



CASE STUDY:

An Evaluation of the Centre for Invasive Species Solutions National Invasive Species Management Coordinator Model

Prepared For

The Centre for Invasive Species Solutions

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Special thanks for input to the Case Study go to (alphabetical order):

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Acronyms and Abbreviations

ACT	Australian Capital Territory
aka	Also Known As
BCR	Benefit Cost Ratio
CBA	Cost-Benefit Analysis
CGA	Commonwealth Grant Agreement
CISS	Centre for Invasive Species Solutions (aka the Centre)
CRRDC	Council of Rural Research and Development Corporations
DAFF	Department of Agriculture, Fisheries and Forestry (Commonwealth)
EIC	Environment and Invasives Committee
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
IACRC	Invasive Animals Cooperative Research Centre
IRR	Internal Rate of Return
MERI	Monitoring, Evaluation, Reporting, and Improvement
MIRR	Modified Internal Rate of Return
NESP	National Environmental Science Program
NGO	Non-Government Organisation
NPV	Net Present Value
NRM	Natural Resource Management
NSW	New South Wales
P01	Portfolio No. 1
PVB	Present Value of Benefits
PVC	Present Value of Costs
RD&E	Research, Development, and Extension
REIF	Research Excellence and Impact Framework
RSPCA	Royal Society for the Prevention of Cruelty to Animals
SOP	Standard Operating Procedure
TBL	Triple Bottom Line
VIC	Victoria

Glossary of Economics Terms

Accounting profit	Accounting profit (or loss) is also known as a company's earned profit, net income, or bottom line. Unlike economic profit, accounting profit is reported on a company's income statement. It is the profit earned after various costs and expenses are subtracted from total revenue or total sales, as stipulated by generally accepted accounting principles.
Benefit–cost analysis:	An economic analysis technique for assessing the economic merit of a proposed initiative by assessing the benefits, costs, and net benefits to society of the initiative. Aims to value benefits and costs in monetary terms wherever possible and provide a summary indication of the net benefit.
Benefit-cost ratio:	Ratio of the present value of economic benefits to the present value of economic costs of a proposed initiative. Indicator of the economic merit of a proposed initiative at the completion of benefit-cost analysis. Commonly used to aid comparison of initiatives competing for limited funds.
Discounting:	The process of converting money values that occur in different years to a common year. This is done to convert the dollars in each year to present value terms.
Economic profit	Economic profit (or loss) refers to the difference between the total revenues, less costs, and the opportunity cost associated with the revenue generated. Opportunity cost is the cost of an opportunity foregone.
Implicit price deflator for gross domestic product	The implicit price deflator for gross domestic product (GDP) is a price index for all final goods and services produced and is calculated as the ratio of nominal GDP to real GDP. The GDP deflator expresses the extent of price level changes, or inflation, within an economy. The implicit price deflator for GDP is used to convert past, nominal dollar terms to current, real dollar terms in a cash flow analysis.
Internal rate of return:	The discount rate that makes the net present value equal to zero. Internal rate of return must be greater than or equal to the discount rate for an initiative to be economically justified. The discount rate is also known as the hurdle rate.
Investment criteria:	A set of parameters used by decision-makers to assess or compare initiatives. Investment criteria may include the benefit-cost ratio, net present value and internal rate of return.
Net present value:	The combined discounted present value of one or more streams of benefits and costs over the appraisal period. The term 'net' denotes that the net present value is calculated as present value of benefits minus the present value of costs.
Present value of benefits:	The sum of the discounted benefit streams (cash flows) over the appraisal period.
Present value of costs:	The sum of the discounted cost streams (cash flows) over the appraisal period.

Executive Summary

The National Invasive Species Management Coordinator Model funded through the Centre for Invasive Species Solutions between 2017/18 and 2022/23 made significant positive contributions to invasive species management. Through the three appointed National Coordinators (wild dogs, feral deer, and feral cats and foxes) and their associated activities, the Centre has facilitated:

- Increased community awareness of invasive species and invasive species impacts,
- Increased and improved adoption of invasive species best practice management,
- Greater collective action and community engagement for invasive species management, and
- More effective and efficient resource allocation in invasive species management and RD&E through better coordination, communication, and prioritisation.

The National Coordinator Model investment has contributed to the following economic, environmental, and social impacts:

1. A net reduction in invasive species impacts costs (damage and control costs), particularly for wild dogs, feral deer, foxes and feral cats.
2. Reduced negative environmental impacts of invasive species such as biodiversity loss.
3. Maintained social license to operate for invasive species managers.
4. Increased capability and capacity of invasive species managers.
5. Increased regional community wellbeing.

The total investment in the National Coordinator Model for the period 2017/18 to 2022/23 was the total investment in the National Coordinator Model for the period 2017/18 to 2022/23 was \$5.55 million (present value terms). The investment generated estimated total expected net benefits of approximately \$107.27 million. This gave a NPV of \$101.71 million and a BCR of about 19.3 to 1. There were no unique solutions for the IRR and the MIRR was not calculable with the undiscounted benefit and cost cash flows estimated.

Sensitivity analyses showed that, if it was assumed that the benefits of the overall Centre RD&E investment were just 1.39% less, the investment criteria for the National Coordinator Model still were positive. This result demonstrates the strongly positive benefits of the National Coordinator Model over the situation where the Model did not exist.

The results of the case study evaluation of the National Coordinator Model are highly positive and the National Coordinator Model investment was found to have achieved exceptional success within the suite of RD&E funded by the Centre. The results should be view favourably by CISS management, funding partners including DAFF and state government, invasive species managers, and other stakeholders.

1.0 Introduction

1.1 Background and Rationale

The Centre for Invasive Species Solutions (the Centre, CISS) was formed after the completion of the Invasive Animals Cooperative Research Centre (IACRC). In July 2017, the Centre was awarded a \$20 million Grant by the Australian Department of Agriculture, Fisheries and Forestry (DAFF)¹ to deliver a range of vertebrate pest and weed research, development and extension (RD&E) activities packaged under a single portfolio (known as Portfolio No. 1; P01). The Commonwealth Grant Agreement (CGA) for the Centre was awarded for a five-year period that ended on 30 June 2022, with an additional three months provided for preparation and submission of final reporting and audited accounts.

In addition to internal performance monitoring, evaluation, reporting and improvement (MERI) activities under the Centre's Research Excellence and Impact Framework (REIF), the Centre commissioned Agtrans Pty Ltd (Agtrans Research), in association with ACRE Economics Pty Ltd (ACRE Economics), to develop and implement an independent Program Evaluation Plan for the P01 Grant and the Centre's various aligned and unaligned RD&E funded from 1 July 2017 to 30 September 2022 (2017/18 to 2022/23). The Plan was developed and reviewed by CISS personnel and finalised in August 2021. The Plan was designed to provide a framework for a comprehensive, robust, and independent Final Evaluation of Centre activities and performance across the whole of the P01 investment and to enable an assessment² of the actual and expected outcomes and impacts of the Centre's total investment from 2017/18 to 2021/23.

At the completion of the development phase of the Program Evaluation Plan (Phase 1, completed August 2021), it was recommended that CISS fund some additional RD&E case study evaluations under the implementation phase of the Plan (Phase 2) to highlight key areas of invasive species RD&E and to better demonstrate the actual and expected outcomes and impacts of the CISS investment. Two case studies were selected and were to be completed as part of the Final Evaluation of the Centre's RD&E investment. The two RD&E topics selected for the case study evaluations were:

1. The National Invasive Species Management Coordinator Model.
2. Digital community platforms - specifically PestSmart, FeralScan, and the new WeedScan platforms.

Implementation of the CISS Program Evaluation Plan commenced in January 2022 and was completed in November 2022. Following a variation with DAFF to extend delivery timeframes for four projects that were not complete by the end of calendar 2022, DAFF and CISS required that the Final Evaluation of the CISS P01 investment be updated. The update included revisions to the case study evaluations.

The current report presents the updated case study evaluation of CISS investment in the National Invasive Species Management Coordinator Model (hereafter referred to as the National Coordinator Model). The case study forms part of the Final Evaluation of the Centre's activities and performance under the CGA for P01 and will contribute to the Centre's Final Report to the Commonwealth.

¹ The Australian Department of Agriculture, Fisheries and Forestry commenced on 1 July 2022. Over the lifetime of the CISS Commonwealth Grant Agreement, the Department was formerly called the Department of Agriculture, Water and the Environment (DAWE, February 2020 to June 2022), the Department of Agriculture (May 2019 to February 2020), and the Department of Agriculture and Water Resources (DAWR, September 2015 to May 2019).

² The terms 'assessment' and 'evaluation' are used interchangeably throughout this report.

1.2 Terms of Reference

- Undertake a moderate-high level case study on key elements of the Centre’s digital community platforms, specifically PestSmart, FeralScan and the new WeedScan platforms.
- Undertake a moderate-high level case study on the National Invasive Species Coordinator Model.
- Incorporate the findings of the two case studies into the Final Evaluation of Investment in CISS Portfolio No. 1.

Description of ‘moderate-high’ level case study inclusions:

An individual, moderate-high level case study, where applicable, will include:

- a. Identification of CISS RD&E activities and outputs contributing to the selected case study topic/ investment area.
- b. Phone and/or email interviews with the key CISS researchers associated with the RD&E as well as other stakeholders/ end users (e.g. landholders, government representatives) identified by CISS personnel (number may vary).
- c. A high-level qualitative assessment of the actual and expected outcomes and associated impacts of the selected topic RD&E.
- d. Development of a benefit-cost analysis (BCA) framework that could be used and/or expanded on in future analyses/ impact assessments.
- e. Completion of a basic, high-level BCA of investment associated with the specific case study topic. The level of detail in the BCA will be based on time available, publicly available information and data, and/or information and data provided by CISS.
- f. A short case study report (3-5 pages) to be presented as an appendix to the CISS Portfolio No. 1 Final Evaluation Report.

1.3 Report Structure

The evaluation of CISS investment in the National Coordinator Model is presented as an impact assessment report that will be included as an appendix to the CISS P01 Final Evaluation. The report is structured as follows:

- *Section 1:* Introduction to the CISS case study evaluations
- *Section 2:* Method used for the impact assessment of investment in the National Coordinator Model
- *Section 3:* Summary of nominal investment costs
- *Section 4:* Description of the activities and outputs of the National Coordinator Model funded from 2017/18 to 2022/23
- *Section 5:* Description of RD&E outputs and outcomes associated with the National Coordinator Model
- *Section 6:* Description of triple bottom line impacts of the investment in the National Coordinator Model
- *Section 7:* Valuation of impacts (cost-benefit analysis)
- *Section 8:* Results of the case study cost-benefit analysis
- *Section 9:* Discussion and conclusions
- *Section 10:* References and the Appendices (as appropriate).

2.0 Evaluation Framework

The impact assessment of investment in the National Coordinator Model from 2017/18 to 2021/23 followed general evaluation guidelines that are now well entrenched within the Australian primary industry research sector. The approach includes both qualitative and quantitative assessment components that are in accord with the impact assessment guidelines of the Council of Rural Research and Development Corporations (CRRDC) (CRRDC, 2018).

The evaluation process followed an input to impact continuum aligned with the Centre's overarching 'Theory of Change'. The evaluation method involved identifying and briefly describing the inputs, objectives, activities and outputs, and actual and expected outcomes across the National Coordinator Model RD&E investments funded through CISS. Any actual and/or potential impacts associated with project outcomes then were identified and categorised into economic, environmental, and social impact types using a triple bottom line (TBL) framework.

Some, but not all, of the National Coordinator Model impacts identified then were valued in monetary terms. The decision to value an impact was based on:

- Data availability and information necessary to form credible valuation assumptions,
- The complexity of the relevant valuation methods applicable given project scope and resources,
- The likely magnitude of the impact and/or the expected relative value of the impact compared to other impacts identified, and
- The strength of the linkages between the RD&E investment and the impact identified.

Where impact valuation was exercised, the impact assessment used cost-benefit analysis (CBA) as a principal quantitative tool. The impacts valued were therefore deemed to represent the principal benefits delivered by the investment in the National Coordinator Model for the 2017/18 to 2021/23 funding period.

3.0 Nominal Investment Costs

The total investment (cash and in-kind) in the CISS RD&E projects that contributed to the National Coordinator Model is shown in Table 1.

Table 1: Total Investment in National Coordinator RD&E Projects
(cash and in-kind, nominal \$)

Project Funding (Cash and In-Kind)	Year ended 30 June						Totals (\$)
	2018 (\$)	2019 (\$)	2020 (\$)	2021 (\$)	2022 (\$)	2023 (\$)	
P01-E-003 (Deer Coordinator)							
Cash	0	0	0	327,500	327,500	0	655,000
In-Kind	0	0	0	275,000	275,000	0	550,000
<i>P01-E-003 Sub-Total</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>602,500</i>	<i>602,500</i>	<i>0</i>	<i>1,205,000</i>
P01-E-005 (Wild Dog Coordinator)							
Cash	14,000	291,900	300,575	260,825	304,075	0	1,171,375
In-Kind	12,216	254,711	262,281	227,595	265,335	0	1,022,137
<i>P01-E-005 Sub-Total</i>	<i>26,216</i>	<i>546,611</i>	<i>562,856</i>	<i>488,420</i>	<i>569,410</i>	<i>0</i>	<i>2,193,512</i>
A-031/A-037 (Cat and Fox Coordinator)							
Cash and In-Kind	0	0	0	444	649,941	571,115	1,221,000
<i>A-031/A-037 Sub-Total</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>444</i>	<i>649,941</i>	<i>571,115</i>	<i>1,221,500</i>
Overall Totals							
Cash	14,000	291,900	300,575	588,769	1,281,516	571,115	3,047,875
In-Kind	12,216	254,711	262,281	502,595	540,335	0	1,572,137
Grand Totals	26,216	546,611	562,856	1,091,364	1,821,851	571,115	4,620,012

Source: Updated data from audited CISS financial statements provided by Shan Southwell (pers. comm., 2023)

Note: Any sum discrepancies for funding totals were due to minor rounding errors.

4.0 The National Invasive Species Management Coordinator Model

4.1 Overview

The RD&E investments that contributed to the National Coordinator Model between 2017 and 2022 were evaluated using a logical framework approach. The objectives, activities, outputs, and actual and expected outcomes for each of the three contributing projects (P01-E-003, P01-E-005, and A-031/A-047) were briefly described. Actual and potential impacts associated with project outcomes then were identified and categorised as economic, environmental, and social impacts. The logical framework for each project is presented in the sections below.

4.2 National Wild Dog Management Coordinator – Activities and Outputs

Table 2: Logical Framework for CISS Project P01-E-005

Project Summary	<p>Project Code: P01-E-005</p> <p>Project Title: National Wild Dog Management Coordinator Project</p> <p>Lead Research Organisation: AWI</p> <p>Project Leader: Greg Mifsud, National Wild Dog Management Coordinator, CISS</p> <p>Partner Organisations: MLA, Animal Health Australia (AHA), Wool Producers Australia, Sheep Producers Australia, Cattle Council of Australia, DAF QLD, DEDJTR, Department of Environment, Land, Water and Planning (DELWP) VIC, DPIRD, NSW DPI</p> <p>Period: 1 July 2017 to 30 June 2022</p> <p>Total Investment: \$2,193,512 (cash and in-kind, nominal \$ terms)</p>
Rationale	<p>The position of the National Wild Dog Management Coordinator (NWDMC) can be traced back to 2006/07 and the original funding of the National Wild Dog Facilitator project through the IACRC. Project PO1-E-005 was funded to continue the highly successful, landscape-scale, nil-tenure, community-led approach to wild dog management. The project builds on the platform for strategic management of wild dogs that had been developed over the past 10 years.</p>
Project Objectives	<p>The overarching aim of the NWDMC project was to improve national management of wild dogs and other vertebrate pest species with an associated reduction in impacts on the livestock industry and native fauna through delivery of the National Wild Dog Action Plan (NWDAP). Specific project objectives were:</p> <ul style="list-style-type: none"> • Adoption of nationally agreed best practice wild dog control techniques, including: <ol style="list-style-type: none"> a. Improved adoption and use of PestSmart and feral scan applications for the management of vertebrate pest species. b. Improved awareness of wild dog management and best practice control techniques amongst the community and industry stakeholders.

	<ul style="list-style-type: none"> c. Greater understanding of the need for wild dog and vertebrate pest control for the protection of agricultural and environmental assets by the broader urban community through delivery of target communications plan. d. Recognition by industry that wild dog and vertebrate pest control can be delivered regularly as part of property management activities. e. Greater coordination of effective and efficient use of appropriate control tools and current best practice management techniques across all tenures. f. Re-establishment of sheep and wool industry in areas of Australia where wild dogs have decimated numbers. g. Coordinated advice on training packages. • Improved conservation of endangered faunal communities through reduced predation following strategic and coordinated control programs for wild dogs but also red foxes and feral cats. • Improved regulatory framework for access to wild dog control products across states. • Support red meat producers to reduce the impacts of wild dogs and vertebrate pests to achieve Meat and Livestock Australia’s 2016-2020 strategic plan key performance indicator of reducing the cost of feral animal and weeds species by \$50 million. • The delivery of consistent and current information on integrated wild dog management to producers involved in the wool and red meat industries while improving communication between other public and private land managers in order to generate more effective wild dog management outcomes.
Key Activities and Outputs	<ul style="list-style-type: none"> • Worked closely with Skills Impact Australia to oversee the development and delivery of a new “Cert III Rural and Environmental Pest Management” course. The course was endorsed by all relevant state regional training authorities. • Developed a new competency for the rural and environmental pest management course around the use of poison baits and entitled “Apply poison baits for vertebrate pest control in rural and environmental landscapes”. This was identified by the coordinator as a major gap in the training and this competency will provide students with knowledge of how each toxin works, how and where it can be applied and how to develop a baiting program to target pest animals safely without impacts on other species or the environment. • Instigated collaborative funding approach between the QLD government, AWI and MLA that saw the appointment of three wild dog and feral animal management coordinators employed across the state. These positions include a new coordinator in south-west and central western QLD as well as a new position based in northern QLD to assist with integrated coordinated management programs for both wild dogs and feral pig control. • Reviewed funding applications and provided support for the administration and management of funds through the QLD feral pest initiative committee. This oversight committee is responsible for administering both state and federal funds allocated for cluster fencing and pest management activities within QLD. • Attended four meetings of the QLD Dog Offensive Group providing advice on the review of current QLD Wild Dog Strategy and assist with development of the future strategy. and Consultants were hired to review the objectives and

deliverables of the current strategy and provide recommendations on how these could be adapted and redeveloped for a new plan the five years.

- Continued to supervise and work closely with the staff employed under the NWDAP. Action plan activities undertaken by these staff including extensive communications on wild dog management activities such as field days and training as well as ongoing communications to increase general awareness of wild dog impacts and control practices.
- Established the NWDAP Coordination Committee. The first meeting of this committee was held in Sydney on 26 and 27th of July 2018.
- Attended all meetings of the Victorian Wild Dog Management Advisory Committee in the capacity as an observer to provide information on current best practice wild dog management as well as exposure to research and evidence of success of wild dog management programs in other states.
- Undertook talks with Organic Certifiers to investigate options for the use of 1080 products on certified properties.
- A set of guidelines was developed to assist organic producers establish areas on their property where 1080 can be used under authorisation by the relevant certifier.
- An independent review and impact assessment of the NWDAP Stage 3 was undertaken by Agtrans. A meeting to explain the review process and seek involvement in its development was held in Canberra on the 2nd May 2019. A decision was made to engage and consult with the stakeholders early in the process so they could be actively involved in its development.
- An Action Plan Writing group was formed and met on the 30th August 2019 to commence re-writing the current plan.
- The NWDMC provided advice to the Office of the Minister for Agriculture that restricting funds from the Communities Combating Pests and Weed Impacts During Drought Program to local governments would result in limited uptake for wild dog and feral animal control because, outside of QLD, local governments played no role in wild dog or feral animal management.
- The NWDMC notified NWDAP stakeholders of the government funding opportunity. The wild dog coordinators in each state were particularly important in brokering arrangements for council access to the funds.
- QLD shires benefited greatly from the funding opportunity through applications for fencing.
- Several Registered Training Organisations (RTOs) have shown interest in delivering the new Certificate III course ACH30318, Rural and Environmental Pest Management.
- The NDWMC facilitated a meeting between the entire MLA Adoption and AWI extension teams in conjunction with Richard Price from CISS, Peter Fleming and Guy Ballard from NSW DPI and Lucinda Hogan, chair of the norther NSW Southern Australia Livestock Research Council committee.
- The objective of the meeting was to get a good understanding of how each of the extension programs between both organisations operate (MLA and AWI) and on where or how CISS could be engaged with these extension programs to ensure the adoption of best practice predator management or control.
- The meeting also was an opportunity to garner further support for the RESET project, discuss funding opportunities and locations for field sites.
- The NWDMC is teaming up with several MLA and AWI consultants that are already delivering programs to roll out predator management demonstration sites to improve their predator management programs and monitor any

subsequent production benefits. In these cases, baselines for lambing have already been established for many years through scanning and weaning rates but fox management hasn't been actively pursued as a factor affecting lamb survival.

- Justin Toohey, the Cattle Council representative on the NWDAP Coordination Committee was successful in making sure dog impact data will be collected as part of a national animal health surveillance project.
- The Cattle Council of Australia is working closely with the Federal Department of Agriculture and Animal Health Australia in trialing a surveillance program targeting several animal-health related conditions affecting, or likely to affect, the cattle industry.
- The national wild dog management coordinator continues to assist with the delivery of projects within the coordinator network.
- The 'learn how to use muzzles for working dog safety' video developed by the national wild dog action plan through funding from NSW LLS, Sheep Producers Australia, Wool Producers Australia and AHA was launched on 17 March 2020. Muzzles purchased through this project have now been distributed across the country through the wild dog coordinator and NSW LLS network.
- The National Wild Dog Action Plan 2020-2030 was formally announced and launched by the Minister for Agriculture, Drought and Emergency Services, David Littleproud on Monday, 29 June 2020.
- The National Wild Dog Action Plan 2020-2030 operational Plan was endorsed by the Federal Government with a funding announcement from the Hon Min David Littleproud for the next 12 months.
- The funding ensures the ongoing employment of the NWDAP support staff until June 2022 as well as a range of key projects identified by stakeholders on the NWDAP coordination committee.
- An agreement was negotiated on nationally endorsed reporting requirements for the National Wild Dog Acton Plan by state and territory governments through the EIC.
- The NWDMC began working with stakeholders involved in the Barfield Rd (QLD) Producer Demonstration Site to investigate improved beef productivity though predator control.
- The first management planning workshop was held on 12 August 2021 with a best practice wild dog management field day in mid-October. The field day looked at reading wild dog sign, effective trapping techniques and the adoption of Canid Pest Ejectors. Feedback on the workshop and field day showed that the activities were extremely well received.
- The coordinator supported NT cattle producers through a series of wild dog management field days.
- In conjunction with NTCA field days were held at Douglas Daly and Katherine. Adam Bowen the NTCA representative on the NWDAP coordination committee and vertebrate pest controller was also involved in the Katherine field day demonstrating wild dog trapping techniques.
- The coordinator facilitated negotiations to secure funding for the NE NSW Wild Dog Coordinator position. The project commenced on the 2nd of April 2021. The project now is administered by CISS and cofounded through arrangements with Northern Tablelands LLS, Hunter LLS and Australian Wool Innovation.
- The NWDAP was displayed at a CISS showcase held by the Parliamentary friends of Farmers on 22 February 2021. The event was attended by members

	<p>of the NWDAP coordination committee Geoff Power and Peter Star in addition to Greg Mifsud and David Worsley (NE Wild Dog Management Coordinator).</p> <ul style="list-style-type: none"> • National reporting on wild dog management activities was received from all states and territories for the first time since its commencement in 2014. The data was based on the reporting recommendations developed through consultation with the Terrestrial Vertebrate Pest Working group of the EIC. • The information was summarized and presented to the NWDAP Coordination Committee but further consultation with • Discussions on the use of 1080 and wild dog management were held with the NTCA and pastoralists from the Alice Springs region in a webinar conducted on the 30th November. The NWDMC was also invited to sit on the Northern Territory Governments Wild Dog Management Working Group to provide expert advice on wild dog management as they review current policies and procedures including bait allocations. • The NWDMC facilitated the development and presented at an online field trip with University of Queensland and Moreton Bay Regional Council to investigate human wildlife interactions for students enrolled in the Wild Management - Human Wildlife Interaction course. • The coordinator attended the MLA NB2 Calves alive project meeting and community field days in Hughenden QLD on the 25th and 26th November 2021. The coordinator discussed how lifting calf survival through effective wild dog management fitted in with other MLA NB2 Calves alive projects as well providing a presentation on the impacts of wild dogs in cattle production in northern Australia and effective Wild Dog Management. • Many of those attending were known to the Coordinator from back in 2008 when he worked with pastoralists and the Flinders shire council to write their first wild dog management plan. • The coordinator was invited to attend and assist with delivery of the South Australian Governments Vertebrate Pest Training course in Adelaide from the 8th to the 12th November. Conducted by PIRSA for the benefit of state government and NRM staff the coordinator provided presentations on the human dimensions of wildlife management, facilitated group workshops and assisted with training attendees in the use of CPEs. • The NWDMC continued in 2021/22 to help drive consistent wild dog reporting by State Governments following EIC endorsement of data collection protocols. Inaugural reports under this arrangement were received between August and December 2021. • Perceptions about the role of dingos in the landscape diverted NWDMC attention. The Coordinator and the NWDAP Coordination Committee took a strong position against the Victorian Gariwerd management plan and reintroducing Dingoes into the Grampians. • The Coordinator on behalf of the NWDAP Coordination Committee wrote a formal submission to the Gariwerd management plan public consultation process arguing against the reintroduction based on sound scientific evidence. The Coordinator also provided a strong public position against the reintroduction undertaking numerous radio and newspaper interviews on the subject. • Working with local consultants, the Coordinator guided the implementation of the Less Predators More Lambs producer demonstration site in Mansfield, Victoria, involving 10 sheep graziers.
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	<ul style="list-style-type: none"> The project, funded through MLA, aims to increase lamb survival through effective predator management, primarily foxes and in some location's wild dogs. Results are showing that foxes will and do regularly kill lambs, and that on average landholders had a 2 to 5% increase in lamb survival as a result of adopting new practices relating to predator management as well as on-farm activities.
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4.3 National Feral Deer Management Coordinator – Activities and Outputs

Table 3: Logical Framework for CISS Project P01-E-003

Project Summary	<p>Project Code: P01-E-003</p> <p>Project Title: National Feral Deer Coordinator</p> <p>Lead Research Organisation: PIRSA</p> <p>Project Leader: Brad Page, Principal Biosecurity Officer, Pest Animals, PIRSA</p> <p>Partner Organisations: Nil</p> <p>Period: 1 May 2020 to 30 June 2022</p> <p>Total Investment: \$1,205,000 (cash and in-kind, nominal \$ terms)</p>
Rationale	<p>To support recent feral deer legislative changes in some states, Feral Deer Control Coordinators were employed (in SA and NSW, external to CISS funding) to engage groups of farmers to increase their awareness of feral deer impacts, their capacity to control deer, and to help farmers coordinate their efforts. The Coordinator model was adapted from the foundational work of the National Wild Dog Facilitator and the VIC Rabbit Action Network.</p> <p>Project P01-E-003 was funded to build on the successful coordinator model, to implement a position of National Feral Deer Coordinator who will support community-led deer control in all states and territories. In all locations, targeted facilitation will be used to dramatically increase both participation and motivation of neighbouring farmers to reduce feral deer impacts.</p>
Project Objectives	<p>Specific project objectives were:</p> <ul style="list-style-type: none"> Promote Awareness and Control Tools: <ul style="list-style-type: none"> a. Raise awareness of not only the importance of deer management and but also the methods that are available to landholders to control feral deer, and ensure resources are accessible. b. Enable the roll out of preliminary findings and products as they become available from existing CISS projects and other Australian and international programs on reducing the impacts of feral deer, and provide visible, practical opportunities for close partnerships between CISS, regional land management agencies, farming groups/bureaus and farmers. c. Promote use of DeerScan as an on-line community planning and management tool. d. Compile national deer distribution data, current state and national laws, policies and practices for the management of deer and to raise awareness of the deer problem.

	<ul style="list-style-type: none"> • Coordination of community-led deer control: <ul style="list-style-type: none"> a. Encourage, empower and facilitate groups of farmers to work together to promote landscape scale community-based control of feral deer. • Coordinate and promote approaches to deer control across agencies, industries and jurisdictions to reduce nation-wide impacts of feral deer. <ul style="list-style-type: none"> a. Facilitate co-development of a National Feral Deer Action Plan with stakeholders from State/Territory and national land management agencies, deer farming and agricultural industries, impacted communities, research, environmental and recreational hunting groups.
Key Activities and Outputs	<ul style="list-style-type: none"> • Dr Annelise Wiebkin from PIRSA was appointed as the new National Feral Deer Coordinator in late calendar 2020. • Activities were inhibited by the global Covid-19 pandemic. However, to date, the National Feral Deer Coordinator project has contributed to or undertaken the following activities/outputs: <ul style="list-style-type: none"> a. Facilitated trials on new control tools to increase the suite of control options available for land managers. These include a trial of thermal assisted aerial control for feral red and fallow deer, an eDNA trial (ongoing) to inform planning of an aerial cull and eradication of an isolated population of feral deer, use of AI and 4G cameras to inform ground culling, and the Coordinator provided oversight of a project (and lead the advisory panel) that investigated potential baits for feral deer. b. Identified and facilitated co-investment of small amounts with community groups to deliver value by demonstrating feral deer control options. Small investments included contributing to a professional shooter in the gold coast Hinterland, to work across many properties strategically, using new 4G real-time cameras, which resulted in on-going funding from the council to continue and grow the program. The Project also contributed to awareness campaigns in 4 regions which supported local investment into ground control. The Project co-funded camera monitoring in Buckleboo, which resulted in the local agency funding a follow up aerial cull. Some community groups have also been successful in grant applications that the Project has co-written, or provided support letters, which has prompted new deer control programs. c. Developed simple metrics for community groups to measure the impacts of feral deer on bushland and has set up on-going programs to track the effectiveness of feral deer control on environmental assets in VIC and QLD. Two community groups have trialled these monitoring protocols. d. Worked with the staff from the threatened species divisions of DAFF to progress a potential nomination of feral deer as a Key Threatening Process (KTP) under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act). The project reviewed the recent literature and compiled relevant information for a KTP submission. e. Raised awareness through state level masterclasses in SA, VIC and QLD, as well as deer control training courses in WA, and community events in VIC and QLD. A national awareness campaign is being piloted in 4 regions in 4 states.

	<p>f. Newsletters, stories, web links and useful operational and planning documents have also been added to the project's website and distributed to community networks to build awareness and capacity. Project staff have also were interviewed for several media stories, and have developed a number of videos tailored to local community audiences.</p> <p>g. A draft National Feral Deer Action Plan was developed and has supported priority actions by State agencies. The draft plan has also been used to support and guide 3 new state deer management plans (TAS, SA and QLD-in draft), and local community plans. Project staff have offered to assist state agencies with development of two state deer plans (ACT and WA).</p>
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4.4 National Feral Cat and Fox Management Coordinator – Activities and Outputs

Table 4: Logical Framework for CISS Project A-031/A-037

Project Summary	<p>Project Code: A-031/A-037</p> <p>Project Title: Strategic Coordination for Best Practice Management of Three Pest Animals (National Feral Cat and Fox Coordinator)</p> <p>Lead Research Organisation: CISS</p> <p>Project Leader: Gillian Basnett, National Feral Cat and Fox Management Coordinator, CISS</p> <p>Partner Organisations: Nil</p> <p>Period: 17 June 2021 to 30 June 2023</p> <p>Total Investment: \$1,221,500 (cash and in-kind, nominal \$ terms)</p>
Rationale	<p>Feral cats threaten the survival of over 100 native species in Australia. They have caused the extinction of some ground-dwelling birds and small to medium-sized mammals. They are a major cause of decline for many land-based endangered animals such as the bilby, bandicoot, bettong and numbat. Feral cats were declared a national pest at the Meeting of Environment Minister in July 2015 (Department of Climate Change, Energy, the Environment and Water, 2022).</p> <p>The European red fox also is a major threat to Australian native species and agricultural production. The fox has played a major role in the decline of ground-nesting birds, small to medium sized mammals such as the greater bilby, and reptiles such as the green turtle. Predation by foxes has been a significant contributor to native animal decline and continues to undermine recovery efforts for threatened species as the malleefowl, the bridled nail-tail wallaby and the night parrot. The fox causes also significant economic losses to farmers by preying on newborn lambs, kid goats, and poultry (Department of Sustainability, Environment, Water, Population and Communities, 2011).</p> <p>Project A-031/A-037 was funded to address feral cat and fox impacts on native species through a Grant provided as part of the Regional Bushfire Recovery for Multiregional Species and Strategic Projects Program funded through the Department of Industry, Science, Energy and Resources (Commonwealth).</p>

Project Objectives	<p>The objective of the Commonwealth Regional Bushfire Recovery for Multiregional Species and Strategic Projects Program underpinning project A-031/A-037 is to deliver bushfire recovery actions in one or more of the seven priority bushfire impacted regions, that address the recovery of identified animal or plant species and/or ecological communities impacted by the 2019-20 bushfires.</p> <p>This was to be achieved through a:</p> <ol style="list-style-type: none"> 1. National Feral Cat and Fox Management Coordinator, 2. Feral Horse Best Practice Management Project, and 3. Supporting the role of the National Deer Management Coordinator.
Key Activities and Outputs (to date and expected)	<ul style="list-style-type: none"> • Environmental scientist and ecologist Gillian Basnett was appointed as the inaugural National Feral Cat and Fox Management Coordinator in July 2021. • To date, the Coordinator has promoted and increased the use of Feral Cat Scan (part of FeralScan) as a reporting tool for collating feral cat detections and damage. • Gillian also has attended a range of community-based events and engaged with community groups promoting best practice management of feral cats and supporting community engagement and participation in the management of feral cats. • As part of the project, a guide to the formation of feral cat and fox management plans was developed and will be available for all community and regional groups to assist in implementing best practice management of feral cats and foxes on the lands that they manage. • The coordinator has worked closely with community groups to expand level of community education and action in managing feral cats. Several demonstration sites have been identified and work is underway to establish working programs in those areas. • The additional support provided for the National Feral Deer Coordinator through this project allowed the appointment of an administrative support person to the coordinator and expanded the activities that were able to be undertaken. • This contributed to the drafting of the National Feral Deer Action Plan and enabled other coordinator activities to be carried out while the Plan was finalized to minimise impact to on-ground of feral deer. • The community engagement portion of the coordinator role also was expanded because of the additional support and facilitated the development of community deer management programs in the Gold Coast Hinterland (QLD), Cape Liptrap (VIC), and Harrietteville (VIC) as well as providing regular support for the Tweed Shire Council (NSW) local deer control program. • The feral horse component of the project is ongoing and involves updating of the current Standard Operating Practices (SOPs) for feral horses. • When completed, the SOPs will be submitted to the relevant state governments and Commonwealth for agreement and approval. • The role of the National Feral Cat and Fox Coordinator has been renewed under a separate contract with the Commonwealth (CISS Project A-037) through to 30 June 2023. <p>Other planned and expected activities and outputs outlined in the Grant agreement include:</p>

Feral Cat Activities and Outputs:

- Ongoing and active participation in national invasive species fora.
- Active membership of the Feral Cat Taskforce national advisory, coordination and oversight group led by the Australian Department of Climate Change, Energy, the Environment and Water.
- Support implementation of the Threat Abatement Plans for feral cat and fox predation.
- Promote of the adoption of best practice management approaches and tools in collaboration with the Australian and State governments and the National Wild Dog Management Coordinator
- Raise awareness of the importance of feral cat and fox management and the methods that are available to land managers to control feral cats/foxes.
- Facilitate engagement between state governments, Natural Resource Management (NRM) groups, land managers, farmers, and Non-Government Organisations (NGOs), to work together to promote regional scale humane, effective and justifiable feral cat and fox control.
- Support establishment or on-going community-led feral cat and fox management programs, including through Landcare and private landholders, through the provision of best practice management approaches and tools.
- Support the adoption, application and implementation of new knowledge and humane products and approaches
- Communicate of best practice control methods, science, research and responsible domestic cat ownership—providing a trusted source of expertise and advice, including engaging with the National Environmental Science Program (NESP) Resilient Landscapes Hub to develop feral cat research priorities and communications products that complement those of the Centre.
- Promote community monitoring and support best practice local pest animal monitoring.
- Encourage and support the submission of these data to national databases through the FeralScan platform.

Feral Horse Activities and Outputs

- Providing practical support to the Australian Capital Territory (ACT), New South Wales (NSW), and Victorian (VIC) governments for feral horse control, with a particular focus on the Alpine region, by updating or developing key national codes of practice and standard operating procedures and guidelines that support effective best practice on-ground action.
- Review and update national Feral Horse Control Method SOPs (PestSmart) and Feral Horse Transport Standards for real world application
- Review feral horse control methods relative humaneness matrix (as per PestSmart best practice management toolkit) to take account of actual practice and chain of custody and cumulative impacts on animal welfare e.g. trapping/holding/transporting/lairage/destruction vs just the act of trapping. Empirical assessments of the welfare outcomes of control methods (beyond desk top based assessment of SOPs). This includes liaison with the national RSPCA³ and seeking support for the outcomes of welfare assessments of control methods.

³ Royal Society for the Prevention of Cruelty to Animals

	<ul style="list-style-type: none">• Facilitate sharing of knowledge on feral horse management across all jurisdictions including in consultation with relevant experts, state/territory agencies and the Australian Environment and Invasives Committee.• Develop national feral horse rehoming standards and guidelines.• Establish minimum standards required to be met by groups and individuals before being permitted to receive feral horses from government trapping and removal programs, thereby reducing individual vetting and checking procedures and the incidence of associated ongoing animal welfare issues in the oversupply of horses.• A survey and report on public attitudes towards feral horse management to fill a vital knowledge gap and inform the application of the SOPs given the controversy associated with feral horse management. <p><u>Supporting the role of the National Deer Management Coordinator</u></p> <ul style="list-style-type: none">• This project provided funding for a support person (and operational funds) for the CISS National Deer Coordinator to focus on coordinated control of deer impacts for recovery of bushfire (2019-20) affected native habitats, to establish environmental metrics to evaluate deer control efforts, and to provide data to support a potential nomination of deer as a key threatening process under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)
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5.0 National Coordinator RD&E Outcomes

5.1 Overview

Investment in the National Coordinator Model RD&E through CISS has produced, and will continue to produce, a wide range of relevant and useful outputs (see Section 4.0) that have the potential to provide positive impacts for Australian farmers, various levels of Government, other invasive species stakeholders, and the broader Australian community. However, whether or not the potential impacts are realised depends on other parties using, utilising and adapting the RD&E outputs. This step on the input to impact chain is known as 'usage' or 'outcomes' (Deloitte Insight Economics, 2007). The following sections describe the actual and expected outcomes at for the CISS National Coordinator Model investment

5.2 National Wild Dog Management Coordinator

- As a result of the public outcry and evidence provided by the Coordinator the reintroduction plans were dropped by the state government managers of the Grampians.
- The NWDMC has facilitated, led, or otherwise contributed to over 150 meetings, presentations, submissions, working groups, demonstrations, workshops, presentations, and other engagement and extension activities.
- The NWDMC has maintained and continued to build collaborative, cooperative, cross-jurisdictional relationships with landholders, invasive species managers, NRM and other community groups, government agencies and local councils, and other interested stakeholders.
- Further, the NWDMC project worked to communicate and extend wild dog and integrated invasive species best practice management and provide information and resources to landholders, invasive species managers, government, and other stakeholders.

5.3 National Feral Deer Management Coordinator

- The project facilitated or directly contributed to about 100 training courses, invasive species management group meetings, international knowledge sharing networks, workshops, awareness campaigns, masterclasses, and other engagement and information extension activities.
- The project has facilitated, empowered or supported several community groups and land management agencies to commence, or increase efforts in their coordinated feral deer control projects.
- This includes new deer management projects in West Tamar (TAS), Buckleboo (SA), Gold Coast (QLD), Gold Coast Hinterland (QLD), Cape Liptrap and Foster (VIC), Mount Best (VIC) and South West Western Australia, and expansion of programs in Limestone Coast (SA), Northern Rivers (NSW) and Harrierville (VIC).
- Working with regional communities has highlighted the diversity among communities, and different resources, capacity, governance, legislation and size of feral deer problems, which has informed the need for best practice to be flexible.
- The project now has a suite of case studies to promote to new communities to show them a range of control and engagement strategies.
- Successes in the use of artificial intelligence with 4G cameras, and eDNA, have also prompted interest in deer program managers in NSW, TAS, QLD and WA, who wish to use this new technology.

- The draft National Feral Deer Action Plan was developed and has supported priority actions by State agencies. The draft plan has also been used to support and guide three new state deer management plans (TAS, SA and QLD-in draft), and local community plans.
- To ensure continued delivery of coordination activities for feral deer following completion of the CISS CGA, funding for the National Feral Deer Management Coordinator project has been shifted to be external to the Centre.

5.4 National Feral Cat and Fox Coordinator

- Increased cooperation of stakeholders on feral cat and fox control
- Greater knowledge base and sharing of information and data on feral cat and fox control to support the protection of the EPBC Act species after the project ends
- An improved understanding by the broader community of the need for fox / cat control to support environmental assets and agricultural productivity
- recovery and resilience of priority threatened species is increased through greater stakeholder cooperation, sharing of information, and improved data.
- Improved feral horse best practice management
- Greater collaboration and knowledge of feral horse best practice management methods amongst jurisdictions.
- Improved awareness of the impacts of feral deer on native habitat to support a potential listing under the EPBC Act
- National coordination and promotion of deer management for environmental recovery of bushland and wildlife habitat, and reduced impacts on native vegetation
- Increased engagement of environmental land managers in the effective control of feral deer

6.0 Triple Bottom Line Impacts

The next step in the impact assessment process is to trace the pathways between the National Coordinator RD&E outputs and outcomes and the expected and potential the impacts across the community as a whole (CRRDC, 2018). Table 5 (below) describe the impacts of the investment in the National Coordinator Model categorised into economic, environmental, and social impact types using a TBL framework.

Table 5: Triple Bottom Line Impacts of the Investment in the National Coordinator Model

TBL Impact Category	National Coordinator Model Impacts
Economic	<ol style="list-style-type: none"> 1. Contribution to a net reduction in invasive species impacts costs (damage and control costs), particularly for wild dogs, feral deer, foxes and feral cats. This impact is driven by: <ol style="list-style-type: none"> a. Increased adoption of invasive species (and integrated invasive species) management best practice. b. Improved implementation of invasive species and other invasive species management practices through: <ol style="list-style-type: none"> i. increased collaboration and cooperation between invasive species management groups/jurisdictions, ii. increased capability and capacity of invasive species managers, iii. improved invasive species management strategies at local, state, and national levels (advancing a nil-tenure approach to invasive species management), iv. increased awareness, understanding, and engagement of invasive species managers and the broader community for invasive species and other invasive species surveillance, monitoring, and management. c. Maintained efficiency/effectiveness of resource allocation for invasive species management and control through improved collaboration and cooperation between invasive species management groups/jurisdictions and reduced duplication of effort.
Environmental	<ol style="list-style-type: none"> 2. Contribution to reduced negative environmental impacts of invasive species, particularly for wild dogs, feral deer, foxes and feral cats because of reduced invasive species density and/or distribution. This impact is driven by increased and/or improved management of invasive species resulting in: <ol style="list-style-type: none"> a. Reduced risk of extinction for native flora and fauna because of reduced predation and habitat destruction, and b. Reduced land degradation contributing to improved water, soil, and air quality through vegetation regeneration.
Social	<ol style="list-style-type: none"> 3. Contribution to maintained social license to operate for invasive species managers through improved community engagement facilitating increased awareness and understanding of invasive species, invasive species impacts, and invasive species management practices. 4. Increased capability and capacity of invasive species managers through education and awareness of and access to wild dog and other invasive species management best practice resources. 5. Increased regional community wellbeing achieved through: <ol style="list-style-type: none"> a. Reduced stress/anxiety, particularly for primary producers, because of engagement with the National Coordinators facilitating improved community engagement and collective action, access to best practice management resources and advice, improved nil tenure management of invasive species, and maintained social license to operate. b. Spillover benefits from more economically sustainable agricultural industries because of reduced invasive species impact costs.

7.0 Impact Valuation

7.1 Context

Economic impacts are usually the impacts that can be valued with most confidence. Economic impacts are generally derived from outcomes that lead to cost-reducing or demand-enhancing changes. Impacts of the project on unit production costs or prices for enterprises involved in an industry are valued and then aggregated by the level of industry adoption already manifest and/or expected. Implementation costs involved in adoption need to be valued and included.

Some impacts on the natural environment, on people and on social well-being are not transmitted or distributed through market transactions. These environmental and social impacts—referred to as non-market impacts—may be significant in some research projects but are rarely subject to rigorous analysis. Efforts to analyse non-market impacts of research are beset by at least three difficulties, which largely explains why they have been neglected in past assessments (CRRDC, 2018):

- Because these goods have not been intensively studied, or because they are not traded, we often lack clear definitions or an accepted language with which to describe them.
- Though we may be able to observe non-market outcomes, it is difficult to define and quantify the effects of R&D on many of the non-market goods in which we are interested.
- Even if we can observe a change in a non-market outcome that is attributable to research-induced agricultural innovation, we often lack a direct basis for valuing the goods and services in question and the impacts they generate.

Some advances have been made in addressing these problems and developing analytical techniques, but analysis of non-market impacts remains a difficult undertaking. Non-market valuations for some impacts, particularly environmental and social impacts, were included in the analysis where appropriate and where project scope and resources allowed.

7.2 Impacts Not Valued

The impact types identified in Section 6.0 were assessed to determine whether or not each impact could be valued in monetary terms for the National Coordinator Model case study evaluation. The decision to value an impact identified was based on:

- Data availability and information necessary to form credible valuation assumptions,
- The complexity of the relevant valuation methods applicable given project resources,
- The likely magnitude of the impact and/or the expected relative value of the impact compared to other impacts identified, and
- The strength of the linkages between the RD&E investment and the impact identified.

Based on the assessment for valuation, only one (1) of the five (5) TBL impacts was not valued within the National Coordinator Model case study evaluation. The impact not valued was:

Impact 4: Increased capability and capacity of invasive species managers.

Though not valued independently, this impact is partially captured in the valuation of Impact 1 (net reduction in invasive species impacts costs) and Impact 2 (reduced negative environmental impacts of invasive species).

7.3 Impacts Valued

Of the five (5) potential impact identified in Section 6.0, four (4) were valued in monetary terms as part of a CBA of the investment in the National Coordinator Model. Each of the impacts valued and the associated valuation framework are described in the sub-sections below.

7.3.1 Key Valuation Considerations

Attribution

The investment in the National Coordinator Model under CISS built on the success of the National Wild Dog Management Coordinator. The position of the National Wild Dog Management Coordinator (NWDMC) can be traced back to 2006/07 and the original funding of the National Wild Dog Facilitator project through the IACRC. The National Coordinator Model also contributed to and received input from other CISS RD&E projects. Building and maintaining community trust and engagement in invasive species management requires long-term commitment and continuity of the National Coordinator roles.

To account for the contributions of past and complementary RD&E in invasive species, an attribution factor was applied to the gross benefits estimated in the analysis of the investment in National Coordinator Model RD&E. An attribution factor consistent with the broader CISS P01 Final Impact Assessment of 45.2% was applied to estimate the total expected net benefits attributable to the specific investment in the National Coordinator Model.

Risk Factors Along the Pathways to Impact

The case study evaluation of investment in the CISS National Coordinator Model is a combination of an ex-ante and ex-post analysis. Though the formal P01 investment period under assessment ended 30 June 2022 (ex-post) many of the outputs of Centre RD&E have only recently been finalised and activities of National Coordinators are continuing into 2022/23 (ex-ante). Therefore, there is some uncertainty regarding the longer-term outcomes (adoption/implementation) and future impacts from the investment.

To account for this uncertainty and future projections of benefits and costs, a risk-based CBA framework was used for the quantitative analysis. Risk factors along the likely pathways to impact were included for each impact valued to estimate the total expected net benefits from the Centre investment.

Counterfactual

Defining the counterfactual, or without investment scenario, is critical to the outcome of the analysis, and usually entails more than simply projecting current industry trends indefinitely into the future. In ex-post analyses, the counterfactual is a hypothetical scenario and determining the characteristics of this counterfactual requires judgements about the course of events that would have transpired in the absence of the research outputs produced by the investment under consideration. This counterfactual scenario obviously did not, and will not occur, and can only be inferred from knowledge of the industry and its markets and through consultation/expert opinion (CRRDC, 2018).

The key drivers of the impacts of the National Coordinator Model are improved coordination of invasive species management, increased and improved adoption of invasive species management best practice, and improved collective action and community engagement. It was assumed that, without the National Coordinator Model investment, invasive species management and RD&E would still have occurred but on a more ad hoc, regionally focused basis. The reduced coordination of invasive species management and RD&E without the National Coordinator Model in turn would lead to less community engagement, reduced collective action, and lower overall adoption of invasive species management practices. Therefore, it was assumed that without the specific investment in the National Coordinator Model, the estimated benefits of the overall RD&E investment by the Centre from 2017/18 to 2022/23 would have been reduced by 20%.

Consistency with the CISS Final Evaluation

To ensure consistency with the broader Final Evaluation and Impact Assessment of investment in CISS P01 under the CGA, the valuation framework and assumptions for each impact valued were made consistent with the valuation frameworks within the broader assessment.

7.3.2 Impact 1: net reduction in the total annual impact costs of endemic invasive animal species

Background

In 2021, the first detailed analysis of the reported costs associated with invasive species to the Australian economy since the 1960s was published (Bradshaw, et al., 2021). The study was based on the recently developed InvaCost database that aims to provide the most comprehensive and standardised compilation of invasions costs globally (Diagne, et al., 2020). The Australian study combined InvaCost data, data from an independent database of costs restricted to invasive herbivore species, and recent data describing the costs of invasive plants and other disease-causing agents. The final assessment comprised 2,257 unique cost entries and categories data entries based on reliability (low or high), geographic region, implementation form (observed or potential), type of environment (aquatic, terrestrial, or mixed), type of cost (damage/loss, expenditure, general costs including R&D, and mixed), and impacted sector (agriculture, authorities-stakeholders, energy, environment, forestry, health, public and social welfare, protected areas, and trade) (Bradshaw, et al., 2021).

Baseline Annual Invasive Species Impact Costs

Based on the detailed analysis, Bradshaw et al. (2021) reported estimated annual invasive species impact costs of US\$731.48 million for the year 2017 (highly reliable, observed data only; model range for 2017 predicted costs of US\$225.31 million to US\$2.38 billion according to the general additive model had the best fit assessed using the highest Akaike's information criterion weights). Annual costs for invasive animals and plants were not reported separately; however, total cumulative invasive species impact costs since 1960 were estimated at US\$183.04 billion (highly reliable, observed data only) with invasive plants estimated to contribute US\$151.68 billion (82.9%) of the total and invasive animals contributing approximately US\$46.43 billion (14.4%) with the remainder coming from unspecified species (US\$4.93 billion or 2.7% of the total highly reliable, observed costs). Therefore, it was assumed that annual invasive plant impact costs for 2017 were 82.9% of the estimated total annual impact costs (US\$731.48 million) equating to US\$606.15 million per annum (2016/17 dollar terms). Annual invasive animal impact costs for 2017 were estimated at 14.4% of the total annual impact costs equating to US\$105.62 million per annum (2016/17 dollar terms).

Temporal Changes in Invasive Species Impact Costs

Tracking temporal trends, Bradshaw et al. (2021) reported that the costs attributed to invasive species in Australia have increased from the 1970s to the present. Taking only the reliable, observed costs, the average annual cost increased from over US\$52.35 million in the 1970s to US\$15.12 billion during the last decade (2010-2020) or an average 6.0-fold increase per decade. Based on estimated total annual impact costs of US\$731.48 million for 2017, it was assumed that, without any significant changes or advancements in current invasive species management, total annual impact costs (animals and plants) would continue to increase by 6.0-fold of the base costs each decade.

Figure 1 shows the expected annual impact costs for invasive animal species based on total annual impact costs for 2017 estimated at US\$731.48 million the (2016/17 dollar terms) and a linear 6.0 fold decadal increase trend for future costs under the status quo.

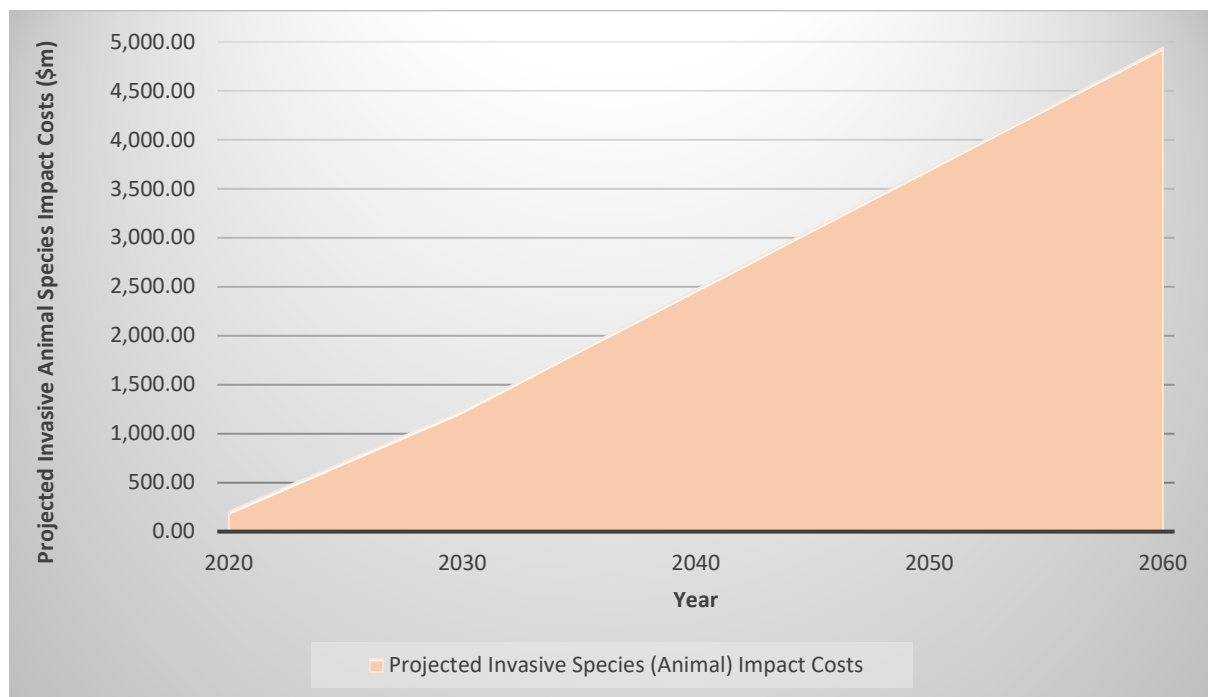


Figure 1: Expected Annual Impact Costs for Invasive Animal Species in Australia
Source: Derived from Bradshaw et al. (2021) for the current analysis

Valuation of Impact 1

The CISS P01 Impact Assessment indicated that the overall investment in CISS P01 has contributed to a range of outputs and outcomes that will result in approximately a 5% net reduction in current and future total annual impact costs of invasive animal species in Australia. Without the specific investment in the National Coordinator Model, it was assumed that this impact would be reduced by 20%.

Specific assumptions for the valuation of Impact 1 are described in Table 6.

Table 6: Summary of Assumptions for Valuation of Impact 1
(Net Reduction in Invasive Animal Species Impact Costs)

Variable	Value/Assumption	Source/Comments
Baseline current and future invasive animal species impact costs (including damages, resource losses, and management costs)	\$205.71 million per annum in the 2010-2020 decade Increasing 6-fold from base estimate each decade to a maximum of \$3,702.85 million in the 2050-2060 decade	See Figure 1 Based on 14.4% of total annual impact costs for 2017 estimated at US\$731.48 million the (2016/17 dollar terms) and a 6.0 fold decadal increase trend derived from Bradshaw et al. (2021) Converted to AUD\$ (USD/AUD exchange rate of 0.6418 ⁴) and real (2023/23) dollar terms using the Implicit Price Deflator for GDP (Australian Bureau of Statistics (ABS), 2022)
<i>With investment in CISS RD&E</i>		
Net reduction in total expected annual invasive animal species impact costs achieved through adoption/ implementation of CISS RD&E outputs	5.0%	Based on bottom-up analysis of CISS RD&E projects and invasive species stakeholder consultation
First year of impact	2017/18	Based on CISS RD&E building on and leveraging investment and outputs from the IACRC
Year of maximum impact	2023/24	One year after final year of CISS Portfolio No. 1
Period of maximum impact	5 years	Analyst assumption – assumes no further large scale coordinated investment through CISS after 2022/23
Decline and residual impact	Declining linearly from 2027/28 to 2032/33 to a residual impact at 10% of maximum	Allows for disadoption and other exogenous changes in invasive species management as well as residual benefits from CISS outputs attributable to the 2017/18 to 2022/23 period

⁴ Reserve Bank of Australia 'Latest Exchange Rates' on 25 September 2023:
<https://www.rba.gov.au/statistics/frequency/exchange-rates.html>

Variable	Value/Assumption	Source/Comments
<i>Without investment in CISS RD&E (Counterfactual)</i>		
Net reduction in total expected annual invasive animal species impact costs achieved through adoption/ implementation of CISS RD&E outputs	4.0%	(1-0.2) x 5% (20% reduction in overall impact)
All other assumptions maintained at base values.		
<i>Other factors</i>		
Attribution of benefits to the specific investment in CISS RD&E from 2017/18 to 2022/23	45.2%	See description of attribution in Section 7.3.1
Probability of output	100%	Based on successful development of a wide range of CISS RD&E outputs contributing to improved invasive species management
Probability of outcome	70%	Represents the likelihood that outputs are adopted/ implemented at the level/ profile assumed
Probability of impact	50%	Represents the likelihood that the benefits estimated occur as assumed given outcomes. Allows for ex-ante uncertainty and exogenous factors that may affect realisation of impacts (e.g. climate change, government policy change, global biosecurity issues, etc.)

7.3.3 Impact 2: reduced risk of extinction of some native Australian flora and fauna species (avoided biodiversity loss)

Willingness to Pay for Protection of Threatened Species

Estimates of environmental values are frequently required as inputs to CBA when evaluating alternative options for managing natural resources. One strategy to avoid the high cost of conducting empirical work when non-market values are involved is to use value estimates from an existing source study and to transfer them to the target context of interest (a practice known as benefit transfer) (van Bueren & Bennett, 2004).

van Bueren and Bennett (2004) undertook a study to systematically investigate the impact of context on value estimates and develop guidelines for calibrating value estimates. The objective of the guidelines was to allow practitioners of benefit transfer to select a set of value estimates that are most appropriate for the target area of interest and, where necessary, make scaling adjustments to the values as a means of correcting for contextual differences between the source study and the target area.

The 2004 choice modelling study included 'endangered native species' as an attribute measured as 'the number of species protected from extinction'. Two types of policy options were presented to respondents for valuation:

1. A status quo scenario whereby the current level of investment in environmental programs continues over the next 20 years (at no extra cost to the respondent); and
2. A levy option whereby respondent households would be required to pay an annual levy in return for environmental improvements over and above what could be achieved under the status quo.

The levy options ranged between A\$20 to A\$200 per annum. Changes in attribute levels resulting from these scenarios were communicated to respondents by measuring all changes relative to a 'do nothing' reference point, defined as the outcomes that would eventuate under a policy of zero investment in the environment (van Bueren & Bennett, 2004).

Using the endangered species attribute as an example of how the outcomes were measured, the status quo option would ensure 50 additional species to be protected relative to the 'do nothing' scenario. In contrast, selecting the levy option would ensure that 140 species are protected, again relative to the 'do nothing' reference point.

For environmental policies or investments that have a national impact, van Bueren and Bennett (2004) recommended that the national model value estimates reported be used and aggregated to the national household population. Therefore, based on the quantitative choice modelling, the study reported a mean implicit price of \$0.67 per household per year per endangered species protected from the national model (\$0.47 - \$0.88, 95% confidence interval, 2003/04 dollar terms). The implicit prices provide a basis for assessing the size of benefits associated with a package of environmental improvements or, alternatively, the cost associated with a decline in environmental quality or rural population at the national level (van Bueren & Bennett, 2004).

Valuation of Impact 2

The Centre has supported RD&E regarding the management of invasive pest animals that threaten native ecosystems, native habitats and endemic species. Centre RD&E projects have produced new and improved invasive species management tools, extension materials and strategies designed to:

- a. Improve surveillance and monitoring,
- b. Improve treatment and control options to mitigate invasive species impacts,
- c. Improve behaviours of invasive species managers, and
- d. Improve collective action and community acceptance of invasive species management practices.

The CISS P01 Impact Assessment provided evidence that the overall investment in CISS P01 has contributed to a net reduction in endemic invasive species impacts (Impact 1). This, in turn, means that Centre RD&E is expected to have contributed to the protection of native biodiversity and reduced the risk of extinction for native species threatened by invasive species through predation, competition for food and habitat, and habitat destruction.

Without the specific investment in the National Coordinator Model, it was assumed that this impact would be reduced by 20%.

Specific assumptions for the valuation of Impact 2 are described in Table 7.

Table 7: Summary of Assumptions for Valuation of Impact 2
(Contribution to Protection of Threatened Native Species)

Variable	Value/Assumption	Source/Comments
Average implicit willingness to pay for species protected from extinction	\$1.20 per household per year per species protected	Based on mean willingness to pay of \$0.67 per household per year per species protected in 2003/04 dollar terms from the national model reported by van Bueren and Bennett (2004) Updated to 2022/23 (real) dollar terms using the Implicit Price Deflator for GDP (ABS, 2022)
Total number of households in Australia	10.8 million private dwellings	ABS Census data (ABS, 2022b)
Total number of native fauna species (terrestrial only) threatened by invasive species	1,257 species	Kearney, et al. (2018)
Number of species threatened by key invasive animals including cats, rats, foxes, pigs, and rabbits	793	
Total national willingness to pay (cost) to protect native species threatened by key invasive species from extinction	\$10,256.37 million per annum	\$1.20 per household per year per species x 10.8 million x 793/1,000,000
With investment in CISS RD&E		
Contribution of CISS RD&E to protecting threatened species from extinction (2017/18 to 2022/23)	0.5%	Conservative estimate based on bottom-up analysis of CISS RD&E projects and invasive species stakeholder consultation
First year of impact	2017/18	Based on CISS RD&E building on and leveraging investment and outputs from the IACRC
Year of maximum impact	2032/24	One year after final year of CISS Portfolio No. 1
Period of maximum impact	10 years	Analyst assumption – assumes no further large scale coordinated investment through CISS after 2022/23 but residual benefits from RD&E outputs adopted

Variable	Value/Assumption	Source/Comments
Decline and residual impact	Declining linearly from 2032/33 to 2037/38 to a residual impact at 5% of maximum	Allows for disadoption and other exogenous changes in invasive species management as well as residual benefits from CISS outputs attributable to the 2017/18 to 2022/23 period
<i>Without investment in National Coordinator Model (Counterfactual)</i>		
Contribution of CISS RD&E to protecting threatened species from extinction (2017/18 to 2022/23)	0.40%	(1-0.2) x 0.5% (20% reduction in overall impact)
All other assumptions maintained at base values.		
<i>Other factors</i>		
Attribution of benefits to the specific investment in CISS RD&E from 2017/18 to 2022/23	45.2%	See description of attribution in Section 7.3.1
Probability of output	100%	Based on successful development of a wide range of CISS RD&E outputs contributing to improved invasive species management
Probability of outcome	70%	Represents the likelihood that outputs are adopted/ implemented at the level/ profile assumed
Probability of impact	50%	Represents the likelihood that the benefits estimated occur as assumed given outcomes. Allows for ex-ante uncertainty and exogenous factors that may affect realisation of impacts (e.g. climate change, government policy change, global biosecurity issues, etc.)

7.3.4 Impact 3: maintained social license to operate

Social License to Operate

The Australian community is increasingly concerned with non-monetary issues, such as ethical governance and environmental sustainability, when making consumer choices. There are many formal legal and regulatory licenses required to operate a legitimate business, including in agriculture and invasive species management. Social license is different and represents the informal “license” granted to an enterprise or individual by various stakeholders who may be affected by the organisation’s/individual’s activities. Such a license is based on trust and confidence (The Ethics Centre, 2018). A loss of social license to operate means invasive species managers may be unable to use certain management and control methods, or conduct invasive species management activities in certain areas, and agricultural producers also may not be able to apply necessary measures to protect their farms from invasive species impacts and therefore suffer reduced profitability.

The Centre has produced a wealth of information and resources, along with community engagement and education, that has:

- a. Improved/optimised use of invasive species management/control methods,
- b. Increased community understanding and awareness of the relative humaneness of invasive species control methods,
- c. Increased and improved use of new, more species-specific and humane invasive species management tools, and
- d. Increased general community awareness of invasive species, invasive species impacts, and invasive species management and control practices.

These social impacts are likely to have reduced the risk of a loss of social license, and therefore profitability, for some invasive species managers and agricultural producers.

Valuation of Impact 3

The total gross value of production (GVP) for Australian agriculture was estimated at \$71.0 billion in 2020/21 (ABS, 2022d). It was assumed that net economic profit represents 10% of the total GVP and that the Centre’s investment has contributed to 0.1% of total profits saved through reduced risk of loss of social license.

The National Coordinator Model has contributed significantly to the area of social licence for invasive species managers through community engagement and extension activities. Without the specific investment in the National Coordinator Model, it was assumed that this impact would be reduced by 20%.

Specific assumptions for the valuation of Impact 3 are described in Table 8.

Table 8: Summary of Assumptions for Valuation of Impact 3
(Maintained Social License to Operate)

Variable	Value/Assumption	Source/Comments
Total GVP of Australian agriculture	\$71.0 billion p.a.	Value of Agricultural Commodities Produced (ABS, 2022d)
Net economic profit as a percentage of GVP	10%	Analyst assumption – conservative estimate
Proportion of agricultural industries (as represented by GVP) at risk of a loss of social license to operate because of invasive species management issues in any given year	0.50%	
With investment in CISS RD&E		
Proportion of agricultural industries (as represented by GVP) at risk of a loss of social license to operate because of invasive species management issues in any given year with CISS RD&E	0.40% (0.1% less at risk in any given year)	Conservative estimate based on bottom-up analysis of CISS RD&E projects and invasive species stakeholder consultation.
Value of profits saved through reduced risk of loss of social licence for some agricultural producers/ invasive species managers	\$7.1 million p.a.	$\$71.0 \text{ billion} \times 10\% \times 0.1\%$
First year of impact	2017/18	Based on CISS RD&E building on and leveraging investment and outputs from the IACRC
Year of maximum impact	2023/24	One year after final year of CISS Portfolio No. 1
Period of maximum impact	5 years	Analyst assumption – assumes no further large scale coordinated investment through CISS after 2022/23 but residual benefits from RD&E outputs adopted
Decline and residual impact	Declining linearly to 5% of the maximum impact by 2032/33	Allows for disadoption and other exogenous changes in invasive species management as well as residual benefits from CISS outputs attributable to the 2017/18 to 2022/23 period.

Variable	Value/Assumption	Source/Comments
<i>Without investment in National Coordinator Model (Counterfactual)</i>		
Proportion of agricultural industries (as represented by GVP) at risk of a loss of social license to operate because of invasive species management issues in any given year with CISS RD&E	0.42% (0.08% less at risk in any given year)	(1-0.2) x 0.1% (20% reduction in overall impact)
All other assumptions maintained at base values.		
<i>Other factors</i>		
Attribution of benefits to the specific investment in CISS RD&E from 2017/18 to 2022/23	45.2%	See description of attribution in Section 7.3.1
Probability of output	100%	Based on successful development of a wide range of CISS RD&E outputs contributing to improved invasive species management
Probability of outcome	70%	Represents the likelihood that outputs are adopted/ implemented at the level/ profile assumed
Probability of impact	50%	Represents the likelihood that the benefits estimated occur as assumed given outcomes. Allows for ex-ante uncertainty and exogenous factors that may affect realisation of impacts (e.g. climate change, government policy change, global biosecurity issues, etc.)

7.3.5 Impact 5: enhanced regional community wellbeing

The Value of a Statistical Life Year

A number of RD&E investments or regulations/policies are aimed at reducing the risk of physical and mental harm, for example, occupational health and safety laws, warning labels on tobacco products and transport safety measures such as seat belt laws. Such investments have raised the issue of how to measure and articulate physical and mental wellbeing benefits in impact assessments. Different methods have been proposed for valuing reductions in the risk of physical and mental harm and Department of the Prime Minister and Cabinet (DPMC) Office of Best Practice Regulation has set out a 'Value of Statistical Life' method as the most appropriate and the best practice (DPMC Office of Best Practice Regulation, 2022).

Based on international and Australian research, a credible estimate of the value of a statistical life is \$5.3 million and the Value of a Statistical Life Year (VoSLY) is \$227,000 in 2021/22 dollar terms. Where an intervention/investment has a benefit of reducing risk of injury, disease/illness, or disability, one method to value such benefits is to adjust the value of statistical life year (which can be interpreted as the value of a year of life free of injury, disease/illness and disability) by a factor that accounts for the type of injury, disease/illness or disability. The Australian Institute of Health and Welfare and other organisations have published disability weights for most diseases/illnesses and injuries that can be used to adjust the VoSLY. As an example, an amputated foot has a disability weight of 0.3, which equates to 30% of a VoSLY or \$68,100 per year ($0.3 * \$227,000$) when measured in 2021/22 dollars (DPMC Office of Best Practice Regulation, 2022).

For the Global Burden of Disease 2013 study, Salomon, et al. (2015) developed an updated set of disability weights to quantify health levels associated with non-fatal outcomes. Salomon, et al., (2015) reported that, for anxiety disorders, ‘moderate’ anxiety had a mean disability weight of 0.133 while ‘mild’ anxiety had a mean disability weight of 0.030 .

Valuation of Impact 5

By investing in RD&E that is likely to contribute to a net reduction in invasive species impact costs and increased community awareness, understanding, and acceptance of invasive species management practices, the Centre has contributed to enhanced regional community wellbeing. This enhanced wellbeing may be described as reduced stress and anxiety because of reduced invasive species impacts (e.g. reduced wild dog and fox attacks, reduced road incidents with feral deer, reduced community conflict, etc.) and increased regional community resilience because of more productive and profitable agricultural industries.

The National Coordinator Model has been a major contributor to the Centre’s community engagement and extension activities and provided knowledge single points of contact for concerned industry and community stakeholders. Without the specific investment in the National Coordinator Model, it was assumed that this impact would be reduced by 20%.

Specific assumptions for the valuation of Impact 5 are described in Table9.

Table 9: Summary of Assumptions for Valuation of Impact 5
(Increased Regional Community Wellbeing – Reduced Anxiety)

Variable	Value/Assumption	Source/Comments
VoSLY	\$240,565	VoSLY updated to 2022/23 dollar terms using the Implicit Price Deflator for GDP, derived from DPMC Office of Best Practice Regulation (2022)
Disability weight for moderate anxiety disorders	0.133	Based on disability weights estimated for the Global Burden of Disease 2013 study, Salomon, et al., (2015)
Disability weight for mild anxiety disorders	0.030	
Estimated total Australian population	25.7 million	ABS Census data (ABS, 2022c)
Proportion of Australian population living in rural/regional areas	28% of total population	Australian Institute of Health and Welfare (2022)

Variable	Value/Assumption	Source/Comments
<i>With investment in CISS RD&E</i>		
Proportion of rural and regional people experiencing reduced stress and anxiety because of improved invasive species management in any given year	0.5%	Conservative estimate based on bottom-up analysis of CISS RD&E projects and invasive species stakeholder consultation
Equivalent number of individuals	35,980 people	0.5% x 28% x 25.7 million
Reduction in disability weight – moderate anxiety decreasing to mild anxiety	0.103	‘moderate’ 0.133 – ‘mild’ 0.030
First year of impact	2017/18	Based on CISS RD&E building on and leveraging investment and outputs from the IACRC
Year of maximum impact	2023/24	One year after final year of CISS Portfolio No. 1
Period of maximum impact	5 years	Analyst assumption – assumes no further large scale coordinated investment through CISS after 2022/23 but residual benefits from RD&E outputs adopted
Decline and residual impact	Declining linearly to zero by 2033/34	Allows for disadoption and other exogenous changes in invasive species management as well as residual benefits from CISS outputs attributable to the 2017/18 to 2022/23 period
<i>Without investment in National Coordinator Model (Counterfactual)</i>		
Proportion of rural and regional people experiencing reduced stress and anxiety because of improved invasive species management in any given year	0.40%	(1-0.2) x 0.5% (20% reduction in overall impact)
Equivalent number of individuals	25,186 people	0.35% x 28% x 25.7 million
All other assumptions maintained at base values.		
<i>Other factors</i>		
Attribution of benefits to the specific investment in CISS RD&E from 2017/18 to 2022/23	45.2%	See description of attribution in Section 6.3.1

Variable	Value/Assumption	Source/Comments
Probability of output	100%	Based on successful development of a wide range of CISS RD&E outputs contributing to improved invasive species management
Probability of outcome	50%	Represents the likelihood that outputs are adopted/ implemented at the level/ profile assumed
Probability of impact	50%	Represents the likelihood that the benefits estimated occur as assumed given outcomes. Allows for ex-ante uncertainty and exogenous factors that may affect realisation of impacts (e.g. climate change, government policy change, global biosecurity issues, etc.)

8.0 Results

8.1 Investment Criteria

All past and future cash flows were expressed in 2022/23-dollar terms using the implicit price deflator for GDP. Past and future cash flows were discounted to 2022/23 using a 5% discount rate. The discounted benefit (present value of benefits; PVB) and cost (present value of costs; PVC) cash flows then were used to estimate portfolio level investment criteria including the net present value (NPV), benefit-cost ratio (BCR), internal rate of return (IRR) and modified IRR (MIRR) for the CISS Portfolio No. 1 investment. The modified internal rate of return (MIRR) was estimated using a 5% reinvestment rate.

The base analysis used the best estimates of each variable, notwithstanding a high level of uncertainty for many of the estimates. All analyses ran for the length of the investment period plus 30 years from the last year of committed investment of the National Coordinator Model through CISS (2022/23). Investment criteria were reported for different time periods at five-year intervals from the last year of investment (year zero) out to 30 years.

Table 10 shows the investment criteria for the total discounted benefits (present value of benefits, PVB) against the discounted total investment from all sources across the CISS National Coordinator Model RD&E.

Table 10: Investment Criteria for Total Investment in CISS National Coordinator Model
(All funding sources, 5% discount rate)

Investment criteria	Number of years from last year of investment						
	0	5	10	15	20	25	30
Present value of benefits (\$m)	36.24	85.87	104.46	105.84	106.35	106.83	107.27
Present value of costs (\$m)	5.55	5.55	5.55	5.55	5.55	5.55	5.55
Net present value (\$m)	30.69	80.32	98.91	100.28	100.80	101.28	101.71
Benefit-cost ratio	6.53	15.46	18.81	19.06	19.15	19.23	19.31
Internal rate of return (%)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
MIRR (%)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

n.s.: no solution. The IRR is the discount rate where the NPV equals zero, as the PVB is positive from year zero no such discount rate exists. This likely occurs because of the nature of the benefit and cost cash flows where the net cash flows (discounted and undiscounted) are positive from 2017/18.

The annual undiscounted benefit and cost cash flows for the total investment for the duration of the CISS investment plus 30 years from the last year of investment are shown in Figure 2.

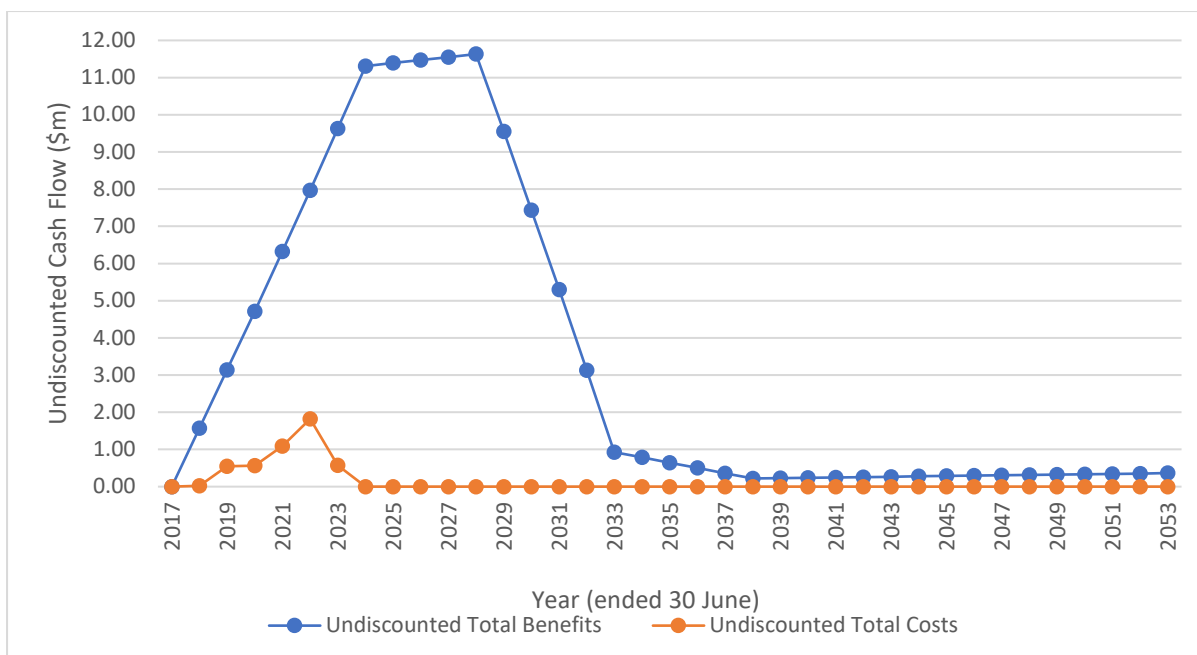


Figure 2: Annual Cash Flow of Undiscounted Total Benefits and Total Investment Costs

8.2 Sources of Benefits

The respective contributions to total benefits from the seven sources of benefits (seven impacts valued where benefits were attributable to the CISS Portfolio No. 1 investment) are provided in Table 11.

Table 11: Contribution of Source of Benefits to the Total PVB
(Total investment, 5% discount rate, 30 years)

Impact Valued	PVB (\$m)	% of Total PVB
Impact 1: net reduction in the total annual impact costs of endemic invasive animal species	6.84	6.4%
Impact 2: reduced risk of extinction of some native flora and fauna species	9.93	9.3%
Impact 3: maintained social license to operate for invasive species managers	1.05	1.0%
Impact 5: enhanced regional community wellbeing	89.45	83.4
Totals	107.27	100.0%

As for the broader CISS P01 evaluation, the largest contributor to the total expected net benefits of the CISS National Coordinator Model investment was Impact 5 (enhanced regional community wellbeing) at approximately \$89.45 million (present value terms) making up 83.4% of the total PVB. This result demonstrates the importance of community impacts achieved through indirect benefits such as reduced stress and anxiety because of reduced invasive species impacts and spillover benefits from more secure and profitable agricultural enterprises.

8.3 Sensitivity Analyses

Sensitivity analyses were conducted on assumptions that were considered key drivers of the investment criteria or were uncertain. The analyses were performed for the total investment and with benefits taken over the life of the investment plus 30 years from the last year of investment. All other parameters were held at their base values.

First, a sensitivity analysis was carried out on the discount rate. Table 12 presents the results. The investment criteria showed a low sensitivity to the discount rate. This was largely because benefit cash flows commenced from the first year of the investment assessed and therefore were subject to relatively less severe discounting.

Table 12: Sensitivity to Discount Rate
(Total investment, 30 years)

Investment Criteria	Discount Rate		
	0%	5% (base)	10%
PVB (\$m)	124.00	107.27	97.52
PVC (\$m)	5.08	5.55	6.07
NPV (\$m)	118.92	101.71	91.45
BCR	24.42	19.31	16.07

A sensitivity analysis was then undertaken on the counterfactual assumption that the impacts of the Centre's investment would have been 20% less without the National Coordinator Model investment. This variable was considered a key driver of the investment criteria and was uncertain. Results are provided in Table 13. The results showed a high sensitivity to the counterfactual assumption. When the counterfactual assumption was reduced to just 1.39% with all other factors at base values, the project is approximately at 'break-even'⁵. This means that, if it was assumed that benefits from the Centre's overall RD&E investment would be reduced by only 1.39% without the National Coordinator Model, the investment the investment criteria were still positive. This indicates the positive value of the National Coordinator Model.

Table 13: Sensitivity to the Counterfactual
(Total investment, 30 years, 5% discount rate)

Investment Criteria	Counterfactual – Reduction in Impacts without the National Coordinator Model Investment		
	2%	5%	20% (base)
PVB (\$m)	8.89	25.28	107.27
PVC (\$m)	5.55	5.55	5.55
NPV (\$m)	3.33	19.73	101.71
BCR	1.60	4.55	19.31

⁵ The break-even point in a CBA is the scenario where the PVB is equal to the PVC giving a NPV of zero (\$0) and a BCR of 1:1.

A final sensitivity analysis was used to investigate how the investment criteria changed with respect to the proportion of rural/regional population experiencing improved wellbeing. This variable was selected because Impact 3 (increased regional community wellbeing) made up the majority of the benefits estimated (83.4%) and was uncertain. The results (Table 14) showed a moderate to high sensitivity to the proportion of the population experiencing improved wellbeing attributable to the CISS investment.

Table 14: Sensitivity to the Proportion of Rural/Regional Population Experiencing Increased Wellbeing Attributable to the CISS RD&E Investment (Total investment, 30 years, 5% discount rate)

Investment Criteria	Proportion of Rural/Regional Population Experiencing Increased Wellbeing		
	0.05% or 3,598 individuals (base)	0.5% or 35,980 individuals (base)	1.0% or 35,980 individuals (base)
PVB (\$m)	26.77	107.27	196.71
PVC (\$m)	5.55	5.55	5.55
NPV (\$m)	21.21	101.71	191.16
BCR	4.82	19.31	35.42

8.4 Confidence Rating

The results produced are highly dependent on the assumptions made, some of which are uncertain. There are two factors that warrant recognition. The first factor is the coverage of benefits. Where there are multiple types of benefits it is often not possible to quantify all the benefits that may be linked to the investment. The second factor involves uncertainty regarding the assumptions made, including the linkage between the research and the assumed outcomes.

A confidence rating based on these two factors has been given to the results of the investment analysis (Table 15). The rating categories used are High, Medium, and Low, where:

High: denotes a good coverage of benefits or reasonable confidence in the assumptions made

Medium: denotes only a reasonable coverage of benefits or some uncertainties in assumptions made

Low: denotes a poor coverage of benefits or many uncertainties in assumptions made

Table 15: Confidence in Analysis of CISS RD&E Investment

Coverage of Benefits	Confidence in Assumptions
High	Medium-Low

Coverage of benefits valued was assessed as High. Four of five impacts identified were valued and the one impact not valued (increased capability and capacity of invasive species managers) was partially captured by the valuation of Impacts 1 and 2.

Confidence in assumptions was rated as Medium-Low, though some of the data and assumptions used were underpinned by credible, published data and/or expert consultation, the high-level of the assessment and a lack specific outcome and impact data meant that a number of key assumptions were conservatively estimated by the analyst.

9.0 Discussion and Conclusions

The National Invasive Species Management Coordinator Model funded through the Centre made significant positive contributions to invasive species management. Through the three appointed National Coordinators (wild dogs, feral deer, and feral cats and foxes) the Centre has contributed to increased awareness of invasive species and invasive species impacts, increased and improved adoption of invasive species best practice management, increased collective action and community engagement, and more effective and efficient invasive species management through better coordination and communication.

The National Coordinator Model investment has contributed to the following economic, environmental, and social impacts:

1. A net reduction in invasive species impacts costs (damage and control costs), particularly for wild dogs, feral deer, foxes and feral cats.
2. Reduced negative environmental impacts of invasive species such as biodiversity loss.
3. Maintained social license to operate for invasive species managers.
4. Increased capability and capacity of invasive species managers.
5. Increased regional community wellbeing.

The total investment in the National Coordinator Model under CISS P01 for the period 2017/18 to 2022/23 was \$5.55 million (present value terms). The investment generated estimated total expected net benefits of approximately \$107.27 million. This gave a NPV of \$101.71 million and a BCR of about 19.3 to 1. There were no unique solutions for the IRR and the MIRR was not calculable with the undiscounted benefit and cost cash flows estimated.

Sensitivity analyses showed that, if it was assumed that the benefits of the overall Centre RD&E investment were just 1.39% less, the investment criteria for the National Coordinator Model still were positive. This result demonstrates the strongly positive benefits of the National Coordinator Model over the situation where the Model did not exist.

The results of the case study evaluation of the National Coordinator Model are highly positive and the National Coordinator Model investment was found to have achieved exceptional success within the suite of RD&E funded by the Centre. The results should be view favourably by CISS management, funding partners including DAFF and state government, invasive species managers, and other stakeholders.

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