of feral pigs in Australia	Queensland Pest Animal Symposium Proceedings and Abstract — Non Refereed	Smith, M, Lapidge, S, Wishart, J and Staples, L	2.U.5e
OUTCOME 3: A BENEFIT OF $7 MILLION P.A. BY REDUCING RODENT DAMAGE BY 20%					

Nil

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
OUTCOME 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					
2.1.3 – Formal article in Scholarly-Refereed Journals	2012, In Press	A review of the biology, ecology, distribution and control of Mozambique tilapia, Oreochromis mossambicus (Peters 1852) (*Pisces: Cichlidae*) with particular emphasis on invasive Australian populations.	*Reviews in Fish Biology and Fisheries*. Online First™, 17 January 2012 DOI 10.1007/s11160-011-9249-z	Russell DJ, Thuesen PA and Thomson FE	4.F.10
2.1.3 – Formal article in Scholarly-Refereed Journals	2012, In Press (being revised for resubmission)	Caspase 2 as a repressible early stage cell death gene in fish	*Marine Biotechnology*	van de Kamp, J, Campbell, G and Thresher, R	4.F.3
2.1.3 – Formal article in Scholarly-Refereed Journals	2012, In Press (being revised for resubmission)	Operating characteristics of a single plasmid tetracycline regulated gene expression system during early embryogenesis in zebrafish (*Danio rerio*)	*Marine Biotechnology*	Campbell, G, van de Kamp, J and Thresher, R	4.F.3
2.1.3 – Formal article in Scholarly-Refereed Journals	30 June 2012 (In Press)	Assessing the risks of genetic control techniques with reference to the common carp (*Cyprinus carpio*) in Australia	*Biological Invasions*	Hayes KR, Leung B, Thresher R, Dambacher JM and Hossack GR	4.F.16
2.1.3 – Formal article in Scholarly-Refereed Journals	30 June 2012 (In Press)	Genetic control of invasive fish: technological options and the role of IPM	*Biological Invasions*	Thresher RE, Hayes K, Bax NJ, Teem J, Benfey TJ and Gould F	4.F.16
OUTCOME 5: DELIVER INNOVATIVE, PRACTICAL CONTROL MEASURES AGAINST CANE TOADS					
2.1.3 –Formal articles in Scholarly-Refereed Journals	Submitted December 2011	Invasive parasites in multiple invasive hosts: the arrival of a new host revives a stalled prior parasite invasion	*Biological Invasions*	Kelehear, C, Brown, GP and Shine, R	5.T.1
2.1.3 –Formal articles in Scholarly-Refereed Journals	Submitted February 2012	The early toad gets the ant: cane toads at an invasion front benefit from higher prey availability	*Ecology*	Brown, GP, Kelehear, C and Shine, R	5.T.1
2.1.3 –Formal articles in Scholarly-Refereed Journals	Submitted February 2012	Host-parasite relationships during a biological invasion: 75 years post-invasion, cane toads and sympatric Australian frogs retain separate lungworm fauna	*Journal of Wildlife Diseases*	Pizzatto, L, Kelehear, C, Dubey, S, Barton, D, and Shine, R	5.T.1
OUTCOME 6: REDUCED IMPACT OF FERAL CATS OVER FIVE MILLION HECTARES					
Nil					
OUTCOME 7: INCREASED AGRICULTURAL PROFITABILITY THROUGH IMPROVED INTEGRATION OF EXISTING BIOLOGICAL, CONVENTIONAL AND NEWLY DEVELOPED CONTROL OPTIONS FOR RABBITS					
2.1.3 – Formal articles in Scholarly-Refereed Journals	2012 - Submitted	A sensitive and specific blocking ELISA for the detection of rabbit calicivirus RCV-A1	*The Virology Journal*	Liu, J, Kerr, PJ and Strive T	7.T.1
OUTCOME 8: DELIVER IMPROVED AND HUMAN APPROACHES TO REDUCE THE PRODUCTION AND BIODIVERSITY IMPACTS OF EXPANDING OR OTHER OVER-ABUNDANT AND WIDESPREAD PEST SPECIES.					
2.1.3 – Formal articles in Scholarly-Refereed Journals	Submitted	Contesting Death: Heritage, Property and Pest Control Technologies in Australia	Ethnos: *Journal of Anthropology*	Meurk, C.S.	10.U.6
2.1.3 – Formal articles in Scholarly-Refereed Journals	In Press	Revelatory moments in fieldwork	*Qualitative Research*	Trigger, DS, Forsey, M and Meurk, CS	10.U.6
2.1.4 – Formal full written conference paper – refereed proceedings	Under Review	Legal Status vs Community Attitudes: The importance of considering context when planning pest management projects.	Queensland Pest Animal Symposium Conference Proceedings 2012.	Finch, N, Meurk, CS, Baxter, G, Murray, P	10.U.6
OUTCOME 9: REDUCED RISKS OF ECONOMIC LOSSES, ENVIRONMENTAL DAMAGE AND SOCIAL STRESS BY FORECASTING AND RESPONDING TO POTENTIAL, NEW, EXPANDING OR EMERGING INVASIVE ANIMAL PROBLEMS					
2.1.3 – Formal articles in Scholarly-Refereed Journals	Accepted	Is it benign or is it a pariah? Empirical evidence for the impact of the Common Myna (*Sturnus tristis*) on Australian birds	*PLoS ONE*	Grarock, K, Tidemann, CR, Wood, J and Lindenmayer, DB	PhD

Product Type	Date Published	Paper or Product Title	Target Journal/Audience & Type	Authors	Relevant Project
2.1.3 – Formal articles in Scholarly-Refereed Journals	Submitted	Are invasive species drivers of native species decline or passengers of habitat modification? A case study of the impact of the Common Myna (*Sturnus tristis*) on Australian bird species.	*Austral Ecology*	Grarock, K, Tidemann, CR, Wood, J and Lindenmayer, DB	PhD
2.1.3 – Formal articles in Scholarly-Refereed Journals	Submitted	Does cavity nest competition by the Common Myna (*Sturnus tristis*) reduce the abundance of two Australian native parrots?	*Wildlife Research*	Grarock, K, Lindenmayer, DB and Tidemann, CR	PhD
OUTCOME 10: GROWTH IN AUSTRALIAN INVASIVE ANIMAL PEST CONTROL INDUSTRIES. THROUGH INDUSTRY COLLABORATION ON THE REGISTRATION, MARKETING, EXPORT AND COMMUNITY UPTAKE OF NEW PRODUCTS THE CRC WILL ENHANCE CONTROL OF PROBLEM SPECIES					
Nil					
OUTCOME 11: INCREASED PROFESSIONAL AND PRACTICAL SKILLS BASE IN INVASIVE ANIMAL MANAGEMENT THROUGH EDUCATION, TRAINING AND COMMUNITY AWARENESS					
2.1.3 – Formal Articles in Scholarly-Refereed Journals	Accepted June 2012	Technical Note: A Permanent Security Post for Camera Trapping	*Australian Mammalogy*	Meek, P, Ballard, G and Fleming, PJS	11.T.5
OUTCOME 12. Established national and local benchmarks for invasive animal impact, density and distribution from which performance on delivery of all outcomes can be assessed					
Nil					
OTHER					
2.1.3 – Formal article in Scholarly-Refereed Journals	In Review	Den use, home range and territoriality of the koomal (*Trichosurus vulpecula hypoleucus*) and implications for current forest management strategies.	*Australian Journal of Zoology*	Cruz, J, Sutherland, DR and Leung, LK.-P	10.U.1
2.1.3 – Formal article in Scholarly-Refereed Journals	In Review	Extrinsic factors limiting populations of the koomal (*Trichosurus vulpecula hypoleucus*), a threatened arboreal marsupial.	*Australian Journal of Zoology*	Cruz, J, Sutherland, DR, Glen, AS, Anderson, DP, de Tores, PJ, Marlow, N and Leung, LK.-P	10.U.1
2.1.3 – Formal article in Scholarly-Refereed Journals	Submitted for publication	Anti-predator responses of koomal against introduced and native predators.	*Behavioural Ecology and Sociobiology*	Cruz, J, Sutherland, DR, Anderson, DP, Glen, AS, de Tores, P and Leung, LK.-P	10.U.1
2.1.3 – Formal article in Scholarly-Refereed Journals	Accepted for publication	Early onset of reproduction in the agile antechinus, *Antechinus agilis*	*Australian Mammalogy*	Buckmaster AJ and Dickman CR	10.U.4

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