CENTRE FOR
INVASIVE SPECIES SOLUTIONS

COLLABORATION | INNOVATION | IMPACT

2019–2020 ANNUAL REPORT

The Centre for Invasive Species Solutions gratefully acknowledges the financial contribution from its members and partners to support its activities.

Invasive Animals Limited governs and manages the Centre for Invasive Species Solutions.

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Designed by Yvette Cazabon

Main image: This is a young Red deer (Cervus elaphus) feeding from a feral deer aggregator prototype, during its trial phase. The image shows the deer's hoof is nicely placed in the 10x10cm mesh, ensuring that the feeder stays open and accessible. In the immediate background is a urea-free salt lick, which is used to attract deer to the feeder and to maintain their interest if the feeder runs out of grain. Trials are still being conducted with more information available in this report. Image by Matt Korcz.

Small images (L–R): The Gargoyle gecko (Rhacodactylus auriculatus) is highly popular in the international pet trade. Found only on the southern end of the island of New Caledonia its habitat is threatened by deforestation on the island. CISS researchers at the University of Adelaide have been studying the Australian demand for international alien pets, and have found that demand is greatest for species popular in the U.S. trade and species with a history of successful invasions. Image by Adam Toomes, West Palm Beach, Florida – Repticon. Ms Katherine Hill is analysing a red-eared slider turtle shell sample as part of her studies to further develop this new forensics chemistry technique. Image supplied Katherine Hill. Peter West (FeralScan Coordinator) meeting with members of GLENRAC (Glen Innes Natural Resources Advisory Committee) and the Northern Tablelands Local Land Services during a FeralScan monitoring and pest control field day at Ben Lomond, Northern Tablelands, 20 February 2020. Image by Emma Sawyers.

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MESSAGE FROM THE **CHAIR**

Invasive Animals Ltd (IAL) & the Centre for Invasive Species Solutions (CISS) have just completed a most demanding year compounded of course by the COVID pandemic. Since its inception every aspect of CISS has been rigorously scrutinised culminating this year with the Independent Performance Review (IPR) followed by the Independent Governance Review (IGR). The IGR was implemented by the Board in response to the recommendations of the IPR to ensure that any governance issues were resolved. The unambiguous conclusion of both reviews was that CISS has a robust structure and stands ready to continue its vital co ordinating and collaborative role into the future.

The Board remains firmly focused on three key core elements of our overall strategy.

Firstly, our revenue diversification strategy to win external investment is well underway. There is significant social good in the creation of a secure futuristic biosecurity shield. Deductible Gift Recipient (DGR) status recognises this aspiration and our application for DGR status is with DAWE, and our Invasive Species Solutions Trust (ISST) is now registered. Her Excellency Mrs Linda Hurley has kindly accepted to be the ISST Patron and Dr Glen Saunders AM our Trust Founder. Two so highly respected Australians backing ISST sets the very positive positioning that CISS needs to embark on our philanthropic push to attract $'s into the national biosecurity RD&E sector. The other integral component to philanthropic success is to make a positive difference in the community and in the landscape. To ensure this outcome it is essential that adoption is woven into every program and project design with Member & partner financial support committed to adoption from the outset. Where possible opportunity must be created to engage citizen science participation educating the wider community about the impact of invasives on their everyday lives.

Secondly, as part of our membership diversification we welcome our first Associate Member, NRM Regions Australia. Given that ferals and weeds are top order management issues for regional NRM bodies across Australia, this is an important partnership in our endeavours to produce new solutions that meet the needs of our land managers. We will continue to seek member base broadening as we move forward with the Centre's delivery.

Thirdly as part of our enhanced engagement and communications, our new Member and Partner Communique meetings are proving to be an excellent opportunity for member and partner feedback on any concerning issue. Each meeting informs Members and partners on Board discussions post Board meetings and the progress in rolling out our Operational Plan. These member, partner, management and Board quarterly exchanges are highly valued by the Board. However, this has been partially offset by COVID 19 which impacts on the very valuable fertile discussions that occur in face to face meetings and conferences.

There have been people changes this year. Dr Glen Saunders AM is retiring from the Board, Glen's contribution spans enabling the IA CRC start, the IA CRC rebid, establishing CISS and now Founder of the ISST. His extraordinary contribution to invasives management and control is well known as is his wildlife conservation work, we are indebted to Glen and grateful that his career focused on the invasive species sector. The Board is also most appreciative of both Carolyn Campbell-Wood and Julie McGuiness, our Company Secretary and Minute taker respectively, who have also retired. They have served the Board over many years with dedication, showing great tenacity during the establishment of CISS.

Board networks always play a significant role in furthering and finding opportunities and support for CISS. Networks and the individual Directors deep knowledge and experience in our three major discrete skill areas of science, innovation or adoption have always benefitted Board discussions. In the coming years, opening up blue sky R&D and possible IP opportunities to create revolutionary change in the future of biosecurity is an exciting and real prospect. The new IAL/CISS Board will be able to focus on the significant unmet potential of the Centre.

Image by Stefan Daniljchenko from Photographer at Large.

On a personal note I am also retiring from the IAL/CISS Board. To Chair the establishment and evolution of CISS has been a great privilege. Over the years I have been well supported by excellent Board Directors who have given valuable guidance, an exceptionally skilled management team led by a highly proficient and effective CEO, and numerous dedicated industry people, I am grateful to you all.

I became involved in the search for a truly coordinated approach to feral animal control over 25 years ago. An approach to alleviate the continuous and arduous futile efforts of land managers to lower the impacts of feral animals and improve the sustainability of our enterprises. We all worked so hard in this extremely frustrating and exhausting never ending ad hoc cycle. To make the difference, there had to be a coordinated attack spanning everyone and every sector from the paddock right through to the parliament - from dirt under the finger nails, to enquiring scientific minds, to policy makers and a raft of skilled support workers between. Over time like-minded people across this spectrum have been drawn together resulting in the Centre for Invasive Species Solutions; the culmination of a vast network of dedicated people focused on a better way to do things. It remains my aim to ensure that CISS continues and now I can best serve that aim as a strong advocate who is not involved in the immediate working of the Board.

It is and always will be the people in CISS who are our greatest asset, indeed it is our collective dedicated work that has been integral in ensuring the success of CISS, my sincere thanks to you all.

I commend the 2019 - 2020 Annual Report to you.

Helen Cathles

Chair
Invasive Animals Limited

Helen Cathles presents at the Invasive Animals Limited Annual General Meeting.

OUR **MEMBERS** AND **PARTNERS**

Full Members

Australian Government
Department of Agriculture, Water and the Environment

ACT Government

CSIRO

mla
MEAT & LIVESTOCK AUSTRALIA

NSW GOVERNMENT

Queensland Government

Government of South Australia

Tasmanian Government

VICTORIA
State Government

GOVERNMENT OF WESTERN AUSTRALIA

Associate Member

NRM REGIONS AUSTRALIA

Partners

THE UNIVERSITY of ADELAIDE

awi Australian Wool Innovation Limited

UNIVERSITY OF CANBERRA

Department of Conservation
Te Papa Atawhai

LA TROBE UNIVERSITY

Murdoch UNIVERSITY

une University of New England


CENTRE FOR
INVASIVE SPECIES SOLUTIONS

CEO SNAPSHOT

With drought starting to break in some areas, and the Bureau of Meteorology outlook indicating above average rainfall across nearly all of Australia in late 2020 to early 2021, rabbits, feral pigs, and weeds will respond quickly. In good times, feral pig populations can double in 12 months, while the purple blanket of Paterson's Curse is already widely visible. Our Centre's Team Australia approach to collaborative innovation is continuing to rise to this relentless national challenge.

New tools through CISS innovation pipelines: The 2019/20 snapshot shows that the Centre is pushing its innovation pipeline agenda forward. The Feral Deer Aggregator is now in large scale trials, while good work is continuing on the next rabbit biocontrol agent in the CISS rabbit biocontrol pipeline strategy. Also, after a 7 year R&D process, the APVMA also recently registered PAPP Putty – a lethal trap device for wild dogs and foxes – which will be available in 2021. I thank Dr Paul Meek for his efforts in leading this project.

Our integrated approach is also building and strengthening key response systems. A good example being the national planning, new genetic and acoustic detection technologies and eradication decision support tools being developed to keep the Asian black spined toad – a national priority exotic environmental biosecurity threat – out of Australia. Additionally, our genetic surveillance innovation platform has extended out from vertebrate pest incursion detection, and is now trialing portable eDNA devices to detect invasive ants, Myrtle rust and Khapra beetles to add value across the National Biosecurity System.

Accelerating adoption of best practice management: The Centre has spent the year consolidating our adoption systems and services to accelerate the uptake of best practice management. This has included adding a new National Deer Management Coordinator – Dr Annelise Wiebkin – to round out our feral deer management RD&E program, as well as launching our on-line best practice management platforms – PestSmart 2.0 and Weeds Australia. The demand in the community for management information can be seen by the high usage for both platforms.

Adapting to the COVID 19 new normal: Like all of Australia, COVID 19 has required the Centre to quickly adapt to a new normal. I am happy to report that our research and innovation portfolio remains on track for delivery by mid 2022. The most significant impact was the postponement of the Australasian Vertebrate Pest Conference originally to be held in Melbourne in May 2020 to 2021.

Towards an innovation centred transformation of the National Biosecurity System: The new CSIRO Biosecurity Futures report again highlights that innovation needs to be a central driver in strengthening the nation's biosecurity shield. A key will be enabling communities to be eyes and ears on the ground, and our new computer vision weed ID app project is a great example of a technology to make community weed surveillance easy and accurate.

All the achievements outlined in this report is testimony of the collaborative effort of our 17 Members and Partners, the 182 researchers driving our innovation agenda, and an extremely dedicated management team.

Finally, I would like to give heart felt thanks to recently retired Carolyn Campbell-Wood and Julie McGuiness for all their efforts in ensuring the Centre runs smoothly, and Helen Cathles whose 13 year leadership propelled the Centre from its Invasive Animals CRC origins into the dynamic organisation that it is today.

Andreas Glanznig

Chief Executive Officer
Centre for Invasive Species Solutions

Image by Stefan Daniljchenko from Photographer at Large.

CENTRE FOR
INVASIVE SPECIES SOLUTIONS

THE 19/20 SNAPSHOT

Our 3rd year of RD&E operations

The problem

Invasive species decrease agricultural productivity

- Vertebrate animals = ~$600 million per year in costs & damages[1]
- Weeds = ~$5 billion per year in costs & damages[2]

Invasive species are the #1 pressure on Australia's threatened species.[3]

The solution

The Centre for Invasive Species Solutions is a national collaborative research, development and extension organisation, formed to tackle the ongoing threat from invasive species through achieving adoption of new innovation and transformational technologies.

17 member and partner organisations:

- **9** governments
- **1** CSIRO
- **5** universities
- **2** research and development corporations

36 institutions involved as third parties to our research

RESEARCH

39 PROJECTS

6 Projects completed

33 Projects are underway

85 PROJECT MILESTONES

89% Achieved

9% Advanced progress

28 PUBLICATIONS PRODUCED

5 technical reports

23 Scientific publications

DEVELOPMENT

68 PRODUCTS IN DEVELOPMENT

7 prototype tools developed for wild dog detection

Feral deer aggregator

53 web scrapers to monitor e-commerce sites

5 New real time eDNA techniques

Weed computer vision ID app

(Red-eared slider turtle, Asian black spined toad, Kaphra beetle, Myrtle rust and invasive ants)

1 'Proof of absence' eradication tool software package

1 NEW PRODUCT REGISTERED

PAPPPutty™ paste for leg hold traps (wild dogs and foxes)

2 AVPMA REGISTRATION PACKAGES IN DEVELOPMENT

GonaCon™ fertility control vaccine for kangaroos and wallabies (urban use)

RHDV2 rabbit biocontrol agent

EXTENSION

FACE TO FACE

156 Stakeholder workshops conducted

12 Conference papers presented

1 Certificate III Course in Pest animal management – redeveloped

DIGITAL

×4 National digital platforms in use

PestSmart
FeralScan
WeedsAustralia
CommunityInvasivesAction

513,521 PestSmart website views

25,754 FeralScan Users

213,000+ FeralScan records

78,000 WeedsAustralia page views (April-June only)

Achieving adoption

1286 vials
of RHDV1 K5 distributed across Australia during the 19/20 FY enhancing integrated rabbit management.

449 pest management groups
are registered within FeralScan using collective data to enhance strategic management outcomes on ground and connect them with government land managers.

2 national pest animal coordinator positions

The wild dog and feral deer national coordinator positions are led through our Centre, with a national feral pig coordinator position led through Australian Pork Limited.

1950+ rabbit tissue samples analysed
through the National Rabbit Biocontrol Monitoring Program from samples collected by the community and land managers

1 McLeod, R. (2016). Cost of Pest Animals in NSW and Australia, 2013-14. eSYS Development Pty Ltd. Report prepared for the NSW Natural Resources Commission.

2 McLeod, R. (2018). Annual Costs of Weeds in Australia. eSYS Development Pty Ltd. Published by the Centre for Invasive Species Solutions, Canberra, Australia.

3 Kearney, S. G., Carwardine, J., Reside, A. E., Fisher, D. O., Maron, M., Doherty, T. S., ... & Wintle, B. A. (2019). The threats to Australia's imperilled species and implications for a national conservation response. Pacific Conservation Biology, 25(3), 328-328.

YEAR IN REVIEW

July 2019

The **Victorian Rabbit Action Network** receives a United Nations Public Service Award for their role in building a community-led approach to managing rabbits at landscape scale

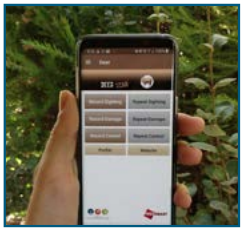
ABC Landline cover our **deer research collaboration**

August 2019

CISS to coordinate the implementation of the **National Environment and Community Biosecurity Research Development and Extension Strategy**

September 2019

DeerScan component of **FeralScan** released



RHDV1 K5 research showcases importance of citizen science data collection

Researchers test real-time **eDNA** kits at the International Trade Aquarium facility in Thailand

October 2019

February 2020

First **Balanced Researcher Program professional development camp** undertaken

CISS RD&E Review Forum held

March 2020

CISS Third Year Independent Performance Review completed

April 2020

Weeds Australia beta site released

Successful trials of the prototype Deer Aggregator **Deer Aggregator** completed

May 2020

$2 million National Landcare Programme grant to develop new **Weeds ID app** and **WeedScan** monitoring program

November 2019

RHDV2 impact across Australia research paper published

Meet The Ferals series airs on **ABC TV** nationally

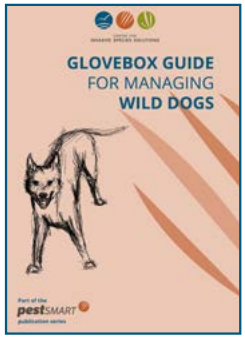
December 2019

National Incursions Response Facilitator project completed and **INVASIVESPLAN** delivered to government

January 2020

June 2020

PestSmart glovebox guides reviewed



5000+ glovebox guides ordered online

July 2020

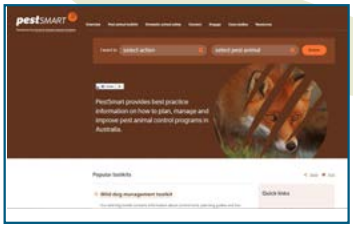
National Wild Dog Action Plan 2020-2030 launched plus new website wilddogplan.org.au

FeralScan upgrade

WildDogScan reaches **100,000** records milestone

August 2020

PestSmart relaunched with brand new interface and usability



Community Invasive Action portal developed

September 2020

Six new CISS projects announced under stage 2 project funding

PAPPPutty™ Lethal Paste for Wild Canids for use on leg-hold traps nationally registered through **APVMA**

OUR **STRATEGY**

Our Vision

Through scientific leadership and alliances we will act as a catalyst to deliver ethical invasive species solutions in Australia and beyond.

Our Mission

We are in the business of creating and brokering powerful and efficient large-scale invasive species RD&E collaborations.

Our Values

As a service and member-oriented company, the Centre for Invasive Species Solutions (CISS) strives to be:

- a trusted authority for delivering effective, independent and science based solutions
- a catalyst for inspiring solutions through collaboration and thought leadership
- a promoter of ethical solutions that respect the welfare of all species
- audacious in pursuing new ideas to disrupt established thinking and identify solutions

Our Five Strategic Pillars

1. Strengthen and build collaborations
2. Develop and implement collaborative RD&E
3. Build capability and best practice management adoption
4. Create new collaboration and innovation opportunities
5. Operate the Centre effectively and efficiently

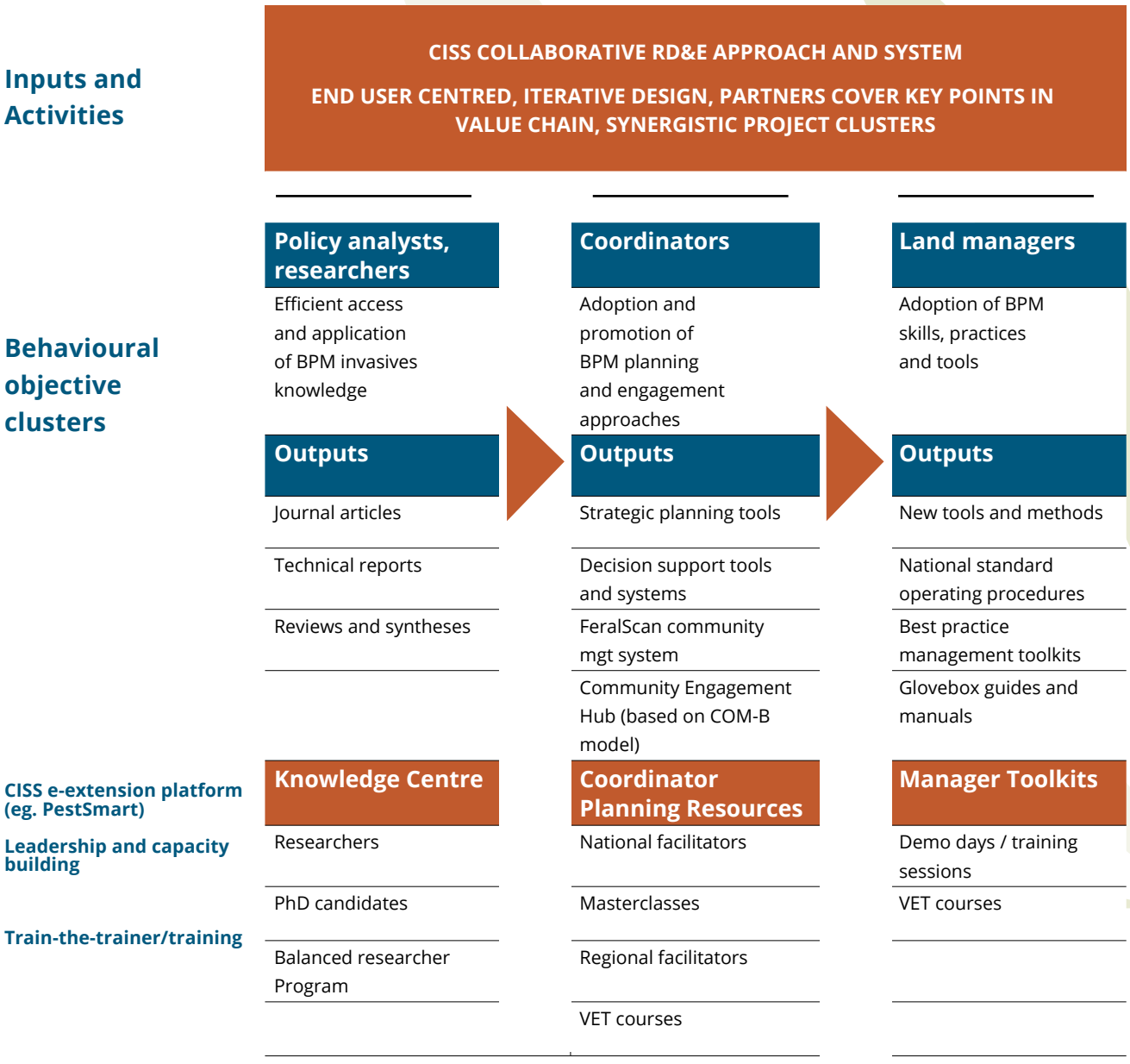
Our Innovation Domains

1. Incursions
2. Integrated Landscape Management
3. Biocontrol
4. Community Engagement and Education

THE **CISS** APPROACH

CISS Research, Innovation and Engagement Model and System

The CISS research, innovation and engagement model has been developed and refined over the 12 year Invasive Animals CRC, and has been instrumental in the design of CISS programs. It aims to cover all key points in the value chain from need identification through to engagement and adoption via a managed distributed network of Member, partner and other organisations. A schematic representation of the generic CISS research, innovation and engagement model is below.



OUR **RESEARCH** AND **DEVELOPMENT**

The Centre's R&D effort is focused on both prevention and early response to new and emerging invasive species, and strategic landscape scale management of established vertebrate and weed pests. Our 39 RD&E project portfolio addresses national biosecurity and invasive species RD&E priorities. The projects' outputs aim to strengthen strategic responses to vertebrate pests and weeds challenges in the following areas:

- Incursion prevention and response, through:
  - development of response tools and systems, and
  - development of detection tools;
- Integrated landscape management and empowering action, through
  - a coordinated feral deer program,
  - a coordinated wild dog program, and
  - other pest products and tools;
- Biocontrol technologies and systems, through
  - a rabbit biocontrol program, and
  - advancement of a nationally coordinated approach to gene drive technology

The research and development section is divided to highlight achievements against the three areas above, supplemented by achievements in cross sectoral capacity building and RD&E planning.

Collaboration

Collaboration is the key to developing and scaling solutions that arise from, and must be implemented in, complex operating environments. For this reason, around 85% of the Centre's Portfolio No.1 projects involve between two and ten collaborating organisations. Collaboration is an important part of ensuring research outputs translate into innovation, positive outcomes and impact by: i) designing solutions that take into account multiple perspectives, ii) building different pathways to adoption tailored to the different operating environments in which decisions are made, and iii) coordinating and clearly communicating about new solutions from the sources considered most credible to different stakeholders.

Working to and facilitating national priorities

All Centre RD&E projects are designed to address national biosecurity priorities, such as those agreed to by the National Biosecurity Committee (NBC) and its Environment and Invasives Committee (EIC). In some cases, however, documented priorities are dated, or new ones are yet to be agreed. In these cases, the Centre can play a role in facilitating and setting future priorities, such as through the preparation of a 10 Year National Investment Plan for Weeds RD&E, which involved considerable national consultation, and through assisting the Office of the Chief Environmental Biosecurity Officer prepare a National Environment and Community Biosecurity RD&E Strategy.

Monitoring, evaluation and reporting

Since early 2018 the Centre has had a Research Excellence and Impact Framework to guide its monitoring, evaluation, and impact assessment activities. The primary elements of the Framework implemented to date cover detailed monitoring of project progress against a range of inception to impact criteria, prospective impact assessments e.g. for our rabbit and wild dog programs, and coordination of a mid-term review of overall Portfolio No.1 progress.

The projects outlined in this section use the following status bar to indicate which stage a project has reached:

Initial planning	Underway	Final stages	Complete

The year of living dangerously

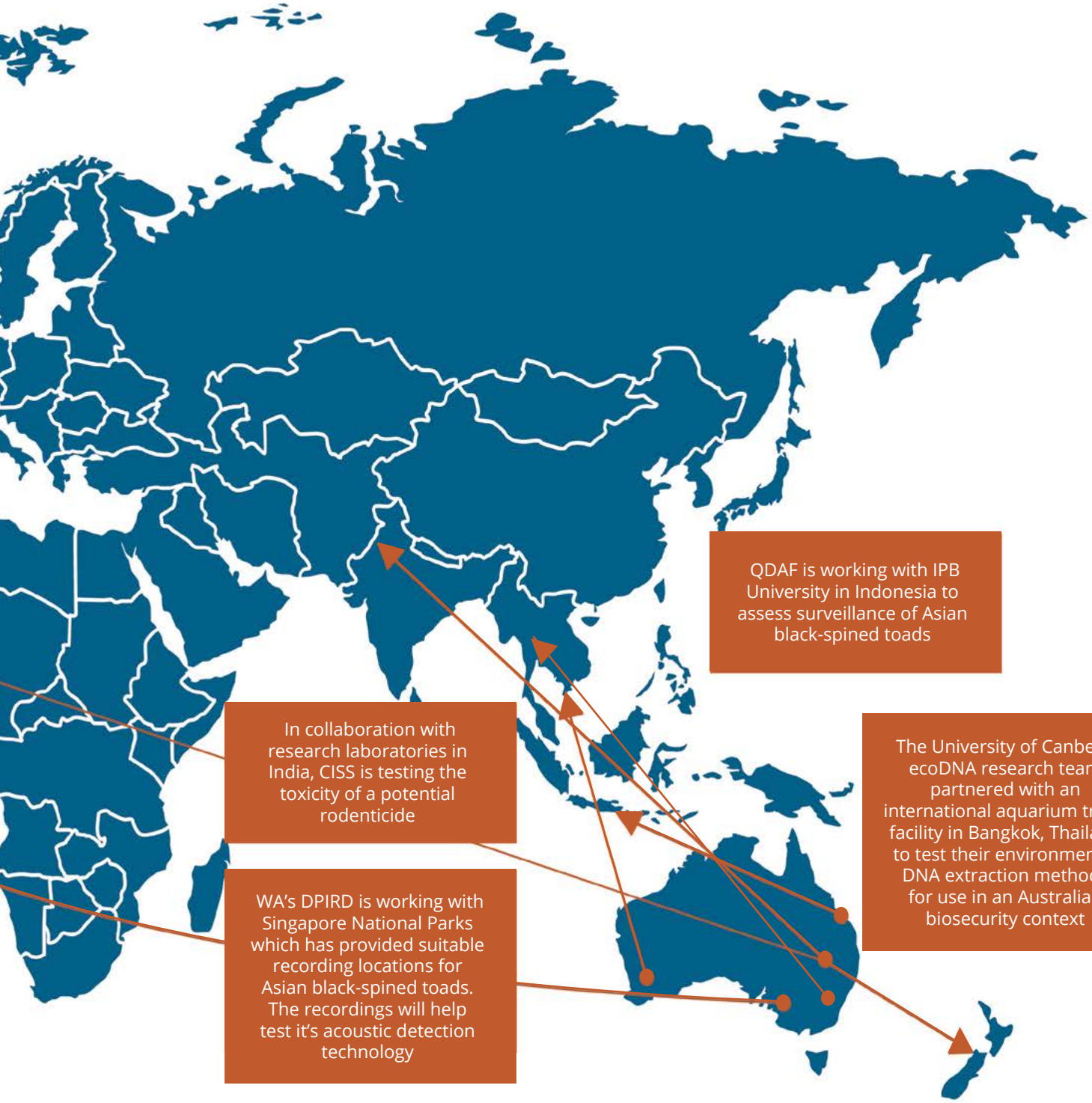
Drought, bushfires, storms, hail damage and COVID-19 were prevalent risks over much of 2019-20. COVID-19 presented the most significant Centre-wide risk, however Centre projects have remained resilient and on track to deliver to specification by June 2022. This is in large part due to the quick risk management responses of CISS members and partners and the amazing effort of CISS researchers to quickly adapt to new research schedules and methodologies.

The Centre applauds the efforts of our researchers and field staff, including those who also contributed during the height of the bushfires, and those who played important roles when seconded to the Australian Government's various COVID-19 taskgroups.

A close up view of the Nov 2019 NE NSW fires from a Prep4Reset project remote camera. Image supplied by Paul Meek (NSW DPI).

The Centre's international collaborations

Along with our numerous national collaborative RD&E programs, our Centre has engaged in a number of key international collaborations



QDAF is working with IPB University in Indonesia to assess surveillance of Asian black-spined toads

In collaboration with research laboratories in India, CISS is testing the toxicity of a potential rodenticide

The University of Canberra ecoDNA research team partnered with an international aquarium trade facility in Bangkok, Thailand to test their environmental DNA extraction methods for use in an Australian biosecurity context

WA's DPIRD is working with Singapore National Parks which has provided suitable recording locations for Asian black-spined toads. The recordings will help test it's acoustic detection technology

The Arthur Rylah Institute is working with NZ Manaaki Whenua Landcare Research to co-develop proof-of-absence software tools for eradication management

Detailed World Map with Countries by Medina Creatives

INCURSIONS PREVENTION AND **RESPONSE**

The Gargoyle gecko (*Rhacodactylus auriculatus*) is highly popular in the international pet trade. Found only on the southern end of the island of New Caledonia its habitat is threatened by deforestation on the island. CISS researchers at the University of Adelaide have been studying the Australian demand for international alien pets, and have found that demand is greatest for species popular in the U.S. trade and species with a history of successful invasions. Image by Adam Toomes (University of Adelaide) at Repticon, West Palm Beach, Florida.

Incursions Prevention and Response

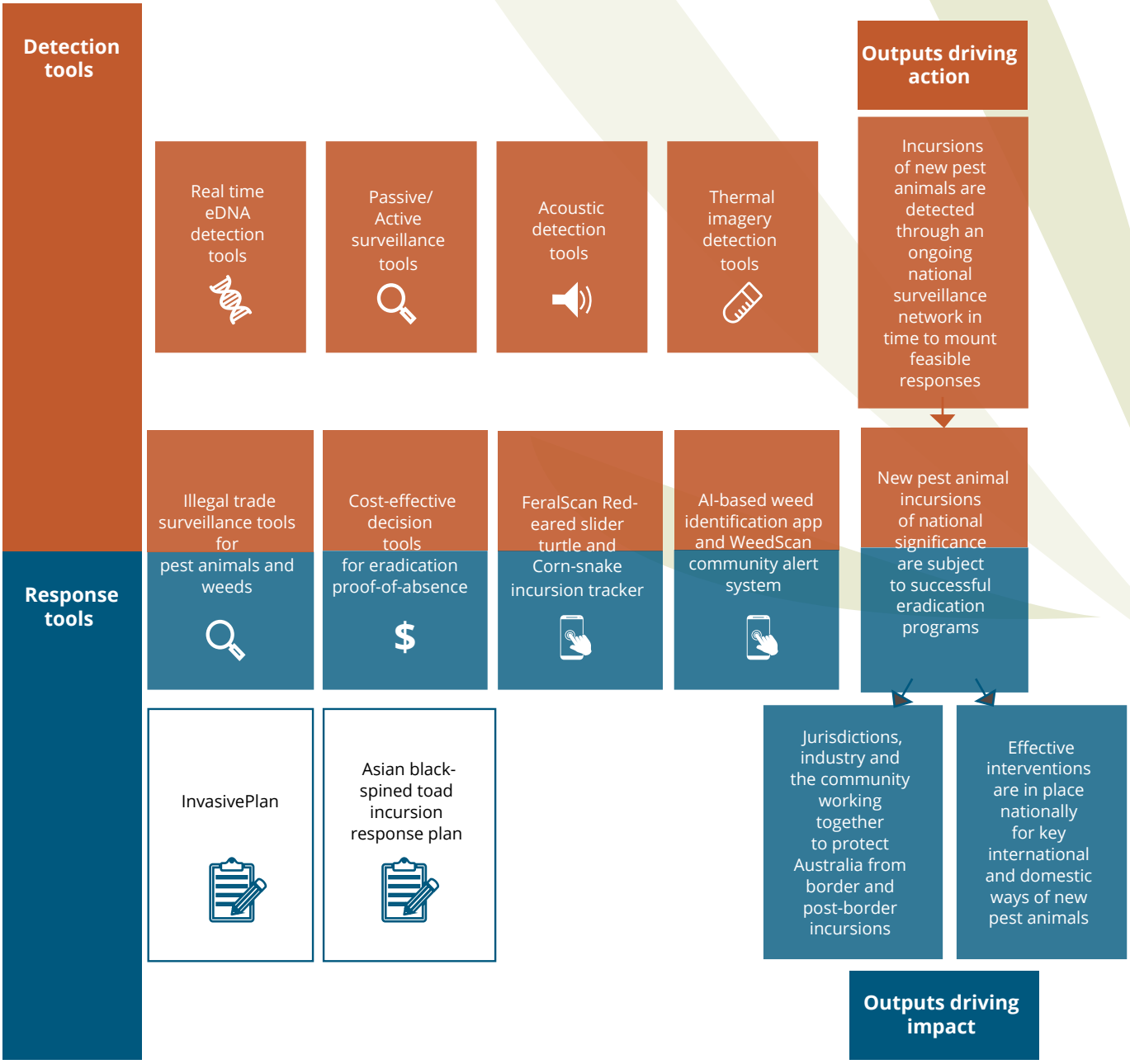
The challenge

Global trade and illegal imports (including e-commerce) will rise markedly over the next decade causing a major increase in incursion risks. These risks are already significant, with 1,551 biosecurity incidents covering 138 vertebrate species between 2010-2015. The most commonly intercepted vertebrate hitch hiker is the Asian black-spined toad. The incursion risk is further amplified by non-native plants and ornamental birds, reptiles and fish which are already in Australia, but are yet to naturalise in the Australian landscape; this includes over 5,900 non-native plant species already in Australia which have weed histories overseas. This large reservoir of potential future weeds is the driver for about 20 new weeds naturalising in the environment each year or 1 every 18 days.

The solution

Our incursions prevention and response projects aim to protect Australia's economy, environment and social amenity from the impacts of new pest animals and invasive plants through the following proposed outputs due to be delivered by 2022.

Expected Outputs



2019/20 progress highlights include

1. Final draft of the National Vertebrate Incursion Prevention and Response Plan (InvasivePlan) 2019-2024 completed and submitted to the Australian Government for National Biosecurity Committee (NBC) endorsement.
2. Automated monitoring of Australian e-commerce sites for alien wildlife trade through the development of a web scraping tool to analyse exotic live animal trade websites is operational.
3. Development of web-based decision support tools for eradication programs commenced with the aim to have a working version ready by late 2020.
4. Strengthened the technical and community capacity to identify potential new invasions, through developing and trialing the efficacy of user friendly eDNA apparatus.
5. Development and application of acoustic detection technologies for monitoring and detecting high risk invasive species and understanding the potential for citizen science networks to play a role in incursion detection.
6. An artificial intelligence-based weeds ID app project has commenced, with protocols developed for weed image sourcing to help train the AI learning process.

Engagement with end-users

Several Incursions projects are at the stage where they will be seeking end-user feedback on the functionality and efficacy of their emerging tools. This will be facilitated through State and Commonwealth government representatives on the Terrestrial Vertebrate Working Group, a subcommittee of the Environment and Invasives Committee, and more specific end-user workshops to ensure the outputs from the Incursions projects meet end-user needs and are easily implemented.

Workshop participants from NZ regional councils and the Department of Conservation with Dr Dave Ramsey (CISS project leader) and his team. As part of the workshop October 2019 they were looking to develop a 'proof of freedom' framework decision support system, which will help land managers evaluate their incursion prevention programs. Image supplied by Andrew Gormley from Landcare Research NZ.

Incursion Prevention and Response Achievements

Response Tools

Development of a national incursion management framework for invasive species

Initial planning	Underway	Final stages	Complete

2019/2020 update

The project prepared a draft National Vertebrate Incursion Prevention and Response Plan (InvasivePlan) 2019-2024. InvasivePlan is being progressed towards National Biosecurity Committee (NBC) endorsement, and its accompanying Framework and Compendium are being further developed under the NEBRA custodianship of the Chief Environmental Biosecurity Office.

Leader: Dr Malcolm Kennedy* and Dr Michelle Christy | Western Australian Department of Primary Industries and Regional Development

Partners: Western Australian Department of Primary Industries and Regions, South Australian Department of Primary Industries and Regions, Victorian Department of Economic Development, Jobs, Transport and Resources, Tasmanian Department of Primary Industries, Parks, Water and Environment, New South Wales Department of Primary Industries, Australian Government Department of Agriculture, Water and the Environment

Aim: To understand roles and responsibilities with respect to the prevention and detection of invasive animal and plant incursions. It also aimed to improve recognition of what is required to increase the efficiency and effectiveness of responses to new animal and plant incursions of national significance.

* Dr Kennedy started a new role with QDAF in early 2020

Development of a national incursion response plan for Asian black-spined toads

Initial planning	Underway	Final stages	Complete

2019/2020 update

As a complementary project to the preparation of InvasivePlan, this project prepared a draft National Response Plan for the ABST as an example of a hitchhiker invasive species. The plan outlined what is needed to respond to an ABST detection, and currently sits with the Office of the Chief Environmental Biosecurity Officer.

Leader: Dr Michelle Christy | Western Australian Department of Primary Industries and Regional Development

Partner: Western Australian Department of Primary Industries and Regions.

Aim: To develop a national incursion response plan for the Asian black-spined toad (ABST) as a model for other invasive amphibian response plans.

Top image: American corn snake spotted in Lithgow, NSW. Image supplied by NSW DPI. Bottom image: Asian black-spined toad, Cloverdale. Image supplied by DPIRD WA.

Response Tools

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

Initial planning	Underway	Final stages	Complete

2019/2020 progress

The project has developed a prototype web-based tool to undertake "proof-of-absence" confirmation of eradication success. It was road-tested using data provided by New Zealand project partners and a working version should be ready by late 2020. The project also provided technical advice to Biosecurity Qld regarding the Red imported fire ant program, with prototype software used to provide an estimate of optimal amount of ant surveillance required to declare freedom in management zones. (See map pg 9-10)

Leader: Dr Dave Ramsey | Arthur Rylah Institute, Victorian Government

Partners: Victorian Arthur Rylah Institute for Environmental Research, CSIRO, University of Adelaide, Victorian Department of Economic Development, Jobs, Transport and Resources, Manaaki Whenua Landcare Research, New Zealand

Aim: To improve the capability of government agencies to make successful and cost-effective eradication decisions to maximise the economic benefits to industry and the environment.

Understanding and intervening in illegal trade in non-native species

Initial planning	Underway	Final stages	Complete

2019/2020 progress

The project has successfully constructed a predictive model for identifying risk of future pest species demand in Australia by correlating exotic animal permit information with pet keeping and incursion frequency. Daily automated monitoring of Australian e-commerce sites for alien wildlife trade is ongoing, with a total of 53 custom web scrapers built so far. Design is also underway for natural language processing models to automatically detect species being traded over the internet.

Leader: Associate Professor Phill Cassey | University of Adelaide

Partners: University of Adelaide, CSIRO, Victorian Arthur Rylah Institute for Environmental Research, South Australian Department of Primary Industries and Regions, Australian Museum

Aim: To develop a comprehensive understanding of the nature of exotic pet keeping and illegal vertebrate species trade in Australia, which will lead to preventing the incursion of new alien species.

Note: please see the Illegal Wildlife Trade infographic on pages 17 & 18

Top image: Red imported fire ants attacking and eating crickets. Image supplied by the National Red Imported Fire Ant Eradication Program. Bottom image: Oliver Stringham (University of Adelaide) working on the 'Understanding and intervening in illegal trade in non-native species' project. Image supplied by A/Prof. Phill Cassey (University of Adelaide).

Red-eared slider turtles have been smuggled into Australia, and have been illegally kept and released, as part of the illegal pet trade. They pose a significant threat if established. Image by Pablo Garcia-Diaz.

ILLEGAL WILDLIFE TRADE (IWT)
A THREAT TO ENVIRONMENTAL BIOSECURITY, BIODIVERSITY, HUMAN HEALTH AND WELLBEING

THE PROBLEM: Illegal wildlife trade directly threatens tens of thousands of species. It is critical that it is taken seriously in order to safeguard our environmental assets and provide resilient landscapes for our unique flora and fauna.

WHAT IS IT?

The illicit sale or exchange of biological resources i.e., naturally harvested, alien or non-domesticated animals and plants. These species may be protected under either domestic or international law, but have been harvested and traded without appropriate legal permission.

pet & ornamental trade

meat & timber trade

fashion trade

Each year, the IWT:

- Produces many thousands of tonnes of wildlife contraband, worth billions of dollars.
- Is a major component of transnational environmental crime and a driver of declines in biodiversity globally.
- Generates novel biosecurity and human health risks through the transport and introduction of alien and invasive species – as well as their pathogens and diseases.

HOW BAD IS IT?

In 2019 over 1 million illegal wildlife items were seized across thousands of global incidents

IWT is increasing and Australia has had more high-profile wildlife seizures in the last three years than in the previous eight years combined.

There is good evidence that rare and endangered species are of higher value in illegal trade, and that the IWT is itself a source of endangerment for thousands of species.

WHY CAN'T WE STOP IT?

Global wildlife trade is regulated by the multilateral Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

While CITES aims to root out illegal trade, the IWT remains a pervasive regulatory issue. For instance, there is no international legal agreement on what constitutes wildlife crime.

Ongoing challenges:

Native Australian species protected under the EPBC Act are not automatically protected outside of Australia, and there is a popular international trade in Australian native species (e.g., reptiles).

Between 1999 and 2016 over 2,795 alien vertebrates were detected in Australia, and many of these were from illegal holding, breeding and importing. These species are a considerable risk to the Australian environment.

Agencies responsible for combatting wildlife crime and enforcing legislation need resources, and in Australia differences in State and Commonwealth legislation lead to difficulties in exchanging intelligence and driving national cooperation.

A lack of public awareness and responsiveness is conflated as illegal wildlife trade can be poorly enforced with low penalties and low rates of prosecution being commonplace globally.

THE SOLUTIONS:

Through the Centre for Invasive Species Solutions, researchers at the University of Adelaide are currently leading a project focused on developing automated data-mining/web-scraping code to identify and characterise the illegal or unwarranted selling of alien species through e-commerce platforms (e.g., Gumtree, Facebook, enthusiast forums, lost and found websites).

Designating greater enforcement and surveillance resources to the global wildlife trade, as well as an increased focus on existing and future risks from IWT to Australian environments, economies and human wellbeing.

Facilitating greater intelligence sharing between agencies responsible for enforcing wildlife crime legislation, as well as cooperating with researchers and practitioners working in environmental biosecurity and wildlife conservation and forensics.

Driving legislative improvements to increase the synergies between State and Commonwealth agencies – including coordination of permitting and surveillance/prosecution legislation, and higher penalties consistent across jurisdictions, which reflect the seriousness of IWT.

Improving public awareness and responsiveness to IWT through education campaigns and conducting social research to understand which aspects of behavioural change provide the greatest social de-incentive.

Image by KHellon

The recent emergence of COVID-19 is causing global human suffering and mortality, and has rapidly become the most acute public health emergency of our generation. While the origin of the novel coronavirus that causes COVID-19 remains uncertain, there is strong evidence that novel zoonotic diseases are linked to human activities that bring wildlife and humans into increasingly intense contact; including the harvesting, trade and consumption of wildlife. By combatting the illegal harvesting and unsustainable trade of wildlife we can improve environmental health and animal welfare, while also reducing human health risks.

Prepared by: Phill Cassey, Talia Wittmann, Adam Toomes & Oliver Stringham who are leading the CISS project 'Understanding and intervening in illegal trade in non-native species'.

Page 17 image credits: Pramuka bird market, Jakarta, Indonesia, March 2011. Image by Erni.
Landscape with large woodpile in the summer forest from sawn old big pine and spruce de-barked logs for forestry industry. Image by Avn photo lab.
Hunting amulets in the form of cut bird and animal paws. The skins of dead foxes and hares. Image by Vavlt.
Iquitos, Peru - December 11, 2018. Caiman heads and claws are sold at the busy upper Belén Market in Iquitos in Peru, alongside potions and other goods. The Caiman (part of the alligator family) are killed in the Amazon river/rainforest and transported to the busy, chaotic markets where their bodies are sold for meat, with the heads mainly used for decoration. Image by G J Quinlan.
Replicated artificial ivory elephant tusk pile on grey dusty ground. Image by MadeK.

Succulents and cacti have become increasingly popular in recent years as ornamental plants. Their hardiness and low maintenance make them ideal for the novice gardener or house plant enthusiast. These same attributes also make some varieties highly invasive weeds, and well adapted to Australia's hot dry climates. CISS researchers at the University of Adelaide are investigating the online trade of declared plants to help prevent and reduce the spread of these invasive species. Image by A/Prof. Phill Cassey (University of Adelaide), McLaren Vale, SA.

Detection Tools

Biosecurity surveillance of e-commerce and other online platforms for illegal trade in plants

Initial planning	Underway	Final stages	Complete

2019/2020 progress

A manual web survey conducted to gather potential sites for web-scraping, other than Facebook, Gumtree and eBay, identified 38 websites as listing targeted declared weed species (with the caveat that many listings are currently 'out of stock'). 1,495 declared weed species including hybrids have currently been identified and catalogued with higher taxonomy to construct a national list of state & territory declared plants.

Leader: Associate Professor Phill Cassey | University of Adelaide

Partners: University of Adelaide

Aim: To ensure that effective interventions are in place nationally for monitoring key international and domestic online sources of illegal plants and e-commerce trade pathways.

Development of integrated passive and active surveillance tools and networks

Initial planning	Underway	Final stages	Complete

2019/2020 progress

The project has sharpened its focus to serve the needs of jurisdictions by generating alerts based on priority vertebrate species lists. Analysis of community reporting rates indicate a high reporting rate for more easily observed and identified species such as cane toads and starlings, with reporting rates for Red-eared slider turtles much lower. A preliminary algorithm was developed for automated acoustic detection of starlings, and acoustic traps for cane toads (TOADINATOR®), modified for Asian black-spined toads, have been deployed in high risk sites around Brisbane. (See map pg 9-10)

Leader: Dr Peter Caley | CSIRO

Partner: CSIRO, Western Australian Department of Primary Industries and Regional Development, University of Adelaide, Queensland Department of Agriculture and Fisheries, University of Canberra, Victorian Arthur Rylah Institute for Environmental Research.

Aim: To develop a coherent, complementary approach for combining community surveillance and targeted surveillance using passive (e.g. community sighting) and active sensing (e.g. eDNA) technologies to detect and manage pest incursions in a timely manner.

Note: please refer overpage for more information on the linkages of this project.

Top image: Velvet Tree Pear (*Opuntia tomentosa)* on grazing land in Central Queensland. Image by Andrew Mitchell. Middle image: Citizen surveillance in action – bird watchers on the Birdsville Track. Image by Nick Gascoigne. Bottom image: Biosecurity Queensland researchers, who are working on the CISS funded project 'Development of integrated passive and active surveillance tools and networks' are working with volunteers in the Rocklea area of Brisbane to help monitor acoustic traps to detect any Asian black spined toad invasions. Image supplied by Steve Csurhes.

Towards a national invasive species surveillance system

How CISS is developing a systems approach to detect a National Priority Exotic Environmental Biosecurity Pest

Using the Asian Black-spined toad (ABST) hitch-hiker pathways as a case study

- Completed through CISS
- Under development through CISS

ABST Incursions Response Plan

Transport pathways for ABST

Detection and surveillance methods

Genetic Surveillance

- Portable, real-time eDNA detection

Acoustic Surveillance

- Portable and sentinel surveillance (eg. high risk sites - Ports)

Passive Acoustic Surveillance

- Species specific detection
- On board algorithm processing
- Storage
- Alerts
- Solar powered

Active Acoustic Surveillance

- Species specific acoustic lure and trap
- Solar powered

Data collated and analysed through the cloud in real time

- Fully scalable
- AI/machine learning
- Algorithm processing
- Disaster recovery

Response initiated

Eradication Decision Support Tool

- Guide decisions for eradication response

Analysis and notification

- View incidents and location maps
- View and analyse presence/absence data
- Classify incidents
- Export incident data
- Notifications

Threat eradicated

Project Partners include

Australian Government
Department of Agriculture, Water and the Environment

CSIRO

UNIVERSITY OF CANBERRA

Queensland Government

VICTORIA State Government

GOVERNMENT OF WESTERN AUSTRALIA

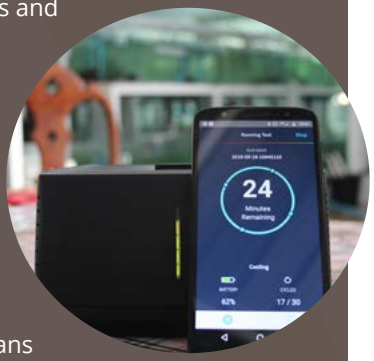
Detection Tools

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

Initial planning	Underway	Final stages	Complete

2019/2020 progress

Water samples analysed for Red-eared slider turtle (REST) eDNA in NSW returned a negative result from all locations, despite visual observations of REST at some locations. Validation tests conducted on captive REST specimens confirmed that eDNA can be detected in water samples. Negative field results may be due to turtles ecological and shedding traits, e.g. their hard-keratinised shell, and ability to travel and spend time outside of water may make turtles less likely to provide consistent shedding of DNA. Reduction of false negative eDNA tests could be improved by analysis of more samples and a greater understanding of the shedding rates and dispersal of turtle eDNA in the environment.



The project is now working with Qld DAF and contacts in Indonesia to try and source Asian black-spined toad (ABST) tissue and eDNA samples.

Sensitivity limits for eDNA detection were tested in a large-scale carp eradication program in Tasmania, results indicate eDNA can detect low-density carp populations though the sensitivity of the surveys was low. eDNA surveys can be a useful tool for detecting remnant individuals following eradication programmes and a cost-efficient means of monitoring where positive detections are likely to be a rare occurrence. (See map pg 9-10)

Leaders: Associate Professor Dianne Gleeson and Dr Elise Furlan | University of Canberra

Partners: University of Canberra, New South Wales Department of Primary Industries

Aim: To develop an enhanced detection method for aquatic invasive species, both those that are identified as high-risk and those that could potentially pose a biosecurity risk, using real-time environmental DNA sampling techniques.

Biosecurity Molecular Screening

Initial planning	Underway	Final stages	Complete

2019/2020 progress

Environmental DNA (eDNA) samples have been collected from an international aquarium trade wholesaler and sequenced and analysed using the Illumina Miseq and the Oxford Nanopore MinION portable sequencer, which is forming the basis of a DNA reference database. Standard operating procedures have been developed to prepare metabarcoding libraries for Illumina and Nanopore sequencing platforms applicable to high priority species. (See map pg 9-10)

Leaders: Associate Professor Dianne Gleeson and Dr Alejandro Trujillo-González | University of Canberra

Partners: University of Canberra, University of Sydney, Cawthron Institute

Aim: To develop a real time eDNA protocol to quickly and easily detect biosecurity threats through the international ornamental fish trade.

Top image: The next-generation portable sequencer, MinION from Nanopore Oxford technologies (United Kingdom) is being tested by UC researchers as part of their eDNA invasive species project. Image by Yvette Cazabon. Middle image: The new Biomeme analysis kit has the ability to analyse samples for DNA within minutes. Image by Dr Alejandro Trujillo-González (UC). Bottom image: Jack A. Rojahn (U.C. PhD candidate supported by CISS) testing the new Biomeme analysis kit in the field in Thailand, as part of our centre's biosecurity molecular screening project. Image by Dr Alejandro Trujillo-González.

Detection Tools

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

Initial planning	Underway	Final stages	Complete

2019/2020 progress

This project has enhanced a starling call reference library with recordings from Adelaide and the Fleurieu Peninsula. Around 660 starling call sequences have been manually retrieved from these recordings to act as an initial reference call set for the training and testing of a detection algorithm(s). For other species, the project has sourced recording units which will be placed strategically to collect Asian black-spined toad and Indian house crow reference calls.

Leader: Dr Susan Campbell | WA Department of Primary Industries and Regional Development

Partners: WA Department of Primary Industries and Regional Development, DKB Solutions and Specialised Zoological

Aim: To demonstrate the benefits of using Passive Acoustic Surveillance technology by deploying multiple units in key locations, building on the development of an automated remote detection system for starlings in the CSIRO sister-project.

Development of an artificial intelligence-based weed identification App and reporting program

Initial planning	Underway	Final stages	Complete

2019/2020 progress

An agreed activity workplan has been developed, a project steering committee formed and protocols prepared for weed image sourcing and selection to underpin the artificial intelligence-based learning system sitting behind the ID app.

Leader: Dr Hanwen Wu, NSW Department of Primary Industries

Partners: CSIRO, Atlas of Living Australia, NSW Department of Primary Industries, SA Dept of Primary Industries and Regions, VIC Department of Jobs, Precincts and Regions, VIC Department of Environment, Land, Water and Planning.

Aim: This project will develop, trial and implement Australia's first real-time, artificial intelligence-based, automated identification of national, state and regional priority weeds, alongside a fit for purpose community weed management, alert, reporting and communication system – WeedScan.

Top image: Starling. Image by Peter Tremain. Second image: *Martynia annua* - small-fruited devil's claw. Bottom (L-R) Asparagus smothering riparian trees, Tingalpa Creek, Brisbane. Alexander Schmidt-Lebuhn (CSIRO) taking photos of willow flowers for computer vision training. Images by Andrew Mitchell.

Creeper tower (Rubber vine) in front of an unaffected tree, Dimbulah, QLD. Image by Andrew Mitchell.

INTEGRATED LANDSCAPE MANAGEMENT AND EMPOWERING ACTION

The Murchison Regional Vermin Cell Fence, is one of four dog proof fences currently under construction in the Southern Rangelands of Western Australia. The fence encloses 52 pastoral properties and 9 Department of Biodiversity, Conservation and Attractions properties in an area larger than Tasmania. Image by Debbie Dowden.

Integrated Landscape Management and Empowering Action

The challenge

Feral deer:
The six deer species established in Australia are expanding in abundance and range. While agricultural, environment and social impacts are increasing rapidly in many regions, there is currently little knowledge on the most cost-effective management strategies, and no best-practice guidelines for managing deer anywhere in Australia.

Wild dogs:
Wild dogs are one of the threats holding back sheep production in Australia and are a major cause for the contraction of the rangeland sheep grazing industry. They also cause major impacts to other livestock industries and peri-urban communities. Large-scale cooperative management strategies are critical to reversing this trend.

Other pests:
Foxes, cats, pigs, and other vertebrate pests continue to wreak environmental havoc and damage to agricultural assets across the country. In many cases these pests are experienced in tandem with each other as well as with deer and wild dogs. This reinforces the need for landscape scale solutions, as well as strategies that ensure the solution to managing one pest species does not create a void for other pest species to fill.

The solution

Our integrated landscape management program aims to see a reduction in the economic, environmental and social costs associated with invasive species through development and demonstration of large-scale integrated management strategies. The program has a specific target towards developing new and improved tools for wild dog and feral deer management and empowering communities to take collective action. Projects such as Prep-for-Reset also consider the challenge of managing multiple pest species. National coordination is an important element of our activities as a means of applying consistent and practices proven through both diverse and collective experience, and in galvanising the critical mass in community responses needed at the landscape scale.

Expected Outputs (Deer)

			Outputs driving action
Understanding impact	Economic impact of deer in Australia	Role of deer in hosting exotic livestock disease	Quantification and evidence supporting a call-to-action for landscape scale management of deer
New tools	Feral deer aggregator		Availability of tools fit for purpose specific to deer
Optimising management	Developing best management strategies for deer in rural environments	Developing management strategies for deer in peri-urban environments	New codes of practice and standard operating procedures for deer management
Community management	National Deer Management Coordinator	Wild DeerScan monitoring and reporting alerts	Best management practice guides and management toolkits
			Outputs driving impact

2019/20 progress highlights include

1. A systematic review of ground-based shooting revealed few examples of this approach successfully reducing overabundant mammal populations. Successful examples used professional rather than volunteer shooters.
2. Two novel viruses have been detected in four of the six deer species found in Australia, with further testing underway to determine prevalence of the viruses.
3. The feral deer aggregator continues to progress, with the final prototype design currently being constructed ahead of large-scale field testing.
4. The national coordinator model has been replicated in the form of a National Deer Management Coordinator, who will support community-led deer control nationally and facilitate the development of a National Action Plan for feral deer.
5. DeerScan component of FeralScan released.

Engagement with end-users

A steering committee of end-users overseeing these projects is acting to provide practical feedback to the researchers and help extend the lessons and tools beyond the immediate sites of research activity. Community and stakeholder engagement continues to be important for monitoring deer in peri-urban environments, with additional monitoring sites identified through management effort and known impact areas from residents.

Expected Outputs (Wild dogs)

				Outputs driving action
Understanding impact	Evaluation of the National Wild Dog Action Plan	Assessment of the biodiversity, economic and productivity benefits of cluster fences		Quantification and evidence supporting a call-to-action for landscape scale management of wild dogs
New tools	PAPPPutty™ based lethal trap devices	Innovative wild dog alert technology	Innovative automated Intelli-traps	Availability of tools fit for purpose for managing wild dogs
Optimising management	Developing landscape scale best management strategies for dogs in a multi-predator context	Developing management strategies for dogs in peri-urban environments		New codes of practice and standard operating procedures for wild dog management
Community management	National Wild Dog Management Coordinator	Bahaviourally effective community engagement strategies for managing wild dogs	WildDogScan monitoring, reporting and alerts	Best management practice guides and management toolkits
				Outputs driving impact

2019/20 progress highlights include

1. Results from canid pest ejector (CPEs) trials in peri-urban Qld indicate a low CPE interaction and activation rate for wild dogs and foxes, however CPEs remain target specific for delivering toxic doses to wild dogs and foxes. This data will help provide recommendations for the effective and safe use of CPE deployment and trapping for managing peri-urban wild dogs.
2. The first study using CPE PAPP capsules for wild dog control in Western Australia (WA) has now finished. The CPE results will now be compared to baiting effectiveness for WA.
3. Control programs have significantly reduced wild dogs within cluster fences in Qld with dog numbers remaining low. The benefits of reduced predation should be more rapid than those from reduced grazing pressure from native herbivores, however it is difficult to detect due to drought conditions.
4. Data from the Australian Bureau of Statistics and remote sensing of vegetation both inside and outside of the Qld cluster fences is being analysed to give insight into changes in ground cover, and can provide analysis of total grazing pressure by species.
5. Prep4Reset continues to control invasive predators at multiple sites in NSW. Two additional monitoring sites have been established, and negotiations are underway to establish research sites in Qld.
6. The FeralScan community mapping program exceeded 25,000 users for the first time, no doubt helped by an incredible 64 training workshops held across the country, both face to face and virtually. The WildDogScan component reached 100,000 records and a new DeerScan component was launched.
7. The National Wild Dog Management Coordinator has played an important role in creating the National Wild Dog Action Plan (NWDAP) 2020-2030 which was formally announced in June 2020.
8. A data gap analysis determined no additional testing sites were required to facilitate the national registration process for the feral cat bait Eradicat®. The efficacy and environment modules are now being prepared for submission to the APVMA.
9. Additional data collation for the APVMA registration of GonaCon™ in Australia is ongoing.
10. Testing is underway to assess toxicity of a new rodenticide.

Engagement with end-users

Invasive animal management in both rural and peri-urban areas relies on successful community engagement. Engagement through workshops allows community members to become informed of, and involved in the research being undertaken in their areas, e.g. helping to develop possible community led plans for invasive animal management. Communication with key stakeholders and land managers such as NSW Local Land Services (LLS) and wild dog coordinators ensures that consistent messages are being conveyed to landholders and the community.

Integrated Landscape Management Achievements

Feral Deer Program

Cost-effective management of wild deer

Initial planning	Underway	Final stages	Complete

2019/2020 progress

A systematic review of ground-based shooting revealed few examples of this approach effectively reducing overabundant mammal populations, and the examples that were successful used professional rather than volunteer shooters. The project team has been involved in aerial shooting programs in NSW, Qld and the ACT in which 10,362 deer have been culled, and preliminary analysis of the data indicates that this control method can rapidly reduce deer populations from high- to low-density. Identifying reasons why some programs are less successful than others will support development of best practice management guidelines.

Leader: Dr Dave Forsyth | New South Wales Department of Primary Industries

Partners: New South Wales Department of Primary Industries, Queensland Department of Agriculture and Fisheries, University of Canberra, Tasmanian Land Conservancy, Charters Towers Regional Council (Qld).

Aim: To investigate cost-effective methods for reducing the impacts of feral deer in Australia and to disseminate this knowledge widely to the deer management community.

The role of wild deer in the transmission of diseases of livestock

Initial planning	Underway	Final stages	Complete

2019/2020 progress

The project is revealing that the risk posed by deer as hosts of exotic disease is real. For example, analysis has revealed the presence of novel Betaretrovirus and Picobirnavirus in serum samples from wild fallow, rusa, sambar and chital deer. The extent of the risk and likelihood of transference of these and other diseases from deer to livestock is subject to further investigation.

Leader: Dr Carlo Pacioni | Victorian Arthur Rylah Institute for Environmental Research

Partners: Victorian Arthur Rylah Institute for Environmental Research, New South Wales Department of Primary Industries, Victorian Department of Economic Development, Jobs, Transport and Resources, La Trobe University

Aim: To investigate the risk posed by deer to the livestock industry as hosts for exotic disease and to evaluate the effectiveness of possible mitigation strategies should an outbreak occur.

Top image: Assessment of the welfare outcomes of aerial shooting, August 2020. Image by Dr Dave Forsyth (NSW DPI). Middle image: Fallow deer. The Role of wild deer in the transmission of diseases of livestock aims to quantify the risk of endemic/exotic disease transmission between wild deer and livestock species. Image by A. Dezsery. Bottom image: Aerial survey of chital deer in north Queensland. Image by Dr Tony Pople (Biosecurity Qld).

Feral Deer Program

Feral deer aggregator

Initial planning	Underway	Final stages	Complete

2019/2020 progress

Several prototype devices have been developed and refined, and a final prototype is being constructed for large scale testing in the field. Previous trials have shown that both red and fallow deer are capable of interacting with the device for the intended effect. No toxins will be trialled in this project.

Leader: Dr Brad Page | South Australian Department of Primary Industries and Regions

Partners: South Australian Department of Primary Industries and Regions, South Australian Department for Environment and Water

Aim: To develop a deer aggregating device for testing in areas with high densities of native fauna e.g. kangaroos, possums and feral deer. It builds on foundational R&D by the NSW Office of Environment and Heritage primarily aimed at goats.

National Deer Management Coordinator

Initial planning	Underway	Final stages	Complete

2019/2020 progress

This project recruited Dr Annelise Wiebkin to the role of National Deer Management Coordinator.

Leader: Dr Annelise Weibkin | South Australian Department of Primary Industries and Regions

Partners: South Australian Department of Primary Industries and Regions

Aim: To support community-led deer control in all states and territories, compile national deer distribution data, current state and national laws, policies and practices, and facilitate the development of a National Action Plan for feral deer.

Top image: Red Deer feeding from deer aggregator. Image by Matt Korcz. Middle image: Feet component of deer aggregators being prepared for next part. Image by Matt Korcz. Second image: Dr Annelise Weibkin. Bottom images: (L-R) Group of female Rusa deer at Lake Kurwongbah, southeast QLD. This work is a collaborative project with local governments within the southeast and funded through CISS. Image by Matt Amos. Rusa deer, Forster, NSW. Image by Ashley Carlson.

Feral Deer and Wild Dog Program

Management of wild dogs and deer in peri-urban landscapes: strategies for safe communities

Initial planning	Underway	Final stages	Complete

2019/2020 progress

Feral deer: Feral deer densities are being monitored by faecal pellet count in response to ground shooting operations in two peri-urban areas in Queensland and New South Wales to identify the best management strategies for these invasive species. 2018 and 2019 faecal pellet data suggests deer numbers have increased. Additional monitoring sites have been identified and will be included in future pellet counts. Analysis of camera grid surveys is underway, which will assess the efficacy of control by local authorities.

Wild dogs: Visitation and capture rates of trapping are being compared to canid pest ejectors (CPE's) to determine the most effective and cost-efficient way to remove wild dogs. Results indicate a low CPE interaction and activation rate for wild dogs and foxes, however CPEs remain target specific for delivering toxic doses to wild dogs and foxes. The data collected will help provide recommendations for the effective and safe use of CPE deployment and trapping for managing peri-urban wild dogs. A community led plan is also being developed through a community working group, with two workshops held to inform participants of the research being undertaken and the results to date.

Leader: Dr Matthew Gentle | Queensland Department of Agriculture and Fisheries

Partners: Queensland Department of Agriculture and Fisheries, New South Wales Department of Primary Industries, ACT Parks and Conservation, New South Wales Local Land Services, Griffith University, Sunshine Coast Council, Brisbane City Council

Aim: To provide pest managers, through collaborations and community-led actions, with alternative strategies for managing wild dogs and deer in peri-urban areas of Australia.

Top image: Peri-urban wild dogs. Image by John Smith. Bottom image: Fog causing delays during winter aerial surveys of chital deer in north Queensland. Image by Dr Tony Pople (Biosecurity Qld).

Rusa deer grazing on a front yard in Forster, NSW. Image by Ashley Carlson.

Wild Dog Program

Assessment of the biodiversity, economic and productivity gains from exclusion fencing in QLD

Initial planning	Underway	Final stages	Complete

2019/2020 progress:

Remote sensing of cover at paired points inside and outside the cluster fences from the past 19 years shows no change in ground cover following cluster fencing. A 40-year time series of grazing pressure for sheep, cattle, macropods and invasive species has been developed. Removal of wild dogs has occurred since 2014, resulting in very low wild dog activity inside and outside the cluster fences and decreasing numbers trapped each year. Dry conditions have resulted in low wildlife activity at the Morven and Tambo sites. Kangaroo density is much lower in the Morven cluster than at Tambo. Producers in the Morven cluster have utilised lower kangaroo numbers to stock sheep, goats and maintain stock levels of cattle.

Leader: Dr Malcolm Kennedy | Queensland Department of Agriculture and Fisheries

Partners: Queensland Government Department of Agriculture and Fisheries, Queensland Government Department of Department of Environment and Science, New South Wales Department of Primary Industries, Western Australia Department of Primary Industries and Regional Development, Meat and Livestock Australia and Central Queensland University

Aim: To determine the cost-effectiveness of cluster fencing in the short and long term through the reduction in predation by wild dogs and reduced competition from kangaroos. This requires an assessment of the effectiveness of pest control by landholders, improvements in pasture production and, ultimately, improvements to livestock production, relative to unfenced areas. It will also assess biodiversity benefits through vegetation cover and increases in wildlife abundance and biodiversity.

Assessment of the biodiversity, economic and productivity gains from exclusion fencing in WA

Initial planning	Underway	Final stages	Complete

2019/2020 progress:

A two-year assessment on the use of CPEs and eight different lures for wild dog control in the Murchison Region Vermin Cell (MRVC) was completed. This study included the first trial of CPE PAPP capsules in the state. CPEs managed more wild dogs in the southern rangelands than baiting but they are a more time-consuming method of control. A new baiting program has commenced to deploy a higher rate of baiting within the Murchison Hub Cell (MHC) to effectively remove all wild dogs from within the smaller cell fenced area. Ongoing monitoring of the livestock, wild dog, and macropods within the MHC is already showing some increase in productivity.

Leader: Dr Tracey Kreplins | Western Australian Department of Primary Industries and Regional Development

Partners: Western Australian Department of Primary Industries and Regional Development, Western Australian Department of Biodiversity, Conservation and Attractions, Murdoch University, Meat and Livestock Australia

Aim: To understand the relationships between active predator management, cell-fencing and water availability on native herbivores, introduced herbivores and introduced predators. It will ultimately identify how changes in predator and herbivore density can be practically utilised by landholders to improve small stock production and native biodiversity.

Top image: Landholders take a tour of the cluster fences in Western QLD, as part of the National Wild Dog Action Plan (NWDAP) stakeholder meeting. Image supplied by NWDAP. Bottom image: Moses Omogbeme (Murdoch University) conducting field work as part of his PhD studies. Image supplied by Tracey Kreplin.

The Murchison Regional Vermin Cell Fence, one of four dog proof fences currently under construction in the Southern Rangelands of Western Australia. The fence encloses 52 pastoral properties and 9 Department of Biodiversity, Conservation and Attractions properties in an area larger than Tasmania. Image by Debbie Dowden.

Wild Dog Program

Preparing for RESET landscape-scale predator management [Prep4Reset]

Initial planning	Underway	Final stages	Complete

2019/2020 progress:

This project is highlighting the challenges of remote R&D, with bush fires destroying many camera traps at some of the project sites, resulting in lost data. These camera traps have now all been replaced, and the remaining cameras serviced. There have also been cases of camera theft and vandalization at some sites. Challenges aside, images from the camera traps have been tagged to indicate the species captured, wild dog DNA testing has commenced and some mapping of genomic patterns across the study areas has also commenced.

Leader: Dr Paul Meek | New South Wales Department of Primary Industries

Partners: New South Wales Department of Primary Industries, New South Wales Local Land Services, Meat and Livestock Australia, Australian Wool Innovation

Aim: To synthesise research and collect before-control predator, wildlife and livestock impact data to enable the planning, implementation and evaluation of the Full Reset project. Prep4Reset also supports crucial networking to generate financial and time co-investment from multiple stakeholders in the Full Reset project.

PAPPPutty™ registration - lethal paste for leg hold trap devices

Initial planning	Underway	Final stages	Complete

2019/2020 progress:

The APVMA advised that the application for the registration of PAPPPutty™ has now been fully assessed and was passed for delegate approval. The registration application for PAPPPutty™ was subsequently granted by the APVMA on the 28th September 2020 and arrangements are underway to distribute them nationaly through Animal Control Technologies Australai (ACTA). The BiteMe™ product was not taken to full commercialisation stage as our commercialisation partner advised that it was not likely that the product would be commercially viable.

Leader: Dr Paul Meek | New South Wales Department of Primary Industries

Partners: New South Wales Department of Primary Industries, Connovation Ltd, Australian Government Department of Agriculture, Water and the Environment

Aim: To register and commercialise a wild dog and fox lethal trap device with the PAPPPutty™ para-aminopropiophenone (PAPP) based product that could be applied on cloth put on trap jaws, which takes advantage of the wild canids tenancy to bite at the trap when captured.

Bottom image: The PAPPPutty gel is within a silicon lethal trap device which is placed onto the leg hold trap as seen in this image suppled by Paul Meek.

Wild Dog Program

Wild Dog Alert

Initial planning	Underway	Final stages	Complete

2019/2020 update

Development and testing of these products is complete, and the core project is complete. The project has entered the commercialisation phase with the State of New South Wales acting through the Department of Primary Industries within the Department of Regional NSW being nominated as the Designated Partner to take the product forward for commercialisation. CISS and the projects Commercialisation Governance Committee will monitor the progress of the commercialisation process.

Leader: Dr Paul Meek | New South Wales Department of Primary Industries

Partners: New South Wales Department of Primary Industries, Meat and Livestock Australia, Australian Wool Innovation and Australian Government Department of Agriculture

Aim: To develop and test several automated detection system to provide land managers with real time evidence that wild dogs are on their land.

e-Technology Hub – Intelli-traps

Initial planning	Underway	Final stages	Complete

2019/2020 update

The development and testing phases of this project are complete, and this project has entered the commercialisation phase with the State of New South Wales acting through the Department of Primary Industries within the Department of Regional NSW as the nominated Designated Party to take the outputs from this project through the commercialisation process. CISS will monitor the commercialisation process as it progresses.

Leader: Dr Paul Meek | New South Wales Department of Primary Industries

Partners: New South Wales Department of Primary Industries, The University of New England, The Department of Primary Industries and Regional Development

Aim: To develop and test remote systems for the management of livestock and biodiversity, a system for targeted delivery of baits for wild dogs and an autonomous gate closure system for trapping feral pigs.

Top image: Dingo. Middle images: Wild Dog Alert can transmit alerts using the BuckEye camera trap system, allowing messages to be transmitted over areas with no telecommunication network. A dingo approaches the sentinel bait station which recognises the animal as a dog and presents a bait and then reloads ready for the next visitor. Bottom image: Simon Croft of Encounter Solutions carrying out Celium Hub tests to measure the transmission distance of the below ground mini-hub. Images by Dr Paul Meek (NSW DPI).

As part of wild dog alert, testing the Celium alert system under harsh Australian conditions was critical to designing the trap alert platform, here Heath Milne is burying a trap alert mole to conduct a drive test to measure transmission distance in the desert. Image by Dr Paul Meek (NSW DPI).

Wild Dog Program

Behaviourally effective communication and engagement in management of wild dogs

Initial planning	Underway	Final stages	Complete

2019/2020 progress:

A survey of landholders has revealed that there are different wild dog management behaviour profiles, from those that are eager to participate in control efforts to non-participants. To address barriers to adoption, effective communication is key through appropriate message framing. The reporting tool WildDogScan (WDS) has commenced evaluation, with focus on increasing the uptake of WDS by landholders, and identifying any additional barriers impeding landholders ability to adopt the technology. This research will assist the WDS developers in improving their promotional, educational and support services.

Leader: Dr Lynette McLeod | University of New England

Partners: University of New England, Western Australian Department of Primary Industries and Regional Development, Meat and Livestock Australia, Australian Wool Innovation

Aim: To use behavioural science principles to assist wild dog facilitators to understand and engage more effectively with non-participating landholders.

National Wild Dog Management Coordinator

Initial planning	Underway	Final stages	Complete

2019/2020 progress:

The National Wild Dog Action Plan (NWDAP) 2020-2030 and new website was formally announced on July 1, 2020. The website has had interest from stakeholders both within Australia and overseas including North America and United Kingdom. A 'Learn how to use muzzles for working dog safety' video was developed by the NWDAP through funding from NSW LLS, Sheep Producers Australia, Wool Producers Australia and Animal Health Australia. Muzzles purchased through this project have now been distributed across the country through the wild dog coordinator and NSW LLS network. The use of muzzles for protecting working dogs is being actively promoted and monitored through our wild dog management networks, with many organisations now purchasing additional muzzles to support ongoing wild dog and fox management in their local regions.

Leader: Greg Mifsud | Centre for Invasive Species Solutions

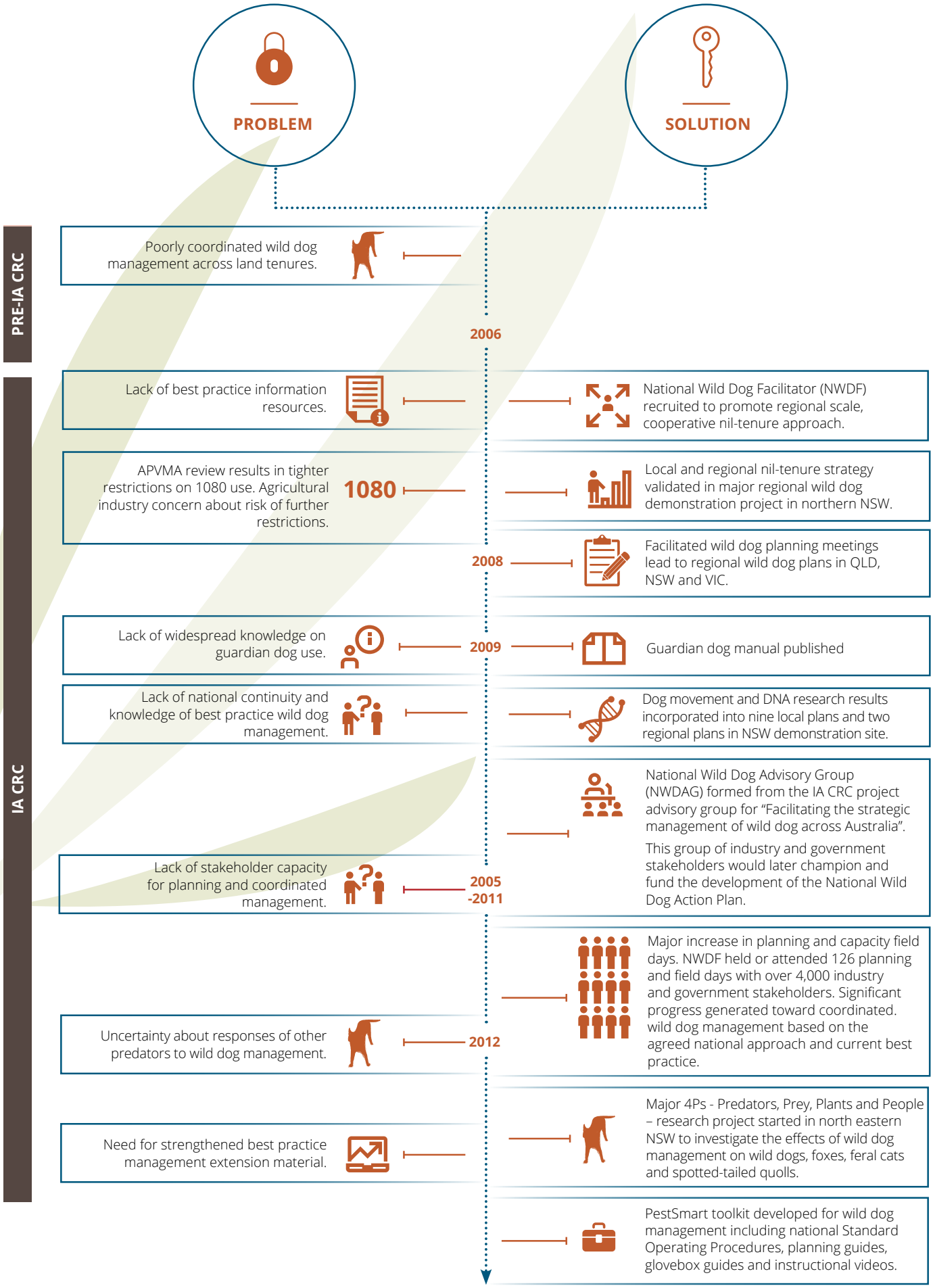
Partners: Australian Wool Innovation, Meat and Livestock Australia, Queensland Department of Agriculture and Fisheries, Victorian Department of Economic Development, Jobs, Transport and Resources, Victorian Department of Environment, Land, Water and Parks, Western Australia Department of Primary Industries and Regional Development, New South Wales Department of Primary Industries, Animal Health Australia, Sheep Producers Australia, Wool Producers Australia

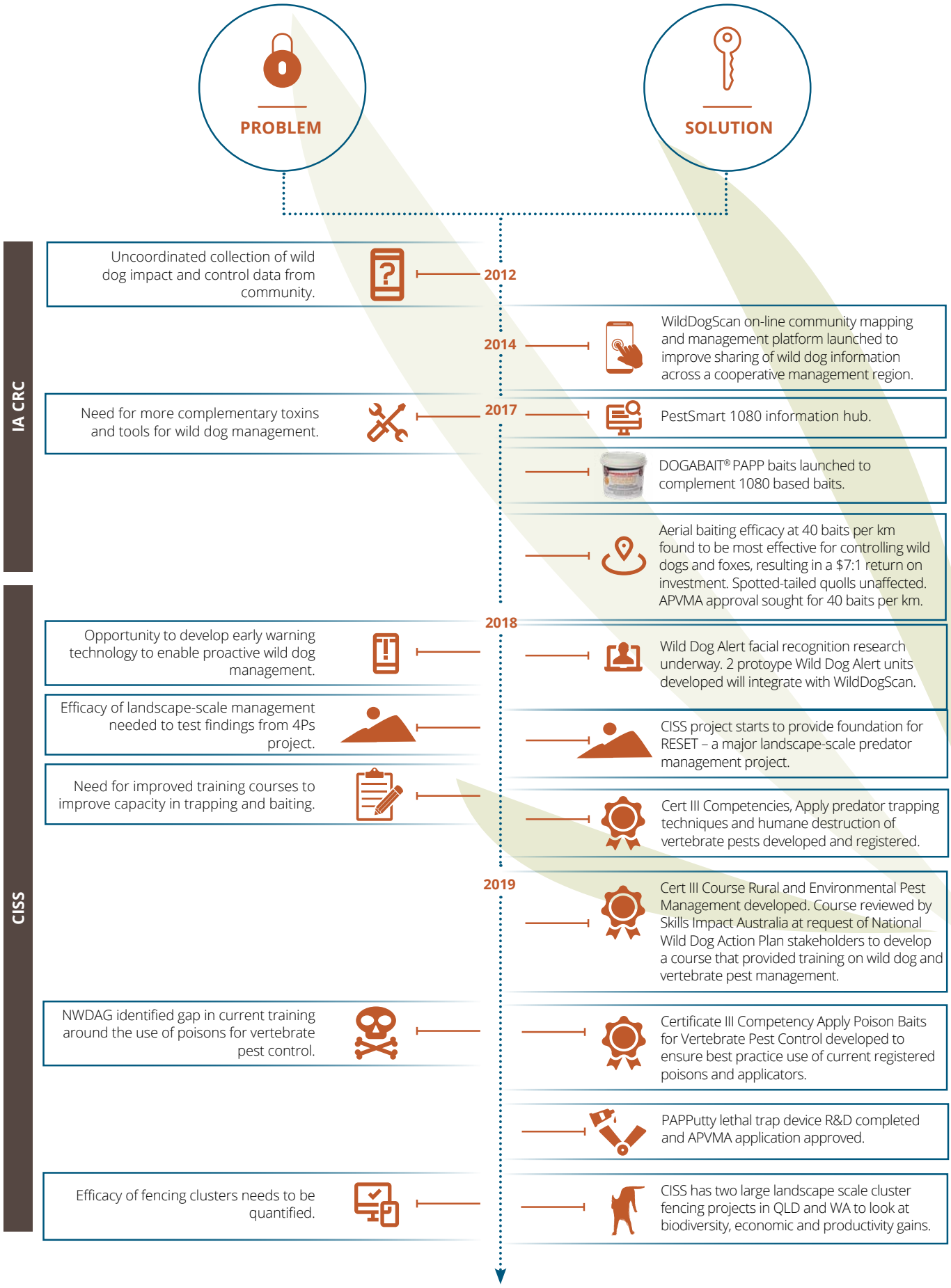
Aim: To build on the platform for strategic management of wild dogs that has been developed over the past ten years.

Top image: Brian Dowley, Industry funded Community baiting program coordinator with DELWP talking about the importance of participation in community wild dog baiting programs at a joint NSW/Victorian Government workshop on cross border feral pig and wild dog management. Bottom image: Greg Mifsud presenting at the Peterborough Predator Control workshop. Images supplied by National Wild Dog Coordinator Greg Mifsud.

Wild dog research, development and extension pipeline

Achieving smarter, more effective and more engaged management through innovation




PROBLEM
SOLUTION
IA CRC
CISS
Uncoordinated collection of wild dog impact and control data from community.
2012
2014
WildDogScan on-line community mapping and management platform launched to improve sharing of wild dog information across a cooperative management region.
Need for more complementary toxins and tools for wild dog management.
2017
PestSmart 1080 information hub.
DOGABAIT® PAPP baits launched to complement 1080 based baits.
Aerial baiting efficacy at 40 baits per km found to be most effective for controlling wild dogs and foxes, resulting in a $7:1 return on investment. Spotted-tailed quolls unaffected. APVMA approval sought for 40 baits per km.
2018
Opportunity to develop early warning technology to enable proactive wild dog management.
Wild Dog Alert facial recognition research underway. 2 protoype Wild Dog Alert units developed will integrate with WildDogScan.
Efficacy of landscape-scale management needed to test findings from 4Ps project.
CISS project starts to provide foundation for RESET – a major landscape-scale predator management project.
Need for improved training courses to improve capacity in trapping and baiting.
Cert III Competencies, Apply predator trapping techniques and humane destruction of vertebrate pests developed and registered.
2019
Cert III Course Rural and Environmental Pest Management developed. Course reviewed by Skills Impact Australia at request of National Wild Dog Action Plan stakeholders to develop a course that provided training on wild dog and vertebrate pest management.
NWDAG identified gap in current training around the use of poisons for vertebrate pest control.
Certificate III Competency Apply Poison Baits for Vertebrate Pest Control developed to ensure best practice use of current registered poisons and applicators.
PAPPutty lethal trap device R&D completed and APVMA application approved.
Efficacy of fencing clusters needs to be quantified.
CISS has two large landscape scale cluster fencing projects in QLD and WA to look at biodiversity, economic and productivity gains.

Other Pest Products and Tools

National registration of a poison cat bait containing 1080 in liquid form

Initial planning	Underway	Final stages	Complete

2019/2020 progress

A data gap analysis indicated that no additional testing sites were required to facilitate the national registration process for Eradicat®. The efficacy and environment APVMA modules be prepared and submitted to the APVMA for a pre-registration technical assessment for the APVMA to determine if additional trials may be needed. If the APVMA identifies trials that are needed they will be commenced.

Leader: Dr Brad Page | South Australian Department of Primary Industries and Regions (SADPIR)

Partners: South Australian Department of Primary Industries and Regions , South Australian Department of Environment and Water and Western Australian Department of Biodiversity, Conservation and Attractions

Aim: To collate available data, and collect new priority data, on bait efficacy and non-target risks to significantly progress the national registration of the bait with APVMA.

GonaCon™ fertility control vaccine registration

Initial planning	Underway	Final stages	Complete

2019/2020 progress

A request for Pre-Application Assistance (PAA) was lodged with the APVMA in November 2018. to ensure that the data collected to support the application was sufficient and that the APVMA was comfortable with the Good Manufacturing Practices of the manufacturer of the product.

Based on the results of the PAA, a data gap analysis was commissioned. This has identified the additional data that is needed for the registration of GonaCon™ in Australia. Collecting and collating these data into the required APVMA application modules is ongoing. (See map pg 9-10)

Leader: Dr Tony Buckmaster | Centre for Invasive Species Solutions

Partners: ACT Government

Aim: After more than a decade of research and field trials through the previous Invasive Animals CRC, a submission package is to be developed to register Gonacon in Australia as an injectable fertility control agent for kangaroos and wallabies in urban areas.

Top image: Feral cat. Image by Darren Marshall. Bottom image: A kangaroo is injected with GonaCon™ as part of a research trial being conducted by the ACT Government. Image supplied by Claire Wimpenny.

New rodenticide toxin registration

Initial planning	Underway	Final stages	Complete

2019/2020 progress:

In collaboration with researchers in the USDA, India and France, CISS is embarking on the first steps towards registration of a new toxin as a rodenticide in both Australia and the United States. Sufficient compound has been synthesised for the initial toxicity and mutagenicity testing. Those tests are currently underway. (See map pg 9-10)

Leader: Dr Tony Buckmaster | Centre for Invasive Species Solutions

Partners: GRDC, USDA

Aim: To progress the R&D and subsequential registration of a new rodenticide for mouse control within Australian crops.

Mount Hope Malleefowl Recovery

Initial planning	Underway	Final stages	Complete

2019/2020 update:

The Mount Hope Malleefowl Recovery project is funded externally by the NSW Department of Planning, Industry and Environment (NSW DPIE). It re-commenced in January 2019 and continued through until the end of June 2020. Predator densities, monitored using an extensive array of camera traps, are declining as a result of the sustained management actions (CPEs and baiting). There is uncertainty around the remaining population of malleefowl populations, which can only be assessed by counting the number of active nests during the breeding season. Monitoring in November 2019 found only two active nests however there were eggshell on most non-active mounds surveyed. As eggshell has a limited lifespan in the environment, it is likely there was an extensive breeding season in approximately 2016, which was the last year there was sufficient rain at an appropriate time in the year.

Leader: Dr Tony Buckmaster | Centre for Invasive Species Solutions

Partners: New South Wales Office of Environment and Heritage, New South Wales National Parks and Wildlife Service, Mt Hope Pest Management Group

Aim: To assess the impacts of feral predator control on the Malleefowl population in western NSW.

Top image: Mouse on a sorghum crop. Image by Julianne Farrell. Bottom image: Geena Correa, Administration Officer from CISS servicing CPEs as part of the Mount Hope Malleefowl Recovery Project.

BIOCONTROL TECHNOLOGIES AND **SYSTEMS**

Elena Smertina PhD Candidate with University of Canberra/CSIRO, testing rabbit tissue samples in the lab in Canberra

Biocontrol Technologies And Systems

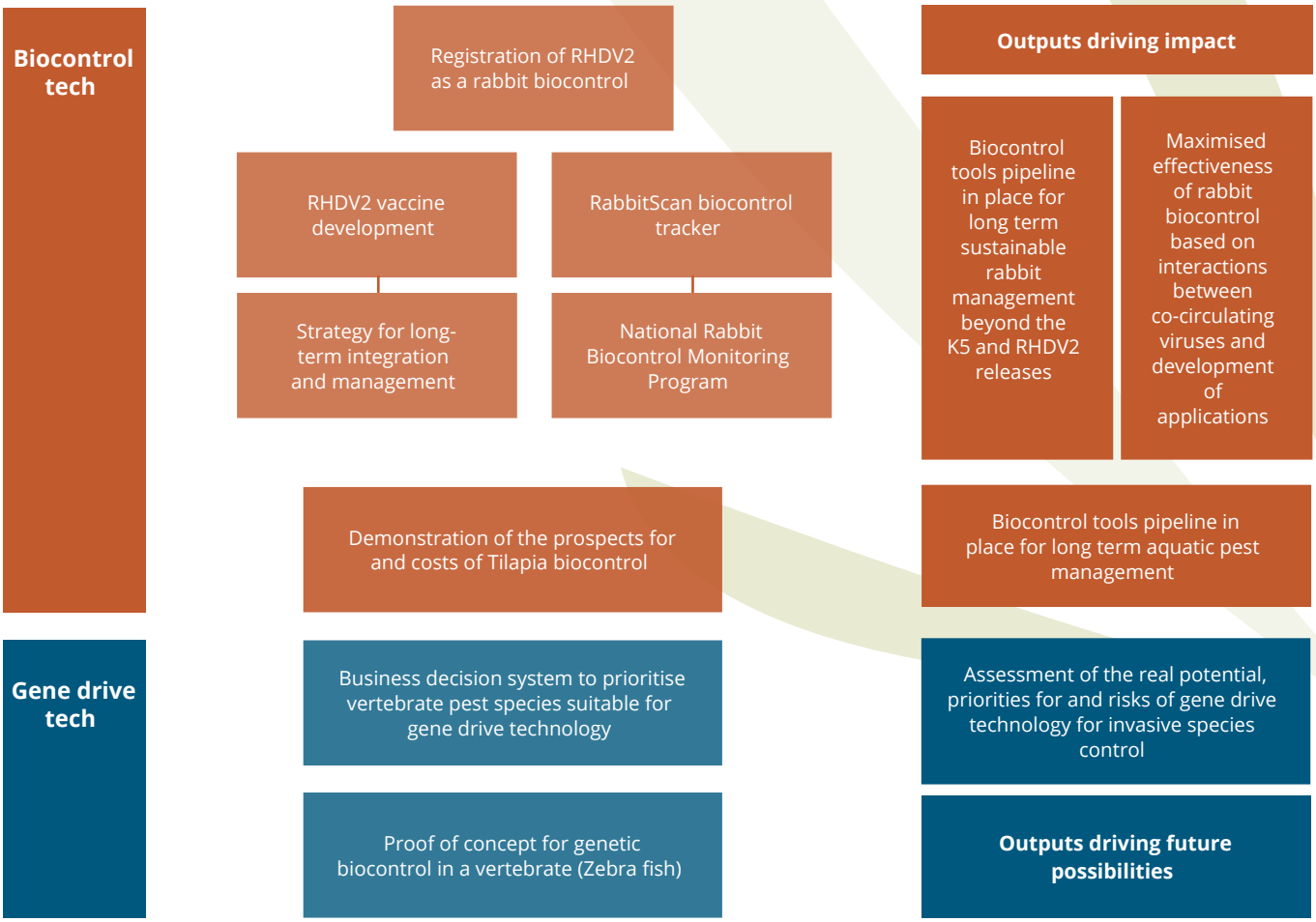
The challenge

Rabbits have invaded two-thirds of Australia and are our most costly vertebrate pest: they cause a $216m/yr loss in agricultural productivity and impact 322 nationally listed threatened species. From a rabbit population high of between 1 and 10 billion rabbits, rabbit biocontrol has led to over $70 Billion in increased agricultural productivity between 1950 and 2010, but on-going genetic resistance to any viral biocontrol agent means that a new agent needs to be released every 8-10 years to secure the benefits of past biocontrol. Additionally, existing biocontrol agents ebb and flow across landscapes over time and thus to maintain effectiveness, on-going releases are needed.

The solution

Our biocontrol program aims to roll out new and improved biocontrol agents every 8-10 years as part of our rabbit biocontrol pipeline, and as a result hopes to see a sustainable reduction of impacts of established pest rabbit populations. The program is also looking at biocontrol and genetic technologies for other species such as pest fish (tilapia) and gene drives.

Expected Outputs



2019/20 progress highlights include

1. Researchers are continuing to gather efficacy data required to register RHDV2 as an additional biocide product for use in Australia – this includes virulence assessments of the virus in rabbits of different ages and the completion of a humaneness assessment of RHDV2.
2. Monitoring of national rabbit calicivirus activity continues, determining which virus is active where and when, providing critical information for the development of tailored application strategies. A fly sampling network monitoring 20 sites across Australia is being assessed as a potential additional monitoring tool.
3. Progress has also been made towards a multivalent vaccine to protect pet and farmed rabbits.
4. A project to assess tilapia lake virus (T:LV) as a potential biocontrol agent for tilapia in Australia has begun.
5. A gene drive R&D business case is being progressed through an expert steering committee.

Engagement with end-users

The Centre's biocontrol and genetic innovation streams have two very different end-user profiles. In the case of biocontrol, our research is shaped by an innovation pipeline strategy where end users, many of whom have been facing and managing the plight of rabbits for decades, actively seek to adopt new and complementary tools including the latest biocontrol releases for on-ground application. As such, land managers have played an important role in intensive release programs (e.g. the K5 release) and continue to play an important role in the Centre's ongoing rabbit monitoring program. Further, some help guide our research through participation alongside industry and government officials on our multi-project Rabbit Steering Committee. In the case of our gene drive research, which delves into prospective over-the-horizon technologies, the risks, regulatory frameworks and associated ethical issues are such that direct engagement is largely at the policy, regulatory and scientific level. That said, community survey work plays a crucially important role in our research, informing a high level steering committee of policy, regulatory, NGO, scientific and industry officials who oversee all our gene drive research.

Rabbit Biocontrol research leaders Dr Patrick Taggart (NSW DPI) and Dr Tanja Strive (CSIRO) at our 3rd year RD&E Review, held in Canberra, February 2020. Image by Yvette Cazabon.

Rabbit Biocontrol Program

Understanding RHDV2 interaction with other RHDVs and its potential as an additional rabbit biocontrol agent

Initial planning	Underway	Final stages	Complete

2019/2020 progress

RHDV2 virulence trials in both adult and young domestic rabbits are complete, the results are currently being prepared for publication. Trials have commenced into how maternal antibodies protect young rabbits against RHDV2 infection. A humaneness assessment of RHDV2 infections was completed using an established welfare matrix scoring process. The updated welfare assessment will be made available through PestSmart. Good progress is being made towards a multivalent vaccine, with trials to date showing excellent protection from the multivalent vaccine currently under development. (See map pg 9-10)

Leader: Dr Pat Taggart | New South Wales Department of Primary Industries

Partners: New South Wales Department of Primary Industries, CSIRO, Primary Industries and Regions South Australia, Meat and Livestock Australia, Australian Wool Innovation

Aim: To explore the potential of RHDV2 (an exotic RHD virus first reported as a biosecurity outbreak in wild rabbits in May 2015) to complement existing biocontrol agents through a series of experimental studies. This project plays a vital role in the Centre's 20-year rabbit biocontrol pipeline and aims to understand the potential use of this virus as a future rabbit biocontrol agent. This project will also support the development of a multivalent vaccine to protect pet and commercially bred rabbits.

National rabbit biocontrol optimisation

Initial planning	Underway	Final stages	Complete

2019/2020 progress

RHDV2 and its recombinants continue to be epidemiologically dominant in the Australian landscape, however we are seeing growing evidence of some local persistence and spread of RHDV1-K5 in Western Australia and Tasmania, and the detection of an RHDV1 field strain demonstrates that this original virus variant has not yet become completely extinct.

RHDV2 causes virus outbreaks and transmission to occur approximately one season earlier than RHDV1. The ability to infect younger rabbits may be a key competitive advantage for RHDV2 in the field, consequently altering the epidemiology of the virus in wild populations of rabbits.

Leader: Dr Tanja Strive | CSIRO

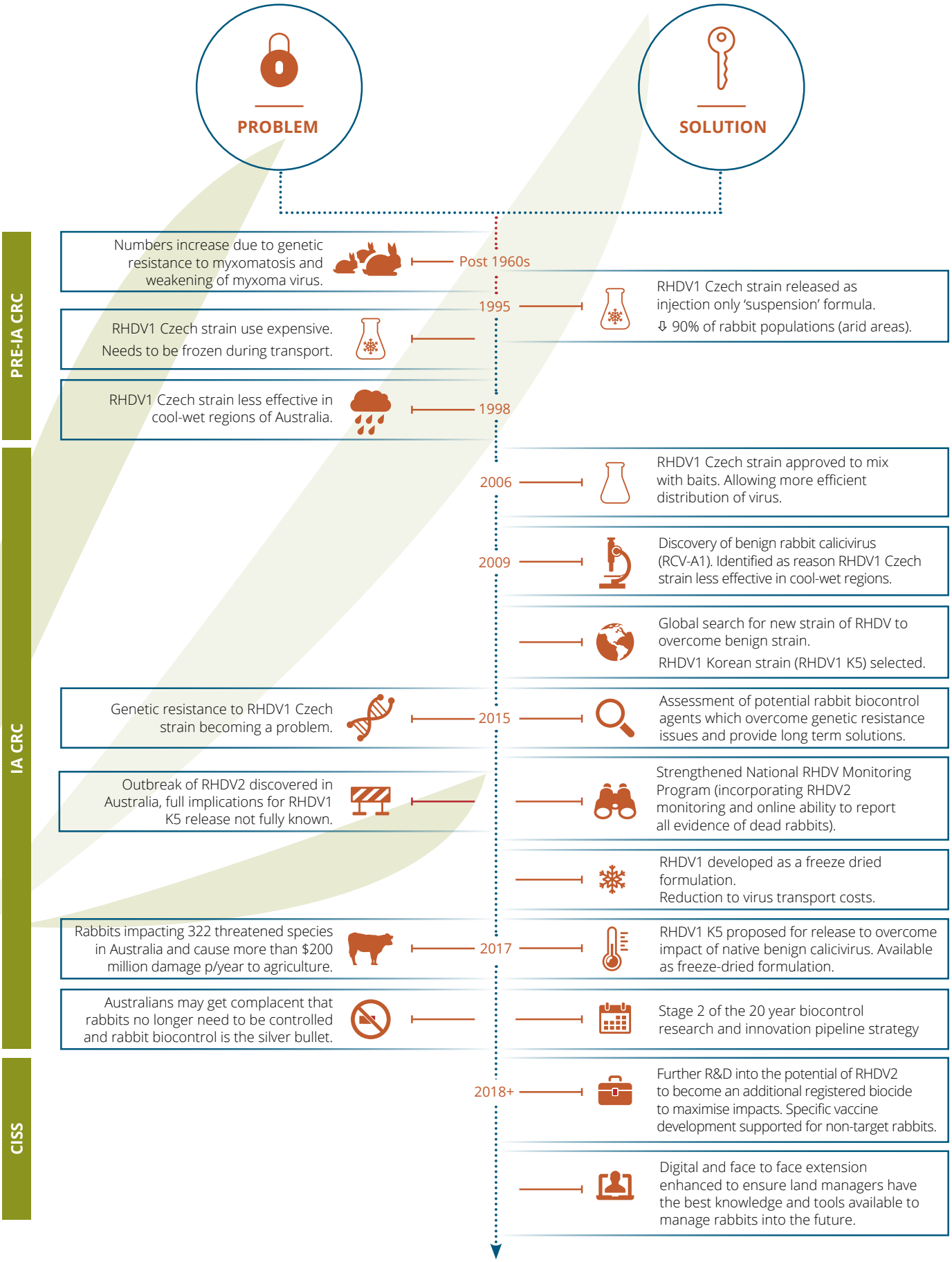
Partners: CSIRO, New South Wales Department of Primary Industries, CSIRO, Primary Industries and Regions South Australia, Meat and Livestock Australia, Australian Wool Innovation

Aim: To improve strategic knowledge about how to apply biocontrol agents to maximise rabbit biocontrol effectiveness, through monitoring and evaluation of current rabbit viruses in the Australian landscape.

Top image: Emma Sawyer (NSW DPI) setting rabbit traps to capture and collect data for rabbit virus analysis. Image supplied by Tarnya Cox (NSW DPI). Middle image: CSIRO rabbit biocontrol lab. Bottom image: Rabbit tissue sample sent in by a member of the public, through the RabbitScan portal. Images by Yvette Cazabon.

Rabbit biocontrol innovation pipeline.

Achieving sustainable landscape scale rabbit management.



Tilapia biocontrol: prospecting and evaluation

Initial planning	Underway	Final stages	Complete

2019/2020 progress:
Commencement of this project was delayed, and the revised project detail for this project was executed in August 2020. Initial work has commenced on the Tilapia disease literature review.

Leader: Dr Agus Sunarto | CSIRO

Partners: CSIRO, Qld Department of Agriculture and Fisheries, James Cook University and University of Sunshine Coast

Aim: To evaluate Tilapia diseases in the context of biocontrol more broadly and conduct a desktop review of Tilapia diseases and assess their potential as biocontrol agents. If one or more candidate agents are identified, then susceptibility of tilapia in Australian waterways will need to be determined followed by target specificity trials.

Advancing Gene Drive Technology

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

Initial planning	Underway	Final stages	Complete

2019/2020 progress:
A facilitated stakeholder workshop was held in February 2020 in Canberra, Australia. Thirty-four external participants representing NGOs, industry organisations, state and federal government departments, universities, and research units attended. A range of policy and regulatory staff, wildlife managers, geneticists, ecologists, and social s cientists were also present.

When asked to consider which priority pests in Australia might be most efficacious for genetic biocontrol, participants most commonly listed rodents and rabbits. The commonly cited reasons for why these pests might be most amenable were: species impact, fecundity, existing knowledge about species' biology, and laboratory/controlled trial-ability. This primary qualitative and quantitative data is currently being assessed and analysed.

Leader: Dr Wendy Ruscoe | CSIRO

Partners: CSIRO, Department of Biodiversity Conservation and Attractions WA, Department of Primary Industries and Regional Development WA

Aim: To explore the use of gene drive modification in vertebrate pest species in Australia. There are many knowledge gaps and technical hurdles to overcome the jump from invertebrate to vertebrate gene drive manipulation. Risk analysis and social license for gene drives will be necessary to establish a framework and prioritization system. This information is necessary for development of appropriate investment strategies in gene drive research as a pest control tool. By developing framework to assess the potential, the priorities and risk scenarios for key target pests (e.g. rabbit, carp) it will give CISS a leading national and international role in this innovative field.

Top image: Tilapia. Image by Samantha Courtney. Bottom image: European Rabbit. Image by Anne Young. Bottom image: A facilitated Stakeholder Workshop was held in February 2020 at CSIRO Black Mountain Science and Innovation Park. Thirty-four external participants representing NGOs, industry organisations, state and federal government departments, universities, and research units attended. A range of policy and regulatory staff, wildlife managers, geneticists, ecologists, and social scientists were involved. Image by Dr Wendy Ruscoe.

Support For National Capacity And Planning

CISS Balanced Researcher Program

Initial planning	Underway	Final stages	Complete

2019/2020 progress

Our Balanced Researcher Program creates multi skilled, industry ready graduates that can enter biosecurity related employment on graduation and actively contribute to the research and operational goals of their chosen workplace. Four PhD students have been recruited to the Balanced Researcher Program. The program has also recruited a Masters by Research student studying in a CISS project, two additional PhD students from Portfolio No.1 aligned projects and two researchers undertaking research in CISS aligned projects. This has allowed diversity within the project and will ensure all participants are able to form extensive cross discipline networks and receive peer support from fellow participants. The first Balanced Researcher camp was held in February 2020 coinciding with the CISS mid-term review. This allowed participants to see the range of projects and research areas that CISS is involved in and to form networks with more experienced researchers both within, and outside, their own field of research.

Developing a CISS-led 10 year weeds RD&E investment plan

Initial planning	Underway	Final stages	Complete

2019/2020 progress

While we have a number of weeds specific projects running concurrently, we are still working on developing a specific CISS-led weeds RD&E program.

The operating and funding environment for weeds RD&E is complex with many actors involved. Stakeholder engagement and an intensive workshop resulted in a list of priority weed species to be developed and agreed on by stakeholders as a guide to the collaborative 10-year investment plan for weeds RD&E for the period 2020-2030. The CISS 10-year Investment Plan for Weed RD&E aims to put in place an enduring model (at least ten-years) of co-investment to enhance the impact of current and future weed management efforts, particularly where they address the priorities of the Australian Weed Strategy 2017-27.

During 2019-20, the Plan was used as the basis for preparing a range of weed proposals for investment. The first, a proposal to develop a machine learning software to support WeedScan photographically identify weed species in situ, was subsequently funded by the National Landcare Program, and commenced in February 2020. The second, a proposal to develop a national network of research and community adaptation sites to manage invasive grasses, was approved, with funding to commence in July 2021.

To complement the 10-Year Plan, and to help prioritise and structure the Centre's future weed RD&E activities, an Implementation Plan was prepared in 2019-20. This Plan, together with the 10-year Investment Plan, was subsequently tabled for National Biosecurity Committee attention at its first meeting in 2020-21.

Top image: CISS Balanced Researcher participants attempting to launch an object as part of the team building challenge at the first Balanced Researcher camp held in Canberra in February 2020. Balanced Researcher participants Moses Omogbeme (Murdoch University) (on left) and Maria Jenckel (CSIRO) (on the right) are being assisted by Ash Dowden (Centre). Middle image: CISS Balanced Researcher participants at the 1st camp held in Canberra in February 2020. Bottom image: *Nassella-trichotoma.* Image by Andrew Mitchell.

National Environmental Biosecurity RD&E Strategy Coordination

Initial planning	Underway	Final stages	Complete

During 2018-19, CISS was appointed by the National Biosecurity Committee (NBC) to assess implementation progress made against the National Environment and Community Biosecurity Research, Development & Extension (NECBRD&E) Strategy 2016-2019, and to assist the Environment and Invasives Committee (EIC) prepare a new strategy for 2020 and beyond.

To achieve these outcomes, this project provides a dedicated national coordinator to assist CISS and the EIC undertake the assessment and prepare the new strategy.

2019/2020 progress:

The project has undertaken an environmental and community biosecurity RD&E stocktake and prepared a gap analysis. The purpose of the gap analysis was to examine the policy setting, current RD&E priorities and capabilities of key stakeholders to inform the development of the forward NECBRD&E. The analysis has found there is general alignment of RD&E priorities across the range of Biosecurity strategies and policies. Despite this, the gap analysis and associated stakeholder consultation has identified the need for better alignment of national RD&E strategies, and a greater emphasis on innovation, monitoring and behavioural research. The gap analysis concludes that the forward NECBRD&E can add the most value to the RD&E space by providing cross-sectoral coordination for shared cross-sectoral RD&E priorities, driving innovation and promoting a culture of collective problem-solving.

CISS Balanced Researcher participants at the 1st camp held in Canberra, in February 2020, discussing the team building challenge of launching an object the highest distance. (L-R) Egi Kardia (CSIRO), Jośe Huaman Torres (LaTrobe University), Jack Rojahn (University of Canberra) and Katie Hill (University of Adelaide).

CISS third year Portfolio Review 12-13 February, 2020






A forum of principle investigators and key researchers of Portfolio No. 1 met with major funding stakeholders in Canberra over 12-13 February 2020 to review progress against project milestones, convene project stakeholder steering committees and open themselves to the questioning by a panel of industry stakeholders (MLA and AWI), the independent performance review panel and DAWE attendees.

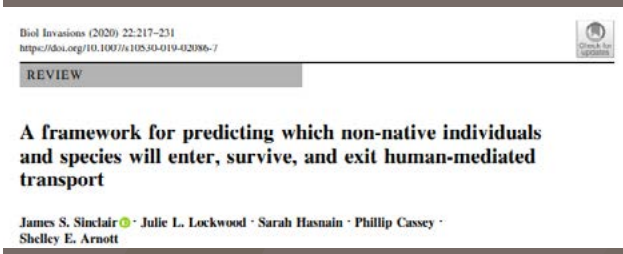
Overall, project progress was found to be solid against milestones to that point in time, though several projects, particularly in the Incursions Domain, showed signs of future risk in terms of output adoption due to delayed engagement processes. In response, stakeholder steering committee arrangements were strengthened across the Portfolio and a new Incursions Domain Steering Committee was formed with its priority focussed on engagement and adoption.

Images by Yvette Cazabon.

Dr Brad Page(PIRSA) (standing) leads discussion with the Incursion Domain project leaders (L-R) Dr Susan Campbell (WA DPIRD), A/Prof. Phill Cassey (University of Adelaide), Prof. Dianne Gleeson (UC), Dr Dave Ramsey (Arthur Rylah Institute) and Dr Peter Caley (CSIRO) at the RD&E review. Image by Yvette Cazabon.

OUR **PRODUCTS** AND **EXTENSION**

22
Registered products and trademarks


Biol Invasions (2020) 22:217–231
https://doi.org/10.1007/s10530-019-02086-7

REVIEW

A framework for predicting which non-native individuals and species will enter, survive, and exit human-mediated transport

James S. Sinclair · Julie L. Lockwood · Sarah Hasnain · Phillip Cassey · Shelley E. Arnott

23
Peer reviewed research publications

$284,000
Online media advertising value equivalent


Finding the 'needle in a haystack' with new portable DNA device

CISS CHRONICLE

4,241
CISS e-news subscribers

1,462
CISS social followers


Centre for Invasive Species Solutions
@CentreInvasiveSpecies · Non-profit organisation
Edit Learn More
Home Groups Events More
Promote View as visitor


FERALSCAN .ORG.AU
Providing a community pest animal recording and management tool
Record pest animal activity in your local area to protect farms, biodiversity and communities
Select a species to get started

25,754
FeralScan users

529,537
PestSmart webpage views


pestSMART
I want to select action select pest animal
PestSmart provides best practice information on how to plan, manage and improve pest animal control programs in Australia.


weedsAUSTRALIA
I want to manage Enter weed... in Regions
Weeds Australia is designed to connect you with knowledge to make informed decisions about managing invasive weeds within Australia.
The site is currently a beta version and we welcome your feedback as we continue to make content updates during 2020.

81,102
WeedsAustralia webpage views
(April-June 2020 only)

Stuart Morant long time member of the Bullioh Wild dog management Group and VFF with his daughter Anita, accepting a working dog muzzles from NWDMC Greg Mifsud at the launch of the industry funded Working Dog Muzzle video in North East Victoria. The video which was cofounded by the Sheep producers Australia, Wool Producers Aust, Animal health Australia and NSW Local Land Services was developed to encourage people to train their working dogs to use muzzles in order to actively participate in wild dog and fox bating programs while protecting the working dogs from harm. Image supplied by Greg Mifsud.

Wild Dog Alert can transmit alerts using the BuckEye camera trap system, allowing messages to be transmitted over areas with no telecommunication network. Image supplied by Paul Meek (NSW DPI).

New products and commercialisation

Over the past year, several new commercial products have been registered or progressed. These include legacy products from the CISS predecessor – the Invasive Animals Cooperative Research Centre (IA CRC) some of which were supported by the Commonwealth Department of Agriculture's White Paper grants, as well as products started in CISS.

IA CRC legacy products include:

- HOGGONE® sodium nitrite feral pig bait. The culmination of a decade+ strategic partnership between Animal Control Technologies(ACTA), Meat and Livestock Australia, US Department of Agriculture, and Invasive Animals Ltd, ACTA obtained Australian Pesticides and Veterinary Medicines Authority (APVMA) registration in September 2019, and Hoggone is now commercially available through them. (https://animalcontrol.com.au/)
- PAPPPutty™ Lethal Paste for Wild Canids for use on leg-hold traps. This is an extensive collaboration between Invasive Animals Ltd, NSW DPI and Connovation Ltd which resulted in PAPPPutty being registered by the APVMA in September 2020. PAPPPutty will be distributed in Australia by ACTA.
- Gonacon Immunocontraceptive Vaccine for the non-surgical serialisation of kangaroos and wallabies is an international collaboration between Invasive Animal Ltd, the US Department of Agriculture, Spayfirst, CSIRO and the ACT Government. Initial difficulties with manufacturing processes have been overcome. Differences in registration processes between the US and Australia are resulting in added impediments along the registration process that are taking time to overcome.
- Wild Dog Alert and E-Tech Hub are collaborative AI/machine learning based technology projects between Invasive Animals Ltd, Australia Wool Innovation, Meat and Livestock Australia, NSW DPI, and the University of New England. They are now cooperating through a Commercialisation Governance Committee to oversight the commercialisation process. Commercialisation of outputs is being managed through the NSW DPI Global Ag-Tech Ecosystem (GATE) program.

New product development or registration started under CISS that will follow a commercialisation pathway to market are the:

- Feral Deer Aggregator which now has several prototype devices currently under trial and suitable devices will be carried through to commercialisation.
- 1080 based feral cat bait, ERADICAT® which is already available in WA, however Invasives Animals Ltd is progressing national APVMA registration of the bait to enable its Australia wide use.
- RHDV2 vaccine, whose development is well progressed.

FOR PROJECT PROGRESS SUMMARIES SEE RESEARCH AND INNOVATION SECTION

Intellectual property management

Licensed IAL IP that generates royalties from the sale of products developed through the IA CRC (2005–17) is reinvested into the new Centre. Licensed intellectual property (IP) that generates royalties from the sale of products from the Pest Animal Control CRC (pre-2012) is disbursed to IP owners from that CRC.

IP that is novated and/or managed by IAL is related to the commercialisation of:

- PIGOUT®, 2019-20 financial year royalty of $1,792.46, distributed to Pest Animal Control CRC Participants
- HOGHOPPER, 20119-20 financial year royalty of $278.60, retained by IAL
- RODEMISE®, 2019-20 financial year royalty of $91.78, retained by IAL
- Wild dog and fox PAPP, 2019-20 financial year royalty of $75.41, retained by IAL
- HOGGONE®, 2019-20 financial year royalty of $1,102.77, retained by IAL

Intellectual property strategy

IP as defined in the Portfolio Agreement No. 1 encompasses all assets resulting from intellectual endeavour excluding Moral Rights. Public Good IP will continue to be managed in the same way as previous years and by the IA CRC — that is, all IP is 100% vested in IAL (called Centre IP) and available to all Portfolio Agreement parties for their own use in research, training and adoption.

IP with commercial potential is managed distinctly from public good IP:

- Co-investors (Investor Partners) in a commercially orientated project (Specified Project) may legally and beneficially co-own project IP.
- Specified Project IP is distinguished from Centre IP.
- Specified Project IP ownership is determined by a process that is agreed to by Specified Project participants directly involved in the project.
- All investors in a Specified Project have a say in developing the terms under which project IP will be commercialised.

This approach is consistent with national principles for the management of IP generated using publicly funded research and ensures that R&D that is commercialised benefits Australia and Australian investors in innovation in pest animal management.

Patents

IAL has maintained and managed patents and patent applications for the use of nitrite salts as poisons in baits for omnivores. The development work in nitrite salts is focused on feral pig control. Patented IP managed during the reporting period includes:

- Australian granted patent AU 2008221237 — Nitrite Salts as Poisons in Baits for Omnivores
- New Zealand granted patent 579357 — Nitrite Salts as Poisons in Baits for Omnivores
- United States of America granted patent US 9750242 — Nitrite Salts as Poisons in Baits for Omnivores
- Canadian patent application 2677935 — Nitrite Salts as Poisons in Baits for Omnivores.

Digital assets

The Centre for Invasive Species Solutions is maintaining and upgrading a number of our leading pest management digital tools, including:

- PestSmart (knowledge hub) – www.pestsmart.org.au
- WeedsAustralia (knowledge hub) - www.weeds.org.au
- Community engagement tool (e-training course) – www.community.invasives.com.au
- FeralScan (community surveillance digital platform) – www.feralscan.org.au
- Decision Support Tools (rabbit specific) - https://landcare.shinyapps.io/SimRab
- Field Guide to Pest Animals of Australia (app) – iTunes Apple store

Digital technology is embraced by CISS and is seen as a core enabler of present and future best-practice pest animal management. All our digital tools have been enhanced and integrated to increase uptake as we execute our updated digital strategy and provide end users with improved community features and better ways to connect.

Intellectual property protected (non-patent)

Table 1: Intellectual Property currently held for commercial purposes

IP DESCRIPTION AND PRODUCT NAME	IP CREATION DATE BY YEAR	LICENCE NATURE
Blue Healer trademark	2005	Not applicable
HOGGHOPPER design and manufacturing specifications	2010	Exclusive (worldwide)
Rodenticide pen/field efficacy studies	2005–2008	Exclusive (in Australia)
Nitrite-based pesticide products: Commercialisation of granted patents	2007	Exclusive (worldwide)
(Aus, NZ, USA and Canada)	2003–2005	Exclusive
PIGOUT pen/field efficacy studies	2005–2014	Exclusive (worldwide)
PAPP wild dog and fox bait and toxin	2012	Not applicable
PestSmart trademark	2015	Not applicable
LandSmart trademark	2016	Not applicable
FarmSmart trademark	2016	Not applicable
AntSmart trademark	2015	Not applicable
AVPC trademark	2015	Not applicable
Centre for Invasive Species Solutions trademark	2017	Not applicable
PlantSmart	2018	Not applicable
FeralScan trademark	2018	Not applicable
BiteMe trademark	2018	Not applicable
PAPPutty trademark	2019	Not applicable
Wild Dog Alert trademark	2019	Not applicable
WeedScan trademark	2019	Not applicable
BiosecuritySmart trademark	2020	Not applicable

Patents

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Canadian patent application 2677935 — Nitrite Salts as Poisons in Baits for Omnivores. Exclusive (worldwide)

Option agreements to commercialise intellectual property

Table 2: Option agreements to commercialise intellectual property

IP DESCRIPTION AND PRODUCT NAME	CONTRACT	IP CREATION DATE	LICENCE NATURE
Rodenticide (CRADA) with USDA	USDA	2013–2017	Exclusive (worldwide)
HOGGONE® USA (CRADA) with USDA	USDA	2013–2017	Exclusive (worldwide)
Microencapsulated sodium nitrite formulations (CRLA) with Texas Parks and Wildlife	Texas Parks and Wildlife Department USDA	May 2015	Exclusive (worldwide)
Rodenticide (CRADA)	USDA	2017–2022	Exclusive (worldwide)

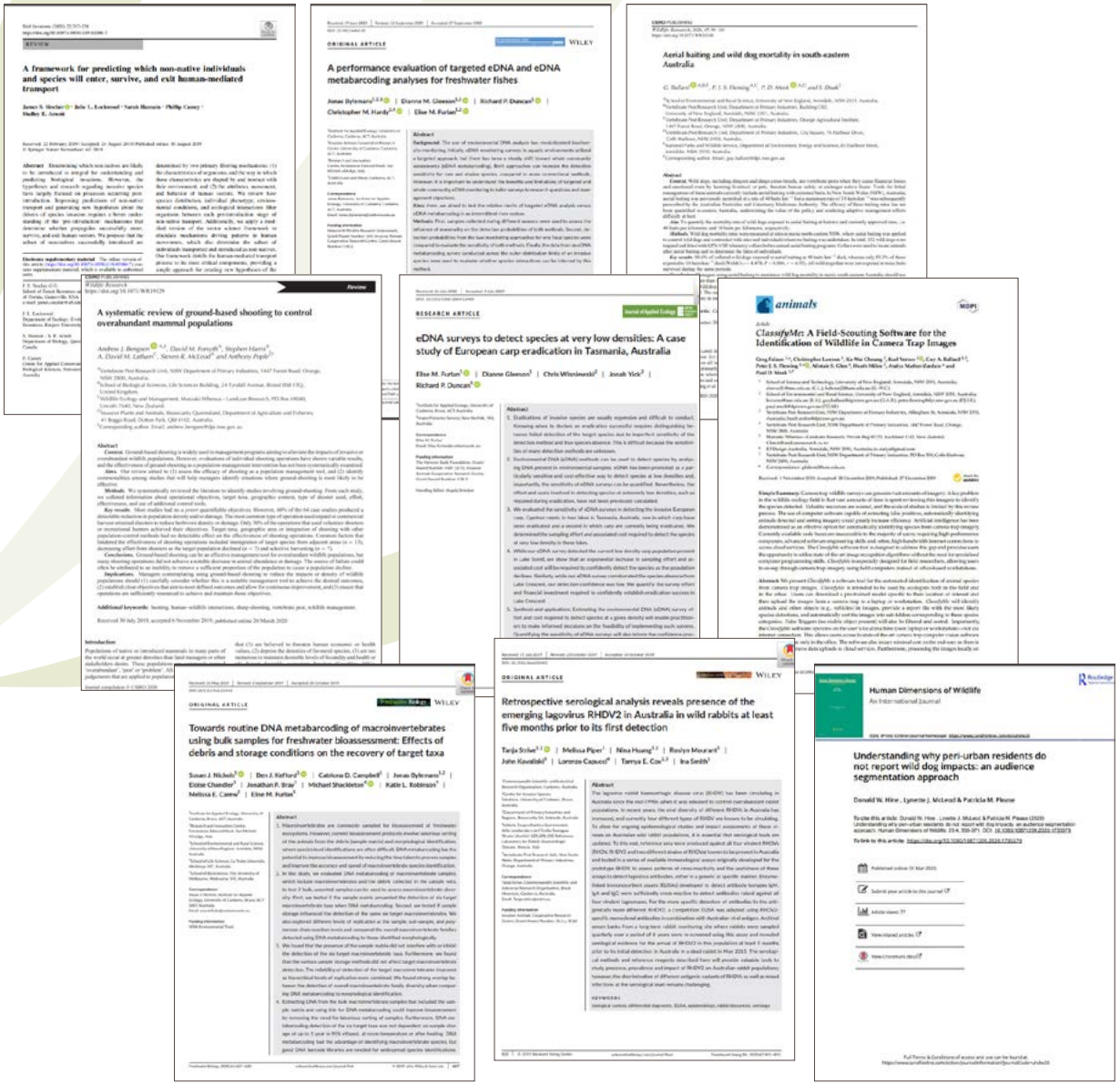
Research excellence

The Centre for Invasive Species Solutions continues to pride itself on research excellence that informs best practice management, and the development and subsequent adoption of new tools, technologies and systems that increase land managers abilities to effectively deal with invasive species.

During the financial year, 23 peer reviewed scientific publications, 5 technical reports were published through our extensive RD&E collaboration.

The majority of these publications are as a direct result of research undertaken as part of the Centre for Invasive Species collaborative research projects while a small number are the result of flow on work from projects of the Invasive Animals CRC that are now coming to fruition. These are all listed in the list of publications on the next page.

In addition to published material from research outputs, the past 12 months has seen CISS projects take part in 156 stakeholder workshops and 12 conferences across Australia and New Zealand. These workshops are conference are an effective method for showcasing best practice pest management techniques and for working with, and increasing the capacity of stakeholders and end users to use best practice invasive species management techniques.



List of Publications

Incursions

1. Bylemans, J., Gleeson, D., Hardy, C., Duncan, R., Furlan, E. (2019). A performance evaluation of targeted eDNA monitoring and eDNA metabarcoding for freshwater fishes. Environmental DNA, 1(4), 402-414.
2. Furlan, E., Gleeson, D., Wisniewski, C., Yick, J., Duncan, R., (2019). eDNA surveys to detect species at very low densities: A case study of European carp eradication in Tasmania, Australia Journal of Applied Ecology, 56(11), 2505-2517.
3. Furlan, E., Davis, J., Duncan, R. (2020). Identifying error and accurately interpreting environmental DNA metabarcoding results: A case study to detect vertebrates at arid zone waterholes. Molecular Ecology Resources.
4. Hill, K. G., Nielson, K. E., Tyler, J. J., McInerney, F. A., Doubleday, Z. A., Frankham, G. J., ... & Cassey, P. (2020). Pet or pest? Stable isotope methods for determining the provenance of an invasive alien species. NeoBiota, 59, 21-37.
5. Nichols, S., Kefford, B., Campbell, C., Bylemans, J., Chandler, E., Bray, J., Shackleton, M., Robinson, K., Carew, M., Furlan E. (2019). Towards routine DNA metabarcoding of macroinvertebrates using bulk samples for freshwater bioassessment: effects of debris and storage conditions on the recovery of target taxa. Freshwater Biology, 65(4), 607-620.
6. Sinclair, J. S., Lockwood, J. L., Hasnain, S., Cassey, P., & Arnott, S. E. (2020). A framework for predicting which non-native individuals and species will enter, survive, and exit human-mediated transport. Biological Invasions, 1-15.
7. Toomes, A., García-Díaz, P., Wittmann, T. A., Virtue, J., & Cassey, P. (2019). New aliens in Australia: 18 years of vertebrate interceptions. Wildlife Research, 47(1), 55-67.

Biocontrol

1. Cox, T. E., Ramsey, D. S., Sawyers, E., Campbell, S., Matthews, J., & Elsworth, P. (2019). The impact of RHDV-K5 on rabbit populations in Australia: an evaluation of citizen science surveys to monitor rabbit abundance. Scientific Reports, 9(1), 1-11.
2. Ramsey, D. S. L., Cox, T., Strive, T., Forsyth, D. M., I., S., Hall, R., . . . Campbell, S. (2020). Emerging RHDV2 suppresses the impact of endemic and novel strains of RHDV on wild rabbit populations. Journal of Applied Ecology.
3. Strive, T., Piper, M., Huang, N., Mourant, R., Kovaliski, J., Capucci, L., Cox, T., Smith, I. (2020). Retrospective serological analysis reveals presence of the emerging lagovirus RHDV2 in Australia in wild rabbits at least five months prior to its first detection. Transboundary and Emerging Diseases, 67(2), 822-833.
4. Strive, T., Cox, T. (2019). Lethal biological control of rabbits – the most powerful tools for landscape-scale mitigation of rabbit impacts in Australia. Australian Zoologist, 40(1), 118-128.

Integrated landscape management

1. Ballard, G., Fleming, P., Meek, P., Doak, S. (2020). Aerial baiting and wild dog mortality in south-eastern Australia. Wildlife Research 47(2).
2. Bengsen, A.J.; Forsyth, D.M.; Harris, S.; Latham, A.D.M.; McLeod, S.R.; Pople, A. 2020. A systematic review of ground-based shooting to control overabundant mammal populations. Wildlife Research 47: 197–207.
3. Fleming, P., Ballard, G. (2019). Yes, killing is sometimes essential for conservation. Australian Zoologist 40, 41-48.
4. Harriott, L., Gentle, M., Traub, R., Soares Magalhães, R., & Cobbold, R. (2019) Geographical distribution and risk factors for Echinococcus granulosus infection in peri-urban wild dog populations. International Journal for Parasitology: Parasites and Wildlife, 10 149–155
5. Kelman, M., Harriott, L., Carrai, M., Kwan, E., Ward, M., Barrs, V. (2020). Phylogenetic and geospatial evidence of canine parvovirus transmission between wild dogs and domestic dogs at the urban fringe in Australia Viruses 12(6): 663.

6. Massetti, L, Colella, V, Zendejas, PA, Ng-Nguyen, D, Harriott, L Marwedel, L, Wiethoelter, A, Traub, RJ 2020, High-throughput multiplex qPCRs for the surveillance of zoonotic species of canine hookworms, PLOS Neglected Tropical Diseases 14(6): e0008392.

Community engagement

1. Arkel, A., Kelman, M., West, P., Ward M. (2019) The relationship between reported domestic canine parvovirus cases and wild canid distribution. Heliyon, e02511.

2. Hine, D.W., McLeod, L.J & Please, P.M (2020) Understanding why peri-urban residents do not report wild dog impacts: an audience segmentation approach. Human Dimensions of Wildlife, 25:4, 355-371.

3. McDonald, I., McKinnon, M. (2019). Communicating biosecurity information to Australian-registered veterinarians. Australian Veterinary Journal, https://doi.org/10.1111/avj.12843.

Wild Dog Alert and e-tech hub

1. Bishop, J., Falzon, G., Trotter, M., Kwan, P., Meek, P. (2019). Livestock vocalisation classification in farm soundscapes. Computers and Electronics in Agriculture, 162, 531-542.

2. Falzon, G., Lawson, C., Cheung, K-W., Vernes, K., Ballard, G, Fleming P, Glen, A, Milne H, Mather-Zardain, AT and Meek, PD (2019). ClassifyMe: A field-scouting software for the identification of wildlife in camera trap images. Animals, 10(1), 58.

3. Meek, P., Ballard, G., Falzon, G., Williamson, J., Milne, H., Farrell, R., ... Fleming, P. (2020). Camera Trapping Technology and Advances: into the New Millennium. Australian Zoologist 40(3), 392-403.

A focus group workshop was held in October 2019 in Orange, NSW with various user groups of the PestSmart website to help inform it's new framework as part of the upgrade process.

Digital Extension

Our centre's digital extension area is a critical and expanding function which is important to promote awareness and adoption of best practice invasive species management.

The resources we manage now span both the management of pest animals and weeds, along with a brand-new community engagement information hub. All our extension websites are now connected by look feel and can be navigated through a side bar connected each site. The pest animal websites are showcased through the orange icon and the weeds websites are showcased through the green icon.

In addition to our current digital extension resources, our centre also supports major national communication campaigns associated with invasive species and the broader biosecurity area. The aim is to have a collaborative approach to managing these community engagement and outreach campaigns in partnership with our members and partners and other key stakeholders.

PestSmart digital platform and publication series

The PestSmart website – pestsmart.org.au - is a key part of our digital extension services, providing end-users with toolkits of pest animal management information and knowledge to plan, manage and improve their control programs.

The new updated website was launched in August 2020, but in its old format, the website again reached more than half a million pageviews during the 2019/20 FY (fig). Number of users to the site was up 6% from the previous financial year with more than 230,000 visitors to the site in the 12-month period.

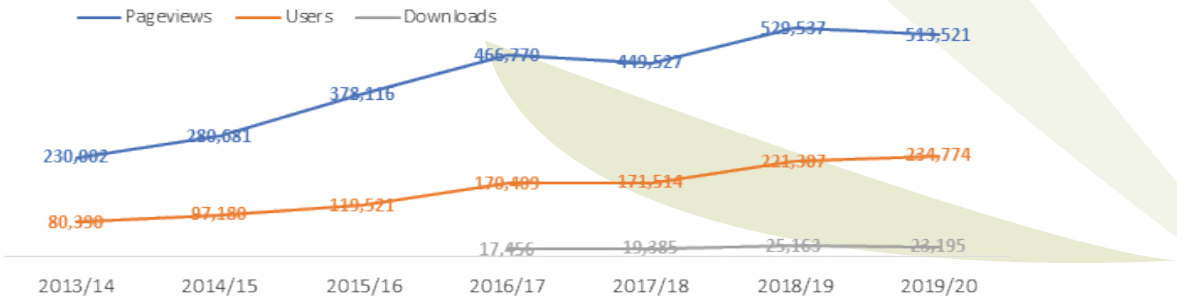


Figure 1: Feral.org.au / PestSmart website trends over time (PestSmart v1.0 launched in March 2015)

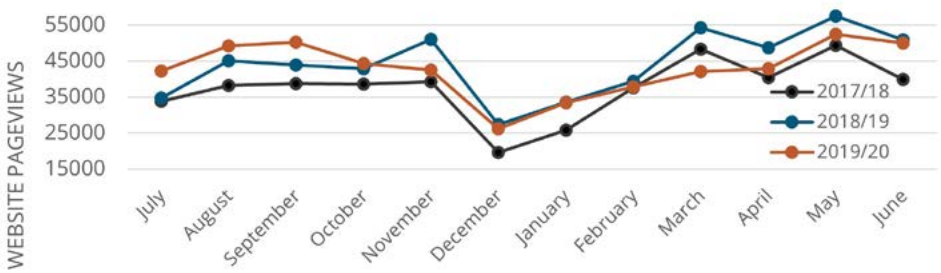
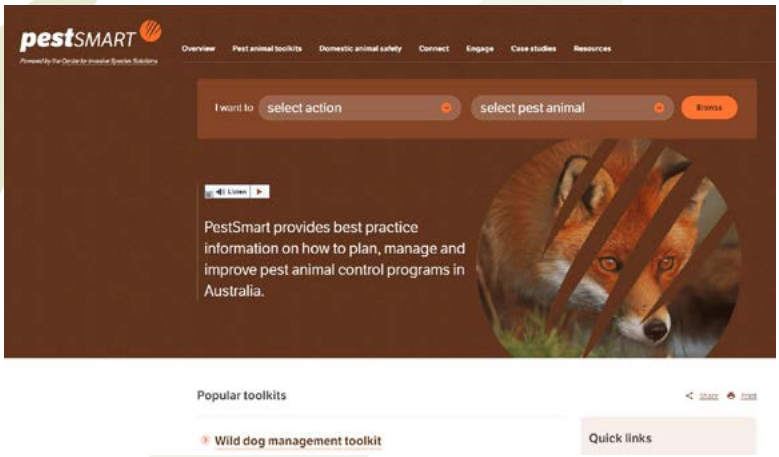


Figure 2: PestSmart website trends per month (3-year period)

During the 19/20 FY, website visitation over the course of each month was relatively stable, in comparison to other years, as seen in Figure 1. More than 75% of users visit the site via a Google search, and 13% visit the site via a direct URL.

We continued to push engagement through our PestSmart social media channels during the 19/20 FY, but this dropped somewhat due to social media platforms moving towards algorithms promoting paid vs organic posts. As a result, we have decided to consolidate all our social channels under one banner for efficiency purposes and have recently merged our CISS and PestSmart Facebook, Twitter and YouTube accounts.

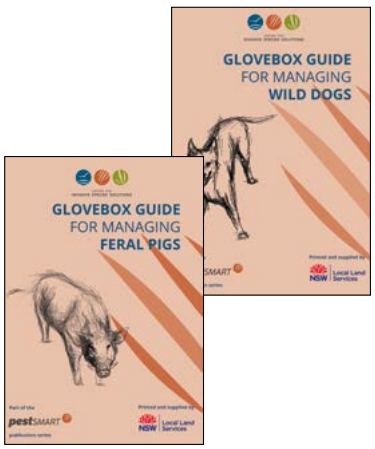
We will be rolling out an enhance digital marketing plan during the 20/21 FY to more effectively market our digital extension products to end users.



Glovebox Guides

Our upgraded PestSmart website now has an online form to easily order our pest animal Glovebox Guides, and also add your organisational logo to the front cover.

Since making the form live in late August 2020, we have already had paid orders from various individuals, councils, biosecurity groups and universities from across the country, with close to 7000 guides requested.



FeralScan community 'mapping and management' program

The FeralScan community mapping program now has over 25,000 online users, of which 19,176 are registered. The resource now hosts more than 213,000 records of pest animals, pest problems and control actions coordinated by landholders and community groups Australia-wide (Table 1).

In the 2019/20 financial year pest animal records nearly doubled in a single 12-month period.

The number of community groups now set up within the system who can share information with each other to ensure they make the best strategic management advice for their region and area. There are now 449 groups across Australia set up to do this, which combine farmers, land managers and government staff.

Table 1: FeralScan trend stats over time. Social media icons by Vecteezy.

	Registered users	Community groups	Total records
13/14	5,534	8	26,581
14/15	6,417	22	30,422
15/16	8,956	85	45,166
16/17	11,786	166	66,722
17/18	13,956	261	90,430
18/19	16,623	365	135,475
19/20	19,176 (up 24%)	449 (up 46%)	213,267 (up 94%)

Peter West (FeralScan Coordinator) meeting with members of GLENRAC (Glen Innes Natural Resources Advisory Committee) and the Northern Tablelands Local Land Services during a FeralScan monitoring and pest control field day at Ben Lomond, Northern Tablelands. Image by Emma Sawyers.

Case Study: FeralScan proves its worth as a pest monitoring and management tool for over **449** community groups

The CISS **FeralScan** Project, developed and managed by Peter West at the NSW Department of Primary Industries, has gone from strength to strength over the past 12 months – and is now Australia's largest community pest animal monitoring and management resource.

FeralScan has been adopted as a monitoring and management resource by over 449 private landholder, community and biosecurity groups. It has been used by over 26,000 people, and it contains 241,000 pest animal records and photographs entered by farmers, landholder groups, pest control professionals, local government councils, and biosecurity groups Australia-wide.

Throughout the past year, a total of 76 face-to-face workshops and online training sessions have been completed in Western Australia, South Australia, NSW, Victoria, Northern Territory, Tasmania and Queensland.

To adapt to Covid-19 restrictions during 2020, Peter has been delivering online training to landholder groups and biosecurity groups Australia-wide, ensuring that he is able to provide continued support to communities and landholder-groups across the country.

Top Images (Left to Right): Peter West presenting at the Queensland Pest and Weed Symposium about FeralScan in 2019. FeralScan display at the Australian National Field Days in October 2019. Images supplied by Peter West. Bottom image: The FeralScan resource consists of a website, live maps, database, and landholder-designed phone App that works in remote areas. IImage supplied by Peter West.

Some notable milestones include

76 workshops and online training sessions delivered by the Coordinator

13,050 alert notifications sent to landholders warning them about local pest issues/incidents

20,041 photographs of pest animals uploaded by the public

25,754 users listed Australia-wide

100,000 wild dog records entered into WildDogScan

As a pest management planning tool, FeralScan provides a web and app-based resource to help people work together to record information about pest animals in their local area. People who use the resource can benefit from accessing a live dashboard of pest records in their area, consisting of charts and tables summarizing trends in pest activity. They can receive or send alert notifications to their landholder network and biosecurity group, which is helping many landholders to quickly report to their local biosecurity officers about pest incidents, such as wild dog attacks on livestock.

For the Hargraves-Hill End Pest Control Group, FeralScan has become a valuable tool for helping with the management of wild dogs. The group uses WildDogScan (part of FeralScan) for monitoring wild dog activity, and they have
44 registered members in their private group, including farmers, a local coordinator, professional pest controllers, and staff from local government departments.

The group has worked with Peter to set up **WildDogScan** to:

1. Provide a single location for all wild dog information for their local community
2. Involve landholders and their community in monitoring and recording wild dog activity
3. Build a detailed wild dog activity map for their local area
4. Use information to guide local control activities
5. Receive email alerts about wild dog attacks to help them respond to wild dog threats
6. View charts, tables and maps of information to evaluate management over time

Helen Lawson – local sheep producer and secretary of the Group said, "I use **FeralScan** all the time. When we record wild dog activity in FeralScan, the map shows where the problem areas are, and what time the wild dogs are coming through. We also get a better idea of how far wild dogs move, because we might map a dog at one end of our local area, and the same dog at the other end. FeralScan gives us some idea of the wild dog's movements."

FeralScan has allowed the group to bring landholders, pest controllers, local biosecurity agencies and land managers together to manage the impacts of wild dog populations.

As **FeralScan** has been developed with continuous feedback and guidance from farmers, community groups and the public, it has concentrated on addressing community interests and needs. As a result, it has become a vital tool for biosecurity groups and landholder groups all over Australia.

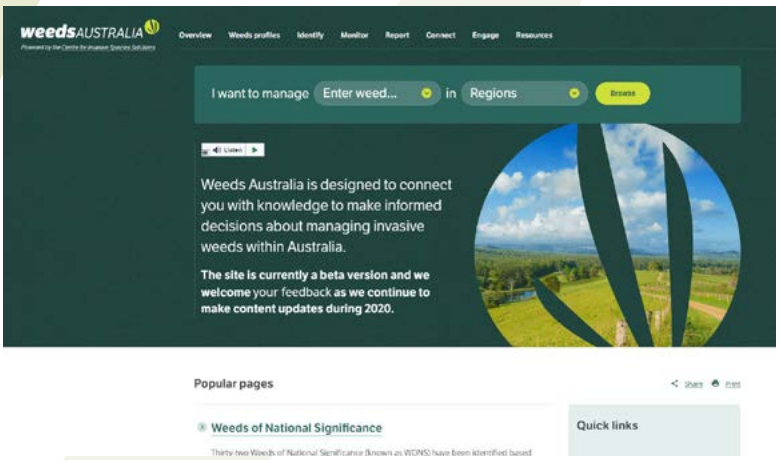
Images (Top to bottom): FeralScan display at the Australian National Field Days in October 2019. Peter West speaking to landholders at a feral pig and wild dog management field day at Gelantipy in Victoria.The Hargraves-Hill End Pest Control Group in NSW use WildDogScan to monitor wild dog activity and prioritise areas for control. Images supplied by Peter West.

WeedsAustralia

In April 2020, we launched the brand-new WeedsAustralia website - https://weeds.org.au as a beta version. Releasing as a beta version allows for feedback to be collected, so improvements can be made over the next 12 months. More than 100 submissions have already been received through our online feedback form with over 50% giving a rating of 3 or more (one in three gave five stars). Those who gave a rating of 1 or 2 provided constructive feedback and explained their reasoning for the score, so we can implement necessary changes.

Since its launch, the beta site has had more than 78,000 pageviews from 18,000 since launch in April (data collected over a 3-month period). The weeds profiles are also hosted through the Atlas of Living Australia ensuring the best possible connections with national technological infrastructure.

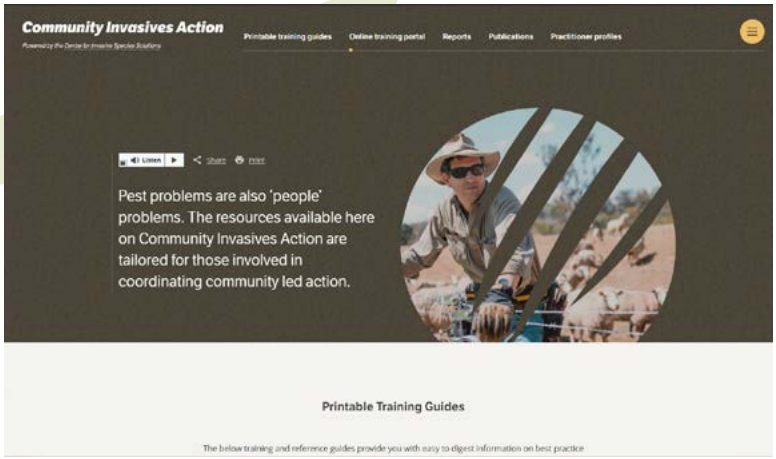
All the weeds profile on the site are currently undergoing a content review and update, which is being led by the SA Herbarium. This consultancy is expected to take under 12 months, prioritising profiles which are nationally significant.



Community Invasives Action

This is a brand-new microsite to showcase our best practice engagement resources to support community coordinators/extension officers. It includes handy training guides and our online community engagement training platform, developed through the UNE in 2016.

This site is also linked from WeedsAustralia and PestSmart via a menu tab called 'Engage' but also has its own landing URL.

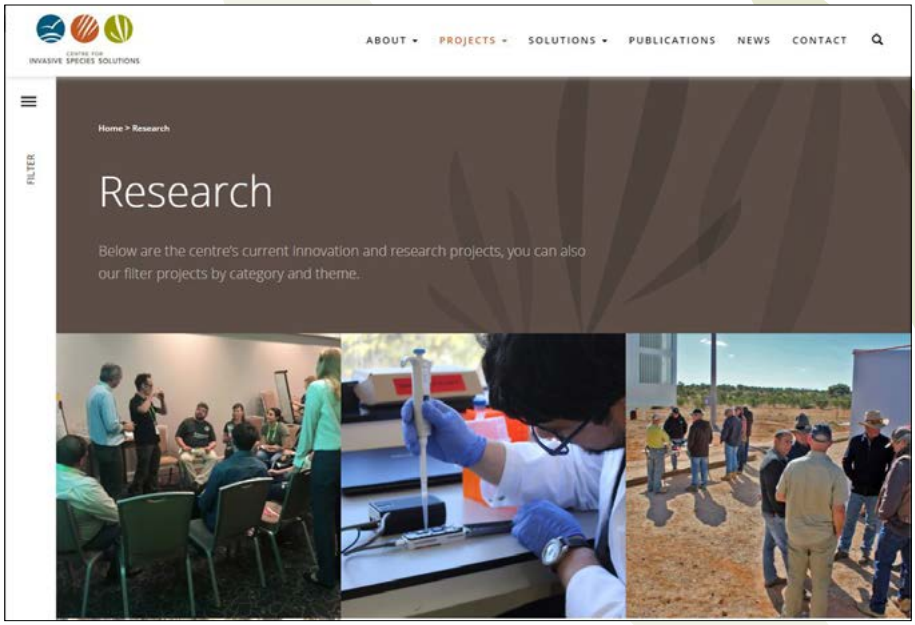


Communication and media

CISS corporate website

Our promotional communications resulted in our CISS website receiving 50,543 page views during the 19/20 FY, via 15,699 website users. It is worth noting, 1 in 3 users (4,921) visited our website via a direct URL, showcasing website strong recognition.

Our corporate website is used as a way of promoting the ongoing impact of our research portfolio as well as news and events. All projects are listed, along with their outputs achieved each 6 months.



CISS e-newsletter

The CISS Chronicle is our Centre's monthly e-newsletter that aims to inform subscribers of the latest CISS achievements, research, publications, events and related external news. The newsletter is aimed at a diverse audience including researchers, farmers, land managers, students and journalists.

Up until 2020, the e-newsletter was named Feral Flyer and distributed fortnightly. It was moved into a monthly format from January 2020 and renamed in June 2020.

There were 4,241 subscribers as of end of June 2020, a net increase of 9% from the previous FY year. A total of 18 e-newsletters were sent out during the FY, with estimated open rates ranging between 30-40% and click rates between 8-16%.

CISS media and news items

Our strategic media interventions resulted in CISS being mentioned within 30 online news items (national and regional) worth an approximate advertising value equivalent of $284,000.

In conjunction with our media releases, 33 news items were written for the CISS news page on our research and project announcements – resulting in 7,534 views to our news page (or 15% website readership), many of these stories were shared across our member and partner networks and social channels.

CISS related management tools and products were mentioned more than 150 times in online media articles, topics included the use of RHDV1 K5, PAPP, HogGone, FeralScan, PestSmart, worth an estimated advertising value equivalent of more than $1.2 million.

Media Highlights included:

JUNE–SEP 	ABC Landline ran a feature story on the feral deer problem within Australia which featured our project leader's, Dr Dave Forsyth from NSW DPI, Brad Page from PIRSA and Dr Carlo Pacioni from VIC ARI. The Canberra Times published a feature article on our centre's new eDNA research program, where Dr Alejandro Trujillo-González is looking at developing real time detection techniques through the use of the BioMeme product.
OCT–DEC 	The Federal Minister for agriculture distributed a media release announcing the funding of our new weeds ID app project. The rural and regional press highlighted the launch of the DeerScan component of FeralScan.
JAN–MAR 	ABC Rural ran a feature article plus a TV and radio news segment on our RHDV2 research program
APRIL–JUNE 	Science Media Exchange promotes our illegal wildlife trade research through the promotion of our new infographic ABC Rural promote new RHDV monitoring technique through the use of carrion flies.

CISS social media

Our CISS social media followers grew 57% during the 19/20 FY, with a total audience of 1,462 followers across Facebook, Twitter and LinkedIn.

A total of 346 posts were sent reaching more than 218,000 accounts and receiving 6,935 engagements (i.e. likes, shares, comments, etc).

These will be our primary channels moving forward

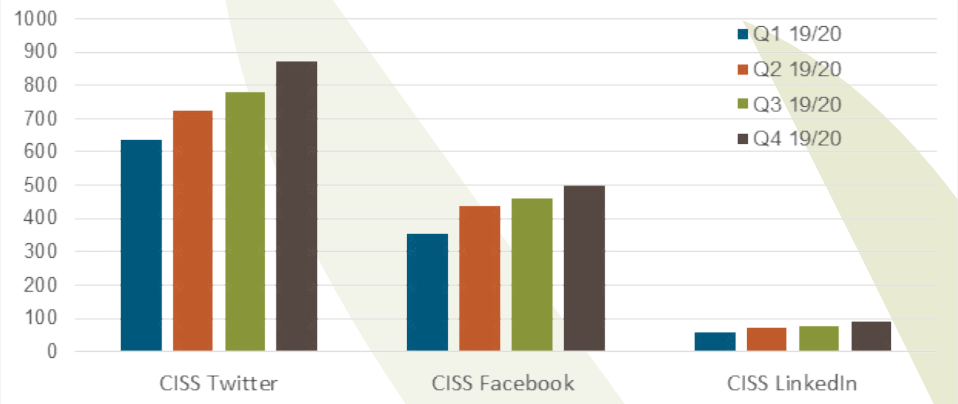


Figure 3:Growth of our socail media following during the 19/20 FY quarters.

Table 2: CISS social media reach and engagement figures against messages sent out. Social media icons by Vecteezy.

SOCIAL MEDIA PLATFORM		18/19	19/20
	Messages sent	108	95
	Accounts reached	50,626	48,696
	Accounts engaged	1,001	3,793
	Messages sent	364	236
	Accounts reached	164,334	168,526
	Accounts engaged	3,589	3,083
	Messages sent	43	15
	Accounts reached	2,197	1,010
	Accounts engaged	178	59

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https://www.facebook.com/CentreInvasiveSpecies

https://www.linkedin.com/company/centre-invasive-species-solutions

Internal Communications

A focus on enhancing internal communication has been a priority for the centre and has seen enhanced engagement with our member and partner representatives through a quarterly communique and virtual meeting, which is held a few weeks after each quarterly board meeting.

All our projects hold regular steering committee meetings a well to ensure engagement with key project investors and stakeholders.

Stakeholder promotion

ABC's Meet the Ferals series aired during 19/20 Landline summer series and on ABC iview. The nine episodes were uploaded to their YouTube channel and have collectively received over 1.2 million views. This series was presented and produced by Prue Adams who worked with our centre as the knowledge partner.

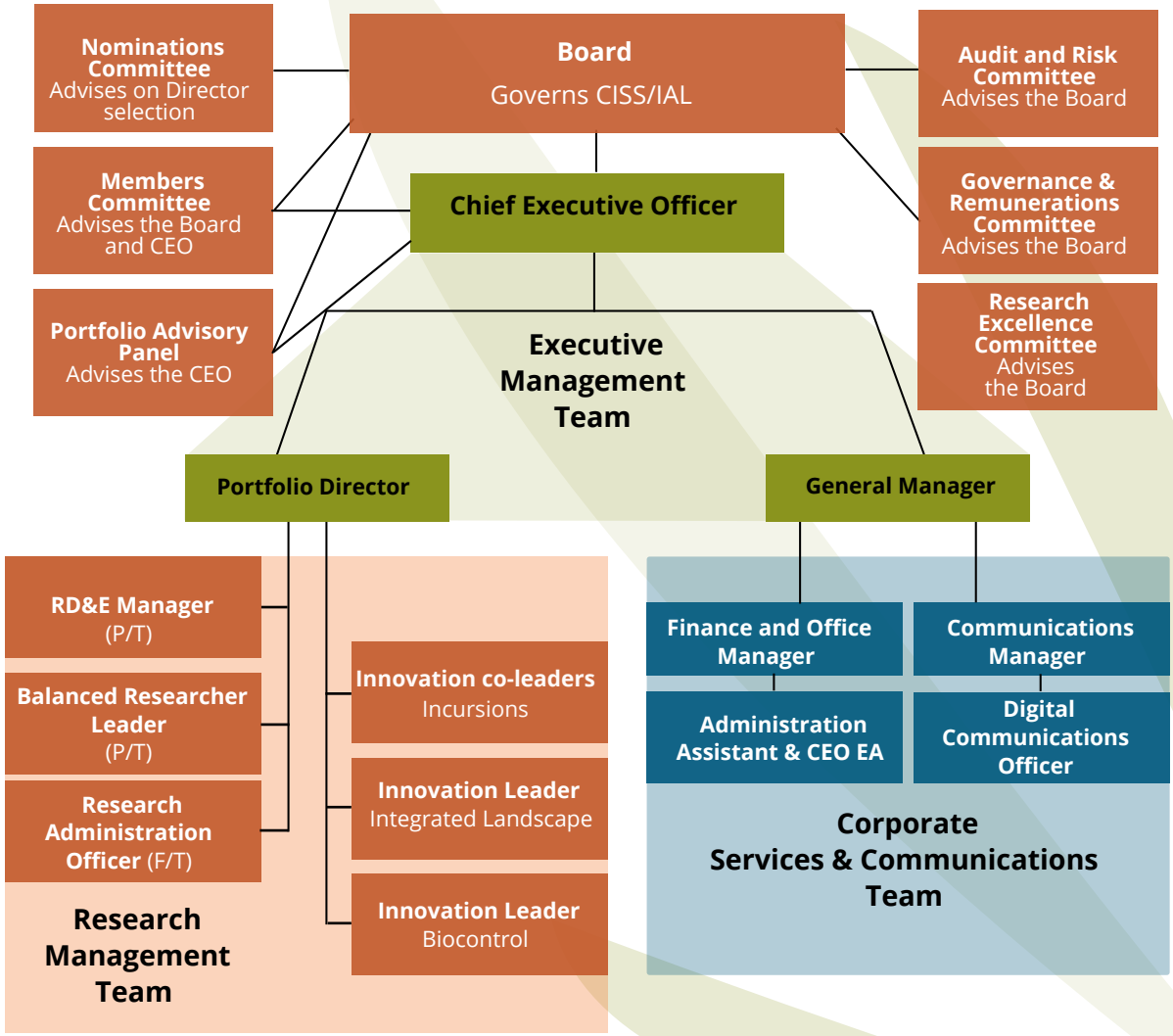
Our member, MLA ran a 6-part Feral Friday series promoting our Centre research and PestSmart/Feral Scan platforms and our partner, AWI ran 7 different stories in their Beyond the Bale printed magazine on wild dogs, rabbits and new technologies, which goes out to all their members within Australia.

We would also like to thank all our stakeholder friends such as Animal Health Australia, Plant Health Australia, NRM Regions Australia, Invasive Species Council, Landcare Australia and many more for sharing our research impact over the financial year.

You can 'Meet the Ferals' thanks to the popular ABC Landline summer series

OUR **GOVERNANCE** AND **MANAGEMENT**

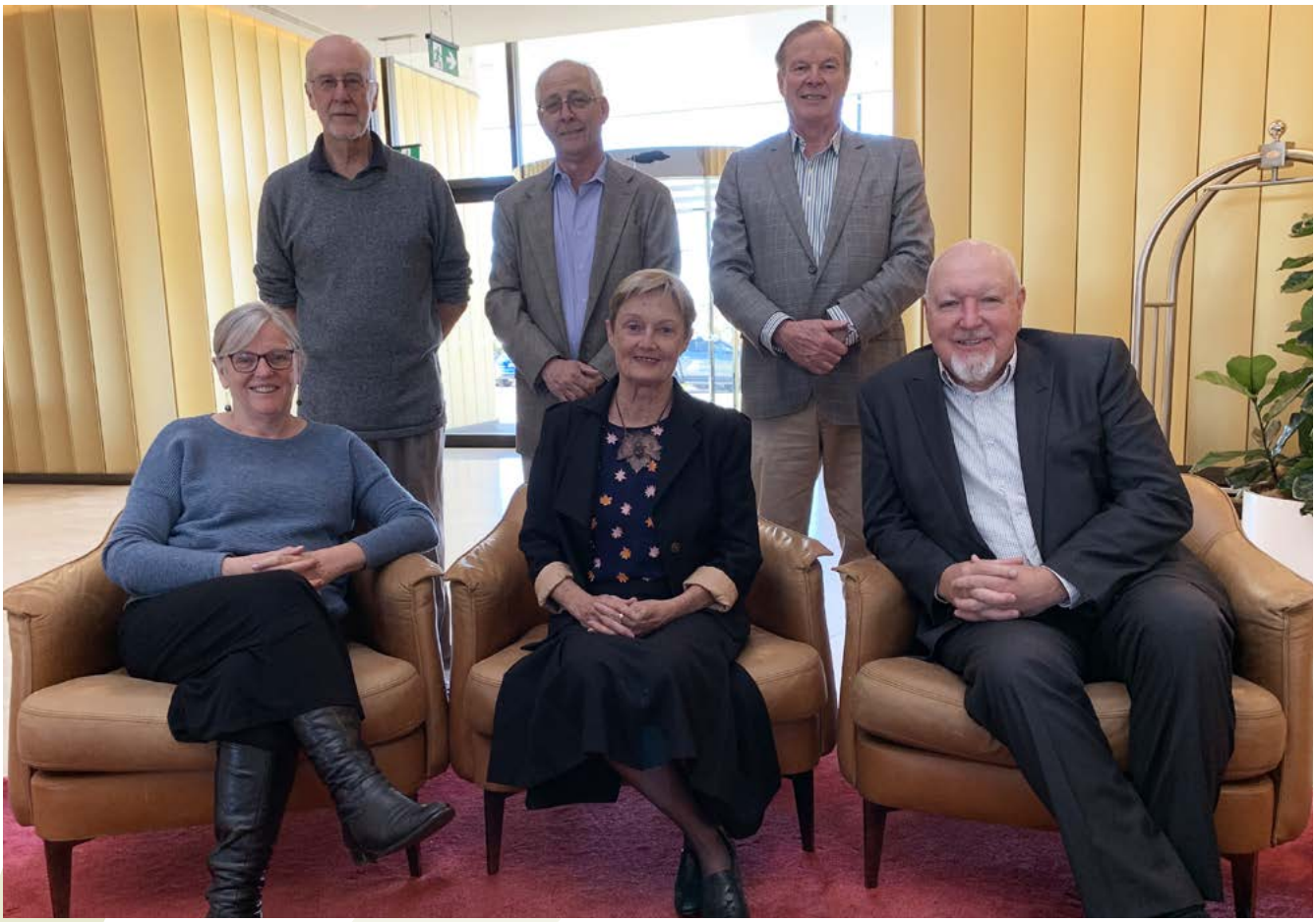
Invasive Animals Ltd is a public company limited by guarantee incorporated and domiciled in Australia. It has been endorsed by the Australian Taxation Office, as a tax concession charity and exempt from income tax and is registered as a Charity with the Australian Charities and not for profits commission.



The structure and governance of the CISS provides strong support to its operations. CISS is led by a Board of skills-based Directors, who are independent from its members and partners. The Governing Board meets at least four times a year and is committed to compliance with both Australian Charities and Not-for-Profit Commission and the Australian Security & Investments Commission Corporate Governance Principles and Recommendations.

In carrying out its governance role, the main task of the Board is to develop and monitor the CISS strategy, ensure compliance to IAL constitution, to develop policies and ensure the company complies with its contractual, statutory and other obligations.

The names and details of the Directors in office during the financial year and at time of publication of this report are as follows.



Invasive Animals Limited Board of Directors: (back row L-R) Dr Glen Saunders, Peter Noble, David Palmer (front row L-R) Jan Ferguson, Helen Cathles and Murray Rankin.

DIRECTORS	ROLE	KEY SKILLS	INDEPENDENT/ ORGANISATION
Helen Cathles	Chair	Director since 2005. Corporate Governance, Primary Production, Pest Animal Control	Independent
Peter Noble	Director	Director since 2015. Legal speciality, Governance & Risk Management	Independent
David Palmer	Director	Director since 2013. Governance, Management & Policy Development	Independent
Murray Rankin	Director	Director since 2013. Governance, Communication, Business & Commercial	Independent
Jan Ferguson OAM	Director	Director since June 2019. Governance, Research & Development, Communication	Independent
Dr Glen Saunders AM	Director	Director since November 2016. Pest Animal Management and Research	Independent
PUBLIC OFFICERS:			
Carolyn Campbell-Wood	Company Secretary	Appointed March 2014 Retired 21 August 2020	Centre for Invasive Species Solutions
Lucie Hassall	Company Secretary	Appointed 14 August 2020	Centre for Invasive Species Solutions
Julie McGuiness	Company Secretary alternate	Appointed CoS February 2018 Retired 30 September 2020	Centre for Invasive Species Solutions

DIRECTORS	BOARD MEETINGS		AUDIT AND RISK COMMITTEE		GOVERNANCE & REMUNERATION COMMITTEE		RESEARCH EXCELLENCE COMMITTEE		TRANSITIONAL NOMINATIONS COMMITTEE	
	No. eligible to attend	2019-20	No. eligible to attend	2019-20	No. eligible to attend	2019-20	No. eligible to attend	2019-20	No. eligible to attend	2019-20
Number of meetings held for the year:	7		5		4	4			2	
Number of meetings attended:										
Directors										
Helen Cathles (Chair)	7	6#	2	2	5	5				
Jan Ferguson	7	7					4	4		
Peter Noble (Chair Governance & Remuneration Committee)	7	6#			5	5			2	2
David Palmer	7	7	5	5						
Murray Rankin (Chair Audit & Risk Management Committee)	7	7	5	5					2	2
Dr Glen Saunders AM (Chair Research Excellence Committee)	7	6#					4	4		
Nominations Committee Members										
Matt Koval - (as representative of the Commonwealth Dept of Agriculture) (Chair Transitional Nominations Comm)	-	-	-	-	-	-			2	2
Dr Bruce Christie - (As representative of the Environment & Invasives Committee)									2	1*
Ms Adrienne Ryan - as representative of the National Farmers Federation	-	-	-	-	-	-			2	2
Mr Michael Rosier - as representative of a State Government									2	2

Directors were on leave at this time
* Apology

Committees

Audit and Risk Committee

The Audit & Risk Committee operates under Terms of Reference as 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 members of the Audit and Risk Committee Committee at any time during the year were:

- Mr Murray Rankin - Chair
- Mr David Palmer

The Chief Executive Officer, and General Manager and external auditors are invited to Audit & Risk Committee meetings at the discretion of the committee.

Governance and Remuneration Committee

The Governance & Remuneration Committee operates under Terms of Reference as approved by the Board.

The members of the Governance and Remuneration Committee at any time during the year were:

- Mr Peter Noble - Chair
- Ms Helen Cathles

The Chief Executive Officer and General Manager are invited to Governance & Remuneration Committee meetings at the discretion of the committee.

Research Excellence Committee

The Research Excellence Committee operates under Terms of Reference approved by the Board.

The members of the Research Excellence Committee at any time during the year were:

- Dr Glen Saunders AM - Chair
- Ms Jan Ferguson OAM

The Chief Executive Officer and Portfolio Director are invited to the Research Excellence Committee meetings at the discretion of the committee.

Nominations Committee

The Nomination Committee operates under Terms of Reference approved by the Board. The Committee for the 2019 - 20 year included:

- Mr Matt Koval – Chair
- Dr Bruce Christie
- Ms Adrienne Ryan
- Mr Michael Rosier
- Ms Helen Cathles
- Mr Peter Noble

This committee participated in the 2019 IAL election.

Staff

The Centre for Invasive Species Solutions has a number of staff which coordinate and maintain its administration, communication and research management function.

NAME	POSITION/ROLE WITHIN CISS	TIME COMMITTED
Mr Andreas Glanznig	CEO	100%
Ms Lucie Hassall	General Manager	100%
Associate Professor Richard Price	Portfolio Director (Research)	100%
Dr Ian McDonald	Communications Manager	100%
Dr Tony Buckmaster	RD&E Manager and Balanced Researcher Leader	100%
Mr Greg Mifsud	National Wild Dog Management Coordinator	100% *
Mr Andrew Mitchell	Research Scientist	100% **
Ms Geena Correa	Research Administration Officer	100%
Ms Yvette Cazabon	Senior Graphic Designer and Content Coordinator	90%
Ms Shan Southwell	Finance and Office Manager	100%
Ms Jane Leslie	Administration Assistant and EA to the CEO	100%

*funded through Portfolio One project funds

**funded through other project funds

Staff changes

Carolyn Campbell-Wood retired 21 August 2020
Julie McGuiness retired 30 September 2020

Domain Leaders

NAME	ORGANISATION	DOMAIN	TIME
Dr Brad Page	Primary Industries and Regions, South Australia	Innovation co-leader, Incursions	28%
Dr Tony Pople	Queensland Department of Agriculture and Fisheries	Innovation leader, Integrated Landscape Management	30%
Dr Tanja Strive	CSIRO	Innovation leader, Biocontrol Domain	20% (pro bono)

FINANCIAL PERFORMANCE

The Company Invasive Animals Ltd was established to be a non-profit institution to promote a managed and co-operative approach to RD&E in the field of invasive species management so as to maximise the benefits from that RD&E.

The Invasive Animals Ltd.'s short term objective is to foster the establishment of the Centre for Invasive Species Solutions, and develop its first RD&E project portfolio – Portfolio No. 1. Portfolio No.1 is funded through a five-year agreement between the Commonwealth Department of Agriculture, Water and the Environment, all States and the ACT, two industry Research and Development Corporations, five universities and the NZ Department of Conservation. It commenced in 2017 and finishes in 2022.

The Invasive Animals Ltd's long term objective is to secure the Centre for Invasive Species Solutions (CISS) as a permanent national collaborative invasive species RD&E institution that enables a more coordinated and efficient approach to drive invasive species management innovation that will assist in future proofing Australia's National Biosecurity System. This is being pursued by broadening our RD&E scope to cover vertebrate pests, weeds and environmental invertebrates and diseases, and revenue diversification that includes attracting additional revenue through the establishment of the Invasive Species Solutions Trust (ISST) and augmented projects aligned to the CISS strategy.

Performance of the Centre

The total resources available refers to the Portfolio No.1 plus aligned and other projects. Total contributions available in 2020 were $13,814,595, up from $13,136,718 available in 2019. 2020 revenue (including IAL reserve funded projects) being $7,712,372 and total In-kind contributions being $6,102,223.

2020 Total Resources Available

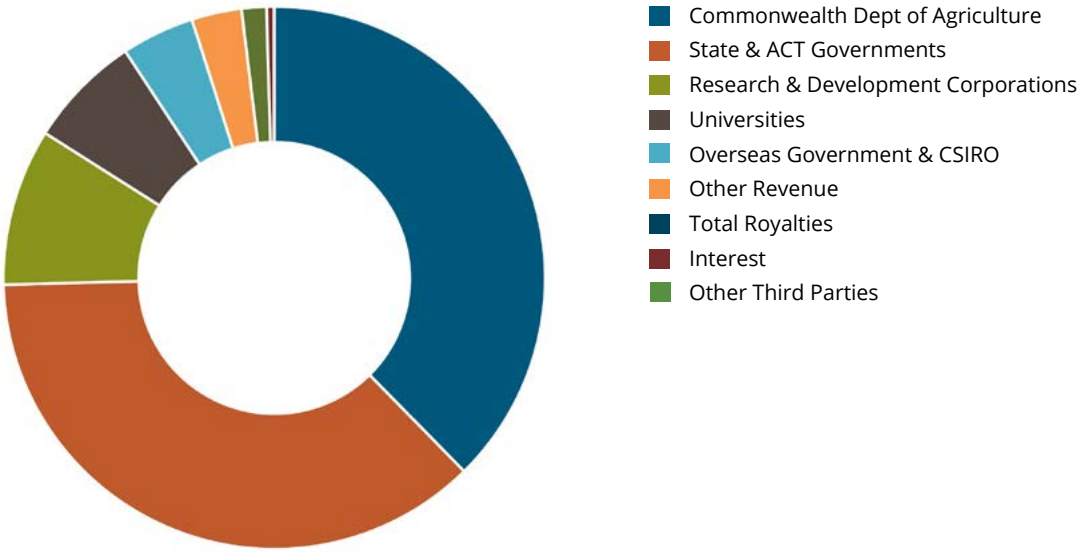


Chart 1: Financial year 2019-20 Total Contributions, both Cash and In-kind by revenue source.

The current CISS leveraging breakdowns show that the Commonwealth Department of Agriculture, Water and the Environment Head Agreement cash contribution for Whole of CISS Operations (35%) has been augmented with 65% of additional cash and in-kind resources over the 5 year Head Agreement. This relative DAWE contribution is expected to decrease as the in-kind and additional cash from the emerging contingency and weed projects come online.

The whole of CISS leveraging ratio is currently at 2.86 and represents $37,183,322 of other cash and in kind committed against the $20,000,000 cash Head Agreement.

Resources applied for 2020

The following Chart reflects, on a percentage basis, the expenditure allocation of the cash revenue and in kind contributions received for the year. The allocation to research activity of 90.4% is consistent with 30 June 2019. This year a cash revenue amount of $3,638,629 was carried forward to future years to be spent on contracted and committed projects.

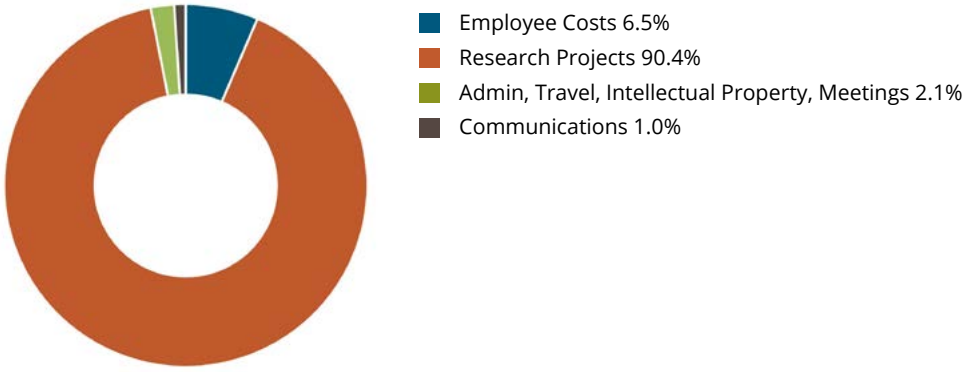


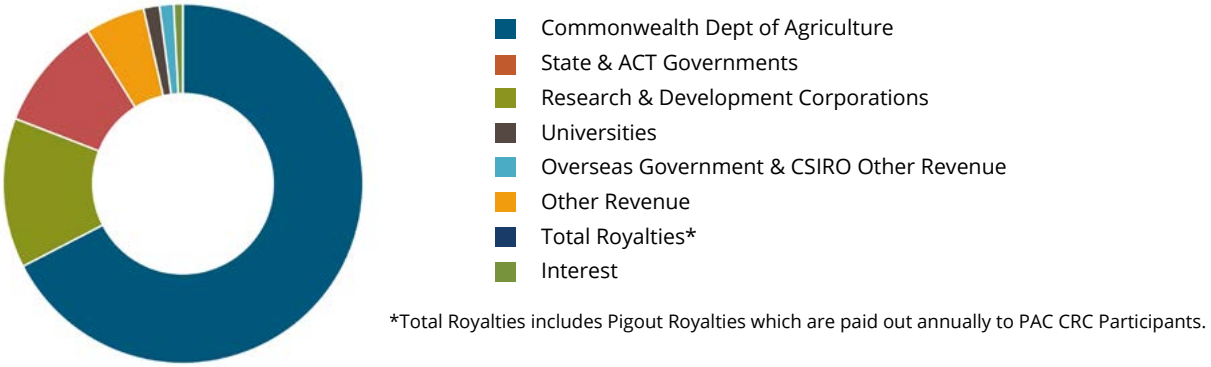
Chart 2: Financial year 2019-20 – Allocation of cash and in kind resources to expenditure by percentage ratio.

Net surplus 2020

The company achieved a net surplus of $298,163 in 2020 (2019: $143,698). Financial savings were achieved during the year 2020 in relation to travel and accommodation costs with the deferral of conferences and remote, rather than in person, meeting attendance. The company also received and accrued a total of $100,000 from the Federal Government as part of the COVID 19 cash boost initiative which has been included in the 2020 net surplus result.

2020 Revenue (cash and other)

The total net revenue of $8,883,506 (total cash $7,712,372 including IAL reserve projects plus carried forward movement of $1,171,134) included $5,198,733 invested by the Commonwealth Department of Agriculture, Water and the Environment, with other members and partners also providing significant revenue: $1,040,622 by Research and Development Corporations, $789,156 by the States and Territories, $110,735 by universities and $97,800 by the NZ government and others.



*Total Royalties includes Pigout Royalties which are paid out annually to PAC CRC Participants.

Chart 3: Financial year 2019-20 - Total revenue received by revenue source.

2020 In-kind Contributions

The total In-kind contributions of $6,102,223 for both Portfolio Agreement No. 1 and aligned projects was invested by the States and Territories, the universities and CSIRO.

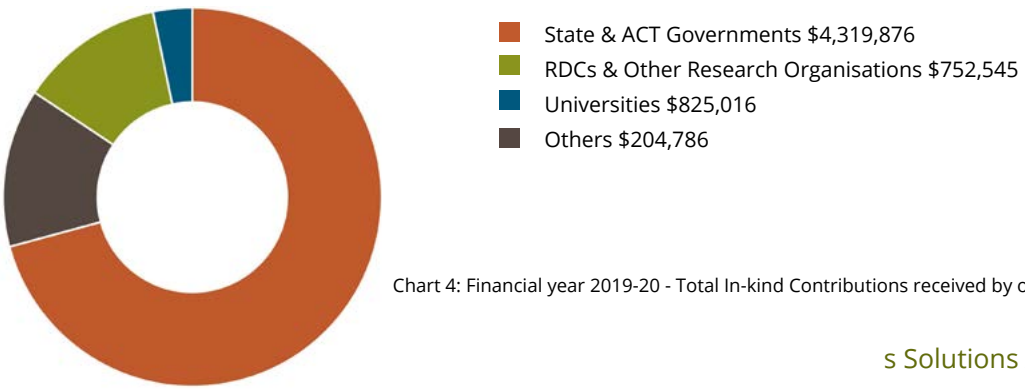


Chart 4: Financial year 2019-20 - Total In-kind Contributions received by organisation.

The positive total asset position at June 2020 of $6,760,536 represents sufficient cash flow to meet the liabilities of $5,280,445.

The Company's equity position at 30 June 2020 was $1,480,091 an increase from $1,181,928 at 30 June 2019.

Balance Sheet

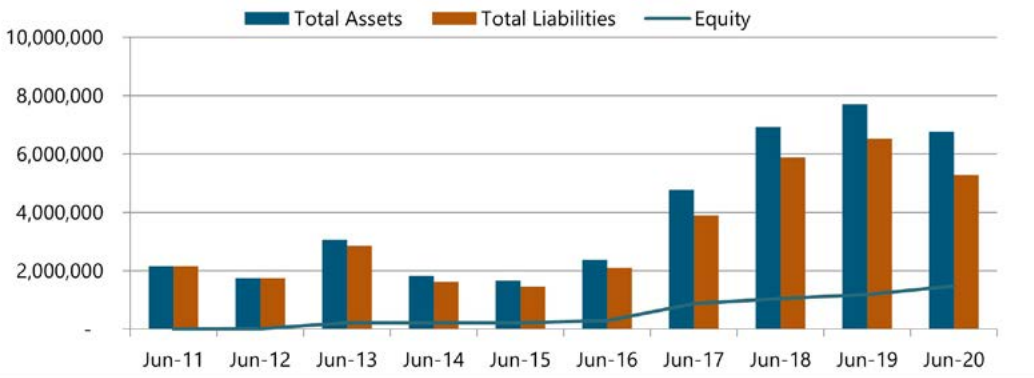


Chart 5: Financial year 2019-20 – IAL Company Balance Sheet reflecting Total Assets to Total Liabilities and resulting Equity (or Earnings).

Total Cash Reserve

Chart 6: Financial year 2019-20 – Total Cash Reserves for the IAL as a quarterly trend over time.

Liquidity Ratio

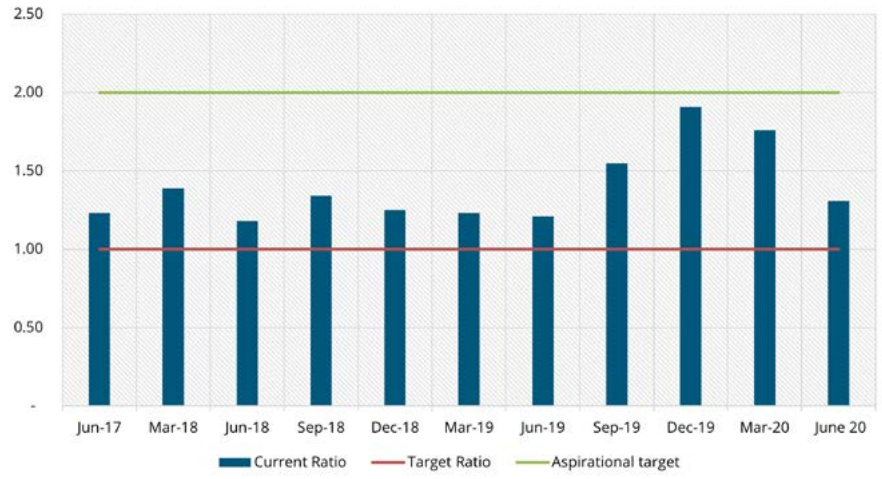


Chart 7: Financial year 2019-20 – IAL's Liquidity Ratio compared to the Commercial best practice benchmark.

The current asset ratio, (a measure of liquidity), as at June 30, 2020 was 1.31

Information used in compiling these graphs has been derived from the complete Audited Financial Statements which are available for download from www.invasives.com.au

CENTRE FOR
INVASIVE SPECIES SOLUTIONS

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