

ANNUAL REPORT 2019-2020

cebra

Centre of Excellence for
Biosecurity Risk Analysis



Australian Government
Department of Agriculture,
Water and the Environment



Ministry for Primary Industries
Manatū Ahu Matua





Contents

Director's introduction	5
CORE ACTIVITIES	6
2019–2020 research projects	7
Project summaries	8
Continuing projects	14
Deliverables and milestones achieved	16
RESEARCH AND DEVELOP RISK METHODS	19
Graduate students	20
Institutional contracts and consultancies	21
Impact and adoption case study: Risk-based intervention utilising CSP sensitivity analysis ..	22
DOCUMENT AND COMMUNICATE FINDINGS	24
Publications	25
Presentations	28
Media articles	31
GOVERNANCE	32
Chair's report: Biosecurity at the forefront of community awareness worldwide	33
CEBRA Advisory Board members	34
Scientific Advisory Committee terms of reference	35
SAC reviewers for 2019–2020	36
Key performance indicators	37

FINANCIAL STATEMENTS.....	43
Financial report summary.....	44
CEBRA in-kind statement	45
Auditor's report.....	46
OUTLOOK.....	47
Future outlook	48
2020–2021 research projects	49
Glossary	50



Director's introduction

It is my privilege and pleasure to introduce the 2019–20 Centre of Excellence for Biosecurity Risk Analysis (CEBRA) annual report.

As managing director for the Centre of Excellence for Biosecurity Risk Analysis, I welcome readers to our annual report for the year ended 30 June 2020 – our second last year with the Australian Department of Agriculture, Water and the Environment and New Zealand's Ministry for Primary Industries under the current deeds.

The past twelve months have been anything but business as usual. From last summer's bushfires to the inconvenient arrival of COVID-19, the times in which we currently find ourselves are, to say the least, challenging. It's a common claim that these times are unprecedented, but students of history only have to look back a hundred years to find a deadlier pandemic. Imagine navigating the Spanish influenza (perhaps more accurately, the *Kansas* influenza!) without the internet.

The biosecurity implications of these recent crises are still becoming clear. Extensive bushfires attenuate habitat, which in turn pushes vulnerable species closer to extinction and consequently at graver risk from the impacts of invasive species. And COVID-19 has impacted trade, travel, human health, and perhaps surprisingly, the way we do work – and concomitantly our productivity.

The movements of international and domestic travellers have been largely restricted, but the pandemic has brought with it increases in mail and some cargo volumes. The restrictions imposed by the Victorian state government have saved many lives from coronavirus and other infectious diseases yet have had an unavoidable economic impact with as yet unknown repercussions for social wellbeing. And many of us have learned to work from home, with the challenges and opportunities that this entails.

At CEBRA, the pandemic has changed the way we interact as academic researchers. Conferences and meetings have migrated online: webinars are replacing seminars, with Zoom as our auditorium. Although the online space is less conducive to those spontaneous interactions that can birth ideas and connections, it has the advantage of greater accessibility and convenience. Importantly, the sharing of research and knowledge continues.

In these times, more than ever, I am grateful for the quality of the team here at CEBRA. An organisation is only as good as its members, and our researchers and professional staff prove their value again and again. Indeed, this value is also recognised in the wider academic community; earlier this year, Professor Jane Elith was elected to the US National Academy of Sciences, a momentous accolade.

I noted that this is CEBRA's second last year under the present deeds. It's a tribute to the incredible work done by the CEBRA team that the department will continue the centre's funding arrangement with the university for a further four years, to June 2025 – and we hope that the ministry will also co-invest. This follows the positive findings from an independent evaluation of the centre, finalised in early 2020. We couldn't be more pleased, and we greatly look forward to continuing this strong, collaborative partnership and the new engagement opportunities with our valued colleagues and stakeholders.

Finally, CEBRA is growing again! This financial year, we welcomed four new members to the team. Dr John Baumgartner is a computational ecologist with a background in climate change and biodiversity. Former ABARES quantitative scientist Nathaniel Bloomfield has worked on projects relating to pest surveillance effectiveness and ballast water systems. Natasha Page has a Masters in Science (Computing) from Imperial College London and a background in optimisation. Dr Chris Baker is an applied mathematician with an interest in invasive species. Since joining CEBRA, John, Nathaniel, Chris and Natasha have already contributed greatly and become integral members of the team.

I want to thank all the staff here at CEBRA for their continuing dedication and proactivity. In these tumultuous times, biosecurity remains of key importance. Our work must continue.

Professor Andrew Robinson

Managing director, CEBRA



CORE ACTIVITIES



2019–2020 research projects

Biosecurity Plant Division

Project ID: 190606
Project Title: Estimating worldwide brown marmorated stink bug risk of establishment
Division: Strengthening surveillance



Project ID: 190804
Project Title: Re-evaluating management of established pests including the European wasp, *Vespula germanica* using biocontrol agents
Division: Data and information



Biosecurity Animal Division

Project ID: 190801
Project Title: Automated image analysis for identifying biofouling risk on vessels
Division: Data and information



Project ID: 190803
Project Title: Updating the Vessel Check biofouling risk assessment framework
Division: Data and information



NZ MPI

Project ID: 19NZ02
Project Title: Strength of evidence: Definition and measurement



Project ID: 19NZ03
Project Title: Risk–return: Economic measurement of impacts



Project ID: 170621 (continuation)
Project Title: Proportional value of interventions across pathways and layers of the biosecurity system
Theme: Strengthening surveillance



Project ID: 180702 (continuation)
Project Title: CEBRA research: Harnessing past and new work to improve uptake and impact of best practice risk analysis approaches in MPI
Theme: Building scientific capability



Biosecurity Compliance Division

Project ID: 190810
Project Title: Advanced profiling for travellers and mail
Theme: Data and information



Biosecurity Operations Division

Project ID: 190808
Project Title: Ensuring a whole-of-department approach to the prioritisation of biosecurity risk and the setting of regulatory intervention levels
Theme: Data and information



Key

- Andrew Robinson
- Susie Hester
- Tom Kompas
- James Camac
- Edith Arndt
- Nathaniel Bloomfield
- Tim van Gelder
- Collaborative with NZ MPI

Project summaries

Strengthening surveillance



190606: Estimating worldwide brown marmorated stink bug risk of establishment

Project leader: Dr James Camac

Commonly, trade restrictions and border inspection rates for goods susceptible to high-threat pests or diseases are made based on the current distribution of a pest or disease. Specifically, if a country is known to have the threat, it will typically experience greater border inspection rates and/or be required to meet additional obligations (e.g. treatments or other restrictions) before the susceptible goods are accepted by a recipient country. While this approach is useful for allocating border surveillance for slow-moving pests or diseases, it is problematic for emerging threats that are fast spreading and may not be immediately detected by exporting countries.

Here, we propose a novel and pragmatic method that integrates border interceptions, trade data, pest occurrence records and climate suitability models to estimate the exposure risk of potential and current trading partners obtaining a new high-threat pest or disease. We illustrate this method using brown marmorated stink bug (BMSB; *Halyomorpha halys*) and Australian interception data as a case study.

We found that, irrespective of whether the model was parameterised using BMSB-specific interception or general contamination data, the same set of countries were identified to be most exposed to incursion and subsequent establishment of BMSB. Furthermore, our model identified the BMSB vulnerable tariff codes that are likely to introduce the greatest number of hitchhikers into Australia. For BMSB

specifically, the highest risk tariffs were HS codes 9401 (seats), 8609 (containers) and 8701 (tractors), while for general contaminations (i.e. the presence of any foreign organism) codes 0810 (fresh fruit), 7318 (screws and bolts) and 8708 (motor vehicles) posed the greatest import risk.

This model provides substantial improvements over the existing approaches. First, our model was designed with the end-users (biosecurity practitioners) in mind. As a consequence, the analytical workflow aims to maximise the use of internally collected border surveillance data (e.g. interception records) and integrate these data with other publicly available data (e.g. trade data and climate data). Second, the workflow is applicable to any plant pest or disease. Third, relative to standard pathway models that focus on identifying risk pathways of entry into an individual country, our model is both inwards and outwards focused, in that it estimates exposure risk across all countries. Finally, and perhaps most importantly, our method explicitly integrates pathway analysis with climate suitability models. This effectively means our model attempts to account for two fundamental geographic barriers to establishment of a pest or disease: firstly, the ability of the pest/disease to reach a location; and, secondly, the suitability of the climate at the destination. This is contrary to standard pathway analyses, which generally ignore climatic suitability, and is also contrary to standard invasive species distribution models (sometimes termed risk maps), which tend to focus on modelling climate suitability without accounting for pathways of entry and subsequent post-border movement of propagules.

The report is currently under internal review by departmental project leaders.

190801: Automated image analysis for identifying biofouling risk on vessels

Project leader: Nathaniel Bloomfield

Biofouling is recognised as a significant pathway for the introduction of non-indigenous marine species causing severe social, environmental and economic impacts.

The 2015 review of national marine pest biosecurity (Department of Agriculture and Water Resources, 2015) recommended developing regulations to set a new, internationally consistent direction in the management of biosecurity risks associated with biofouling of vessels. However, setting required management actions is challenging as evaluating the effectiveness of different approaches requires conducting in-water inspections. These inspections can be expensive as a potentially large

amount of data needs to be assessed by a biofouling expert. The development of an automated system to identify biofouling risk on vessels would allow this activity to be expanded and reduce the variability in assessment outcomes.

This project utilised modern image analysis techniques to analyse images taken as part of in-water vessel inspections for biofouling. Data collected by DAWE, MPI and other sources was used to train a prototype deep convolutional neural network that can detect the presence and severity of biofouling in an image of a vessel hull with close to expert accuracy. If implemented, this innovation will significantly decrease the time required to assess the biofouling risk of vessels and allow inspection activity to be expanded.





190803: Updating the Vessel Check biofouling risk assessment framework

Project leader: Dr Edith Arndt

Biofouling is the transport of sessile organisms (e.g. mussels, clams, fanworms) attached to hard surfaces on vessels which can establish populations at new locations (Barry et al, 2015). It is widely recognised as one of the most significant pathways for the introduction of non-indigenous marine species that can cause severe social, environmental and economic impacts (MEPC, 2011). Currently, there are no legislative requirements under the Quarantine Act 1908 or the Biosecurity Act 2015 for international vessels to have managed biofouling prior to entering Australian waters. However, the 2015 Review of National Marine Pest Biosecurity (DAWR, 2015) recommended developing regulations to set an internationally consistent direction in the management of biosecurity risks associated with biofouling of vessels.

A key business need of the Department of Agriculture, Water and the Environment is to rapidly and consistently assess the risk associated with a vessel's biofouling based on its prior biofouling management practices. In 2015, the Western Australian Department of Primary Industries and Regional Development (WA DPIRD) developed Vessel Check, an online pre-arrival biofouling risk assessment tool for vessel owners and operators.

In 2018, WA DPIRD undertook a review of Vessel Check and, together with DHI Water and Environment (Australia), developed a significantly altered version of Vessel Check, which was released in November 2019. As a consequence, most of the activities outlined in the initial business plan for CEBRA project 190803 could not be undertaken because suitable data for the validation of the effectiveness of the new Vessel Check portal was not available. The business plan for this project was revised and includes the following three deliverables:

- i. a comprehensive literature review of the factors that influence biofouling
- ii. a simple process model of biofouling
- iii. an assessment of the risk metrics implemented in the Vessel Check portal

The timelines for this project have been extended because of the unexpected change of direction and the temporary reallocation of project resources to another CEBRA project in early 2020. The work is expected to be finalised by the end of September 2020.

This project has tested, reviewed and refined the assumptions and risk factors used in the current version of the Vessel Check tool with the aim to develop and validate an updated risk assessment framework based on Vessel Check.



190804: Re-evaluating management of established pests, including the European wasp (*Vespula germanica*), using biocontrol agents

Project leader: Dr Susie Hester

Established pests such as the European wasp (*Vespula germanica*) are often overlooked as candidates for management programs (eradication and/or containment) because the use of traditional control techniques over very large areas becomes economically infeasible. Usually, the only economically feasible option, in these contexts, is the use of biocontrol agents. However, the processes around approvals for release of biocontrol agents can take significant amounts of time and resources, especially if screening and testing of potential agents is required.

This project investigated whether the European wasp could be a candidate for a renewed management program, given the availability of a biocontrol agent, following successful screening and testing of an agent (*Sphecohyphaga vesparum vesparum*) in the 1980s. Whether a biological control program is worthwhile pursuing depends on the size of the benefits to industry, community and the environment from a reduction in European wasp abundance.

Benefits and costs of European wasp management were explored using a decision analysis model. While the full set of parameter values for the population dynamics of the European wasp and the biocontrol agent were not readily available for Australia, plausible estimates of parameters based on New Zealand studies and available Australia data allowed the exploration of scenarios in which biological control would succeed in suppressing the European wasp. Given the parameter values used in the modelling, the preliminary findings are as follows:

- Impacts of European wasps are significant, and if allowed to continue spreading across Australia without a formal management program, damage could be in the order of \$2.7 billion in present value terms over a 50-year time horizon. More than half of this is due to the damage that European wasps cause to the use of public places for recreational and sporting activities.

- Non-market impacts of European wasp outweigh market impacts. Without a formal management program, the impacts on biodiversity, use of public places for recreation and human health were estimated to be more than four times the market impacts over a 50-year period.
- Benefits of biological control outweigh the costs. Four plausible biological control scenarios were chosen for analysis. In all cases the introduction of the control agent reduced damages.

Additional scientific research and experiments to refine key parameter values is required before a formal recommendation to introduce a biocontrol program can be made. Undertaking specific case studies to determine not only whether biological control should take place, but where it should take place, would also provide additional insights.





190808: Ensuring a whole-of-department approach to the prioritisation of biosecurity risk and the setting of regulatory intervention levels

Project leader: Professor Andrew Robinson

The department develops and implements policies and programs to ensure that Australia's agricultural, fisheries, food and forestry industries remain competitive, profitable and sustainable. An ability to effectively manage biosecurity risk, given the available operational workforce, is critical to the success of these activities. However, due to the increasingly complex and dynamic risk environment, the department faces substantial challenges when attempting to effectively prioritise and manage new and emerging biosecurity risks.

In conjunction with the relevant policy divisions, the Biosecurity Operations Division (BOD) is responsible for delivering inspection, assessment, audit, veterinary, quarantine, scientific and surveillance services, as well as community engagement and contact centre services. To ensure the optimal allocation of resources in real time, an improved prioritisation model that leverages the work previously undertaken by the department, including for risk–return resource allocation, is required as the current arrangements are unsustainable and not sufficiently responsive in a dynamic risk environment.

This project comprised two key phases to assist in establishing a whole-of-department approach to biosecurity risk prioritisation and operational resource allocation. These were:

1. The assessment of selected items on an existing list of low-return biosecurity risk management activities currently delivered by BOD that may be reduced or stopped in the event of a greater priority activity. In addition to the development of a list of low-return activities, the first phase also identified potential data sources and options to establish a systematic approach to informing regulatory intervention levels, which would be delivered under a second phase, if approved.
2. Scoping for the development of an evidence-based biosecurity risk activity prioritisation model and associated resourcing tool to assist BOD, and thus the department, in delivering a systematic and responsive approach to the prioritisation of its operational activity in the longer-term.

The proposed combination of activities are intended to enable BOD to more effectively and efficiently address its short-term need to reduce the demands on the regulatory workforce to within the available resource base, while simultaneously laying the foundations for (i.e. scoping the feasibility of) a more sophisticated resource allocation tool.



190810: Advanced profiling for air travellers and mail

Project leader: Professor Andrew Robinson

The department faces significant challenges in the inbound air traveller and mail pathways due to increasing volumes and the resources required to manage the increased biosecurity risk that this presents.

In 2009 the Quarantine Operations Division (now Compliance Division) commenced work with ACERA (now CEBRA) to develop a national profiling methodology to support the reform to move from the mandatory at-border intervention introduced under the Increased Quarantine Intervention (IQI) towards a risk-based approach for the management of biosecurity risks associated with the clearance of international travellers (as also applied to mail). The national cohort profiling methodology was subsequently endorsed on 10 August 2011. This methodology has not been reviewed and remains the basis for international traveller and mail profile development.

Effective profiling is a critical control system and enabler for the management and intervention of biosecurity risk posed by the inbound movement of people, goods and mail at the border. The application of advanced analytics, statistical methods and border system deployment for international air traveller profiling methods will be critical for the department's delivery of biosecurity risk management outcomes into the future.

The objective of this project is to deliver improvements to automated profiling that will further enhance the department's approach to baseline targeting of high-risk air travellers. It will guide the priority alignment of the allocation of limited inspection resources at the border to biosecurity risk.



New Zealand Ministry for Primary Industries

19NZ02: Strength of evidence: Definition and measurement

Project leader: Dr Tim van Gelder

Some MPI decisions, such as import health standards decisions, are informed by MPI reports, and specifically by the evidence and arguments presented in import risk analysis reports. Since 2015 MPI has been taking steps to improve the presentation of evidence and arguments in these reports. These have included introducing the CASE (contention, arguments, sources, evidence) argument mapping framework as basis for drafting report sections. To what extent have these steps improved the presentation? And have these improvements made a difference to decisions? More generally, how does the manner of presentation of arguments and evidence in reports affect decision-making on the basis of those reports? To the best of our knowledge this question has had very little attention.

To determine what difference, if any, CASE argument mapping has made to decisions, we have been qualitatively coding MPI reports for CASE instantiation, and comparing pre-2015 reports with post-2015 reports. Results so far suggest that CASE mapping has indeed been making a significant impact. To gain independent verification that these changes are improving the presentation of arguments and evidence, an additional study on Mechanical Turk using a “forced choice” methodology is being conducted. Combining our own coding results with the forced choice data should allow us to determine with reasonable confidence what impact CASE argument mapping is having on MPI reports.

To assess the difference these changes may have made to decision-making, we are studying the alignment of import health standards decisions with the recommendations made in the relevant import risk analysis reports. The core idea is that the stringency of the requirements imposed by the import health standards decisions should reflect (or align with) the level of risk identified in the import risk analyses. It is hypothesised that there will be better alignment post-2015, due to the improved presentation of arguments and evidence. Coding of import health standards decisions in order to test this hypothesis is currently underway.

Based on the results from these exercises, and additional qualitative insights gained in the course of the work, we will make recommendations regarding continuation and/or modification of the overall MPI strategy for improving decision making by improving presentation of arguments and evidence. The final report will be delivered in late 2020.

19NZ03: Risk–return: Economic measurement of impacts

Project leader: Professor Tom Kompas

This project was a continuation of work completed in CEBRA projects 1606E and 170621. The goal for this year was to complete the pathway-based decision support tool to provide performance information on the relative contribution of various intervention measures to biosecurity performance. Building on previous progress, this stage involved developing the final part of the decision support tool, to provide an overlay of the economic cost of interventions, giving an overview of the greatest returns (risk reduction) on investment, as well as developing and implementing workflows for the capture and use of existing MPI data resources.

The work undertaken this financial year focused on the biosecurity organisms already evaluated within the earlier risk part of the project. These were Queensland fruit fly, brown marmorated stink bug, brown mussel, red imported fire ant and especially gypsy moth, as the key case study.



Continuing projects

The following projects were first approved in earlier work plans, and continued during 2019–2020.

New Zealand Ministry for Primary Industries

170621: Proportional value of interventions across pathways and layers of the biosecurity system

Project leader: Professor Andrew Robinson

This project is an extension of project 1606E: *Scoping the value of performance of interventions across New Zealand's biosecurity system*.

The ministry's biosecurity system faces increasing pressure from significant increases in goods and passengers, changing pathways and types of goods. With this increasing pressure, all layers of the system need to work together cost-effectively to maximise the reduction of biosecurity risk to New Zealand under sharply constrained resources.

To increase the efficiency of biosecurity investment and to identify opportunities for substantial improvement, the ministry needs to determine the relative contribution of each layer towards biosecurity effectiveness. Presently, there is no agreed framework or process available to evaluate the comparative value of biosecurity activities implemented at intersecting sites across the biosecurity system matrix. Without knowledge on the likely effectiveness and costs of activities and control measures, risk management decisions on measures and allocation of resources at different 'nodes' cannot be systematically evaluated.

This project's objectives are an extension to those provided for 1606E:

1. develop a fit-for-purpose pathway-based framework using the seven layers of New Zealand's biosecurity system that will allow risk management decisions to be made on a risk–return basis
2. provide specific performance outputs for specified pests such as fruit fly, BMSB and selected pathways

Comparative analyses will ultimately, after the completion of this scoping project, appropriate generalisation of its outcomes, and implementation of its recommendations:

- illustrate the value of the current allocation of biosecurity activities and resources
- inform and justify reallocation of resources where needed
- provide evidence-based information for adjustment of existing measures at specific nodes in the biosecurity system matrix

Support communication of the holistic and interdependent nature of the biosecurity system to all stakeholders.

The first year of the study (2016–2017) initiated a framework through which MPI could summarise the

actions of the biosecurity system against a pest.

The second year of the project (2017–2018):

- established that
 - a. the simple framework advanced in the first year was unable to capture the complexities of the interactions of post-border investment choices
 - b. often, pre-border activities did not fall neatly into the three pre-border layers
 - c. the structure of the three pre-border categories implied a hierarchy that was unsupported by reference to the activities being undertaken
- trialled a two-stage approach whereby more detailed snapshots of pathways will be used to estimate the impacts of activities, and simpler representations (namely, pre-/at-/post-border) used as summary tools
- reviewed candidate bio-economic models to best represent the impacts of post-border investment
- developed a suitable representation of uncertainty
- developed a means of handling pest groups efficiently, e.g., timber pests

The project is now representing the system across three main areas (pre-, at- and post-border) with four main pathways (craft, cargo, mail and passengers) overlaid with the seven groups of biosecurity risk assessment/management activities (anticipate, prevent, screen, prepare, direct, respond and recover) as identified in CEBRA project 1607A: *The health of the Australia biosecurity system*.

Year 3–4 of the project (2018–2020):

- tested and finalised the biological component (specifically, estimates of risk reduction across intervention activities of the system) of the risk decision support tool by running four priority pests identified by MPI through the matrix
- identified the need to handle marine and terrestrial pests differently, because of their different approach pathways and post-border dispersal vectors
- programmed an end-to-end case study example that provided useful intelligence about the impact of the system upon the biosecurity risk of an example pest (namely, gypsy moth) and propagated expert and data uncertainty

Year 5 of the project (2020–2021) will:

- identify opportunities for enhancements, automation or simplification including acquisition and use of MPI data and resources
- develop a scaleable version of the model that can be implemented by MPI



180702: CEBRA research: Harnessing past and new work to improve uptake and impact of best practice risk analysis approaches in MPI

Project leader: Dr Susie Hester

To ensure that New Zealand's Ministry for Primary Industries capitalises on existing research outputs from ACERA and CEBRA, the overarching objective of this project was to develop a mechanism that would result in access for MPI staff to a tangible repository of CEBRA research projects, their outcomes and impacts – a CEBRA 'knowledge base'. As part of achieving this objective, the project focused on knowledge management within the ministry. Knowledge management is a discipline that builds on theoretical foundations from a wide range of disciplines

related to management and organisational design. Insights from the knowledge management literature and semi-structured interviews with staff were used to understand the current use of CEBRA research and research culture at the ministry in general, and were the basis of recommendations for improving knowledge management in the future.

Development of a publicly available and searchable repository was completed in 2020 and now allows:

- the efficient capture and dissemination of existing CEBRA research outputs
- the efficient development of new projects by ministry staff
- an improved understanding of the ministry's return on investment from CEBRA projects

Deliverables and milestones achieved

The following table lists the key project outputs. It also details which outputs will be submitted to the Commonwealth for endorsement in accordance with clause 3.9 of the funding agreement.

Table 1: Research outputs

NZ MPI					
Project	ID	Output	Milestone date	For endorsement	Status
19NZ02	1	Interim report 1	Jul 2020		Complete
	2	Interim report 2	Aug 2020		In progress
	3	Draft final report	Oct 2020		
	4	Final report	Nov 2020	✓	
19NZ03	1	Methodology and data sources identified	Sep 2019		Complete
	2	Provision of data from NZ MPI	Dec 2019		Complete
	3	Alignment of return methodology with risk model completed	Jan 2020		Complete
	4	Estimates of returns on investments for organisms completed, with an emphasis on gypsy moth as a key case study	May 2020		In progress
	5	Final report delivered	Jun 2020	✓	In progress
180702*	1	Interview questions completed	May 2019		Complete
	2	Interviews with MPI staff	June 2019		Complete
	3	System design	Aug 2019		Complete
	4	System available for use and evaluation	Oct 2019		Complete
170621*	1	Priority pests identified	Sep 2018		Complete
	2	Workshop to discuss analytical strategies	Feb 2019		Terminated
	3	Balance of twenty studies	Jun 2019	✓	Complete

*continuing projects

Strengthening surveillance					
Project	ID	Output	Milestone date	For endorsement	Status
190606	1	Meeting between CEBRA and DAWE project leaders	Jul 2019		Complete
	2	Estimate country by goods trade volumes	Dec 2019		Complete
	3	BMSB climate suitability model	Feb 2020		Complete
	4	Draft country risk table and map provided to DAWE for comment	Jun 2020		Complete
	5	Draft final report sent to DAWE for comment	Jul 2020		Complete
	6	Draft final report sent to SAC	Sep 2020		In progress
	7	Final report	Nov 2020	✓	In progress

Data and information

Project	ID	Output	Milestone date	For endorsement	Status
190801	1	Literature review	Aug 2019		Complete
	2	Data identification and provision	Oct 2019		Complete
	3	Software scoping workshop	Aug 2019		Complete
	4	Preliminary software identification	Oct 2019		Terminated
	5	Building analytical pipeline	Dec 2019		Complete
	6	Project workshop	Jan 2020		Complete
	7	Refine and test analytical approach	Mar 2020		Complete
	8	Draft report (SAC)	May 2020		Complete
	9	Peer reviewed publication of report	Jun 2020		In progress
	10	Final report	Jun 2020	✓	In progress
190803	1	Literature review	Aug 2019		Complete
	2	Data identification and provision	Aug 2019		Terminated
	3	Data summary and strategic assessment (stop-go milestone)	Aug 2019		Terminated
	4	Testing of vessel check with existing data, including any data cleaning required	Oct 2019		Terminated
	5	Sensitivity analysis of the inputs into the tool	Nov 2019		Terminated
	6	Workshop	Dec 2019		Terminated
	7	Amend and test assumptions	Feb 2020		Terminated
	8	In-depth literature review of risk factors influencing biofouling	May 2020		Complete
	9	Assessment of current metrics used in vessel check 2.0	Aug 2020		In progress
	10	Expert elicitation workshops for weightings (if needed)	Sep 2020		Terminated
	11	Draft process model for biofouling on commercial vessels	Sep 2020		In progress
	12	Report writing and internal approvals	Sep 2020		In progress
	13	Final report	Sep 2020	✓	In progress

Data and information

Project	ID	Output	Milestone date	For endorsement	Status
190804	1	Review of European wasp management in Australia	Aug 2019		Complete
	2	Meeting to discuss model and data	Sep 2019		Complete
	3	Simulation model: complete conceptual model	Nov 2019		Complete
	4	Meeting to discuss progress	Feb 2020		Complete
	5	Non-market valuation (benefit transfer)	Mar 2020		Complete
	6	Final report and recommendation	Jun 2020	✓	Complete
190808	1	Project initiation meeting	Jul 2019		Complete
	2	BOD stakeholder interviews	Oct 2019		Complete
	3	Divisional priority nomination (including supporting data stocktake)	Dec 2019		Complete
	4	Desktop review/ analysis	Aug 2020		In progress
	5	Preliminary framework for consultation	Aug 2020		In progress
	6	Feasibility scoping	Aug 2020		In progress
	7	Final report sent to DAWE	Aug 2020	✓	In progress
190810	1	Stocktake and horizon scan workshop	Aug 2019		Complete
	2	Updated profile development methodology using existing data	Jul 2020		Complete
	3	Survey sample sizes required to inform profiling are recommended to DAWE	Aug 2020		In progress
	4	Possible triggers for a profile update are identified	Nov 2020		
	5	Development of processes for semi-automated profile creation via R (with preparatory scripts and reports), including self-reporting with process checks	Jan 2021		
	6	Examine the approach survey method	Mar 2021		



RESEARCH AND DEVELOP RISK METHODS





Graduate students

CEBRA continues to make substantial investments in postgraduate research training. Our PhD students research and develop specialist techniques to tackle real-world problems, building biosecurity risk analysis capacity and capability in Australia and around the world.

Table 2: Current 2019–2020 PhD students

Current PhD Students		
Student	Title	Supervisor
Thiripura Vino	Human mobility models with imperfect data	Professor Andrew Robinson
Nayomi Attanyake	Efficient estimation of hazard cut-points for risk-based fleet management	Professor Andrew Robinson
Gayan Dharmarathne	Exploring the statistical aspects of expert-elicited experiments	Professor Andrew Robinson

Institutional contracts and consultancies

CEBRA conducts robust scientific analysis and provides expert advice to a range of biosecurity stakeholders. Here are the institutional contracts and consultancies we have been awarded, relevant to the 2019–2020 financial year.

Table 3: Institutional contracts and consultancies

Client	Year	Project	Amount (ex GST)	Investigators
Department of Agriculture, Water and the Environment	2020	Extended capability of the Australian animal disease spread (AADIS) model to include African swine fever	A\$75 000	Dr Richard Bradhurst
NSW Environment Protection Authority	2020	Developing an expert-derived risk model to guide prioritisation of chemicals of interest	A\$45 949	Dr Kelly de Bie Dr Libby Rumpff Dr Anca Hanea Professor Andrew Robinson
NSW Environment Protection Authority	2020	Detecting emergence of chemical concern	A\$44 966	Dr Jason Whyte Professor Tom Kompas
Department of Agriculture, Water and the Environment	2020	Theoretically predict environmental concentrations of copper under different in-water cleaning scenarios within key Australian ports	A\$23 447	Mr Nathaniel Bloomfield
Cawthron Institute Trust Board	2019–2021	Aquaculture health strategies to maximise productivity and security	A\$80 000	Professor Andrew Robinson Dr Anca Hanea Dr James Camac
NSW Environment Protection Authority	2019	Chemical risk anticipation tool validation	A\$41 200	Professor Andrew Robinson Dr Jason Whyte
Australian Research Council	2017–2019	DP170104795 Predicting the ecological and economic outcomes of trade	A\$588 500	Professor Brendan Wintle Professor Tom Kompas Professor Mark Burgman
Australian Research Council	2016–2018 (extended to 2020)	DP160100745 Maximising the benefits of emerging technologies for ecological survey	A\$350 600	Professor Andrew Robinson Adjunct Professor Andrew (Sandy) Liebhold Dr Joslin Moore Dr Aaron Dodd





Impact and adoption case study: Risk-based intervention utilising CSP sensitivity analysis

The department's ability to implement biosecurity risk-based intervention protocols is often limited by a lack of understanding about characteristics of import supply chains that may decrease or increase biosecurity risks, compliance rates, and thus approach rates at the border. This project set out to investigate how diverse types of information could enhance implementation of biosecurity risk-based inspection protocols at the border, including further rollout of the Compliance Based Intervention Scheme (CBIS).

The CBIS uses two continuous sampling plan (CSP) algorithms to determine whether a given consignment requires inspection. This has been applied on a range of plant-product pathways, including dried fruit and herbs, fresh produce, nuts, grains and processed seed. The project sought to develop a decision support tool to make it easier for officers in the Biosecurity Plant Division to choose the most suitable CSP parameters to determine the qualification number and risk-based inspection rate for a given pathway.

The decision support tool translates a statistical problem

into a risk management setting by allowing officers to interactively explore and assess alternative inspection strategies. Where limited or no inspection history exists, officers can use the sensitivity analysis tool to develop recommendations based on the trade-offs associated with choosing different CSP parameter choices.

The tool provides a graphical representation of 'what if' scenario testing to show the effects of different CSP parameters on pest leakage for a given pathway.

It has also been enhanced to estimate the percentage of inspections saved and the rate of post-intervention non-compliance. To utilise the model, officers must answer up to four questions on failure definitions, maximum leakage thresholds and CSP modes.

The tool is still in its infancy and is actively being tested by officers in the Plant Import Operations (PIO) branch. For example, immature corn was used to trial different scenarios.

The tool is being tested in parallel to the ABARES simulation models that officers use when assessing suitable plant commodities for CBIS (such as recent corn



CBIS sensitivity tool in action

analyses). This allows time to test the boundaries of the tool and provides confidence that it can be relied on. The tool will be considered for incorporation into the routine CBIS assessment methodology but will also be available to officers as a stand-alone tool to guide preliminary decisions.

PIO are trialling the tool to design sampling protocols to verify offshore devitalisation treatment. Animal Division are also exploring the application of this tool for a range of animal products.

The tool is currently being adapted to determine threshold tolerances for non-compliance that will inform decisions on renewing import permits. This requires the team to produce range estimates for the likelihood, establishment and spread costs associated with a given pest leakage.

Next steps

There is a need to draw on advice and evidence from other policy areas to help inform quantification of the likely monetary consequences associated with pest leakage, establishment and spread.

This information will need to be developed or derived in collaboration with the Plant Sciences and Risk Assessment branch's work on pest risk analyses, Biosecurity Implementation Branch's Risk-Return Resource Allocation model outputs, the Value of the Biosecurity System project and the Environmental Biosecurity Division's work to better define environmental risk.



DOCUMENT AND COMMUNICATE FINDINGS

Publications

At CEBRA, we collaborate with researchers across many disciplines to apply and develop scientific methods. Our research is published in a range of peer-reviewed journals and other publications. For a full list of publications, please visit www.cebra.unimelb.edu.au/engage/journal-articles.

Table 4: CEBRA publications summary with average citations and InCites impact factor as at 30/07/2020

Calendar year	Total publications	Total citations	Average citations	Average InCites impact factor	CEBRA project-specific publications
2019	16	71	4.44	3.77	6
2018	26	306	11.77	3.88	8
2017	39	906	23.23	3.53	14
2016	29	853	29.41	3.89	8
2015	29	1294	44.62	5.43	12
2014	16	785	49.06	5.46	3
2013	27	5866	217.26	5.41	11

CEBRA publications with InCites impact factor and number of citations

Table 5: CEBRA publications with InCites impact factor and citations as at 30/07/2020

Key:  CEBRA project-specific publications

	InCites impact factor 2019	No. of citations as at 30/07/20
IN PRESS/EARLY VIEW		
Baker, CM & Bode, M (in press) <i>Recent advances of quantitative modelling to support invasive species eradication on islands. Conservations Science and Practice</i>	n/a	0
Whyte, J (accepted) <i>Model structures and structural identifiability: What? Why? How? Matrix Annals of 2019</i>	n/a	0
2020		
Ahmed, S, LeMay, V, Yanchuk, A, Robinson, A, Marshall, P & Bull, G (2020) <i>Meta-modelling to quantify yields of white spruce and hybrid spruce provenances in the Canadian boreal forest. Forests</i>	2.221	0
Alahmadi, A, Belet, S, Black, A, Cromer, D, Flegg, JA, House, T, Jayasundara, P, Keith, JM, McCaw, JM, Moss, R, Ross, JV, Shearer, FM, Tun, STT, Walker, J, White, L, Whyte, JM, Yan, AWC & Zarebski, AE (2020) <i>Influencing public health policy with data-informed mathematical models of infectious diseases: Recent developments and new challenges. Epidemics</i>	2.976	2
Arndt, E, Burgman, M, Schneider, K & Robinson, A (2020) 'Working with government - innovative approaches to evidence-based policy-making' in Sutherland, WJ, Brotherton, Peter, NM, Davies, ZG, Ockendon, N, Pettorelli, N & Vickery, JA (eds) <i>Conservation research, policy and practice. Cambridge University Press</i>	n/a	0
Firestone, SM, Hayama, Y, Lau, MSY, Yamamoto, T, Nishi, T, Bradhurst, R, Demirhan, H, Stevenson, M & Tsutsui, T (2020) <i>Transmission network reconstruction for foot-and-mouth disease outbreaks incorporating farm-level covariates. PLOS ONE</i>	2.74	0
French, S, Hanea, AM, Bedford, T & Nane, GF (2020) 'Introduction and overview of structured expert judgement' in Hanea, AM, Nane, GF, Bedford, T & French, S (eds) <i>Expert judgement in risk and decision analysis. Springer</i>	n/a	0
Hanea, AM, Nane, GF, Bedford, T & French, T (2020) <i>Expert judgement in risk and decision analysis. Springer</i>	n/a	0

Hanea, AM & Nane, GF (2020) 'An in-depth perspective on the classical model' in Hanea, AM, Nane, GF, Bedford, T & French, S (eds) <i>Expert judgement in risk and decision analysis</i> . Springer	n/a	0
Hemming, V, Hanea, AM, Walshe, T & Burgman, M (2020) <i>Weighting and aggregating expert ecological judgements</i> . Ecological Applications	4.248	0
Nane, GF & Hanea, AM (2020) 'Building on foundations: The SEJ interview with Roger Cooke' in Hanea, AM, Nane, GF, Bedford, T & French, S (eds) <i>Expert judgement in risk and decision analysis</i> . Springer	n/a	0
Marcot, B & Hanea, AM (2020) <i>What is an optimal value of k in k-fold cross-validation in discrete Bayesian network analysis?</i> Computational Statistics	0.744	0
Marshall, AM, Link, TE, Robinson, AP & Abatzoglou, JT (2020) <i>Higher snowfall intensity is associated with reduced impacts of warming upon winter snow ablation</i> . Geophysical Research Letters	4.497	0
Roscoe, K, Hanea, AM, Jongejan, R & Vrouwenvelder, T (2020) <i>Levee system reliability modelling: The length effect and Bayesian updating</i> . Safety	1.87	0
Wu, CH, Dodd, AJ, Hauser, CE & McCarthy, MA (2020) <i>Reallocating budgets among ongoing and emerging conservation projects</i> . Conservation Biology	5.405	0
2019		
Bradhurst, R, Garner, G, East, I, Death, C, Dodd, A & Kompas, T (2019) <i>Management strategies for vaccinated animals after an outbreak of foot-and-mouth disease and the impact on return to trade</i> . PLOS ONE	2.74	0
Briscoe, NJ, Elith, J, Salguero-Gómez, R, Lahoz Monfort, JJ, Camac, JS, J, Giljohann, KM, Holden, M, Hradsky, BA, Kearney, MR, McMahon, S, Phillips, BL, Regan, TJ, Rhodes, JR, Vesk, PA, Wintle BA, Yen, JDL & Guillera-Aroita, G (2019) <i>Forecasting species range dynamics with process-explicit models: Matching methods to applications</i> . Ecology Letters	8.665	15
Firestone, SM, Hayama, Y, Bradhurst, R, Yamamoto, T, Tsutsui, T & Stevenson, MA (2019) <i>Reconstructing foot-and-mouth disease outbreaks: A methods comparison of transmission network models</i> . Nature Scientific Reports	3.998	11
Grafton, R, Doyen, L, Bene, C, Borgomeo, E, Brooks, K, Chu, L, Cumming, G, Dixon, J, Dovers, S, Garrick, D, Helfgott, A, Jiang, Q, Katic, P, Kompas, T, Little, R, Matthews, N, Ringler, C, Squires, D, Steinshamn, S, Villasante, S, Wheeler, S, Williams, J & Wyrwoll, P (2019) <i>Realizing resilience for decision-making</i> . Nature Sustainability	12.08	11
Hanea, AM & Nane, GF 2019 <i>Calibrating experts' probabilistic assessments for improved probabilistic predictions</i> . Safety Science	4.105	1
Hemming, V, Armstrong, N, Burgman, M & Hanea, AM (2019) <i>Improving expert forecasts in reliability: Application and evidence for structured elicitation protocols</i> . Quality and Reliability Engineering International	1.718	2
Hoffmann, AA, Rymer, PD, Bryne, M, Ruthrof, KX, Whinam, J, McGeoch, M, Bergstrom, DM, Guerin, GR, Sparrow, B, Joseph, L, Hill, SJ, Andrew, NR, Camac, JS, Bell, N, Riegler, M, Gardner, JL & Williams, SE (2019) <i>Impacts of recent climate change on terrestrial flora and fauna: Some emerging Australian examples</i> . Austral Ecology	1.551	16
Hood, Y, Sadler, J, Poldy, J, Starkey, CS, & Robinson, AP (2019) <i>Biosecurity system reforms and the development of a risk-based surveillance and pathway analysis system for ornamental fish imported into Australia</i> . Preventive Veterinary Medicine	2.304	3
Johnson, S, Hick, P, Robinson, AP, Rimmer, A, Tweedie, A & Becker, J (2019) <i>The impact of pooling samples on surveillance sensitivity for the megalocytivirus infectious spleen and kidney necrosis virus</i> . Transboundary and Emerging Diseases	4.188	2
Keith, JM, Spring, D & Kompas, T (2019) <i>Delimiting a species' geographic range using posterior sampling and computational geometry</i> . Scientific Reports	3.998	1
Kim, JH & Robinson, AP (2019) <i>Interval-based hypothesis testing and its applications to economics and finance</i> . Econometrics	2.139	2



Kompas, T, Chu, L, Van Ha, P & Spring, D (2019) <i>Budgeting and portfolio allocation for biosecurity measures. The Australian Journal of Agricultural and Resource Economics</i>	1.386	1
Kompas, T & Van Ha, P (2019) <i>The 'curse of dimensionality resolved': The effects of climate change and trade barriers in large dimensional modelling. Economic Modelling</i>	1.93	4
Lane, SE, Cannon, RM, Arthur, AD & Robinson, AP (2019) <i>Sample size for inspection intended to manage risk within mixed consignments. Neobiota</i>	2.643	0
Robinson, AP (2019) 'Testing Simulation Models Using Frequentist Statistics' in Beisbart, C & Saam, NJ (eds) <i>Computer simulation validation – Fundamental concepts, methodological frameworks and philosophical perspectives. Springer</i>	n/a	0
Trouvé, R, Nitschke, CR, Andrieux, L, Willersdorf, T, Robinson, AP & Baker, PJ (2019) <i>Competition drives the decline of a midstorey tree species: Habitat implications for an endangered marsupial. Forest Ecology and Management</i>	3.17	2



Presentations

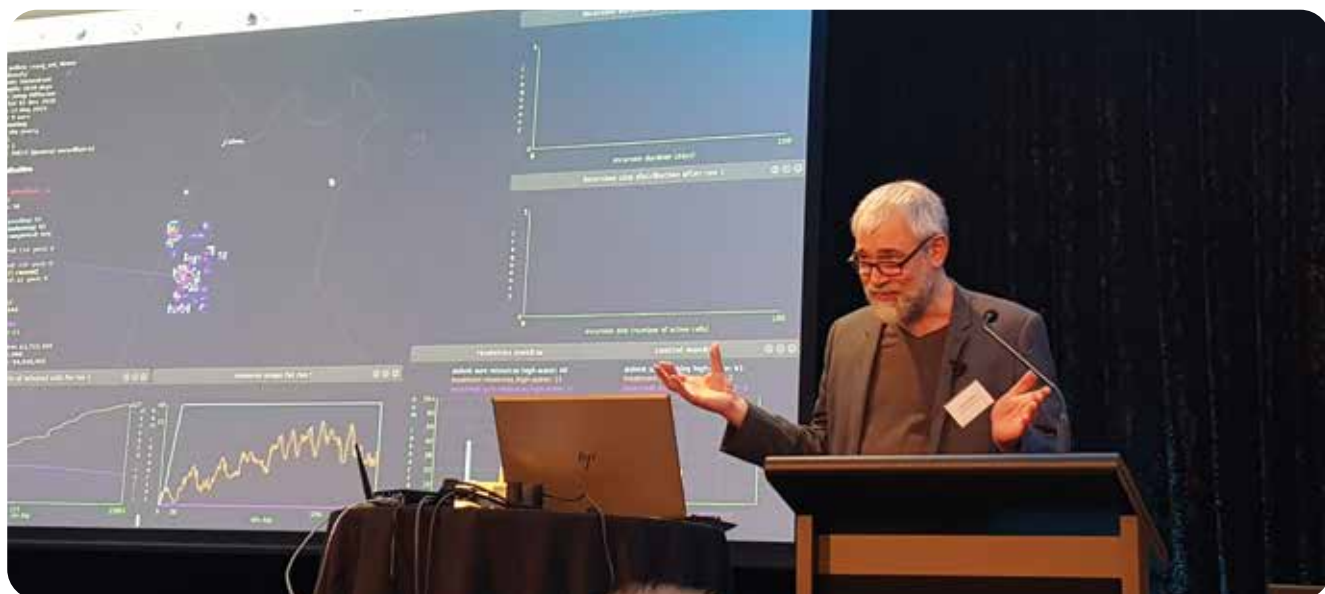
Building networks and communicating our research keeps CEBRA connected and accountable. Our researchers attend meetings in Australia and internationally, to share our research and stay knowledgeable about the latest developments in biosecurity and risk analysis. We regularly chair, address and facilitate workshops and conferences.

Table 6: Presentations (talks and workshops) given by CEBRA researchers in 2019–2020

Dates of Event	Topic Event	Location	Organisation	Facilitator(s)
4–6 July 2019	RepliCATS workshop SCORE program	Rotterdam, The Netherlands	DARPA	Dr Anca Hanea
9–11 July 2019	MOOC: Decision-making under uncertainty: Introduction to structured expert judgement	Timisora, Romania	Delft University of Technology (TU Delft) and Equinor	Dr Anca Hanea
22 July–2 August 2019	Data assimilation and its applications Summer school	Timisora, Romania	TU Delft & Equinor	Dr Anca Hanea
13 August 2019	Global economic gains from complying with the Paris Accord ANU seminar	Canberra	Crawford School of Public Policy and Arndt-Corden Department of Economics	Professor Tom Kompas

Dates of Event	Topic Event	Location	Organisation	Facilitator(s)
3–6 September 2019	A matter of survival: A simple model for the detection of an invasive species under surveillance International Pest Risk Research Group (IPRRG) Annual Meeting	Poznan, Poland	IPRRG	Professor Andrew Robinson
3–6 September 2019	Is biosecurity doing a good job in keeping invasive pests out? IPRRG Annual Meeting	Poznan, Poland	IPRRG	Dr Edith Arndt
3–6 September 2019	Predictive propagule pressure reduction from biosecurity inspection IPRRG Annual Meeting	Poznan, Poland	IPRRG	Dr Raphael Trouvé
4–5 September 2019	The technology conundrum and progress on the national research and innovation agenda Queensland Biosecurity Partners Forum and National Roundtable	Brisbane	Queensland Government	Dr Aaron Dodd
5 September 2019	Public good research and innovation for the biosecurity system Biosecurity Queensland Partners Forum	Brisbane	Biosecurity Queensland	Dr Aaron Dodd
5 September 2019	APPDIS – The Australian plant pest and disease model Queensland Biosecurity Partners Forum and National Roundtable	Brisbane	Biosecurity Queensland	Dr Richard Bradhurst
11 October 2019	Guest lecture AGRI30043 (resource management economics) class	Melbourne	University of Melbourne	Dr Susie Hester
23 October 2019	The development of Australia's ballast water risk management system Biosecurity Research Seminar	Canberra	The Department of Agriculture, Water and the Environment	Nathaniel Bloomfield
31 October 2019	The benefits of moving to a clean economy Lighter Footprints Community Forum	Melbourne	Lighter Footprints	Professor Tom Kompas
31 October 2019	Economic damages, country inequality and the cost of emissions reduction in a large dimensional global trade and climate model Engage workshop on integrating impacts, mitigation and inequality	Potsdam, Germany	Potsdam Institute for Climate Impact Research	Professor Tom Kompas
4–8 November 2019	Epidemiological modelling workshop featuring the Australian animal disease model (AADIS)	Fort Collins, USA	USDA Centre of Epidemiology and Animal Health	Dr Richard Bradhurst
6 November 2019	RepliCATS workshop SCORE program	Melbourne	SCORE	Dr Anca Hanea
13 November 2019	Structured expert judgement for cost prediction in customized furniture manufacturing Society for Risk Analysis – Australia and New Zealand (SRA-ANZ) and Australasian Bayesian Network Modelling Society (ABNMS) Combined Conference	Wellington, New Zealand	SRA-ANZ	Dr Anca Hanea
13 November 2019	Oh bother, where art thou? Predicting locations of ballast discharge SRA-ANZ/ABNMS Conference	Wellington, New Zealand	SRA-ANZ	Professor Andrew Robinson
13 November 2019	Neural networks, drones and GPUs: Can we use machine learning to identify biofouling risk of vessels? SRA-ANZ/ABNMS Conference	Wellington, New Zealand	SRA-ANZ	Nathaniel Bloomfield
19–21 November 2019	Epidemiological modelling workshop featuring AADIS	Ottawa, Canada	Canadian Food Inspection Agency	Dr Richard Bradhurst

Dates of Event	Topic Event	Location	Organisation	Facilitator(s)
26–28 November 2019	A simple model for size-at-detection of an invasive species under surveillance New Zealand Statistical Association Conference	Dunedin, New Zealand	New Zealand Statistical Association	Professor Andrew Robinson
1–6 December 2019	A simple model for size-at-detection of an invasive species under surveillance 23rd International Congress on Modelling and Simulation (MODSIM)	Canberra	MODSIM	Professor Andrew Robinson
1–6 December 2019	WeedSearch: a toll for weed eradication programs 23rd International Congress on Modelling and Simulation	Canberra	MODSIM	Dr Susie Hester
28 January 2020	User group meeting for the European foot-and-mouth disease model (EuFMDiS)	Rome, Italy	European Commission for the Control of Foot-and-mouth Disease within the Food and Agriculture Organisation of the United Nations (EuFMD FAO UN)	Dr Richard Bradhurst
29 January 2020	Advisory group meeting for EuFMDiS	Rome, Italy	EuFMD FAO UN	Dr Richard Bradhurst
31 January 2020	Expert meeting on incorporating wildlife pathways in exposure-at-default simulation modelling	Rome, Italy	EuFMD FAO UN	Dr Richard Bradhurst
10–14 February 2020	Under what conditions is biocontrol of established pests justified? 64th Annual conference of the Australasian Agricultural and Resource Economics Society (AARES)	Perth	AARES, University of Western Australia	Dr Susie Hester
19 February 2020	Expert elicitation workshop	Canberra	Food Standards Australia New Zealand	Dr Anca Hanea
20 February 2020	The wicked risks of biosecurity	Radio interview	RRR Radio station	Nathaniel Bloomfield
26 May 2020	County inequality, Australia and the economic damages from global warming Australian Climate Roundtable	Webinar	Australian Climate Roundtable	Professor Tom Kompas
1 June 2020	EuFMDiS outbreak simulation model	Podcast interview	EuFMD FAO UN	Dr Richard Bradhurst



Media articles

CEBRA researchers readily share insights with a wider readership, drawing on their reservoir of scientific knowledge and research to communicate on issues facing the world.

Table 7: Media articles contributed by/quoting CEBRA researchers in 2019–2020

Date	Topic	Publication/organisation	Staff member
16 December 2019	Morrison government delays \$300m biosecurity levy	The Age	Professor Andrew Robinson
8 January 2020	Ross Garnaut's climate change prediction is coming true and it's going to cost Australia billions, experts warn	ABC News	Professor Tom Kompas
22 January 2020	Tackling climate change in a 'post-truth' world	Asia and the Pacific Policy Forum	Professor Tom Kompas
28 January 2020	The bushfire crisis: implications for Australia's unique alpine flora and fauna (invited blog post)	Mountain Research Initiative	Dr James Camac
14 February 2020	What are the full economic costs to Australia from climate change?	Melbourne Sustainable Society Institute	Professor Tom Kompas
17 February 2020	China to fast-track biosecurity law in coronavirus aftermath	South China Morning Post	Professor Andrew Robinson
18 February 2020	The wicked risks of biosecurity	Pursuit, The University of Melbourne	Professor Andrew Robinson and Nathaniel Bloomfield
22 February 2020	Labor commits to net-zero emissions by 2050, but can't tell you what it costs	SBS News	Professor Tom Kompas
29 February 2020	Political warfare over climate change action	The Saturday Paper	Professor Tom Kompas
30 March 2020	Modelling suggests going early and going hard will save lives and help the economy	The Conversation	Professor Tom Kompas
30 March 2020	Experts wary despite signs COVID-19 growth is easing	Financial Review	Professor Tom Kompas
30 March 2020	ANU modelling shows COVID-19 cases to hit 5,000 in coming days	The Guardian	Professor Tom Kompas
30 March 2020	Australia's coronavirus cases set to hit 5,000 in coming days	Medical Express	Professor Tom Kompas
30 March 2020	Sums, germs and fear	Asia & The Pacific Policy Forum	Professor Tom Kompas
30 March 2020	COVID-19 modeller warns caution despite slowing of virus cases	ABC News	Professor Tom Kompas
1 April 2020	Coronavirus: We're playing our part apart and it's helping slow the spread	The Australian	Professor Tom Kompas
1 April 2020	Coronavirus: Hopeful signs but caution advised	The Australian	Professor Tom Kompas
7 April 2020	Is Australia's coronavirus strategy the hammer or the scythe?	Canberra Times	Professor Tom Kompas
7 April 2020	COVID-19: The scythe and the hammer	Asia & The Pacific Policy Forum	Professor Tom Kompas
7 April 2020	Modelling suggests going early and going hard will save lives and help the economy	Sify	Professor Tom Kompas
23 April 2020	Virus modelling masks flawed inputs	Financial Review	Professor Tom Kompas
24 April 2020	There's no one-size-fits-all approach to COVID	Canberra Times	Professor Tom Kompas
2 June 2020	The interconnectedness of human, animal and environmental health	Pursuit, The University of Melbourne	Dr Richard Bradhurst



GOVERNANCE

Chair's report: Biosecurity at the forefront of community awareness worldwide

As a consequence of the COVID-19 pandemic, the concepts of biosecurity and risk have become widely understood, as governments, health systems, economies, communities and individuals grapple with the impacts of the virus. Biosecurity and risk are the core concepts on which CEBRA is founded. They are central to the work it undertakes on behalf of the Australian Department of Agriculture, Water and the Environment (DAWE) and New Zealand's Ministry for Primary Industries (MPI) – work that assists both countries to protect human health, the natural environments and agricultural production systems from incursion, establishment and spread of pests and diseases.

Notwithstanding the natural protection conferred on Australia and New Zealand by their island status, managing biosecurity is a complex challenge. This has become evident with COVID-19, where it is manifest in the risk management practices introduced by governments to mitigate impacts of the virus in both countries.

Like many organisations in this environment, CEBRA moved to a working from home practice. This presented challenges for a multidisciplinary research culture that thrives on interaction and communication. However, staff have maintained a high degree of professional and social cohesion through the use of electronic media. The CEBRA Advisory Board (CAB) has also, for the first time, conducted its business through visual online technology. This has been challenging, as there has been considerable change to board membership during the year.

Professor Helen Sullivan, Dr Marion Healy, Dr Steve Hatfield-Dodds and Ms Christine Reed all left the board for reasons ranging from retirement to change of professional responsibilities. I thank them for their valuable contributions to CEBRA over the years. Ms Sarah Corcoran, who joined the board last year, recently changed her employment and is now CEO of Plant Health Australia, the peak plant production industry body, and has agreed to remain on the board.

Changes to the board require some adjustment, but also present opportunity for renewal and refocus. The Deed of Agreement with DAWE that governs CEBRA's operations requires that the CAB be representative of the broad range of interests and technical disciplines in the biosecurity domain. In this context, CEBRA has been fortunate that it has been able to replace the experience and diversity of its board members through its recent appointments.

Dr Robyn Martin, Mr Peter Gooday and Dr Michael Ormsby bring a wealth of policy, technical and operational experience to the CAB. Additionally, University of Melbourne Professors Jodie McVernon and Anna Meredith bring copious experience in highly relevant applied research. I look forward to working with them as we



continue to tackle the complex challenges of biosecurity.

Despite the changes in working environment and CAB membership, CEBRA had a productive year that included completion of two strategic three-year projects focussing on the value and health of Australia's biosecurity system. The 'value project' established a baseline evaluation of the costs and benefits of maintaining the assets protected by the biosecurity system and aims to foster a culture of regular evaluation reporting. The 'health project' established a framework for evaluating the health, or the performance, of the system against relevant criteria, using agreed performance indicators. Both projects, endorsed by DAWE, will, when adopted, provide valuable insights into areas where biosecurity investment can best achieve system improvements.

CEBRA staff also disseminated their research findings to a broad audience through participation in more than fifty workshops, conferences, seminars and media articles. This was despite travel limitations imposed by COVID-19 restrictions in the second half of the financial year. In terms of governance, CEBRA met all the key performance indicators established under its agreements. It has been especially pleasing to note the high rate of adoption of its outputs by DAWE and MPI.

As has been seen with the outbreak of COVID-19 across the globe, managing biosecurity is a constantly evolving and challenging responsibility for governments and communities. I believe CEBRA is well placed to continue to assist DAWE and MPI to achieve a high standard of biosecurity protection in Australia and New Zealand. On behalf of the CAB, I commit it to this endeavour as we enter the last year of the current funding cycle from both countries.

Dr Colin J Grant
BSc (Hons), PhD JCU OA

CEBRA Advisory Board members

Name	Position	Organisation
Dr Colin Grant	Chair	Independent
Dr Steve Hatfield-Dodds	Board member*	Executive Director, Australian Bureau of Agricultural and Resource Economics and Sciences
Mr Peter Gooday	Board member	Assistant Secretary, Australian Bureau of Agricultural and Resource Economics and Sciences
Dr Marion Healy	Board member*	First Assistant Secretary, Biosecurity Plant Division, Department of Agriculture, Water and the Environment
Dr Robyn Martin	Board member	First Assistant Secretary, Biosecurity Animal Division, Department of Agriculture, Water and the Environment
Ms Christine Reed	Board member*	Biosecurity Science and Risk Assessment, Ministry for Primary Industries New Zealand
Dr Michael Ormsby	Board member	Biosecurity Science and Risk Assessment, Ministry for Primary Industries New Zealand
Ms Sarah Corcoran	Board member	CEO, Plant Health Australia
Professor Helen Sullivan	Board member*	Director, Crawford School of Public Policy, The Australian National University
Professor Ian Robertson	Board member (Scientific Advisory Committee Chair)	Professor Emeritus, Veterinary Epidemiology, College of Veterinary Medicine, Murdoch University
Professor Pauline Ladiges	Board member (host)	Professor Emeritus, Botany School of BioSciences The University of Melbourne
Professor Peter Taylor	Board member (host)	Director, ARC Centre of Excellence for Mathematical and Statistical Frontiers School of Mathematics and Statistics, The University of Melbourne
Professor Jodie McVernon	Board member (host)	Director, Peter Doherty Epidemiology Institute for Infection and Immunity
Professor Anna Meredith	Board member (host)	Head, Melbourne Veterinary School, The University of Melbourne
Professor Andrew Robinson	Board member (ex officio)	Director, Centre of Excellence for Biosecurity Risk Analysis, The University of Melbourne
Professor Tom Kompas	Board member (ex officio)	Centre of Excellence for Biosecurity Risk Analysis, The University of Melbourne

*retired 2019–20 board members



Scientific Advisory Committee terms of reference

The Scientific Advisory Committee (SAC) reviews and approves all draft project plans and provides an assessment of all final reports.

The role of the SAC is to:

- assist the director in evaluating research proposals based on criteria of:
 - scientific and practical merit for risk analysis
 - capacity/capability to deliver
 - budget viability
- obtain peer reviews of final reports prior to submission to the Department of Agriculture, Water and the Environment for endorsement
- provide relevant advice to researchers conducting CEBRA projects, as requested by the director.

The composition of the SAC is:

- chair: Professor Emeritus Ian Robertson
- a broad committee of members covering relevant fields of environmental, animal and plant sciences; biosecurity; physical, mathematical and social sciences; psychology; philosophy; and statistics.

The responsibilities of SAC members are as follows:

- The chair will seek advice and peer reviews from appropriate SAC members and other colleagues on proposals, and interim and final reports, as appropriate. Reviews will be forwarded to investigators for their consideration.
- SAC members may be provided with copies of project proposals or interim reports, and may be invited, without obligation, to provide advice to researchers or the SAC.
- The chair will attend advisory board meetings to report on SAC matters.

It is anticipated that most of the business of the SAC will be conducted electronically. Formal meetings may be called at the discretion of the chair in consultation with the director.

SAC reviewers for 2019–2020

Name	Organisation
Associate Professor Michael Bode	Queensland University of Technology
Dr John Brennan	Independent consultant
Professor Oscar Cacho	University of New England
Dr Arthur Campbell	Monash University
Dr Rob Cannon	Independent consultant
Barney Caton	Center for Plant Health Science and Technology, United States Department of Agriculture
Dr Brendan Cowled	Ausvet
Dr Christina Devorshak	Animal and Plant Health Inspection Service, United States Department of Agriculture
Professor John Edwards	Ausvet
Professor David Fox	The University of Melbourne
Dr Karyn Froud	Biosecurity Research Ltd, New Zealand
Dr Jonathan Happold	Ausvet
Dr Keith Hayes	Commonwealth Scientific and Industrial Research Organisation
Professor Philip Hulme	Lincoln University
Dr Stephen Johnson	NSW Department of Primary Industries
Dr John Kean	AgResearch Ltd New Zealand
Dr Andrew Liebhold	United States Department of Agriculture Forest Service
Dr Justin McDonald	Department of Primary Industries and Regional Development WA
Professor Simon McKirdy	Murdoch University
Dr Hugh Millar	Hugh Millar & Associates Pty Ltd
Associate Professor Roger Paskin	Independent consultant
Dr Craig Phillips	AgResearch Ltd New Zealand
Professor John Rolfe	Central Queensland University
Professor Shashi Sharma	Independent consultant
Dr Reid Tingley	Monash University
Dr Darren Ward	Landcare Research, New Zealand
Dr John Weiss	Agriculture Victoria, Department of Jobs, Precincts and Regions
Associate Professor Ben White	The University of Western Australia
Emeritus Professor Richard Whittington	The University of Sydney

Key performance indicators

Activity – Research						
Strategic Objective		Accountability	Rating Key		Progress/Outcome	
To research and develop methods relevant to biosecurity risk by engaging a range of disciplines relevant to the analysis of biosecurity risk, to that the Australian and New Zealand governments remain at the forefront of practical biosecurity risk assessment.		Director	✱ Over performance ● On target ■ Target at risk ◆ Target not achieved ★ Completed		● On target	
Key Performance Indicator	Measure	Officer	Delivery Date	Rating	Progress/Outcome	
1.1 Research project quality and completion rates achieve a high standard	At least 90% of project proposals are approved, pending budget allocations	Director, Biosecurity Research Team, SAC	Ongoing	✱	2020-2021 project proposals have been approved and MPI projects are currently under development	
	At least 90% of output (milestones, reports, systems, software, guidelines etc.) completed satisfactorily	Director, business manager	Ongoing	●	The satisfactory completion of outputs continues to track above 90%	
	At least 80% outputs completed on time per year	Director	Ongoing	●	The on-time completion of project deliverables is currently tracking toward the 80% target	
	At least 90% of projects to be delivered on budget	Director, business manager	Ongoing	✱	Projects continue to track on or below budget	
1.2 Research project s contribute positively to the University's Excellence in Research for Australia (ERA) ranking based on standard measures	Organisational H-Index ranking	Director	Ongoing	●	CEBRA's H index is 38 CEBRA/ACERA's combined H index is 75	
	Number of Publications per year by CEBRA staff	Director	Ongoing	●	CEBRA staff have published numerous journal articles badged as CEBRA work (details are provided in Table 5)	
1.3 Biosecurity risk analysis capacity in Australia and New Zealand is enhanced	Number of research higher degree students enrolled	Director	Ongoing	★	CEBRA has supported two higher degree students over the past twelve months. These students have now completed/ graduated and CEBRA has taken on no further students as we are nearing the end of our funding agreement.	
	Number of research higher degree students graduated	Director	Ongoing	★	Two PhD students have graduated in the past twelve months: Nayomi Attanyake Gayan Dharmarathne	
	Number of postdoctoral research fellows employed	Director	Ongoing	●	Eight postdoctoral research fellows are funded through the CEBRA grant and work directly on CEBRA projects: Edith Arndt John Baumgartner Richard Bradhurst James Camac Aaron Dodd Anca Hanea Raphael Trouvé Jason Whyte There are two additional research fellows funded through the CEBRA grant and working directly on CEBRA projects: Nathaniel Bloomfield Natasha Page	

Activity – Research						
	Strategic Objective		Accountability	Rating Key		Progress/Outcome
	To research and develop methods relevant to biosecurity risk by engaging a range of disciplines relevant to the analysis of biosecurity risk, to that the Australian and New Zealand governments remain at the forefront of practical biosecurity risk assessment.		Director	✱ Over performance ● On target □ Target at risk ◇ Target not achieved ★ Completed		● On target
	Key Performance Indicator	Measure	Officer	Delivery Date	Rating	Progress/Outcome
1.4	Engagement and collaboration between CEBRA funding bodies and other organisations in planning and conducting CEBRA research projects	Director engages with DAWE (BRISC) and MPI to discuss context and details of research projects	Director	BRISC meetings held on: 5 Sep 2019 4 Dec 2019 19 Mar 2020 22 Jun 2020	★	The centre's executive management have been represented at each BRISC meeting to report on centre activities and to foster engagement with funding bodies
		Director engages with the Ministry for Primary Industries to discuss context and details of research projects	Director	Ongoing	●	The director visits MPI at least four times per year to discuss projects and practices (NB: video link used in place of physical visit)
		At least three substantial collaborations with other research organisations per year	Director	Ongoing	●	No new collaboration agreements have been executed in 2019–2020, however collaborations continued with: The Australian National University University of New England Scion Research, New Zealand Lincoln University, New Zealand
1.5	Peer review of all draft project plans	Scientific Advisory Committee successfully reviews and oversees revision of all project reports	Director, SAC chair	Ongoing	●	The SAC will review all submitted business cases and provide constructive feedback to proponents to improve proposals

Activity – Communications						
Strategic Objective			Accountability	Rating Key		Progress/Outcome
To document and communicate research findings to governments and others engaged in biosecurity decision making in order work to promote excellence in risk analysis			Director, business manager, communications PR	✱ Over performance ● On target □ Target at risk ✖ Target not achieved ☆ Completed		● On target
Key Performance Indicator	Measure	Officer	Delivery Date	Rating	Progress/Outcome	
2.1	An effective flow of media information and publicity about the objectives and achievements of CEBRA	Director, business manager, communications PR	Ongoing	●	CEBRA e-newsletter distributed quarterly and news items regularly placed on website and social media	
	Use of website, blogs and social media to increase brand awareness. An average of 1000 website page views per month.				CEBRA Facebook page and Twitter account are regularly updated	
	At least three working groups conducted and summaries completed per year				CEBRA staff have completed at least three workshops in the reporting period (detailed information is provided in Table 6)	
2.2	Regular involvement in national and international conferences and similar forums	Director	Ongoing	●	CEBRA staff have made at least twelve presentations badged as CEBRA work (detailed information is provided in Table 6)	
	At least two international presentations by CEBRA participants (badged as CEBRA work) per year				CEBRA staff have made at least six international presentations badged as CEBRA work (detailed information is provided in Table 6)	
2.3	Broad recognition of CEBRA as a centre of standing in quality research	Director	Ongoing	●	CEBRA staff have made at least three plenary presentations (detailed information is provided in Table 6)	
	At least three invitations to chair or host conferences, or participate in key advisory forums, or similar				CEBRA has hosted: Professor Birutė Mikulskienė, Faculty of Politics & Management, University of Lithuania Davina Saccaggi, DAFF South Africa B3 Economics Workshop in October 2019 attended by Melissa Welsh (Scion, NZ), John Kean (Agresearch NZ), Michael Ormsby (MPI NZ), Rebecca Epanchin-Neill (RFF, USA), Andrew Liebhold (USDA Forest Service, USA), Eckehard Brockerhoff (WSL, Switzerland)	
	At least one international visitor per year				In September 2019 Professor Andrew Robinson visited and presented seminars to the Bundesinstitut Fur Riskobewertung (BFR) and the Leibniz Institute for Zoo and Wildlife research (IZW) In Berlin, Germany	
	At least one visit to international laboratories by CEBRA personnel per year					

Activity – Adoption						
	Strategic Objective		Accountability	Rating Key		Progress/Outcome
	To improve the adoption of CEBRA outputs by the Australian and New Zealand biosecurity authorities in support of strengthening the integrity of biosecurity systems based on risk management		Director, government CEBRA Advisory Board members	✱ Over performance ● On target □ Target at risk ◆ Target not achieved ★ Completed		● On target
	Key Performance Indicator	Measure	Officer	Delivery Date	Rating	Progress/Outcome
3.1	Use of CEBRA materials is routine in government biosecurity management	Each CEBRA project proposal has at its inception a clearly articulated and measurable adoption/uptake strategy (one page)	Biosecurity Research Section (DAWE) and MPI	Prior to project approval	●	Each business case in the workplan has a clearly articulated adoption/uptake section
		Director to report on completion of CEBRA research outputs to DAWE and MPI	Director	Ongoing	●	Director provides summary of completed research findings to DAWE and MPI
		DAWE and MPI CAB members to provide advice on adoption of project outputs to CEBRA Advisory Board twice per year, including details of transfer of capability	Biosecurity Research Section (DAWE) and MPI	Twice per year	□	Biosecurity Research Section confirms progress towards adoption reporting is on track. DAWE and MPI provide adoption summary report to CEBRA Advisory Board biannually.
3.2	Achievement of a high rate of research project endorsement by DAWE	At least 90% of submitted project outputs are endorsed by DAWE per year	Director, BRISC	Ongoing	★	The following reports were submitted for endorsement: 1505A final report 1502D final report 1608C final report 170606 final report 170615 final report 170621 final report 170714 final report (phase 2) 170714 final report (phase 3) 170820 final report 180601 final report Endorsements received: 1505A (16/2/20) 1502D (20/3/20) 170606 (30/6/20) 170621 (17/4/20) 170714 Phase 2 (3/10/19) 170714 Phase 3 (26/6/20) 170820 (2/11/19)

Activity – Governance

Activity – Governance						
	Strategic Objective		Accountability	Rating Key		Progress/Outcome
	To manage CEBRA in accordance with the funding agreement, strategic objectives and key performance indicators, taking account of relevant industry standards and best practice guidelines		Director, chair	✱ Over performance 🔵 On target 🟡 Target at risk 🔴 Target not achieved ★ Completed		🔵 On target
	Key Performance Indicator	Measure	Officer	Delivery Date	Rating	Progress/Outcome
4.1	Budget and workplan developed and approved annually	Submit to DAWE and MPI a budget and workplan for research projects each financial year	Business manager	14 Jul	★	The budget and workplan was submitted to DAWE and MPI on 12/7/19
		Review budget and workplan and approve (subject to amendments)	DAWE, MPI	31 Jul	★	DAWE and MPI approved the budget and workplan on 24/7/19
4.2	Payment of funding in support of CEBRA	DAWE and MPI to pay CEBRA funding payments twice annually	DAWE, MPI	31 Jan, 31 Jul	★	Invoices issued to: DAWE • Invoice No. 781157 issued on 3/7/19 • Invoice No. 791359 issued on 6/1/20 MPI • Invoice No. 781401 issued on 3/7/19 • Invoice No. 791408 issued on 6/1/20
		The University of Melbourne contributes \$450 312 in funds and \$1 000 364 in-kind per annum, the latter being support for CEBRA Staff, including space for the CEBRA IT system maintenance and general administrative support	Business manager	Mar 2019	★	• \$300 208 received from The University's Chancellery Strategic Investment (DVCR) on 28/1/20 • \$75 052 received from the Faculty of Science on 14/2/20 • \$75 052 received from the School of BioSciences on 31/2/19 • In-kind contribution has been calculated at \$948 260.50 for 2019-2020
4.3	Provide regular reports to funding partners on CEBRA activities as required in the funding agreement	CEBRA to provide DAWE and MPI with progress reports as set out in schedule 3 of the funding agreement	Business manager	31 Mar, 31 Jul, 30 Nov	★	• PR #18 was submitted to DAWE and MPI on 30/7/19 • PR #19 was submitted to DAWE and MPI on 29/11/19 • PR #20 was submitted to DAWE and MPI on 30/3/20
		CEBRA to provide DAWE and MPI with a financial report for the preceding six months biannually as set out in schedule 3 of the funding agreement.	Business manager	21 Jan, 16 Jul	★	• FR #12 was submitted to DAWE and MPI on 12/7/19 • FR #13 was submitted to DAWE and MPI on 22/1/20
4.4	Provide an annual report on CEBRA activities and performance annually, and an auditor's report confirming that CEBRA has managed funding and maintained appropriate accounts and records	CEBRA to supply DAWE and MPI with an annual report and auditor's report as set out in schedule 4 of the funding agreement	Business manager	Annual report: 30 Sep Auditor's report: 31 Aug	★	The annual report was submitted to DAWE and MPI on 30/9/2019 and the auditor's report was submitted to DAWE and MPI on 15/8/2019

Activity – Governance

Strategic Objective		Accountability	Rating Key		Progress/Outcome	
To manage CEBRA in accordance with the funding agreement, strategic objectives and key performance indicators, taking account of relevant industry standards and best practice guidelines		Director, chair	<div>✱ Over performance</div> <div>🕒 On target</div> <div>🟡 Target at risk</div> <div>🔴 Target not achieved</div> <div>★ Completed</div>		🕒 On target	
	Key Performance Indicator	Measure	Officer	Delivery Date	Rating	Progress/Outcome
4.5	Provide a final report on Centre activities at the completion of the term of the funding agreement	CEBRA to supply DAWE and MPI with a final report for the term of the agreement as set out in schedule 4 of the funding agreement	Business manager	30 Sep, 2021	🕒	Not required in the reporting period
4.6	CEBRA Advisory Board advises on broad direction setting for risk analysis research	CEBRA Advisory Board meets four times per year with a minimum attendance of 80% of members (maximum of two members missing)	Board chair, director	23 Aug 2019 22 Nov 2019 28 Feb 2020 15 May 2020	★	To date, all meetings were held as indicated
		Conduct one CEBRA Advisory Board every second year in New Zealand commencing 2018	Board chair, director, NZ member	15 May	🟡	Board meeting #28 was scheduled to be held in Wellington NZ on 15/5/2020 but this meeting was changed to an online Zoom meeting due to COVID-19 restrictions. The NZ meeting will be rescheduled.
		The board comprises a range of experience appropriate to the objectives of CEBRA, as set out in schedule 2 of the funding agreement	Board chair, director	Annual review of membership	★	The board is comprised of an independent chair and members drawn from DAWE, MPI, the University of Melbourne, a state jurisdiction and tertiary institutions
4.7	Conduct a twice yearly review of advisory board performance with a view to achieving best practice in quality of advice and organisational management	Twice yearly review questionnaire completed by all board members and discussed at appropriate board meeting	Board chair	May–Aug 2019	★	Review completed and presented at CAB meeting #24 on 31/5/2019



FINANCIAL STATEMENTS

Financial report summary

CEBRA FINANCIAL STATEMENT 2019-2020

INCOME

Balance brought forward	\$323 684
Department of Agriculture, Water and the Environment	\$1 807 000
Ministry for Primary Industries	\$377 546
Host contribution	\$450 312
Interest	\$9 915
SUBTOTAL	\$2 644 773
OPERATING FUNDS (REVENUE + BALANCE CARRIED FORWARD)	\$2 968 457

LESS EXPENDITURE

Salaries	\$240 031
Operations	\$10 979
Business development	\$152 520
Research contracts	\$2 033 434
SUBTOTAL	\$2 436 965
BALANCE	\$531 492



CEBRA in-kind statement

Infrastructure costs: staff (on campus laboratory) \$86 490/FTER per annum (grant and University of Melbourne funded)

Professor A Robinson	100%	\$86 490
Professor T Kompas	50%	\$43 245
Dr E Arndt	60%	\$51 894
Dr C Baker	25%	\$21 622
Dr R Bradhurst	62%	\$53 283
Dr J Baumgartner	96%	\$82 886
Dr J Camac	100%	\$86 490
Dr A Dodd	91%	\$78 631
Dr A Hanea	55%	\$47 631
Dr R Trouvé	50%	\$43 245
Dr J Whyte	67%	\$58 015
Ms K Schneider	40%	\$34 596
Mr N Bloomfield	100%	\$86 490
Ms N Page	83%	\$72 075
Ms C Watts	35%	\$30 272
Ms E Kecorius	60%	\$51 894
SUBTOTAL		\$928 760

Infrastructure costs: RHD student (on campus laboratory) \$39 000/FTER per annum

G Dharmarathne	50%	\$19 500
SUBTOTAL		\$19 500
TOTAL		\$948 260

Auditor's report

DENCH McCLEAN CARLSON

C O R P O R A T E A D V I S O R Y

29 July 2020

INDEPENDENT AUDIT REPORT

TO COMMONWEALTH OF AUSTRALIA – DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT(DAWE) IN RELATION TO THE FUNDING AGREEMENT FOR THE CENTRE OF EXCELLENCE FOR BIOSECURITY RISK ANALYSIS (CEBRA)

I advise that an audit has been conducted of the Financial Statement and In-kind Support Statement for the Centre of Excellences for Biosecurity Risk Analysis (CEBRA) the period 1 July 2019 to 30 June 2020.

AUDIT OBJECTIVE

The objective of the audit was to provide an auditor's report in accordance with clause 20.4 of the Funding Deed dated 20 May 2013. Specifically, this includes forming an opinion on whether the financial reports provided under this clause are true and fair and the University of Melbourne has complied with its obligations to expend grant payments in accordance with the Agreement.

AUDIT SCOPE

The audit was conducted in accordance with Australian Auditing Standards to provide reasonable assurance as to whether the financial statements are free of material misstatement. The audit procedures included an examination, on a test basis, of evidence supporting the amounts in the financial statements. The funds form part of the University's overall accounts, which have been audited and signed off by the Victorian Auditor-General's Office.

The prevention and detection of fraudulent activity is the responsibility of University of Melbourne management. Our audit procedures were conducted with a focus on addressing specific objectives from a control systems design perspective. We did not examine all transactions over the defined review period, and while an outcome of these procedures may be the detection of fraud, this was not the objective of the review. As a consequence, we do not provide a guarantee that all errors or omissions, whether intentional or otherwise were detected.

AUDIT OPINION

I confirm that in my opinion:

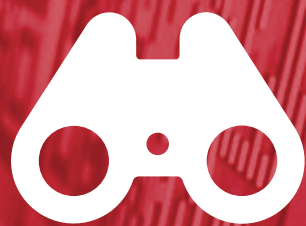
- the University has incurred \$2,436,964.75 expenditure on the Project; and
- the contributions of the University are \$450,312.00 in cash and \$948,260.50 in-kind in accordance with the terms of the Agreement.

The Financial Statement and Summary of In-kind Support Statement signed by the Director of the Centre of Excellence for Biosecurity Risk Analysis (CEBRA), in accordance with the Agreement are attached.



Craig Geddes
Partner
Dench McClean Carlson Pty Ltd

Dench McClean Carlson Pty Ltd ACN 050 237 315 / ABN 42 050 237 315
Level 5, 171 Collins Street, Melbourne Victoria 3000 Australia
Phone: (613) 8617 8141 Mobile 0418 349 570
E-Mail: admin@dmcca.com.au
Website: www.dmcca.com.au



OUTLOOK



Future outlook

Biosecurity in Australia, New Zealand and the world remains a science of vital importance. The risks posed by invasive species are still considerable. Recently, there have been a number of incursions, both close to home and abroad. In February, panama disease was detected in Cairns and fall armyworm was detected in the Torres Strait and Cape York Peninsula. Brown marmorated stink bug remains high on national, state and international pest priority lists. This highly damaging pest was recently detected for the first time in England.

COVID-19 has led to a decrease in international travel with an uncertain outlook for the future. According to the Australian Department of Home Affairs, there were approximately 16 million passenger arrivals via air and sea into Australia during the financial year 2019–2020, a reduction of approximately 26%, compared with 2018–2019. However, the five-year trend up to 2020 showed a growth of approximately 5.2% per annum¹. The Australian government has extended the biosecurity emergency period until December 17, restricting arrivals of international travellers and cruise ships². New Zealand's borders, similarly, remain closed to the wider international community³. The future outlook for traveller volumes remains uncertain. With short-term stay travellers unable to enter and Australian and New Zealand residents forced to cancel holiday plans, the future years may see a compensatory greater-than-usual increase in traveller volumes once restrictions are eased.

Mail and freight volumes have also been affected. The volume of mail has increased as a result of COVID-19. According to Australia Post, there has been a surge in online commerce⁴, although a large portion of the increase is in domestic purchases.

In the face of this uncertain future, CEBRA stands well placed to continue its support of the Australian Department of Agriculture, Water and the Environment and New Zealand's Ministry for Primary Industries. Protecting Australia's and New Zealand's people, environment, economy and agricultural industries remains as important as ever.

Our research priorities for 2020–2021 are *risk analysis*, improving the effectiveness of *surveillance*, *diagnostics* and *screening* tools and how our stakeholders can analyse and benefit from *data and intelligence*. This will be the final year of engagement between the university, the department and the ministry under the existing deed. Accordingly, an important part of our work will be tying up loose ends and checking project outcomes and double-checking processes and documentation – essential work as we cement the wonderful contributions of CEBRA 2013–2021. We'll also be investing in a few past projects for the future. Look to see us hit the ground running with a fresh relationship in 2021!

¹ <https://www.homeaffairs.gov.au/research-and-statistics/statistics/visa-statistics/live/overseas-arrivals-and-departures>

² <https://www.health.gov.au/ministers/the-hon-greg-hunt-mp/media/human-biosecurity-emergency-period-extended-by-three-months>

³ <https://www.immigration.govt.nz/about-us/covid-19/border-closures-and-exceptions>

⁴ <https://auspost.com.au/business/marketing-and-communications/access-data-and-insights/ecommerce-trends>

2020–2021 research projects



Department 2020–21 themes

Data and intelligence

Project ID: 19081002
Project Title: Advanced profiling for travellers and mail
Division: Compliance

AR

Risk analysis (assessment, management and communication)

Project ID: 20110801
Project Title: Improving the methodology for consequence assessment of amenity and environmental pests
Division: Biosecurity Plant

SH

Surveillance, diagnostics and screening

Project ID: 20121001
Project Title: Using pest establishment likelihood maps to inform multi-pest early detection surveillance designs
Division: Biosecurity Plant

JC

NZ MPI

Project ID: 20NZ01
Project Title: Design a statistically valid pathway slippage audits system
Division: MPI

AR

Project ID: 20NZ02
Project Title: Design a framework for responding to inspection success or failure
Division: MPI

AR

Project ID: 20100201
Project Title: Review of document assessment processes in relation to their management of biosecurity risk
Division: Biosecurity Operations

NB

Project ID: 20110901
Project Title: Improved profiling of risks associated with seed interceptions in the international mail pathway
Division: Biosecurity Plant

RT

Project ID: 20121501
Project Title: Modelling the spread and control of African swine fever in feral pigs and the epidemiological impact on domestic pig herds
Division: Biosecurity Animal

RB

Project ID: 17062102
Project Title: System implementation of risk-return Model
Division: MPI

AR

Project ID: 20100401
Project Title: User consultation to guide uptake of, and improvements to, the spatio-temporal asset damage model developed during CEBRA Project 170713
Division: Biosecurity Policy and Implementation

AD

Project ID: 2011101
Project Title: Environmental biosecurity risk assessment for conservation areas
Division: Chief Environmental Biosecurity Office

TK

Project ID: 19NZ02
Project Title: Impact of evidence on decision-making
Division: MPI

TvG

Key

- AD – Aaron Dodd
- AR – Andrew Robinson
- SH – Susie Hester
- TK – Tom Kompas
- JC – James Camac
- NB – Nathaniel Bloomfield
- RT – Raphael Trouvé
- RB – Richard Bradhurst
- TvG – Tim van Gelder



Glossary

- AADIS:** Australian animal disease model
- AARES:** Australasian Agricultural and Resource Economics Society
- ABARES:** Australian Bureau of Agricultural Resource Economics and Sciences
- ABNMS:** Australasian Bayesian Network Modelling Society
- ACERA:** Australian Centre of Excellence for Risk Analysis (precursor of CEBRA)
- ANU:** The Australian National University
- ARC:** Australian Research Council
- BMSB:** brown marmorated stink bug
- BOD:** Biosecurity Operations Division
- CAB:** CEBRA Advisory Board
- CASE:** contention, arguments, sources, evidence (argument mapping)
- CBIS:** compliance-based intervention scheme (formerly, compliance-based inspection scheme)
- CEBRA:** Centre of Excellence for Biosecurity Risk Analysis
- CSP:** continuous sampling plan
- DAWE:** Department of Agriculture, Water and the Environment
- DAWR:** Department of Agriculture and Water Resources (precursor of DAWE)
- DPIRD:** (Western Australia's) Department of Primary Industries and Regional Development
- EuFMD:** The European Commission for the control of foot and mouth disease
- FAO UN:** Food and Agriculture Organization of the United Nations
- FMD:** foot-and-mouth disease
- IPRRG:** International Pest Risk Research Group
- IQI:** Increased Quarantine Intervention
- MEPC:** Marine Environment Protection Committee
- MPI:** Ministry for Primary Industries
- PIO:** Plant Import Operations
- SAC:** Scientific Advisory Committee
- SRA–ANZ:** Society for Risk Analysis – Australia and New Zealand





WEB

<http://www.cebra.unimelb.edu.au>

EMAIL

cebra-info@unimelb.edu.au

PHONE

+61 (0)3 8344 4405

POST

Centre of Excellence for Biosecurity Risk Analysis (CEBRA)
School of BioSciences, The University of Melbourne,
Victoria, Australia 3010



Australian Government
Department of Agriculture,
Water and the Environment



Ministry for Primary Industries
Manatū Ahu Matua



cebra
Centre of Excellence for
Biosecurity Risk Analysis