CENTRE FOR
INVASIVE SPECIES SOLUTIONS

PORTFOLIO NO 1:
INVASIVE SPECIES ACHIEVEMENTS

MESSAGE FROM THE CHIEF EXECUTIVE

I have the pleasure of introducing the projects and key research and innovation outputs of the Centre's first five year RD&E portfolio (2017–22). They clearly show that collaborative action delivers national scale benefits. I thank everyone involved in making the Centre's 'Team Australia' approach a reality, which has brought 22 government, industry, NRM and conservation organisations into an unique strategic partnership to deliver better solutions to our growing pest and weed problems.

Andreas Glanznig
Chief Executive

AND A WORD FROM OUR PORTFOLIO DIRECTOR

Threats to Australia's biosecurity are not going away soon. Agricultural systems and environment landscapes are at risk and require deep thinking and innovation to overcome the threats of pest plants and animals. The achievements outlined here represent important guidelines, tools and practices to support better biosecurity responses by governments, industries, communities and individuals. I thank my 250 or so research colleagues who worked tirelessly behind this work.

Associate Professor
Richard Price
Portolio Director

Portfolio No.1 was funded by:

Australian Government
Department of Agriculture, Fisheries and Forestry

The purpose of the portfolio

Invasive species cost Australia around **A$24.5 billion a year**, or an average 1.26% of the nation's gross domestic product. The costs total **at least A$390 billion in the past 60 years**. They have also had a substantive role in nearly all native species extinctions since the 1960s and impact over 80 per cent of nationally listed threatened species.

The Centre for Invasive Species Solutions was created in 2017 to maintain the momentum built up by the former Invasive Animals Cooperative Research Centre and dramatically reduce the negative impact of priority invasive pests and weeds on farm profitability, native species survival and the well-being of regional communities.

DETECTION AND INCURSION RESPONSE PROJECTS

1. Development of a national incursion management framework for invasive species

Achievement: A national incursion management framework for invasive species, known as InvasivesPlan, was prepared in consultation with all state and territory governments and tabled with the national Environment and Invasives Committee in 2019.

Principal Investigator:
Dr Michelle Christy, Department of Primary Industries and Regional Development, Western Australia.

2. Development of a national incursion management framework for Asian Black-spined toad

Achievement: A National Response Plan for the Asian Black-spined toad was delivered consistent with the *Terrestrial Snakes National Incursion Plan*. It provides basic information and procedures that can be used to prevent, plan and respond to Asian Black-spined toad incursions in Australia.

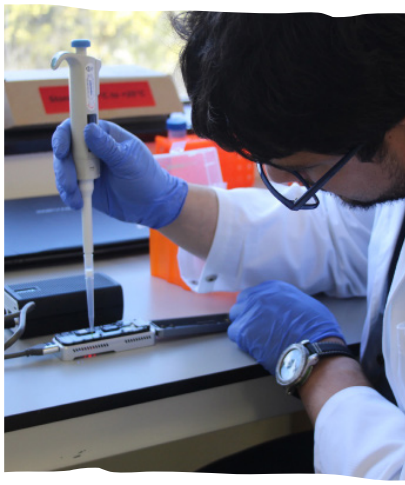
Principal Investigator:
Dr Michelle Christy, Department of Primary Industries and Regional Development, Western Australia.

3. Understanding and intervening in illegal trade in non-native species

Achievement: The Digital Surveillance of Illegal Wildlife Trade tool, known as 'DIWT' for short, monitors domestic and international e-commerce sites for trade of pest animals and plants. The tool has been tested with Commonwealth and State Governments and is being adopted by the States.

Principal Investigator:
Associate Professor Phill Cassey,
University of Adelaide.

4. Real time eDNA tools to improve early detection and response approaches for high-risk pest animals



Achievement: This project focused on detecting Red-eared slider turtle and the Asian black-spined toad using eDNA techniques.

Our eDNA project has led to national capability and capacity to deliver eDNA surveillance methods for biosecurity application.

The establishment of the National eDNA Reference Centre at the University of Canberra in 2022 is a substantive endorsement of eDNA technology and usage as a mainstream tool in pre-and post-border protection.

Principal Investigator:
Professor Dianne Gleeson,
University of Canberra.

5. Automated detection: triggering smarter, faster, better responses to incursions

Achievement: The world's first fully automated 'smart' listening station programmed to detect starlings has been produced and successfully field-tested. The starling detection algorithm is in the process of being licensed to various state environment departments to be re-trained to enable the detection of threatened and endangered species such as the Western ground parrot, the Bayesian thrush and Australasian Bittern.

Principal Investigator:
Dr Susan Campbell, Department of Primary Industries and Regional Development, Western Australia.

6. Automated thermal imagery analysis platform for multiple pest species

Achievement: Artifical intelligence (AI) vertebrate detection has progressed. Developing AI software algorithms for thermal imaging has resulted in an automated detection and analysis platform — ThermEye. It can detect and differentiate between seven vertebrate species commonly found in the Australian landscape. A trademark application has been lodged to protect ThermEye intellectual property.

Principal Investigator:
Dr Peter Adams and Dr Stuart Dawson,
Department of Primary Industries and Regional Development, Western Australia.

7. Development of integrated passive and active surveillance

Achievement: Australia's best defences against future invasions of vertebrate pests involve the eyes, ears, knowledge, cameras and phones of its citizens, in combination with targeted surveillance when citizen surveillance is inadequate.

The Passive and Active Surveillance project points to ways to combine these defences.

Principal Investigator:
Dr Peter Caley, CSIRO.

8. Tools for developing cost-effective decisions for managing invasive pest eradications

Achievement: Three online apps were developed as part of a pest eradication project to support personnel managing incursions. These apps measure feasibility and progress of eradication. The tools have been tested in New Zealand and on Kangaroo Island and are ready to use for agencies overseeing pest eradications.

Principal Investigator:
Dr Dave Ramsey, Arthur Rylah Institute, Victoria.

INTEGRATED LANDSCAPE MANAGEMENT PROJECTS

1. PREP4RESET: Landscape-scale predator management

Achievement: The expansion of the RESET project with new sites in NSW is actively demonstrating to a wider audience the benefits of integrated predator management over the past practices of single species management.

Principal Investigator:
Dr Paul Meek, NSW Department of Primary Industries.

2. Management of wild dogs and deer in peri-urban landscape: Strategies for safe communities

Achievement: Progress has been made in managing wild dogs in peri-urban areas over the past five years. Besides the trialling of soft-jaw trapping, best practice Canid Pest Ejector guidelines and monitoring tools have been prepared.

These demonstrate that an integrated approach can be successful, with fewer detections and complaints to councils.

Principal Investigator:
Dr Matt Gentle, Department of Agriculture and Fisheries, Queensland.

3. Assessment of biodiversity, economic and productivity gains from exclusion fencing in Queensland and Western Australia

Achievement: Exclusion or cluster fences in regional Queensland and Western Australia are improving biodiversity and supporting farm productivity, though in some areas increased kangaroo numbers are adding to total grazing pressure. These fences are however removing invasive predators and preventing reinvasion across the fence line.

Principal Investigators:
Dr Malcolm Kennedy, Department of Agriculture and Fisheries, Queensland, and
Dr Tracey Kreplins, Department of Primary Industries and Regional Development, Western Australia.

4. National registration of a feral cat bait with the Australian Pesticides and Veterinary Medicines Authority (APVMA), stage one

Achievement: A technical assessment package was submitted to the APVMA as the first step towards assessing the viability of national registration of the cat bait, Eradicat®.

A two-stage registration process is now being pursued, as the APVMA considers that there may be enough environmental data for to extend the registration of the bait from Western Australia to South Australia, the Northern Territory and Queensland. The Authority have asked for 'further data or argument' to expand registration to cool temperate regions of New South Wales, Victoria and Tasmania.

Principal Investigator:
Dr Brad Page, Department of Primary Industries and Regions, South Australia.

5. National Wild Dog Management Coordinator

Achievement: The National Wild Dog Management Coordinator has overseen the development and implementation of the third phase of the National Wild Dog Action Plan with a focus on concerted local community action.

This included engagement opportunities involving over 170 events, and conservatively reaching at least 2,500 individual stakeholders.

Principal Investigator:
Greg Mifsud, Centre for Invasive Species Solutions.

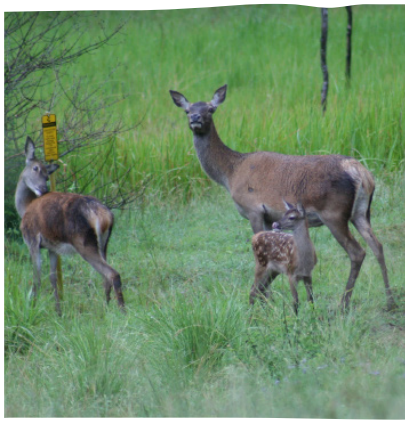
6. Cost-effective management of wild deer

Achievement: We have produced deer management guidelines and evaluated aerial and ground shooting for wild deer, giving land managers viable options for controlling deer effectively and humanely.

Assessing the annual economic cost of wild deer (about $46 million per year) has shown that wild deer need continuing and active management.

Principal Investigator:
Dr Dave Forsyth, NSW Department of Primary Industries.

7. The role of wild deer in the transmission of diseases and livestock



Achievement: Genetic data show that the majority of deer dispersal events occur within 20 km and very rarely over 50 km.

These results suggest a buffer zone of 20–50 km should be considered when establishing an asset protection program or a biosecurity exclusion zone to prevent pathogen transmission.

Principal Investigator:
Dr Carlo Pacioni, Arthur Rylah Institute.

8. Feral Deer Aggregator

Achievement: A Deer Aggregator prototype is ready to progress. The project has delivered a field-tested prototype that can be commercialised and deployed more widely. Trials confirm it is a cost-effective, deer-specific feeder that can attract deer to particular locations for more effective control by shooting or trapping.

Principal Investigator:
Dr Brad Page, Department of Primary Industries and Regions, South Australia.

The Impacts of Invasive Species

Invasive species impose significant impact costs on the Australian economy, particularly the agricultural sector. The most recent and comprehensive study of invasive species impact cost data, undertaken by Bradshaw et al. (2021)[1], estimated that invasive species have cost Australia more than $390 billion (AUD, 2017-dollar terms) since 1960.

Invasive species have also had a substantive role in nearly all native species extinctions since the 1960s[2] and impact over 80 per cent of nationally listed threatened species[3].

Whilst these are relatively current figures, the situation was essentially the same when the Centre for Invasive Species Solutions was created in 2017 out of the former Invasive Animals Cooperative Research Centre. The Centre was created to maintain the momentum in developing solutions needed to dramatically reduce the negative impact of priority invasive pests and weeds on farm profitability, native species survival and the well-being of regional communities.

It's estimated that invasive species have cost Australia **more than $390 billion** since 1960.

1 Bradshaw, C. J., Hoskins, A. J., Haubrock, P. J., Cuthbert, R. N., Diagne, C., Leroy, B., ...Courchamp, F. (2021, July 29). Detailed assessment of the reported economics costs of invasive species in Australia. NeoBiota, 67, 511–550. Retrieved from https://neobiota.pensoft.net/article/58834/

2 Woinarski, J.C.Z., Braby, M.F., Burbidge, A.A. *et al*. (2019). Reading the black book: The number, timing, distribution and causes of listed extinctions in Australia. *Biological Conservation*, 239.

3 Kearney et al. (2018). The threats to Australia's imperilled species and implication for a national conservation response. *Pacific Conservation Biology*, 25:231–244.

The Benefits of the Centre

Talia Hardaker, Acre Economics

The Centre for Invasive Species Solutions delivered a benefit-cost ratio (BCR) return on investment of 5.1 to 1 over five years, which compares favourably with evaluations across other agricultural RD&E programs.
The total investment in the Centre's Portfolio No. 1 (total funds committed between 1 July 2017 to 30 June 2022) is estimated at $96.55 million (present value terms). This investment generated estimated total expected net benefits of $490.78 million (present value terms).
This gave a net present value of $394.24 million, an internal rate of return of 178.7% and a modified internal rate of return (MIRR) of 17.8% (over 30 years using a 5% discount rate and a 5% reinvestment rate for the MIRR).

The Centre has also been able to leverage the Commonwealth Government's investment in its portfolio to secure almost three times as much additional funding (cash and in-kind).
By 30 September 2022, the Centre had achieved a nominal leverage ratio of between 2.33 and 2.93 to 1. That is, in nominal dollar terms, the Centre has secured $2.33 to $2.93 in additional funding (cash and in-kind) from co-contributors for every $1.00 invested by the Commonwealth Government grant.

9. Towards registering a toxic bait for feral deer

Achievement: Some knowledge gaps have been addressed to proceed towards registration of a 1080-based deer bait. The next stage is to fill outstanding gaps through the design pen trials for humaneness of a 1080 and to design pen trials for palatability and efficacy of either sodium nitrite, PAPP or cyanide.

Principal Investigator:
Dr Brad Page, Department of Primary Industries and Regions, South Australia.

10. National Feral Deer Management Coordinator

Achievement: A new National Feral Deer Management Coordinator position has been created to support coordinated feral deer management efforts across Australia.

The National Coordinator has helped draft a National Feral Deer Action Plan that even before its finalisation has already supported priority actions by State agencies, particularly new feral deer control programs in Tasmanian National Parks and peri-urban areas around Launceston, and eradications of satellite populations in Peel Harvey (Western Australia) and Eyre Peninsula (South Australia). It has also been used to support and guide three new state deer management plans — in Tasmania, South Australia and Queensland-in draft — and local community plans.

Principal Investigator:
Dr Annelise Wiebkin, Department of Primary Industries and Regions, South Australia.

1. Understanding RHDV2 interaction with other RHDVs and its potential as an additional rabbit biocontrol agent; national rabbit biocontrol optimisation

Achievement: Studies indicate that RHDV1 K5 is likely to be a more effective biocide today than 2017, when it was initially rolled out nationally. This is due to RHDV2 being the dominant virus in the landscape today and, in some cases, K5 overcoming pre-existing immunity to RHDV2.

After several discussions, the National Rabbit Steering Committee decided to not progress RHDV2 registration at this stage (endorsed by the Environment and Invasives Committee).

Due to frequent natural outbreaks of RHDV2 and high levels of population immunity, a registered RHDV2 product is unlikely to achieve substantial knock downs from additional releases. Despite this, all APVMA package documents that would be required for its registration as an additional rabbit biocontrol have been updated with RHDV2 relevant information.

A multivalent RHDV vaccine for domestic rabbits has been produced and successfully trialled, but with the imported Filavac vaccine now being available, it is becoming harder to justify additional expense to get the locally produced vaccine across the line.

Principal Investigators:
Dr Pat Taggart, NSW Department of Primary Industries, and Dr Tanja Strive, CSIRO.

2. Tilapia biocontrol: Prospecting and evaluation

Achievement: Tilapia lake virus has been identified as the most likely candidate for biological control of Tilapia. A business case running alongside the science proposes a six stage Research, Development and Engagement program, including this original project investment, to advance the selection, testing and potential release of new tilapia biocontrols in Australia.

Principal Investigator:
Dr Agus Sunarto, CSIRO.

3. Business decision system to prioritise vertebrate pest species for development of gene drive for population control

Achievement: A decision framework for genetic biocontrol (gene-drive) investment was published, which covers firstly, the current investment and management environment for organisations potentially funding, supporting or governing genetic biocontrol options; secondly, the critical conditions for investment in genetic biocontrol options; and finally the enabling conditions for investors to support, sponsor and/or fund genetic biocontrol initiatives.

Principal Investigator:
Dr Wendy Ruscoe, CSIRO.

4. Proof of concept for genetic biocontrol in a vertebrate

Achievement: In seeking to create gene expressions in zebra fish models that will aid in population control of invasive fish, two different types of zebrafish have been generated. This achievement is a critical first step in the path to generating a final 'synthetic species' as an example for other vertebrate gene drive options.

Principal Investigator:
Dr Mark Tizzard, CSIRO.

COMMUNITY ENGAGEMENT AND EDUCATION PROJECTS

1. Behaviourally effective communication and engagement in management of wild dogs

Achievement: We have a new approach to surveying producers for engagement, and designing behaviour change programs. Following extensive social research, a practical guide on how to survey producers to segment them for tailored engagement processes is ready for publication, together with a guide to designing behaviour change interventions for sustainable land management. The study, undertaken during COVID-19 lockdown, includes lessons for for remote engagement, such as how to run effective online engagement activities.

Principal Investigator:
Dr Lynette McLeod, University of New England.

2. Facilitating community adoption of digital resources (FeralScan)

Achievement: Total FeralScan records stand at 303,643, with 45,374 records added over 2021–22. Total FeralScan users stand at 38,805, comprising 27,883 registered users plus 10,922 non-registered users. This equates to 32,436 new users since July 2017. Total FeralScan Groups stand at 606, representing 440 new groups since July 2017.

FeralScan functionality has been enhanced to allow for real-time sharing of FeralScan occurrence data with the Atlas of Living Australia, and to support a new interactive management map for the National Wild Dog Action Plan partners.

Principal Investigator:
Peter West, NSW Department of Primary Industries.

3. Development of a national invasive species management digital information portal

Achievement: The PestSmart website has undergone a complete overhaul, while several former government weed websites have been transformed into the new WeedsAustralia website.

A digital strategy has been developed that will guide actions to harmonise all the Centre's digital assets and platforms. This will also see the Community Invasives Action website gain in prominence.

Six updated or new glovebox guides have been produced and will be uploaded to PestSmart together with over 30 technical papers.

Principal Investigators:
Frank Exon, Centre for Invasive Species Solutions;
Dr Ian McDonald, formerly with the Centre for Invasive Species Solutions.

4. Balanced Researcher Program

Achievement: Eight PhD students and a Post-Doc researcher participated in the third phase of the Balanced Researcher Program. Six have already submitted their PhD theses, with two to be submitted soon.

A longitudinal study of the Program covering the past 15 years showed a PhD completion rate of 96% and a retention of capacity within the biosecurity sector of over 50%. These figures far exceed the university sector norm.

Principal Investigator:
Dr Tony Buckmaster,
Centre for Invasive Species Solutions.

1. Weeds Investment Plan

Achievement: A 10-year National Investment Plan for Weeds Research, Development and Engagement was prepared in 2019. The Plan was underpinned by economic analyses that suggest the cost of weeds to Australia is around $5 billion.

These documents have helped support successful project bids and new proposals for integrated weed management and biocontrol.

Principal Investigators:
Tony Webster, Policy Partners, and
Dr Ross McCleod, eSYS.

2. Biosecurity surveillance of e-commerce for illegal trade in declared plants

Achievement: The weed component of the Digital Surveillance for Illegal Wildlife Trade database is now complete following extensive testing with state government agencies.

Enabling the monitoring of illicit trade in weeds, the platform is already in routine use within some jurisdictions, with several instances of such trade resulting in breech notifications.

Principal Investigator:
Associate Professor Phill Cassey,
University of Adelaide.

3. Review / update control sections of Weeds of National Significance manuals

Achievement: A new project has been commissioned to update the management and control sections of 27 Weeds of National Significance manuals commenced. This will be the first significant update of these manuals since their original release around 15 years ago.

Principal Investigator:
Dr Shauna Potter, Wild Matters.

OUR MEMBERS, ASSOCIATE MEMBERS AND PARTNERS

Many organisations have contributed to the success of the projects that together have made up Portfolio No 1. We thank them all.

Our members

Australian Government
Department of Agriculture, Fisheries and Forestry

NSW GOVERNMENT

Queensland Government

Government of South Australia

Tasmanian Government

GOVERNMENT OF WESTERN AUSTRALIA

VICTORIA State Government

ACT Government

CSIRO

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Our associate members

Nature Foundation

NRM REGIONS AUSTRALIA

WOOLPRODUCERS AUSTRALIA

RABBIT-FREE AUSTRALIA
Bilbies Not Bunnies

invasive species council

Agricultural systems and environment landscapes are **at risk** and **require deep thinking and innovation** to overcome the threats of pest plants and animals.

Our partners

THE UNIVERSITY of ADELAIDE

LA TROBE UNIVERSITY

Murdoch UNIVERSITY

une University of New England

awi Australian Wool Innovation Limited

Department of Conservation *Te Papa Atawhai*

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