CASE STUDY:
An Evaluation of the Centre for Invasive Species Solutions Digital Community Platforms

FINAL REPORT

Prepared For

The Centre for Invasive Species Solutions

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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.

Summary

The Digital Community Platforms funded through the Centre for Invasive Species Solutions (CISS) have and will continue to make positive contributions to invasive species management. Through the various platforms, including PestSmart, FeralScan, and WeedsAustralia, the Centre has contributed to increased community awareness and understanding of invasive species, invasive species impacts, and invasive species management, improved community engagement, and increased and improved adoption of invasive species management best practice.

The CISS investment in Digital Community Platforms has contributed to the following economic, environmental, and social impacts:

1. Reduced endemic invasive species (animal and plant) impact costs.
2. Avoided future impact costs from exotic invasive species
3. Increased efficiency and/or effectiveness of resource allocation for invasive species research, development, and extension (RD&E)
4. Reduced negative environmental impacts of invasive species such as biodiversity loss (indirectly through improved invasive species management).
5. Maintained social license to operate for invasive species managers.
6. Increased capability and capacity of invasive species managers.
7. Increased regional community wellbeing.

The total investment in the CISS Digital Community Platforms for the period 2017/18 to 2022/23 was approximately $4.63 million (present value terms). The investment generated estimated total expected net benefits of approximately $18.52 million. This gave a NPV of $13.89 million, a BCR of about 4.0 to 1, an internal rate of return (IRR) of 72.1%, and a modified IRR of 16.2%.

Sensitivity analyses showed that, if it was assumed that the benefits of the overall adoption of Centre RD&E outputs was reduced by 0.5% without the Digital Community Platforms investment, the investment criteria still were positive. This result demonstrates the positive benefits of the Digital Community Platforms investment over the situation where the Platforms did not exist.

The results of the case study evaluation of the CISS Digital Community Platforms are positive and should be view favourably by CISS management, funding partners including the Australian Department of Agriculture, Fisheries and Forestry, state governments, invasive species managers, industry, 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 2016/17 to 2021/22. 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 assessment[2] of the actual and expected outcomes and impacts of the Centre's total investment from 2016/17 to 2021/22.

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 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. The current report presents a case study evaluation of CISS investment in Digital Community Platforms. 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 CISS Digital Community Platforms 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 CISS Digital Community Platforms
- *Section 3*: Summary of nominal investment costs
- *Section 4*: Description of the activities and outputs of the CISS Digital Community Platforms funded from 2017/18 to 2021/22
- *Section 5*: Description of RD&E outputs and outcomes associated with the CISS Digital Community Platforms
- *Section 6*: Description of triple bottom line impacts of the investment in the CISS Digital Community Platforms
- *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 Method

The impact assessment of investment in the CISS Digital Community Platforms from 2017/18 to 2021/22 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 CISS Digital Community Platforms 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 CISS Digital Community Platforms 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 CISS Digital Community Platforms for the 2016/17 to 2021/22 funding period.

3.0 Nominal Investment Costs

The total investment (cash and in-kind) in the CISS RD&E projects that contributed to the Digital Community Platforms is shown in **Error! Reference source not found.**.

Table 1: Total Investment in CISS Digital Community Platforms 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-002 (FeralScan)							
Cash	219,300	219,300	219,300	219,300	219,300	0	1,096,500
In-Kind	184,044	184,044	184,044	184,044	184,044	0	920,221
P01-E-003 Sub-Total	*403,344*	*403,344*	*403,344*	*403,344*	*403,344*	*0*	*2,016,721*
P01-E-008 (PestSmart Upgrade)							
Cash	115,205	115,205	115,205	115,205	115,205	0	576,027
In-Kind	0	0	0	0	0	0	0
P01-E-005 Sub-Total	*115,205*	*115,205*	*115,205*	*115,205*	*115,205*	*0*	*576,027*
PestSmart Extension and Communication and Other Digital Community Platforms Investment							
Cash and In-Kind	167,349	167,349	167,349	167,349	239,169	370,000	1,278,565
Other Sub-Total	*167,349*	*167,349*	*167,349*	*167,349*	*239,169*	*370,000*	*1,278,565*
Overall Totals							
Cash	501,854	501,854	501,854	501,854	573,674	370,000	2,951,092
In-Kind	184,044	184,044	184,044	184,044	184,044	0	920,221
Grand Totals	**685,899**	**685,899**	**685,899**	**685,899**	**757,719**	**370,000**	**3,871,313**

Source: Data from audited CISS financial statements provided by Shan Southwell (pers. comm., 2022)

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

4.0 The CISS Digital Community Platforms

4.1 Overview

The RD&E project investments that contributed to the CISS Digital Community Platforms 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 and other non-project activities (where applicable) 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 applicable project is presented in the sections below.

4.2 Project P01-E-002: Facilitating Community Adoption of Digital Resources (FeralScan) – Activities and Outputs

Table 2: Logical Framework for CISS Project P01-E-002

Project Summary	Project Code: P01-E-002 Project Title: Facilitating community adoption of digital resources – Delivering science-based community engagement, data collection, and customised pest control toolkits to pest management stakeholders (FeralScan) Lead Research Organisation: NSW DPI Project Leader: Peter West, Senior Research Officer and Invasive Species Officer (Engagement), NSW DPI Partner Organisations: AWI Period: 1 July 2017 to 30 June 2022 Total Investment: $2,016,721 (cash and in-kind, nominal $ terms)
Rationale	The rapid growth in digital mobile technology has untapped potential to enhance biosecurity and productivity of agricultural systems and to maximise industry, community and environment benefits for landholders and the community. Project P01-E-002 was funded to support the integration of PestSmart and the proven community-centred FeralScan pest surveillance, detection, mapping, and response technologies (with mobile apps) developed under the IACRC, to become the centrepiece for community engagement for CISS.
Project Objectives	The project aimed to focus on connecting communities, addressing community and landholder needs, and facilitating community adoption, using client-based services to identify and deliver customised pest control support and resources tailored specifically to client needs. Specific project objectives were: • Enhance existing Web- and App-based pest surveillance, detection, and Alert Systems for farmers and regional management organisations with interactive pest mapping services, client-based products and marketing. This will build on the highly successful FeralScan system, incorporating new incursion detection and response services, community networking tools, and real-time data sharing with all regional and state management authorities.

	• Support the development and adoption of new community networking resources to connect land managers to services, supporting organisations, pest control practitioners, regional organisations and access the latest pest control technologies, advice and extension services. • Package and deliver customised pest control resource toolkits tailored to meet the needs of community groups, local government organisations, landholder associations, regional NRM bodies, and pest management agencies. This will be developed using a client-based support system to define and address user needs. • Integration of FeralScan with PestSmart digital platform. • Develop Podcasts, Webinars, Farmer-teaching-farmer training for mobile device users, delivered through online services, and sharable across platforms and management agencies. • Develop a client-focused system for data access, data sharing, pest control support and accessing local/regional services. • Build public and stakeholder investment in surveillance, reporting and response through regionally marketed web and app-based pest mapping technology, via FeralScan. • Facilitate collaboration through regional, business and local government partnerships. • Participate in strategy development discussions on the best way to harmonise regional, state and national biosecurity information systems.
Key Activities and Outputs	• FeralScan software was configured and supplied to State/Territory jurisdictions including: a. Western Australia – Configuration of FeralScan (WildDogScan) for WA Government (DPIRD) and WA-based regional/recognised biosecurity organisations. This was to enable all regional groups to monitor wild dog activity, and the outcomes of licensed pest control technicians (LPMTs) across the regions. This included provision of wild dog attack alert notifications (via email) to relevant biosecurity and government staff, and data sharing with WA Government (DPIRD). b. South Australia (SA) – Configuration of FeralScan (WildDogScan) for SA Government (PIRSA) and 21 Local Area Planning regions (involving 221 landholders/pastoral station owners). This includes provisions of Wild Dog Attack Alert Notifications (via email) to all landholders/ pastoralists within those LAP regions and sharing of relevant wild dog data to SA government for management planning. This has enabled all LAP regions to monitor wild dog activity and attacks and use that information to guide local wild dog control activities. c. NSW Government – Configuration of FeralScan for NSW Government organisations (including NSW Department of Primary Industries, NSW Local Land Services, NSW Office of Environment and Heritage), and several Local Government Councils. This has involved (1) the commencement of services for 30 landholder groups in the Northern Tablelands LLS region, (2) services for numerous groups in the Hunter LLS region, (3) services for four wild dog control professionals in the Hunter LLS, (4) the redesign of Alert Notifications across 20 sub-regions within LLS jurisdictions, (5) sharing of non-restricted data with NSW BioMAP, and (6) inclusion of cane toads within the FeralScan App for NSW Office of Environment and Heritage Saving-our-Species monitoring.

	• Training in FeralScan and PestSmart was conducted across five States/Territories (SA, WA, NSW, southern QLD, and VIC) involving biosecurity stakeholders in partnership with State Government, regional biosecurity organisations, landholder groups, such as Wild Dog Control Associations. This involved the training of LPMTs across regions in WA, and equivalent in NSW. Training was delivered via Field Days, Workshops, face-to-face landholder meetings, as well as online via video conferencing and teleconferencing. • Training was also provided to staff on King Island, Kangaroo Island, Flinders Island, Christmas Island and Norfolk Island. • A week-long training program was delivered in April 2018. The training involved seven regional/recognised biosecurity organisations, WA-Government departments, AWI wild dog facilitators, and landholder groups and biosecurity stakeholders. Training included a series of workshops followed by dissemination of training materials, and teleconferencing support to participants. • The project successfully utilised the RabbitScan rabbit Biocontrol tracker website and App (with minor upgrades) to collect RHDV1-K5 data from engaged community volunteers following the release of RHDV1-K5 in early 2017, and into 2018. This provided continuity of the service during the national monitoring of K5 after the March 2017 release coordinated by the IACRC. • A prototype FeralScan data dashboard was designed and developed as a co-designed interactive service for farmers, landholder groups and Biosecurity stakeholders. This was road-tested with biosecurity groups in WA, VIC, NSW, and will offer registered users of FeralScan (and relevant biosecurity stakeholders) the capacity to view pest animal data (including pest activity, impacts and control data) in Charts, Tables and Heat Maps. Once the pilot testing is completed, this will be deployed for all FeralScan users, and will also include an optional service for users to request an automatically supplied end-of-month FeralScan Report Card, to automatically receive a summary of pest data from FeralScan for each user. • FeralScan was redesigned, updated and released (including the website and Apps) to enable pest control professionals the ability to record pest control or repeatable pest monitoring (such as wild dog/fox baiting, rabbit warren mapping) quickly using a “repeat record” button. • A total of 302 small user groups (including community groups, landholder associations, local government councils, landcare groups, schools) were registered in FeralScan for community-usage of FeralScan for monitoring, mapping and reporting pest activity levels. • 1,800 Wild Dog Alert Notification emails were communicated to landholder groups, wild dog control associations, Biosecurity agencies and stakeholders. • Final revisions were made to the DeerScan community feral deer reporting service. Some road-testing and field-trial of DeerScan was conducted with community groups in WA, TAS, VIC, and NSW. • Scoping was undertaken during the reporting period to define the development of the CARPMAP national community survey (including website, database, and real-time mapping) for launch in late 2018 in a partnership with the Fisheries Research and Development Corporation. • A Data Access Portal was designed for external clients to request access to FeralScan datasets, and support importation of datasets to FeralScan.

	• A new incursions reporting platform was scoped using the FeralScan program as technology, enabling public reporting of possible new incursions of pest animals. • A Guide to Introduced Pest Animals of Australia was published. • Training was provided to front-line staff within NSW LSS and NSW DPI at two Feral Deer management Master classes (held by NSW DPI) in Jindabyne (Southern NSW) and Quirindi (northern tablelands). • AWI supported training was provided in the Northern Tablelands LLS region of NSW at four events (Tenterfield, Armidale, Walcha, and Chandlers River) involving landholders, community representatives, NSW LLS, and NSW Office of Environment and Heritage. • The DeerScan community feral deer reporting website and app were officially made available via www.feralscan.org.au/deerscan and www.deerscan.org.au. Since a soft release in February 2019, it attracted 1500 community reports of deer problems. • A preliminary survey of user-groups was conducted in 2019 to document usage behaviour. A more advanced user-group survey and behaviour assessment commenced through a partnership with NSW LLS and UNE. • Training was provided to major stakeholder groups, including simultaneous consultation to cocreate enhancements to the FeralScan platform. • Community and biosecurity group workshops, training and consultation were conducted with 425 people representing 35 groups across 52 training workshops, information sessions and planning meetings throughout the reporting term. • The events focused on PestSmart resources, Glovebox guides, FeralScan and Camera-trap training, and consultation to determine user-needs. • Minor upgrades were made to the FeralScan App/website to address requests and user-feedback regarding WildDogScan, FeralPigScan, DeerScan, FoxScan, and FeralCatScan – to address National Coordinator needs. • National Facilitators profiles were incorporated into each website, and all FeralScan data was provided to national coordinators. • A new method of delivering alert messages to wild dog controllers was designed and road-tested in South East LLS throughout 2021. The new in-app and SMS alerts were designed to enable faster reporting from landholders to local appointed wild dog controllers. • A prototype new wild dog management map was developed. The map consists of a new interface for entering and displaying public information about current wild dog management programs. A new demand emerged to provide an outward facing Wild Dog management Map for the Australian public and funding through the NWDAP was sourced to held develop the prototype. • This new wild dog map interface will be hoisted within WildDogScan, and will be transferable to all major pest species (including deer, feral pigs, etc). • The project also commenced a number of new working partnerships. For example, with the Heytesbury Cattle Company – a major pastoral company in NT, is now using WildDogScan across a 2.5 million hectare property consisting of 10 stations and 40+ station staff. The Company is very interested in CISS products and technology. • A new CISS-staff designed logo for FeralScan was developed and placed on digital and printed resources to enhance bran linkages with CISS/PestSmart

	• A range of new promotional materials (banner, poster and magnets) were developed, with support of a CISS Senior Graphic Designer, for the national coordinators (pigs, dogs, deer, foxes/cats). • Data Sharing processes commenced with the ISC as a recommendation from the CISS CEO, to deliver DeerScan data to ISC staff. The project delivered a number of FeralScan achievements, including: • Community and Biosecurity Group Training: Provision of 51 training workshops and information sessions to major stakeholder groups, including over 670 people representing 55 pest management groups throughout the past 12 months. The events focused on PestSmart resources, Glovebox guides, FeralScan and Camera-trap training, and individualisation of support to assist groups adopt online technology to support best practice pest management. • WildDogScan - 148,000 WildDogScan reports, from landholders, pest controllers and biosecurity groups Australia-wide. • Total FeralScan records: 303,643 (representing 45,374 records during 2021/22, and constituting 236,921 reports from the public since commencement of the project in July 2017). This equates to an average of 1,000 new reports from the public per week throughout the 5-year project term. • Total Users: 38,805 (27,883 registered users plus 10,922 non-registered users). This equates to 32,436 new users since July 2017, and an average of 6,500 new people using FeralScan per year across the 5-year project term. • Total FeralScanGroups: 606 (representing 440 new groups since July 2017). • Alert Notifications: 25,603 email and in-App alert notifications have been sent from FeralScan (reaching 101,130 biosecurity staff, farmers, landholder groups, and pest controllers since project commencement). A total of 4,682 have been deployed in 2021/22 alone – reaching 23,103 users. The project coordinator has setup and manages 1,215 individualised purpose-built notifications for users Australia-wide. • Photographs of pest animals: 37,496 (representing 5,936 new photos during the past year). All photos are now associated to pest records, and are managed by the project coordinator. • Data-sharing with the ALA: A new agreement and arrangement has been implemented for real-time sharing of FeralScan occurrence data with the ALA, via a series of secure web API's. This will enable the sharing of previous, current and future data and ensure FeralScan data is accessible to ALA and associated government, industry, research and community stakeholders. No data is shared with ALA where it has been classified as private, sensitive or yet to be classified. No personal details of people using FeralScan or their properties have been shared with ALA. • A new National Wild Dog Management program map for the NWDAP has been developed with the National Wild Dog Coordinator and NWDAP partners for road-testing. and the national facilitator, to enable the Australian public to view aggregated information about wild dog activity, wild dog management programs. This will be hosted within WildDogScan (https://www.feralscan.org.au/wilddogscan/default.aspx) and accessible via the NWDAP website (https://wilddogplan.org.au/). The remaining step for this to be launched is adding data about wild dog programs Australia-wide in collaboration with the National Wild Dog Coordinator.

	• A new method of delivering Alert messages to wild dog controllers (particularly pest controllers who react to landholder reports) has been designed and road-tested to enable faster reporting from landholders to locally appointed wild dog controllers. This has been road-tested in South-east Local Land Services throughout 2021 and 2022, involving the Pest Animal Controllers (PAC's) to alert them quickly about landholder reports. This functionality will now be rolled out Australia-wide. • Commencement of a prototype of a new National Feral Deer management program map for the National Feral Deer Action Plan, and the national facilitator, to enable the Australian public to view aggregated information about feral deer populations, problems, and management programs. This will be hosted within DeerScan (https://www.feralscan.org.au/deerscan/default.aspx) and accessible via the national Feral Deer Action Plan website (https://feraldeerplan.org.au/). • New WildDogScan mapping interface capabilities developed and tested to display wild dog information from multiple organisations in NSW (e.g. NPWS, State Forests, NSW LLS, professional pest controller and private farmers) within the existing WildDogScan Maps for wild dog control groups. This service is provided to provide user-groups including Wild Dog Control Associations in NSW. This will be road-tested with groups across NSW and recommendations presented to CISS for a similar approach to adoption Australia-wide. • Series of 46 new webinars and 8 new videos on monitoring and managing pest animals. A total of 38 webinars and training session were delivered online to pest management stakeholders (including community). A total of 8 new videos have been developed in partnership with NSW Local Land Services, and Landcare groups in Victoria and NSW. The videos cover how to use the FeralScan App and website, how to use other technology with FeralScan (namely pest monitoring camera's), and the community/environmental/agricultural benefits of recording pest species. • Development of a new FeralScan Data Access Portal for external clients to request access to FeralScan datasets, and support importation of datasets (including pest and administration data). This service will enable more effective sharing of FeralScan data with pest management stakeholders, and improved value to landholders/communities using FeralScan as an interactive platform.

4.3 Project P01-E-008: Development of a National 'Invasive Species Management' Digital Information portal - – Activities and Outputs

Table 3: Logical Framework for CISS Project P01-E-008

Project Summary	Project Code: P01-E-008 Project Title: Development of a national 'invasive species management' digital information portal Lead Research Organisation: CISS Project Leader: Ian McDonald Partner Organisations: Nil Period: 1 July 2017 to 30 June 2022 Total Investment: $567,027 (cash and in-kind, nominal $ terms)
Rationale	The existing PestSmart toolkit distilled 12 years of IACRC research on best practice pest animal management and offered a central resource library and repository of information. A major aspect of this toolkit was the PestSmart Connect website originally launched in March 2015. It was considered important that resources were allocated to ensure that CISS digital material could be updated so that it would continue to align with current state, territory and commonwealth legislation and was optimised to ensure it remains relevant to end-users. Project P01-E-008 was funded to ensure that invasive species best practice information is easily and readily available to end-users and can be shared through CISS partner and member organisations, so they can be confident they are sharing information that is factual and relevant to their stakeholders.
Project Objectives	Specific project objectives were: • Undertake a review of current and future digital biosecurity and invasive species tools to ensure collaboration, coordination and investment in an innovative product that is not in direct competition with already existing programs. • Develop a robust and end-user driven digital resource tailored to the objectives of our partner and member organisations. • Provide purpose-built and engaging Pest Animal and Weed toolkits and resources for best practice management planning, coordination and monitoring via digital and printed means. • Ensure integration of invasive species data (where possible) across platforms such as FeralScan and independent programs to enable a one-stop shop for invasive species information. • Undertake monitoring and evaluation of the digital assets to assess the impact of awareness and knowledge in the sector.
Key Activities and Outputs	• A weeds website strategy was completed and a partnership with the Atlas of Living Australia was facilitated to deliver an engaging and dynamic national website. • The upgrade of the PestSmart website was progressed and end-user surveys were undertaken.

	• The WeedsAustralia and PestSmart websites form Australia's first invasives portal. • After two years of stakeholder engagement and co-design the new national weeds website (www.weeds.org.au) and an upgraded PestSmart website (www.pestsmart.org.au) were launched. • Further, a new community engagement information portal, Community Invasives Action (www.community.invasives.com.au) was launched in July 2020. • Feedback on the new and upgraded sites then was collected through an online evaluation process. • The PestSmart website attracted 223,963 users with 324,930 unique page views. The top five toolkits accessed during the reporting period were feral camels, feral cats, feral pigs, rabbits and foxes. A total of 9,728 glovebox guides orders were received and delivered during FY22. • The FeralScan website attracted 108,428 users with 281,192 unique page views. The top five pages accessed during the reporting period were DeerScan, WildDogScan, FoxScan, MouseAlert and ToadScan. FeralScan number of users continues to increase (now over 38,805) and community groups has grown to 606. • The WeedsAustralia website attracted 83,403 users with 233,229 unique page views. The two most visited pages were the Identify page and the first page of the Weeds profiles. The top three weed profiles accessed were Tribulus cistoides (Puncture Vine), Vinca major (Blue Periwinkle), and Puerarai lobata (Kudzu). • The Community Invasives website attracted 942 users with 1,171 unique page views. The three most visited pages were videos of Harley West, Lisa Adams and Michael Reid.

5.0 CISS Digital Community Platforms Outcomes

5.1 Overview

Investment in the CISS Digital Community Platforms 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 CISS Digital Community Platforms l investment

5.2 Project P01-E-002 (FeralScan) Outcomes

- Overall, the project continued to develop and deliver FeralScan web- and App-based community pest surveillance, monitoring and management resource, for farmers, landholder groups, community volunteers, local government, regional biosecurity stakeholders and State/Territory governments.
- Over 200 training sessions/courses, webinars, workshops, meeting presentations, working group meetings, other presentations, information sessions, and other project engagement activities were completed.
- Improvements to the FeralScan web- and app-based resources in conjunction with significant stakeholder engagement and education has significantly increased adoption of FeralScan as a community pest surveillance, monitoring and management resource by farmers, landholder groups/invasive species managers, community groups and volunteers, government, and regional biosecurity stakeholders.
- This increased adoption has been demonstrated and reported through the FeralScan use data.

5.3 P01-E-008 (PestSmart Upgrade)

- The Centre's digital strategy is in the process of being updated to better position the Centre's digital assets in light of significant external and internal digital drivers.
- CISS management commissioned Rohan Rainbow to revise the CISS digital strategy and prepare a long-term digital asset plan to guide further upgrade and harmonisation of community engagement platforms.
- The Centre's digital community platforms continue to be maintained and monitored, providing invasive species managers and the community with up-to-date information and resources on invasive species, invasive species impacts, and invasive species best practice management.

6.0 Triple Bottom Line Impacts

The next step in the impact assessment process is to trace the pathways between CISS Digital Community Platforms outputs and outcomes and the expected and potential the impacts across the community as a whole (CRRDC, 2018). Table 4 (below) describe the impacts of the investment in the CISS Digital Community Platforms categorised into economic, environmental, and social impact types using a TBL framework.

Table 4: Triple Bottom Line Impacts of the Investment in the CISS Digital Community Platforms

TBL Impact Category	**CISS Digital Community Platforms Impacts**
Economic	• Reduced endemic invasive species impact costs through improved pest surveillance, monitoring, and management from adoption of the improved FeralScan platform. This impact will be driven by: a. Increased and improved adoption of FeralScan by new and existing users. b. Increased effectiveness of the FeralScan platform through functionality and usability improvements. c. Increased capability and capacity of invasive species stakeholders for the use of FeralScan and associated resources because of targeted engagement and education activities. d. Increased efficiency/effectiveness of resource allocation for landscape-scale invasive species surveillance and monitoring because of increased adoption of the FeralScan platform. e. Increased engagement of invasive species stakeholders in pest surveillance, monitoring, and management activities. f. Availability and increased awareness of up-to-date, evidence-based invasive species and invasive species management information and resources facilitating improved invasive species management. • Contribution to avoided impact costs from exotic invasive species through improved community monitoring and surveillance (e.g., FeralScan) and awareness of priority exotic species reducing the risk of incursion, establishment and/or spread. • Increased efficiency and/or effectiveness of resource allocation for invasive species RD&E through increased availability of invasive species data generated by digital community pest surveillance using FeralScan and increased engagement of invasive species stakeholders.
Environmental	• Indirectly, some contribution to improved environmental outcomes such as increased biodiversity, improved animal welfare, etc. through the increased and improved adoption of invasive species management best practice.
Social	• Contribution to maintained social license to operate for invasive species management through improved community engagement facilitating increased awareness and understanding of invasive species, invasive species impacts, and invasive species management practices, and • Contribution to increased capability and capacity of invasive species managers achieved through: a. Provision of best practice management information, education, and tools, and b. Improved education and access to invasive species management best practice resources.

TBL Impact Category	CISS Digital Community Platforms Impacts
Social	• Some contribution to increased regional community wellbeing driven by: a. Increased community awareness and understanding of invasive species, invasive species impacts, and invasive species management. b. Improved community engagement in invasive species management. c. Reduced negative invasive species impacts because of increased and improved adoption of invasive species management best practice. d. Spillover benefits from more economically and environmentally sustainable agricultural industries.

7.0 Impact Valuation

7.1 Introduction

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 seven (7) impact types identified in Section 6.0 were assessed to determine whether or not each impact could be valued in monetary terms for the CISS Digital Community Platforms 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 CISS Digital Community Platforms case study evaluation. The impact not valued was:

Impact 6: Increased capability and capacity of invasive species managers.

Though not valued independently, this impact is partially captured in the valuation of other impacts. For example, increased capacity of invasive species managers has contributed to Impact 1 (net reduction in invasive species impacts costs) which was valued in the assessment.

7.3 Impacts Valued

Of the seven (7) potential impacts identified in Section 6.0, six (6) were valued in monetary terms as part of a CBA of the investment in the CISS Digital Community Platforms. 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 CISS Digital Community Platforms maintained and built on the successful PestSmart, FeralScan, and other digital resources developed under the former IACRC. The CISS Digital Community Platforms also contributed to and received input from other CISS RD&E projects.

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 CISS Digital Community Platforms. 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 CISS Digital Community Platforms.

Risk Factors Along the Pathways to Impact

The case study evaluation of investment in the CISS Digital Community Platforms is a combination of an ex-ante and ex-post analysis. Though the formal 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 associated with the CISS Digital Community Platforms 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).

Key drivers the of impacts of the CISS Digital Community Platforms include increased community awareness and understanding of invasive species, invasive species impacts, and invasive species management, improved community engagement, and increased and improved adoption of invasive species management best practice. It was assumed that, without the CISS Digital Community Platforms investment, invasive species management and RD&E extension and communication would still have occurred but on a more ad hoc, regionally focused basis. The reduced coordination of invasive species management and RD&E extension and communication without the CISS Digital Community Platforms 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 CISS Digital Community Platforms, adoption of CISS outputs (probability of outcome) contributing to the estimated benefits of the overall RD&E investment by the Centre from 2017 to 2022 would have been reduced by 2%.

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 1a: 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 species based on 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 for future costs under the status quo.

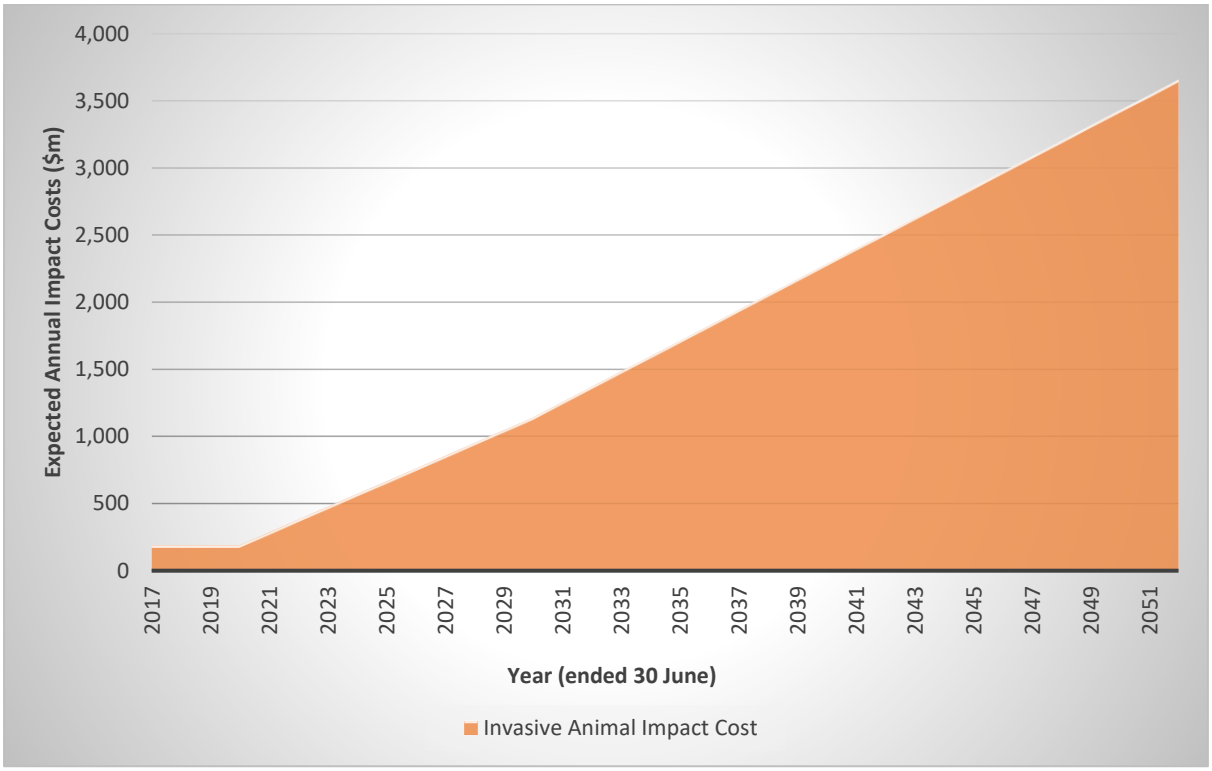

Figure 1: Expected Annual Impact Costs for Invasive Animal Species in Australia
Source: Derived from Bradshaw et al. (2021) for the current analysis

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.

It was assumed that, without the specific investment in the CISS Digital Community Platforms, adoption (probability of outcomes) for the CISS RD&E investment would have been reduced by 2%.

Specific assumptions for the valuation of Impact 1 are described in Table 5.

Table 5: 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)	$190.29 million per annum in the 2010-2020 decade Increasing 6-fold from base estimate each decade to $3,425.25 million in 2050	See Figure 1 Based on 14.4% of total annual impact costs for 2017 estimated at US$731.48 million the (2016/17 dollar terms) and a 6.0 fold decadal increase trend derived from Bradshaw et al. (2021) Converted to AUD$ and real (2021/22) dollar terms using the Implicit Price Deflator for GDP (Australian Bureau of Statistics (ABS), 2022)
With investment in CISS RD&E		
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	2022/23	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 2021/22
Decline and residual impact	Declining linearly from 2026/27 to 2031/32 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 2016/17 to 2021/22 period
Other factors		
Attribution of benefits to the specific investment in CISS RD&E from 2017/18 to 2021/22	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

Variable	Value/Assumption	Source/Comments
		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.)
Without investment in CISS RD&E (Counterfactual)		
All other assumptions maintained at base values.		
Probability of outcome	68%	2% lower than with the CISS Digital Community Platforms investment

7.3.3 Impact 1b: a net reduction in the total annual impact costs of endemic invasive plant species

Baseline Annual Invasive Species Impact Costs

See baseline annual invasive species costs described in Section 7.3.2.

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).

Temporal Changes in Invasive Species Impact Costs

See baseline annual invasive species costs described in Section 7.3.2.

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 (above) depicts the expected annual impact costs for invasive animal species and invasive plant species based on 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 for future costs under the status quo.

Valuation of Impact 1b

Similar to the valuation for Impact 1 (Section 7.3.2), through the bottom-up analysis of CISS RD&E project impacts and consultation with invasive species stakeholders, the investment in CISS P01 is expected to have contributed to a 0.05% net reduction in future total annual impact costs of invasive plant species in Australia.

It was assumed that, without the specific investment in the CISS Digital Community Platforms, adoption (probability of outcomes) for the CISS RD&E investment would have been reduced by 2%.

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

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

Variable	**Value/Assumption**	**Source/Comments**
Current and future invasive plant species impact costs (including damages, resource losses, and management costs)	$1,092.07 million per annum in the 2010-2020 decade Increasing 6-fold from base estimate each decade to $19,657.25 million in 2050	See Figure 1 Consistent with Impact 1. Based on 82.9% of total annual impact costs for 2017 estimated at US$731.48 million the (2016/17 dollar terms) and a 6.0 fold decadal increase trend derived from Bradshaw et al. (2021) Converted to AUD$ and real (2021/22) dollar terms using the Implicit Price Deflator for GDP (ABS, 2022)
With investment in CISS RD&E		
Net reduction in total expected annual invasive animal species impact costs achieved through adoption/ implementation of CISS RD&E outputs	0.05%	Conservative estimate based on bottom-up analysis of CISS RD&E projects and invasive species stakeholder consultation
First year of impact	2019/20	Based on initial publication of the 10-year National Investment Plan for Weeds Research, Development and Engagement in calendar 2019
Year of maximum impact	2022/23	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 2021/22
Decline and residual impact	Declining linearly from 2026/27 to 2029/30 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 2021/22 period
Other factors		
Attribution of benefits to the specific investment in CISS RD&E from 2017/18 to 2021/22	45.2%	See description of attribution in Section 7.3.1

Counterfactual – benefits that may have been delivered in the absence of the CISS RD&E investment	50%	See description of counterfactual scenario 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	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.)
Without investment in CISS RD&E		
Probability of outcome	48%	2% lower than with the CISS Digital Community Platforms investment
All other assumptions maintained at base values.		

7.3.4 Impact 2: avoided impact costs of exotic invasive animal and plant species through the Centre's contribution to improved biosecurity and preparedness

The Value of Australia's Biosecurity System

Biosecurity is the management of risks to the economy, the environment and the community from pests and diseases entering, establishing or spreading in the Australian landscape. The Australian, state and territory governments, researchers (funders and providers), industries, landholders, and the community, all contribute to the Australia's National Biosecurity System to reduce the risk of exotic pest and disease incursions that could cause harm to people, animals, plants and other aspects of the environment (ABARES, 2015).

The productivity of Australia's agricultural sector is particularly affected by Australia's biosecurity system. Freedom from many of the world's major pests and diseases provides agricultural industries with a significant trade advantage and is important for maintaining access to valuable export markets as well as maintaining the productivity and profitability of the sector (ABARES, 2015).

Biosecurity RD&E and associated management practices help to reduce the risk of pest and disease incursions and manage outbreaks when they occur, thereby reducing the potential for harm and damage to agricultural industries. The potential value of an effective biosecurity system is usually only evident following an incursion—when farmers face additional costs to control and mitigate pest and disease damage, and earn less as a result of production losses and disrupted access to export markets (ABARES, 2015).

A 2015 study by ABARES estimated the value of Australia's biosecurity system 'at the farm gate', using a case study approach. The study considered the effect on annual farm enterprise profits of an

outbreak of six potentially significant biosecurity threats to Australian agriculture: foot-and-mouth-disease (FMD), Mexican feather grass, citrus greening, highly pathogenic avian influenza (HPAI), Karnal bunt and red imported fire ants (RIFA). The value of biosecurity was approximated by the on-farm costs and losses avoided as a result of biosecurity activities that target the pathways through which pests, diseases and weeds enter, become established and spread throughout Australia (ABARES, 2015).

The ABARES (2015) study reported that Australia's biosecurity system improves the annual profits of five case study farms (representing average broadacre farms) by $12 000 to $17 500.

Valuation of Impact 2

A range of RD&E undertaken and managed through the Centre contributed to the National Biosecurity System through:

a. Improved monitoring and surveillance (such as PAS, community surveillance, and webscraping etc.),
b. Detection and identification (e.g. eDNA),
c. Faster and more coordinated incursion responses (e.g. InvasivePlan, ABST National Incursion Response Plan), and
d. More effective/efficient eradication programs (e.g. EradSim, and other eradication modelling tools).

It was assumed that the Centre's RD&E investments in incursions and eradication RD&E have contributed to the current and future value of Australia's National Biosecurity System.

Further, it was assumed that, without the specific investment in the CISS Digital Community Platforms, adoption (probability of outcomes) for the CISS RD&E investment would have been reduced by 2%.

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 Avoided Impacts from Exotic Incursions)

Variable	**Value/Assumption**	**Source/Comments**
Total average annual value of Australia's National Biosecurity System 'at the farm gate'	$17,620 per farm	Average of ABARES case study estimates of on-farm value of biosecurity of $14,750 (between $12,000 to $17,000) in 2015 dollar terms Updated to 2021/22 (real) dollar terms using the Implicit Price Deflator for GDP (ABS, 2022).
Total average number of broadacre farms in Australia	50,392 farms	5-year average – population of broadacre farms reported by ABARES Farm Data Portal (ABARES, 2022)
With investment in CISS RD&E		
Proportion of Australian farms directly benefiting from the National Biosecurity System	60%	Analyst assumption – allows for changes in global pest and disease pressures relevant to different farm enterprise types and locations

Variable	Value/Assumption	Source/Comments
investment and activities in any given year		
Contribution of CISS RD&E from 2017/18 to 2021/22 to the value of the National Biosecurity System	1.0%	Analyst assumption – based on 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	2022/23	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 2021/22
Decline and residual impact	Declining linearly from 2026/27 to 2031/32 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 2021/22 period
Other factors		
Attribution of benefits to the specific investment in CISS RD&E from 2017/18 to 2021/22	45.2%	See description of attribution in Section 6.3.1
Counterfactual – benefits that may have been delivered in the absence of the CISS RD&E investment	50%	See description of counterfactual scenario in Section 6.3.1
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.)
Without investment in CISS RD&E		

Variable	Value/Assumption	Source/Comments
Probability of outcome	68%	2% lower than with the CISS Digital Community Platforms investment
All other assumptions maintained at base values.		

7.3.5 Impact 3: increased effectiveness and/or efficiency of invasive species RD&E and management resource allocation

Expenditure on Invasive Species RD&E

Over the period 1 July 2017 to 30 September 2022, the Centre invested approximately $74.32 million (cash and in-kind) in invasive species RD&E under P01 as well as various aligned and unaligned projects. The investment in invasive species RD&E through the Centre was equivalent to approximately $14.9 million per annum.

The investment in invasive species RD&E through the Centre represents only a part of the total annual investment in invasive species RD&E funded by the Australian, state and territory governments, other researchers (funders and providers such as RDCs and universities), industries, landholders, and the community. However, it was assumed that the CISS investment was a reasonable estimate for large scale, collaborative, nationally directed invasive species RD&E expenditure.

Valuation of Impact 4

Through invasive animal and plant RD&E investments spanning all components of the invasion curve (incursion, eradication, containment, and asset protection) CISS has produced a variety of scientific knowledge, models and tools, and other outputs that are expected to inform and guide future RD&E.

It was assumed that the CISS investments have contributed to improved knowledge, understanding, and prioritisation for the next phase of invasive species RD&E after 2021/22 leading to improved efficiency of resource allocation for future RD&E. Further, it was assumed that, without the specific investment in the CISS Digital Community Platforms, adoption (probability of outcomes) for the CISS RD&E investment would have been reduced by 2%.

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

Table 8: Summary of Assumptions for Valuation of Impact 3
(Increased Efficiency of Resource Allocation for Invasive Species RD&E)

Variable	Value/Assumption	Source/Comments
Expected annual RD&E expenditure without the CISS investment 2017/18 to 2021/22	$16.4 million	(1+0.1) x $14.9 million
With investment in CISS RD&E		
Efficiency dividend for future invasive species RD&E	10%	Analyst assumption – indicates that research funding would have to be 10% greater to achieve the same outputs and impacts

Variable	Value/Assumption	Source/Comments
Average annual investment in invasive species RD&E	$14.9 million	Based on the total cash and in-kind investment managed by CISS from 2017/18 to 2021/22
RD&E savings from efficiencies gained	$1.5 million p.a.	$16.4 m - $14.9 m
First year of impact	2019/20	Based on first major outputs from CISS RD&E (first projects completed)
Year of maximum impact	2022/23	One year after final year of CISS Portfolio No. 1
Period of maximum impact	10 years	Analyst assumption – assumes efficiencies can affect RD&E for a maximum of two consecutive 5-year investment periods
Decline and residual impact	Declining linearly from 2031/32 to 2033/34. Zero residual impact from 2034/35.	Allows for reduced relevance of input and prioritisation elements of RD&E from the 2017/18 to 2021/22 investment period
Other factors		
Attribution of benefits to the specific investment in CISS RD&E from 2017/18 to 2021/22	100%	Given assumption made, the impact would not have occurred without the specific investment managed by CISS from 2017/18 to 2021/22
Counterfactual – benefits that may have been delivered in the absence of the CISS RD&E investment	0%	
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	90%	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.)
Without investment in CISS RD&E		
Probability of outcome	88%	2% lower than with the CISS Digital Community Platforms investment
All other assumptions maintained at base values.		

7.3.6 Impact 4: 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 4

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 threated by invasive species through predation, competition for food and habitat, and habitat destruction.

It was assumed that, without the specific investment in the CISS Digital Community Platforms, adoption (probability of outcomes) for the CISS RD&E investment would have been reduced by 2%.

Specific assumptions for the valuation of Impact 4 are described in Table 9.

Table 9: Summary of Assumptions for Valuation of Impact 4
(Contribution to Protection of Threatened Native Species)

Variable	**Value/Assumption**	**Source/Comments**
Average implicit willingness to pay for species protected from extinction	$1.11 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 2021/22 (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	$9,499.1 million per annum	$1.11 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	0.5%	Conservative estimate based on bottom-up analysis of CISS RD&E

Variable	Value/Assumption	Source/Comments
species from extinction (2016/17 to 2021/22)		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	2022/23	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 2021/22 but residual benefits from RD&E outputs adopted
Decline and residual impact	Declining linearly from 2031/32 to 2036/37 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 2016/17 to 2021/22 period
Other factors		
Attribution of benefits to the specific investment in CISS RD&E from 2017/18 to 2021/22	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.)
Without investment in CISS RD&E		
Probability of outcome	68%	2% lower than with the CISS Digital Community Platforms investment
All other assumptions maintained at base values.		

7.3.7 Impact 5: 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 5

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.

It was assumed that, without the specific investment in the CISS Digital Community Platforms, adoption (probability of outcomes) for the CISS RD&E investment would have been reduced by 2%.

Specific assumptions for the valuation of Impact 5 are described in Table 10.

Table 10: Summary of Assumptions for Valuation of Impact 5
(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	0.50%	

Variable	Value/Assumption	Source/Comments
because of invasive species management issues in any given year		
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 billion x 10% x 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	2022/23	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 2021/22 but residual benefits from RD&E outputs adopted
Decline and residual impact	Declining linearly to 5% of the maximum impact by 2031/32	Allows for disadoption and other exogenous changes in invasive species management as well as residual benefits from CISS outputs attributable to the 2016/17 to 2021/22 period
Other factors		
Attribution of benefits to the specific investment in CISS RD&E from 2017/18 to 2021/22	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

Variable	Value/Assumption	Source/Comments
Probability of outcome	90%	Represents the likelihood that outputs are adopted/ implemented at the level/ profile assumed
Probability of impact	90%	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.)
Without investment in CISS RD&E		
Probability of outcome	88%	2% lower than with the CISS Digital Community Platforms investment
All other assumptions maintained at base values.		

7.3.8 Impact 7: 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 diability weight of 0.030 .

Valuation of Impact 7

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.

It was assumed that, without the specific investment in the CISS Digital Community Platforms, adoption (probability of outcomes) for the CISS RD&E investment would have been reduced by 2%.

Specific assumptions for the valuation of Impact 7 are described in Table 11.

Table 11: Summary of Assumptions for Valuation of Impact 7
(Increased Regional Community Wellbeing – Reduced Anxiety)

Variable	**Value/Assumption**	**Source/Comments**
VoSLY	$227,000	2021/22 dollar terms, 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)
With investment in CISS RD&E		
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	2022/23	One year after final year of CISS Portfolio No. 1
Period of maximum impact	5 years	Analyst assumption – assumes no further large scale coordinated

Variable	Value/Assumption	Source/Comments
		investment through CISS after 2021/22 but residual benefits from RD&E outputs adopted
Decline and residual impact	Declining linearly to zero 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 2016/17 to 2021/22 period
Other factors		
Attribution of benefits to the specific investment in CISS RD&E from 2017/18 to 2021/22	45.2%	See description of attribution in Section 6.3.1
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	90%	Represents the likelihood that outputs are adopted/ implemented at the level/ profile assumed
Probability of impact	90%	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.)
Without investment in CISS RD&E		
Probability of outcome	88%	2% lower than with the CISS Digital Community Platforms investment
All other assumptions maintained at base values.		

8.0 Results

8.1 Investment Criteria

All past and future cash flows were expressed in 2021/22-dollar terms using the implicit price deflator for GDP. Past and future cash flows were discounted to 2021/22 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 CISS Digital Community Platforms (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 12 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 Digital Community Platforms investment.

Table 12: Investment Criteria for Total Investment in CISS Digital Community Platforms (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 ($m)	7.55	16.07	18.19	18.33	18.40	18.47	18.52
Present value of costs ($m)	4.63	4.63	4.63	4.63	4.63	4.63	4.63
Net present value ($m)	2.92	11.44	13.56	13.70	13.77	13.84	13.89
Benefit-cost ratio	1.63	3.47	3.93	3.96	3.97	3.99	4.00
Internal rate of return (%)	57.6	71.9	72.1	72.1	72.1	72.1	72.1
MIRR (%)	62.9	47.2	32.9	25.4	21.0	18.2	16.2

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.

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.

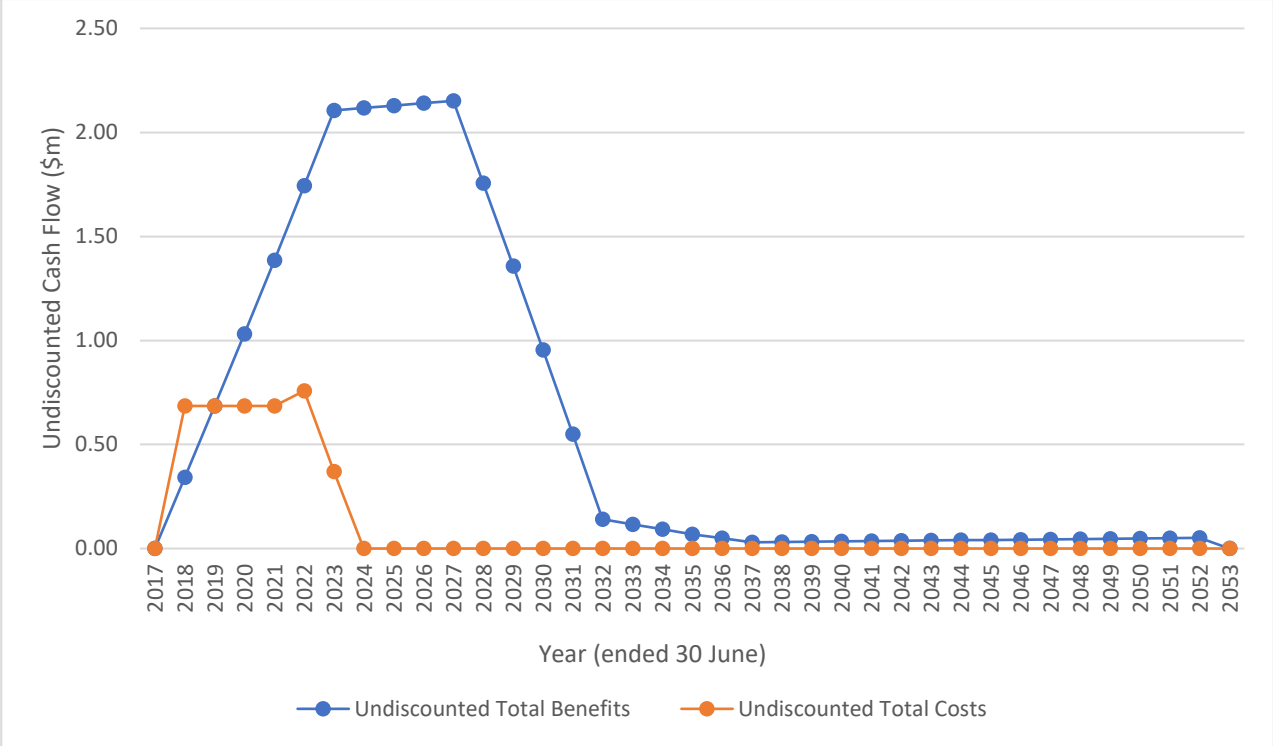

Figure 2: Annual Cash Flow of Undiscounted Total Benefits and Total Investment Costs

8.2 Sources of Benefits

The respective contributions to total benefits from the six sources of benefits (six impacts valued where benefits were attributable to the CISS Portfolio No. 1 investment) are provided in Table 13.

Table 13: Contribution of Source of Benefits to the Total PVB
(Total investment, 5% discount rate, 30 years)

Impact Valued	**PVB ($m)**	**% of Total PVB**
Impact 1a: net reduction in the total annual impact costs of endemic invasive animal species	0.81	4.3%
Impact 1b: net reduction in the total annual impact costs of endemic invasive plant species	0.04	0.2%
Impact 2: avoided impact costs of exotic invasive animal and plant species through the Centre's contribution to improved biosecurity and preparedness	0.09	0.5%
Impact 3: increased effectiveness and/or efficiency of invasive species RD&E and management resource allocation	0.15	0.8%
Impact 4: reduced risk of extinction of some native Australian flora and fauna species (avoided biodiversity loss)	1.27	6.9%
Impact 5: maintained social license to operate	16.02	86.5%
Impact 7: enhanced regional community wellbeing	0.14	0.8%
Totals	**18.52**	100.0%

As for the broader CISS P01 evaluation, the largest contributor to the total expected net benefits of the CISS Digital Community Platforms investment was Impact 7 (enhanced regional community wellbeing) making up 86.5% 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 14 presents the results. The investment criteria showed a low sensitivity to the discount rate. This was largely because benefit cash flows for commenced from the first year of the investment assessed and therefore were subject to relatively less severe discounting.

Table 14: Sensitivity to Discount Rate
(Total investment, 30 years)

Investment Criteria	**Discount Rate**		
	0%	**5% (base)**	**10%**
PVB ($m)	21.57	18.52	16.60
PVC ($m)	4.24	4.63	5.06
NPV ($m)	17.33	13.89	11.53
BCR	5.09	4.00	3.28

A sensitivity analysis was then undertaken on the counterfactual assumption that the adoption of Centre RD&E outputs would have been 2% less without the Digital Community Platforms investment. This variable was considered a key driver of the investment criteria and was uncertain. Results are provided in Table 15.

The results showed a moderate to high sensitivity to the counterfactual assumption. When the counterfactual assumption was reduced to just 1.0% with all other factors at base values, the project is approximately at 'break-even'[3]. This means that, if it was assumed that adoption of Centre RD&E outputs was reduced by only 0.5% without the Digital Community Platforms investment, the investment criteria were still positive. This indicates the positive value of the Digital Community Platforms investment.

[3] The break-even point in a CBA is the scenario where the PVB is equal to the PVC giving a NPV of zero and a BCR of 1:1.

Table 15: Sensitivity to the Counterfactual
(Total investment, 30 years, 5% discount rate)

Investment Criteria	Counterfactual – Reduction in Probability of Outcome (Adoption) without the CISS Digital Community Platforms Investment		
	0.5%	2.0% (base)	5.0%
PVB ($m)	4.63	25.23	46.29
PVC ($m)	4.63	5.14	4.63
NPV ($m)	0.00	20.09	41.66
BCR	1.00	4.91	10.00

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 16). 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 16: 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. six of seven 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 other impacts.

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 Digital Community Platforms funded through the Centre have and will continue to make positive contributions to invasive species management. Through the various platforms, including PestSmart, FeralScan, and WeedsAustralia, the Centre has contributed to increased community awareness and understanding of invasive species, invasive species impacts, and invasive species management, improved community engagement, and increased and improved adoption of invasive species management best practice.

The CISS investment in Digital Community Platforms has contributed to the following economic, environmental, and social impacts:

8. Reduced endemic invasive species (animal and plant) impact costs.
9. Avoided future impact costs from exotic invasive species
10. Increased efficiency and/or effectiveness of resource allocation for invasive species RD&E
11. Reduced negative environmental impacts of invasive species such as biodiversity loss (indirectly through improved invasive species management).
12. Maintained social license to operate for invasive species managers.
13. Increased capability and capacity of invasive species managers.
14. Increased regional community wellbeing.

The total investment in the CISS Digital Community Platforms for the period 2017/18 to 2022/23 was approximately $4.63 million (present value terms). The investment generated estimated total expected net benefits of approximately $18.52 million. This gave a NPV of $13.89 million, a BCR of about 4.0 to 1, an internal rate of return (IRR) of 72.1%, and a modified IRR of 16.2%.

Sensitivity analyses showed that, if it was assumed that the benefits of the overall adoption of Centre RD&E outputs was reduced by 0.5% without the Digital Community Platforms investment, the investment criteria still were positive. This result demonstrates the positive benefits of the Digital Community Platforms investment over the situation where the Platforms did not exist.

The results of the case study evaluation of the CISS Digital Community Platforms are positive and should be view favourably by CISS management, funding partners including DAFF and state government, invasive species managers, and other stakeholders.

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