CEBRA Annual Report

2013/14

THE UNIVERSITY OF MELBOURNE

cebra
Centre of Excellence for Biosecurity Risk Analysis

Contents

01 DIRECTOR'S INTRODUCTION

It gives me great pleasure to present this first Annual Report of the Centre of Excellence for Biosecurity Risk Analysis (CEBRA).

Professor Mark Burgman, Director.

The first year of CEBRA has been busy with the commencement of many projects and the setting of an exciting research agenda for the period ahead.

There have been many highlights.

CEBRA was officially launched by Secretary of the Department of Agriculture, Fisheries and Forestry, Mr Andrew Metcalfe AO and the Vice Chancellor of Melbourne University, Glynn Davies.

In opening CEBRA Mr Metcalfe said that managing Australia's biosecurity system is a big job and that the research of CEBRA will inform robust policy and operational decisions that help concentrate our efforts on the areas of greatest risk.

The launch set the tone for CEBRA's research agenda and reinforced the importance of delivering practical outcomes that support Australia's biosecurity policy and management decision makers.

The first year of operations was especially noteworthy because CEBRA formed a new research partnership with the New Zealand Ministry for Primary Industries. It now drives a number of research projects across our research themes and has taken the Centre in exciting new directions.

Having a broad perspective on Australia's biosecurity risk and management is critical to delivering effective and cost efficient responses. CEBRA has continued to build relationships with key stakeholders including other Federal and State government departments and agencies.

Amongst its many activities, CEBRA welcomed a group of 25 Indonesian risk professionals for a half-day visit arranged by Indonesian Center for Risk Management Studies and the Audit Board Indonesia.

"The launch set the tone for CEBRA's research agenda and reinforced the importance of delivering practical outcomes"

CEBRA was also pleased to co-sponsor the 7th Annual Conference of the Society for Risk Analysis (Australia and New Zealand Chapter), held from 10-12 September, at the Crawford School of Public Policy, Australian National University.

The conference provided a wonderful opportunity for more than 100 like-minded professionals from a wide variety of disciplines and organisational interests to share innovations and explore common ground in risk analysis, management and communication. We look forward to supporting this year's event.

On the research front we have enjoyed a seamless transition from ACERA to CEBRA with researchers continuing to deliver a number of ACERA projects under the CEBRA banner.

CEBRA Objectives

CEBRA aims to benefit government and the broader Australian community through the provision of sound biosecuirty risk analysis. The objectives of the Centre are to deliver practical, rigorous solutions and advice related to the assessment, management, perception and communication of biosecurity risk. To achieve this, the Centre will:

1. Research and develop new and existing methods relevant to biosecurity risk;
2. Engage the range of disciplinary skills relevant to the analysis of biosecurity risk, to ensure governments remain at the forefront of practical risk assessment;
3. Collaborate and engage with end users to improve adoption of methods and increase the impact of research findings;
4. Document and communicate research findings to governments and others engaged in biosecurity decision making;
5. Work to promote excellence in risk analysis.

With our focus on delivering against CEBRAs key objectives, over the past 12 months we have been implementing a research agenda across five Core Activity themes:

- **Data Mining** This research will provide government agencies with tools to inform the design and implementation of biosecurity strategies, as well as providing real-time information to support timely biosecurity strategic decisions.
- **Spatial Analysis** This research will provide government agencies and managers with information to develop cost-effective targeted, monitoring, control or eradication programs.
- **Intelligence** Intelligence research develops and tests tools to assist biosecurity managers to foresee new threats. Such tools will assist governments and other managers to minimise the threat of future biosecurity incursions.
- **Benefit Cost** The knowledge and tools gained from this research provide governments with the information to make cost efficient decisions in dealing with biosecurity risk.

> "The objectives of the Centre are to deliver practical, rigorous solutions and advice related to the assessment, management, perception and communication of biosecurity risk"

- **Pathways** Pathways research develops tools and protocols for structuring the information about biosecurity threats on various exposure pathways, including traded commodities, vessels, and natural dispersal pathways. The research assesses how different strategies can be used to reduce the probability of incursion.

Notable research highlights throughout the first year of CEBRA include:

- Collaboration with CSIRO Scientist Simon Barry and Australian Research Council Future Fellow, Dr Jane Elith, on CEBRA Project 1402B – Tools for Species Distribution Modelling for Surveillance.
- Completing 13 workshops over the last 7 months with the Department of Agriculture in support of Project 1304B – Handling Uncertainty in the Risk-Return Resource Allocation (RRRA) Model. The workshops have been critical in eliciting specific data from the accumulated experience and observations of Department staff.
- Research collaboration with New Zealand's Ministry for Primary Industries on Project 1402C – Estimation of National-Level Farm Demographic Data for Preparedness of Highly-Infectious Livestock Disease Epidemics.
- Project 1304A – Cost–effective surveillance for foot-and-mouth disease (FMD) has constructed a very useful, detailed bioeconomic model for optimal 'early detection' measures against a possible FMD incursion using different surveillance protocols.
- Further collaboration with NZ through the Intelligence Gathering and Analysis project. The project delivered consolidated software into a single platform and launched the new animal and plant site in September. In October 2013 CEBRA held workshops in Wellington to induct the staff of the Ministry for Primary Industries New Zealand to the new intelligence gathering and analysis software.

Through implementing this research agenda, our focus remains firmly on the Centre's objective to deliver practical solutions and advice for assessing and managing Australia's biosecurity risks.

In our first year as CEBRA we have delivered 29 peer-reviewed publications, secured 7 external contracts or consultancies, participated in 25 conferences and presentations, as well as completing drafts of several technical reports for external review.

I would like to thank everyone who contributed to establishing CEBRA, making our first year such a success and to helping transition so smoothly from ACERA.

Prof Mark Burgman FAA

Recognition for Professor Mark Burgman

CEBRA's Professor Mark Burgman has been awarded the 2013 Royal Society of Victoria Medal for Excellence in Biological Sciences (Non-human).

The 'Medal lecture' was presented by Mark Burgman to the Society after the presentation, titled: *Confidence, scientific judgement and the intelligence game.*

The society's most prestigious medal is based on demonstration of the candidate's excellence and leadership in scientific research.

Professor Burgman accepted his award from The Hon Alex Chernov AC QC, Governor of Victoria and Patron of the Society at a ceremony in December 2013.

02 CORE ACTIVITIES

Summary of Core Activities

The Core Activities that the Centre undertook during the Financial Year 2013/2014 comprise the following project plans approved at Biosecurity Research Steering Committee Meeting # 2 on June 24, 2013:

TABLE 1 CORE ACTIVITIES FOR 2013/14

PROJECT	TITLE	2013-2014 BUDGET
	DATA MINING	
1301A	Data mining to improve biosecurity risk profiling	$240,000
1301B	Analytical assessment of leakage surveys	$90,000
1301C	Improving ballast water risk tables	$90,000
	SPATIAL ANALYSIS	
1302A	Evaluation of arrival pathways and species distribution models	$101,000
	INTELLIGENCE	
1303A	Intelligence gathering and analysis	$216,000
	BENEFIT COST	
1304A	Cost effective surveillance of foot-and-mouth disease	$95,000
1304B	Handling uncertainty in the Risk-Return Resource Allocation (RRRA) model	$50,000
1304C-SP	Market-based incentives for biosecurity compliance	$65,000
	PATHWAYS	
1305A	Ornamental fish import surveillance systems	$50,000
1305B	Plant-product pathways and the Continuous Sampling Plan	$77,000
TOTAL		**$1,074,000**

2013/14 CEBRA Biosecurity Research Projects

DATA MINING

AR

Project ID 1301A
Title Data mining to improve biosecurity risk profiling
Leader Greg Hood
MPI Collaborator Christine Reed
Sponsor Raelene Vivian
Budget (13/14) $240,000

AR

Project ID 1301B
Title Analytical assessment of leakage surveys
Leader Alan Kuffer
MPI Collaborator Sean Callis
Sponsor Wayne Terpstra
Budget (13/14) $90,000

AR

Project ID 1301C
Title Improving ballast water risk tables
Leader Peter Stoutjesdijk
Sponsor Carol Sheridan
Budget (13/14) $90,000

SPATIAL ANALYSIS

MB

Project ID 1302A
Title Evaluation of arrival pathways and species distribution models
Leaders Chris Starkey, Ian Gaze, Peter Stoutjesdijk, Tony Arthur
Sponsor Tim Chapman
Budget (13/14) $101,000

INTELLIGENCE

MB

Project ID 1303A
Title Intelligence gathering and analysis
Leaders Geoff Grossel, Neil Grant, Sam Hamilton
MPI Collaborator Christine Reed and Haritina Mogosanu
Collaborator Shaun Moss
Sponsor Andrew Cupit
Budget (13/14) $216,000

BENEFIT COST

TK & SH

Project ID 1304A
Title Cost effective surveillance of foot-and-mouth disease
Leader Graeme Garner
MPI Collaborator Christine Reed
Sponsor Tim Chapman
Budget (13/14) $95,000

MB

Project ID 1304B
Title Handling uncertainty in the Risk-Return Resource Allocation (RRRA) model
Leader Jean Chesson
Sponsor Greg Williamson
Budget (13/14) $50,000

SH

Project ID 1304C
Title Market-based Incentives for biosecurity compliance
Leaders Christina Aston and Jessica Sibley
MPI Collaborator Jeremy Chirnside and Sean Callis
Collaborator Peter Bardsley
Sponsor David Heinrich
Budget (13/14) $65,000

PATHWAYS

AR

Project ID 1305A
Title Ornamental fish import surveillance systems
Co-Project Leader Ramesh Perera
MPI Co-Project Leader Brian Jones
Sponsor Andrew Cupit
Budget (13/14) $50,000

AR

Project ID 1305B
Title Plant-product pathways and the Continuous Sampling Plan
Leaders Christina Aston and Jessica Sibley
Sponsor Tom Aldred
Budget (13/14) $77,000

KEY

CEBRA Project Managers:

- MB Mark Burgman
- AR Andrew Robinson
- SH Susie Hester
- TK Tom Kompas

Project Summaries

1301A DATA MINING TO IMPROVE BIOSECURITY RISK PROFILING

The Department of Agriculture has adopted a risk-based approach to managing the biosecurity risk of various pathways. During Increased Quarantine Intervention (IQI), introduced in 2001, inspection for a number of pathways was increased to 100%. A risk-based approach to management would be based on a statistical analysis of inspection outcomes, and enable the commitment of inspection resources to higher-risk pathways and activities.

CEBRA project 1301A comprises a suite of seven sub-projects, each of which focuses on a separate compliance undertaking and uses a different analytical tool. The sub-projects are as follows:

1. Geocoding international mail interceptions applies spatial analysis to the delivery addresses and categories of mail articles that are intercepted carrying high-risk biosecurity material;
2. Generalised pattern analysis for international passengers applies data mining tools to a passenger interception database that has been augmented by data from the Departments of Immigration and Customs;
3. Detecting anomalous broker activity uses combinations of Customs and Agriculture data to profile import brokers;
4. Risk factor extraction with VMS uses data mining techniques to profile international vessels;
5. Estimating compliance with inadequate data (transfer learning) assess the degree to which information from well measured pathways can be 'shared' with less known pathways;
6. Performance indicators for Cargo Compliance Verification develops statistical tools that can be used to report the CCV undertaking; and
7. Predicting hitchhiker pest activity combines interception information and the biology of invasive pests to try to refine intervention efforts.

These sub-projects have been prioritised, and substantial progress has been made against sub-projects 1, 2, 4, and 6; this is reported in CEBRA Report 1301A OID1.

1301B ANALYTICAL ASSESSMENT OF LEAKAGE SURVEYS

The Department of Agriculture screens and inspects in the international passenger and mail pathways. For the last ten years the Department has assessed its intervention and screening effort in these pathways by means of endpoint surveys. The endpoint surveys involve inspecting a sample of the passengers or mail after all other intervention. This two-year project involves a review of how the endpoint surveys are carried out along with recommendations as to how it could be improved. The components of the project are both underway, namely, a review of relevant literature, and conference call interviews with the border staff who manage the pathways and undertake the inspection and endpoint survey activities.

1301C IMPROVING BALLAST WATER RISK TABLES

The Department of Agriculture uses Ballast Water Risk Tables (BWRT) to prescribe ballast water management for vessels that travel from port to port within Australia. The major user of these tables is the Marine Pest Sectoral Committee (MPSC). These tables are based on a combination of departure port, departure month, and arrival port. The algorithm uses port surveys, climate data (measured for some ports and modelled for the others), and models of pest uptake, life cycle, and reproduction, to predict the risk that any of seven invasive pests might successfully invade the arrival port as a consequence of ballast water exchange. Ballast water exchange in the port is prohibited if the risk is too high.

BWRT construction was based on a workflow developed in a suite of projects undertaken by CSIRO, and involved a complex sequence of steps that required shifting between software platforms. Previous work by ACERA identified several shortcomings in the implementation of the tables. The current project has developed candidate fixes for these shortcomings. The conclusion of the project has been delayed to obtain MPSC consent to the proposed upgrades.

1302A SPATIAL ANALYSIS TOOLS

The primary objective of this project was to evaluate spatial tools and methodologies which can inform high risk pathways and priority locations for the potential establishment of species of concern (SOC). The Department of Agriculture's (DA) current risk assessment tools for the marine environment do not have the capacity to characterise high risk pathways based on the current distribution and ecological tolerances of biofouling species of concern, or ports visited by international vessels arriving in Australia. In terrestrial environments there is no single broadly accepted, easy to implement methodology to pinpoint high priority locations for potential SOC establishment.

In order to select the most appropriate tools, a range of DA and academic experts participated in several workshops. These workshops identified the range of available methodologies to be assessed, the criteria they were to be assessed against, and example scenarios in both marine and terrestrial contexts for the methodologies to be applied to. Criteria for assessment were broadly based on the defensibility of the methodologies and the human and organisational factors that needed to be considered for successful implementation. For each method experts assessed each of the criteria using a Likert score as well as providing comments.

The final report outlined the experts' assessments of the methodologies and the method recommendations for the marine and terrestrial contexts. The results of this work were used to design the follow-up projects, to run in 2014-15, to develop new, spatially explicit modelling tools that are suited to a range of biosecurity contexts, and suitable for marine and terrestrial contexts.

1303A INTELLIGENCE GATHERING AND ANALYSIS (IBIS)

In 2012-13, the project team developed a new web site, AquaticHealth.net, an open-source aquatic biosecurity intelligence gathering and analysis application. The system collected information in much the same way as other similar systems (e.g. HealthMap, BioCaster). However, the information collected undergoes minimal automated analysis, and analysis is largely left to AquaticHealth.net's users. The result was an automated system of intelligence gathering, combined with a manual system of intelligence analysis. This approach relies on a large number of users, and so AquaticHealth.net relies on an open-intelligence analysis method: any user can publish their own analyses for all to see and analyse further. By combining automated data collection and human analysis, AquaticHealth.net provides fast and accurate forecasts, accompanied with nuanced explanations.

"The result was an automated system of intelligence gathering, combined with a manual system of intelligence analysis." (CEBRA Project 1303A)

This research compliments other intelligence initiatives and activities within the Department of Agriculture. The project was progressed as a proof-of-concept and resulted in the creation as part of the current project in 2013-14 of aquatic health (www.aquatichealth.net), plant health (www.planthealth.org), and animal health (www.animalhealth.org), of which the aquatic site is the most operationally advanced. In the final stages of this project, the aquatic and terrestrial animal and plant intelligence gathering and analysis tools were integrated on one site (named the International Biosecurity Intelligence System or IBIS). Integration on a single platform improves intelligence sharing, achieves synergies in research and IT building efficiency and simplifies ongoing site maintenance. The site development included many changes to the graphic interfaces and data summary pages, to enhance performance and understanding. The research group also developed manuals to support users, and implemented searches of materials in languages other than English.

> "The project has also generated a new analytical platform for solving optimal surveillance problems based on simulation results"
> (CEBRA Project 1304A)

1304A COST-EFFECTIVE SURVEILLANCE OF FOOT-AND-MOUTH DISEASE

The project is halfway through its two-year funding period. It has constructed a bioeconomic model for optimal 'early detection' measures against a possible FMD incursion using different surveillance protocols. The initial focus is on Victoria and the dairy regions in particular. Contrary to expectations, results show that the value of bulk-milk testing for the early detection of FMD is not cost effective at any reasonable parameter values. Enhanced passive surveillance measures (e.g., educational programs, on-farm training, etc.) appear to be more promising and cost-effective, underscoring the importance of the work on enhanced passive surveillance done by Animal Health Australia. The project has also generated a new analytical platform for solving optimal surveillance problems based on simulation results. This should be applicable to a wide variety of surveillance activities in the Department.

1304B HANDLING UNCERTAINTY IN THE RISK-RETURN RESOURCE ALLOCATION (RRRA) MODEL

The Risk-Return Resource Allocation (RRRA) project provides a framework for the department to make resource allocation decisions that account for biosecurity risk. The project team has developed a model for estimating risk and cost given specified biosecurity investment scenarios. The model has been applied to 51 pathways. The RRRA project contributes to the Department of Agriculture's priorities of 'continuing the transition to a fully integrated risk-based approach to managing biosecurity risk offshore, at the border and onshore' and 'to develop a decision support system that will analyze the cost and effectiveness of biosecurity controls, thereby supporting the Department of Agriculture's Executive to make risk based decisions on biosecurity expenditure'.

The basic structure of the model is complete. It allows users to compare output from alternative scenarios to determine whether a change in investment would be desirable. Currently, the model calculates expected (mean) values. The model estimates the number of organisms of quarantine concern that are expected to arrive on each pathway. Risk is defined as the probability that an organism enters, establishes and spreads in Australia multiplied by the consequences of its spread. Each pathway application of the RRRA model includes many parameters (>100). As in all risk analyses, model structures and the values of individual parameters are uncertain.

The objective of this project is to identify and evaluate methods for characterizing and reporting uncertainty in the stochastic RRRA model. Uncertainties arise from;

- the different ways in which operational details are simplified in the model's functions and assumptions,
- the natural variation that occurs in input parameters such as the volume of trade, composition and country of origin of trade, prevalences of pests and diseases in consignments, and so on, and
- lack of knowledge about these parameters.

The project final report outlines methods for dealing with each of these sources of uncertainty, and scopes alternative ways of analyzing them to support decision making. It identifies and evaluates methods for characterizing and reporting uncertainty in the stochastic RRRA model.

1304C MARKET-BASED INCENTIVES FOR BIOSECURITY COMPLIANCE

This project aims to understand the response of import-chain participants to compliance-based inspection protocols, and supports the Department of Agriculture's move towards a risk-based approach to biosecurity inspections. One feature of compliance-based protocols might be that importers with good compliance history are rewarded with a lower frequency of inspection, such as is the case with the CSP-3 adaptive sampling algorithm, recently implemented on several plant-product pathways.

The project's first workshop was held November 2013 and was used to discuss project objectives, key players in the import-supply chain, inspection regimes and possible case-study pathways. A group of thirteen potential case studies were suggested and after analysis of AIMS (AQIS Import Management System) and incident data, six plant-product pathways were selected for further investigation: green coffee beans; peat; cut flowers; plant-based stockfeed; dried vegetables; and vegetable seeds. Five customs brokers and five importers on each pathway were invited to participate in an interview where they would be asked to share their experiences with Australia's biosecurity system, and give details of interactions with other import-chain participants for their particular pathway. Interviews commenced in June 2014 and are providing valuable (and sometimes unexpected) information about the intricacies and peculiarities of the importing process for each pathway.

Along with theoretical modelling, analysis of the interviews will help reveal the degree to which different agents in the supply chain (i.e. suppliers, customs brokers and/or importers) may be influenced by introducing compliance-based protocols; the type of measures that would provide the greatest potential to influence behaviour; and how inspection protocols could be designed to encourage import-chain participants to comply with biosecurity requirements.

1305A ORNAMENTAL FISH IMPORT SURVEILLANCE SYSTEMS

Trade in live animals facilitates spread of infectious diseases. Ornamental finfish are of particular biosecurity concern worldwide because they carry viruses in three genera of the family Iridoviridae (referred to generally as iridoviruses). The current requirements for importation of ornamental fish to Australia include pre-border health certification and a mandatory on-arrival quarantine period of one to three weeks (depending on the species) in registered quarantine-approved premises (QAPs). Quarantined fish are observed for signs of disease, but are not directly tested. Diseased fish can be asymptomatic and so may not show visible signs of disease.

The Department of Agriculture has proposed changes to the way it manages the disease risks associated with imported ornamental fish. The proposed changes include the introduction of on-arrival health surveillance that will allow the department to monitor the performance of overseas authorities and exporters in meeting the health requirements for ornamental fish exported to Australia. This ongoing project focuses on developing and trialling a sampling framework for the proposed surveillance program. Phase two of the sampling framework is underway in the South East Regional Office.

1305B PLANT-PRODUCT PATHWAYS AND THE CONTINUOUS SAMPLING PLAN

Studies of CSP (continuous sampling plan) strategies carried out by ACERA, ABARES and the Plant Division of the Department of Agriculture have shown that CSP combined with stratification by factors such as importers, suppliers, and countries can increase detection rate relative to random sampling with the same effort for some pathways of import activity. This project is designed to extend the usability of CSP technology into further pathways by various means.

This ongoing project involves recoding of the CSP software to increase its speed of execution and improve its concordance with pathway risk management, an examination of the natures of the fails detected, and development of more reliable ways of analysing the data that arise from CSP sampling to underpin better management of the biosecurity risk both within and between pathways.

Deliverables and Milestones Achieved

The following table details the Core Material that was produced in the financial year in review as a result of conducting the Core Activities, which Core Material will be submitted to the Commonwealth for endorsement in accordance with clause 3.9 of the Funding Agreement and the current status of the Core Material.

TABLE 2 RESEARCH OUTPUTS

PROJECT ID	OUTPUT ID	OUTPUT	DUE DATE	FOR ENDORSEMENT	STATUS
1301A	1	Review of data sources	Jan-14	Yes	Complete
	2	Report of first suite of project	Sep-14	Yes	In Progress
	3	Report of second suite of project	Jun-15	Yes	In Progress
1301B	1a	Detailed plan for workshops	Mar-14	No	Complete
	2a	Conduct workshops	Jul-14	No	In Progress
	3a	Conduct literature review	Jul-14	Yes	In Progress
	4a	Complete draft report of findings	Nov-14	No	In Progress
	5	Finalise report incorporating feedback from stakeholders, and submit to Steering Committee for endorsement	Jan-15	Yes	In Progress
	6	Discussions with key stakeholders on the preferred solutions to identified issues	Apr-15	No	In Progress
	7	Complete draft procedural documentation to address the issues as agreed	Jun-15	Yes	In Progress
1301C	1	Refine existing methodology to address issues identified for Phase	Oct-13	No	Complete
	2	Development of new R code to implement new methodology	Jun-13	No	Complete
	3	Summary of proposed risk changes to be provided to MPSC	Jan-14	No	Complete
	4	Generation of new risk tables using new R code based on current port survey dataset and updated temperature dataset	Jan-14	No	Complete
	5	Determination of appropriate format of BWRA outputs to address issue of month to month voyages	Mar-14	No	In Progress
	6	Provision of a draft final project report	May-14	No	In Progress
	7	Provision of final copy-edited report	Jun-14	Yes	In Progress

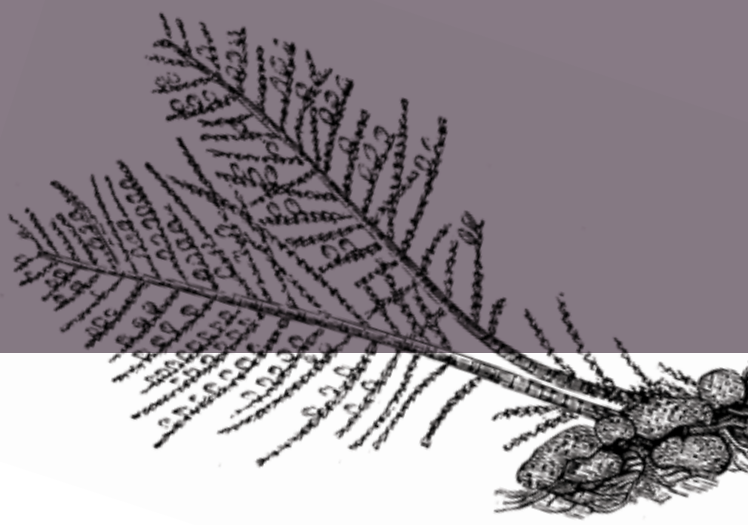
TABLE 2 RESEARCH OUTPUTS CONT.

PROJECT ID	OUTPUT ID	OUTPUT	DUE DATE	FOR ENDORSEMENT	STATUS
1302A	1	Finalisation of project outline	Oct-13	No	Complete
	2	Workshop to develop assessment criteria and finalise scenarios	Mar-14	No	Complete
	3	Distribution and collation of technical assessments	Mar-14	No	Complete
	4	Interim report outlining technical tools, scenarios and assessment criteria	May-14	No	Terminated
	5	Completion of iteration of assessments of tools against criteria for each scenario	Dec-13	No	Complete
	6	Final Report documenting	May-14	Yes	In Progress
1303A	1	1a – IBIS aquatic health site operational 1b – IBIS aquatic health site beta-testing complete	Aug-13	No	Complete
	2	1c – IBIS terrestrial site operational 1d – IBIS terrestrial site beta-testing complete	Oct-13	No	Complete
	3	1e – Outline of development plan and timelines for plant health site	Dec-13	No	Complete
	4	2a – Independent legal advice on social media issues	Oct-13	No	Complete
	5	3a – Cluster and geo-spatial analysis	May-14	No	Complete
	6	3b – Expert elicitation system implemented	May-14	Yes	Terminated
1304A	1	Establish a Project Steering Committee	Jul-13	No	Complete
	2	Establish an End-Users Group (including representatives from DoA and AHA) and meetings with the Project Team throughout the term of the project.	Ongoing	No	Complete
	3	Develop and conduct a scoping workshop for the project, establishing project design, collaboration and additional reporting mechanisms.	Aug-13	No	Complete
	4	Draft Report for candidate surveillance measures and workshop.	Apr-14	No	Complete
	5	Presentation of the results to stakeholders and at international and domestic conferences and workshops.	Sep-14 Dec-14	No	In Progress
	6	Final presentation to DoA and Policy Briefing.	Jun-15	No	In Progress
	7	Final report	Jun-15	Yes	In Progress
1304B	1	Agreed approaches and evaluation criteria	Aug-13	No	Complete
	2	Interim Report	Dec-13	No	Complete
	3	Final Report	May-14	Yes	Complete
1304C	1	Initial workshop	Oct-13	No	Complete
	2	Completion of importer interviews/surveys	Feb-14	No	Complete
	3	Completion of data analysis	May-14	No	In Progress
	4	Completion of theoretical principles underpinning incentives	Aug-14	No	In Progress
	5	Completion of final report	Dec-14	Yes	In Progress

TABLE 2 RESEARCH OUTPUTS CONT.

PROJECT ID	OUTPUT ID	OUTPUT	DUE DATE	FOR ENDORSEMENT	STATUS
1305A	1	Initial draft sampling framework	Jul-13	No	Complete
	2	Analysis and evaluation of trial phase 1	Mar-14	No	Complete
	3	Design of trial phase 2	Feb-14	No	Complete
	4	Working definition of healthy and unhealthy bags for fish inspection officers	Sep-14	No	In Progress
	5	Evaluate trial phase 2 at intervals throughout the operation and at the completion	Sep-14	No	In Progress
	6	Spreadsheet tool for phase 2	Sep-14	No	In Progress
	7	Identify protocols/analysis that can be used to prioritize signs of emerging diseases. a. Clarify criteria used in the diagnosis of an infectious disease and their analysis to identify an emerging disease that may require further investigation. b. Analysis of external and internal information, including pathology from histology, on health of ornamental fish	Dec-14	No	In Progress
	8	Updated spreadsheet tool for the ongoing surveillance system (includes monitoring for emergent risks and flexibility for expansion)	Mar-15	No	In Progress
	9	Design and recommendations for the full surveillance system	Jun-15	Yes	In Progress
1305B	1	Re-code the simulation tool	Dec-13	No	Complete
	2	Report on failure types	Dec-14	No	In Progress
	3	CSP utility measure methodology	Dec-14	No	In Progress
	4	Data mining and profiling report	Jun-15	Yes	In Progress
	5	Block bootstrapping assessment	Dec-14	No	In Progress
	6	Develop reporting tools on performance metrics	Jun-15	Yes	In Progress

03 RESEARCH & DEVELOP RISK METHODS



Adoption Activity

POST ENTRY QUARANTINE (PEQ)

The Department of Agriculture is making fundamental changes to the way that it processes live animal and high-risk plant imports; consolidating operations that were previously carried out in five separate facilities into one, in Mickleham, just north of Melbourne. In order to plan for the consolidation, the Department needed to know not only what operations were carried out at each of the existing facilities, but how they would interact with one another when all performed simultaneously at one. A simulation model was constructed of the facility using special simulation software, arrival and processing records from the facilities, and expert opinion. This simulation model allowed the Department to design the structure and function of the new facility with greater confidence, and furthermore is being used to help set and refine staffing levels.

PLANT BSG QUARANTINE INSPECTION AND AUDITING (1101C) AND PLANT PRODUCT PATHWAY ANALYSIS (1206F)

These projects involved identifying a real time, risk-based resource-allocation tool, and developing statistical diagnostic routines that could be used for identifying which quarantine pathways would be best suited for management using the tool. The projects identified CSP-3 as the best among a number of candidate tools, and provided guidelines for data mining approaches that could be used on the Department of Agriculture's historical inspection data, for example, low contamination rate, high variation of contamination rates among importers, low or zero contamination for the largest importers, etc. The Department has adopted CSP-3 for managing the risk of several low-risk imported plant pathways, including dried apricots, hulled sesame seeds, dates, and green coffee beans, and is assessing its use for risk-based management of live fish. Furthermore, the Department has invested in developing a new capacity within its data management system (AIMS) that enables CSP-3 to be used for any combination of tariff, importer, and supplier. Finally, the Department is undertaking efforts to identify other low-risk pathways that can be managed similarly.

DEVELOP RISK-PROFILING MODELS AND APPROACHES FOR INTERNATIONAL PASSENGERS (1001G)

This project focused on solving a substantial challenge that the Department of Agriculture faced in identifying higer-risk cohorts of passengers that should be preferentially screened upon arrival in Australia, a process referred to as 'profiling'. Previously, profile construction had been hampered by a lack of knowledge of a key quantity, namely the number of passengers of each cohort that are processed in each channel, which include assess and release, detector dogs unit, x-ray, and manual inspection. This project identified a component of the passenger intervention, namely the leakage survey, as a potential source of the needed data. Further, the project advocated the use of an adjustment of the estimates so obtained by using a technique called raking, which updates the estimates using the known totals of cohort numbers and channel numbers, delivering improved performance and providing protection against certain kinds of selection bias. The Department has implemented this approach to profile construction for risk management in both the international passengers and international mail pathways.

"As a result of this project, EpiTools has been used in the recent Banana Freckle (*Phyllosticta cavendishii*) outbreak in the Northern Territory."

ADOPTION OF MEANINGFUL PERFORMANCE INDICATORS (1001I AND 1101D)

These projects involved the development and demonstration of performance indicators that the Department of Agriculture could use to assess the biosecurity risk and the effects of its intervention across a range of quarantine inspection operations. The project advocated four indicators, namely Before-intervention compliance rate (BIC), Post-intervention compliance rate (PIC), Non-compliance effectiveness, which refers to the probability that a contaminated item will be correctly identified, and Hit rate, which summarizes the amount of effort undertaken per contaminated item detected. These performance indicators have been calculated and reported quarterly since 2013 in the international passengers and international mail programs, are being adopted for reporting against the management of other pathways such as imported plant products, and are being considered for usage in the compliance verification scheme.

EPITOOLS

EpiTools is an online set of tools originally developed to support the selection of survey designs for estimating disease prevalence or demonstrating freedom from diseases in animal herds. ACERA Project 1004A demonstrated the use of a several of the statistical functions provided in EpiTools in a plant-surveillance context (citrus canker in the Northern Territory) with the help of biosecurity managers in Darwin. As a result of this project, EpiTools has been used in the recent Banana Freckle (*Phyllosticta cavendishii*) outbreak in the Northern Territory. Banana Freckle is a fungal disease that affects only bananas, causing blemishes on fruits and reducing their commercial value, although does not affect eating quality or human health from consumption. Epitools was used in delimiting surveillance in the Darwin / Palmerston town areas.

PHD Students

CEBRA has made substantial investments in postgraduate research training to produce graduates in all disciplines with specialist skills in risk analysis with the objective to build biosecurity risk analysis capacity in Australia.

TABLE 3 PHD STUDENTS

NAME	DESCRIPTION	SUPERVISOR
	CURRENT PHD STUDENTS	
Ashton, Raquel	PhD. Facilitation and expert judgement	Prof. Mark Burgman
Bisono, Indriati	On modeling spatial extremes	Dr Andrew Robinson
Dodd, Aaron	PhD. Predicting invasion success	Prof. Mark Burgman
Hicks, John	MPhil. Robust optimal decision making in traditional Aboriginal culture	Prof. Mark Burgman
Jones, Stuart	PhD. Numerical methods for biosecurity risk analysis	Prof. Mark Burgman
Karavarsamis, Natalie	Methods for estimating occupancy	Dr Andrew Robinson
Lazaridis, David	Regularised mixed–effects models	Dr Andrew Robinson
Malishev, Matthew	PhD. Feeding ecology and behavior	Prof. Mark Burgman
Rose, Lucy	PhD. Managing Melbourne water for biodiversity	Prof. Mark Burgman
	COMPLETED PHD STUDENTS	
Addison, Prue	PhD. Control charts for marine monitoring	Prof. Mark Burgman
Estevez, Rodrigo	PhD. Social and amenity value in risk analysis	Prof. Mark Burgman and Dr Terry Walshe
McBride, Marissa	PhD. Eliciting expert judgement	Prof. Mark Burgman
Wintle, Bonnie	PhD. Motivational bias in environmental risk assessments	Prof. Mark Burgman

Institutional Contracts and Consultancies

The specific expertise of CEBRA's staff have resulted in several institutional contracts and consultancies being executed with CEBRA. These consultancies require experience in contract management, administration, financial planning, strategic planning and business management.

TABLE 4 INSTITUTIONAL CONTRACTS AND CONSULTANCIES

CLIENT	YEAR	PROJECT	AMOUNT	INVESTIGATORS
Australian Research Council	2014-2016	LP 130100435 Red listing ecosystems – testing the new global standard for conservation	$389,065	Keith, Prof David A Kingsford, Prof Richard T Burgman, Prof Mark A Nicholson, Dr Emily Auld, Dr Tony D Rodriguez, A/Prof Jon P Regan, Dr Tracey J Pisanu, Dr Philip Lester, Dr Rebecca E
Australian Research Council	2011-2014	DP110103159 New models for effective surveillance	$255,000	Robinson, Dr. Andrew P Thompson, Prof. Mark Thompson, Prof. Colin
Forestry Tasmania	2013-2014	Technical Report of Forestry Tasmania's Proposed Specialty Timber Resource Assessment and Projection	$7,308	Robinson, Dr. Andrew P
Foursight Associates Pty Ltd and DEP	2012-2013	New National Fire Danger Rating System	$8,800	Robinson, Dr. Andrew P
Victorian Department of Environment and Primary Industries	2012-2013	Analysis of Statewide Forest Inventory (SOP 32)	$20,000	Robinson, Dr. Andrew P
Australian Government, Director of National Parks	2014	Development of a decision tool for conservation management in Commonwealth National Parks	$30,000	Walshe, Dr Terry V
Barwon Otway Bushfire Risk Landscape; Client: Victorian Department of Environment and Primary Industries	2013-2014	Decision support for strategic risk assessment and strategy selection	$46,181	Walshe, Dr Terry V

04 DOCUMENT & COMMUNICATE FINDINGS

Publications

Many of CEBRA's reports have been published in a range of international scientific journals, ensuring the latest findings are communicated to the scientific community, students, governments and other interested stakeholders around the world. CEBRA publications have appeared in PNAS, Ecological Applications, Risk Analysis, PLoS One, Ecography and Applied Ecology, among others.

TABLE 5 LIST OF RESEARCH PUBLICATIONS WITH ISI IMPACT FACTOR AND CITATIONS

	ISI IMPACT FACTOR 2013	NO. OF CITATIONS AS AT 30/6/14
IN PRESS/EARLY VIEW		
Burgman, M.A., Regan, H.M., Maguire, L.A., Colyvan, M., Justus, J., Martin, T.G. and Rothley K. (2014 early view) Voting systems for environmental decisions. **Conservation Biology**.	4.355	-
Decrouez, G. and Robinson, A.P. (2014 submitted) Measuring the inspectorate: point and interval estimates for performance indicators. **Journal of Agricultural, Biological, and Environmental Statistics**.	N/A	-
Elith, J. (2014 accepted) Chapter 6: predicting distributions of invasive species. available now from arXiv: http://arxiv.org/abs/1312.0851 In, Walshe, T.R., Robinson, A., Nunn, M. and Burgman, M.A. ***Risk-based decisions for biological threats***. Cambridge University Press.	N/A	-
Jaskierniak, D., Benyon, R., Kuczera, G., and Robinson, A.P. (2014 submitted) A new method for measuring stand sapwood area in forests. **Ecohydrology**.	2.775	-
Keith, D.A., Elith, J. and Simpson, C.C. (2014 early view) Predicting distribution changes of a mire ecosystem under future climates. **Diversity and Distributions**.	6.122	-
Keith, D.A., Mahony, M., Hines, H., Elith, J., Regan, T.J., Baumgartner, J.B., Hunter, D., Heard, G.W., Mitchell, N.J., Penman, T., Parris, K.M., Tracey, C., Scheele, B., Simpson, C.C., Tingley, R., West, M. and Akcakaya, H.R. (2014 in press) Detecting extinction risk from climate change by IUCN Red List criteria. **Conservation Biology**.	4.355	-
Mills, M., Nicol, S., Wells, J.A., Lahoz-Monfort, J.J., Wintle, B., Bode, M., Wardrop, M., Walshe, T., Probert, W.J.W., Runge, M.C., Possingham, H.P. and McDonald Madden, E. (2014 in press) Minimizing the cost of keeping options open for conservation in a changing climate. **Conservation Biology**.	4.355	-
Panetta, D.F. and Cacho, O. (2014/ Early View) Designing weed containment strategies: An approach based on feasibilities of eradication and containment. **Diversity and Distributions**.	6.122	-

TABLE 5 LIST OF RESEARCH PUBLICATIONS CONT.

	ISI IMPACT FACTOR 2013	NO. OF CITATIONS AS AT 30/6/14
2014		
Burgman, M.A. and Regan, H.M. (2014) Information-gap decision theory fills a gap in ecological applications. **Ecological Applications**, 24: 227-228.	3.815	1
Mills, M., Nicol, S., Wells, J,A., Lahoz-Monfort, J.J., Wintle, B., Bode, M., Wardrop, M., Walshe, T., Probert, W.J.M., Runge, M.C., Possingham, H.P. and McDonald Madden, E. (2014) Minimizing the cost of keeping options open for conservation in a changing climate. **Conservation Biology**. 28: 646 – 653.	4.355	-
Runge M.C and Walshe T. (2014) Identifying objectives and alternative actions to frame a decision problem. In Guntenspergen, G.R. ***Application of Threshold Concepts in Natural Resource Decision Making***. Springer pp. 29-44.	N/A	-
Shtilerman, E., Thompson, C.J., Stone, L., Bode, M. and Burgman, M. (2014) A novel method for estimating the number of species within a region. **Proceedings of the Royal Society**, Series B.	n/a	-
2013		
Addison, P.F.E., Rumpff, L., Bau, S.S., Carey, J.M., Chee, Y.E., Jarrad, F.C., McBride, M.F. and Burgman, M.A. (2013) Practical solutions for making models indispensable in conservation decision-making. **Diversity and Distributions** 19: 490-502	6.122	4
Burgman, M.A., McCarthy, M.A., Robinson, A., Hester, S.M., McBride, M.F., Elith, J and Panetta, F.D. (2013) Improving decisions for invasive species management: reformulation and extensions of the Panetta-Lawes eradication graph. **Diversity and Distributions**. 19: 603-607.	6.122	4
Burgman, M., Roberts, B., Sansford, C., Griffin, R. and Mengersen, K. (2013) The role of pest risk analysis in plant biosecurity. In. Gordon Gordh and S. McKirdy (eds) ***The Handbook of Plant Biosecurity***. Chapter 9, pp. 235-267. Springer, New York.	n/a	
Burgman, M. A. and Yemshanov, D. (2013) Risks, decisions and biological conservation. **Diversity and Distributions**, 19: 485-489	6.122	-
Crase, B., Liedoff, A., Vesk, P.A., Burgman, M., and Wintle, B.A. (2013) Hydroperiod in the main driver of the spatial pattern of dominance in mangrove communities. **Global Ecology and Biogeography** 22: 806-217.	7.223	2
Dormann, C.F., Elith, J., Bacher, S., Buchmann, C., Carl, G., Carré, G., Diekötter, T., García Marquéz, J., Gruber, B., Lafourcade, B., Leitão, P.J., Münkemüller, T., McClean, C., Osborne, P., Reineking, B., Schröder, B., Skidmore, A.K., Zurell, D. & Lautenbach, S. (2013) Collinearity: a review of methods to deal with it and a simulation study evaluating their performance. **Ecography**, 36: 27–46.	5.124	132
Decrouez, G, and Robinson, A.P. (2013) Time-series models for border inspection data. **Risk Analysis**, 33: 2142-2153	2.278	-
Drescher, M., Perera, A.H., Johnson, C.J., Buse, L.J., Drew, C.A., and Burgman, M.A. (2013) Towards rigorous use of expert knowledge in ecological research. **Ecosphere**, 4: 1-26.	n/a	2
Elith, J. & Franklin, J. (2013) Species distribution modeling. In ***Encyclopedia of Biodiversity***, 2nd Edition (ed. S.A. Levin), pp. 692-705. Academic Press, Waltham, MA.	n/a	-
Elith, J. Simpson, J., Hirsch, M. & Burgman, M. A (2013) Taxonomic uncertainty and decision making for biosecurity: spatial models for myrtle/guava rust. **Australasian Plant Pathology**, 42: 43-51	1.021	7
Estevez, R.A., Walshe, T. and Burgman, M. A (2013) Capturing social impacts for decision-making; a Multicriteria Decision Analysis perspective. **Diversity and Distributions**, 19:608-616	6.122	2

TABLE 5 LIST OF RESEARCH PUBLICATIONS CONT.

	ISI IMPACT FACTOR 2013	NO. OF CITATIONS AS AT 30/6/14
Guisan, A., Tingley, R., Baumgartner, J.B., Naujokaitis-Lewis, I., Sutcliffe, P.R., Tulloch, A.I.T., Regan, T.J., Brotons, L., McDonald-Madden, E., Mantyka-Pringle, C., Martin, T.G., Rhodes, J.R., Maggini, R., Setterfield, S.A., Elith, J., Schwartz, M.W., Wintle, B.A., Broennimann, O., Austin, M., Ferrier, S., Kearney, M.R., Possingham, H.P. & Buckley, Y.M. (2013) Predicting species distributions for conservation decisions. **Ecology Letters**, 16: 1424-1435.	17.949	19
Hester, S.M., Cacho, O.J., Panetta, F.D. and Hauser, C.E. (2013) Economic aspects of weed risk management, **Diversity and Distributions**, 19: 580-589.	6.122	12
Holliday, J.L., Jones, S.A., Simpson, J.A., Glen, M., Edwards, J., Robinson, A. and Burgman, M.A. (2013) A novel spore collection device for sampling exposure pathways: a case study of Puccinia psidii. **Plant Disease**, 97: 828-834.	2.455	-
Keith D.A., Rodrıguez J.P., Rodrıguez-Clark K.M., Nicholson E., Aapala K., Alonson, A., Asmussen A., Bachman S., Basset A., Barrow E.G., Benson J.S., Bishop M.J., Bonifacio R., Brooks T.M., Burgman M.A. et al. (2013) Scientific Foundations for an IUCN Red List of Ecosystems. **PLoS ONE** 8(5): e62111. doi:10.1371/journal.pone.0062111	3.73	18
Karavarsamis, N., Robinson, A.P., Hepworth, G., Hamilton, A.J., and Heard, G.W. (2013) Comparison of four bootstrap-based interval estimators of species occupancy and detection probabilities. **Australian and New Zealand Journal of Statistics**, 55(3):235-252.	n/a	-
Lyon, A., Grossel, G., Burgman, M.A. and Nunn, M. (2013) Using intelligence to manage biosecurity risks: a case study for aquatic animal health. **Diversity and Distributions**, 19: 640-650.	6.122	4
Lyon, A., Mooney, A. and Grossel, G. (2013) Using AquaticHealth.net to Detect Emerging Trends in Aquatic Animal Health. **Agriculture**, 3(2): 299-309.	n/a	-
Mitchell, M., Gude, J., Anderson, N., Ramsey, J., Thompson, M., Sullivan, M., Edwards, V., Gower, C., Cochrane, J., Irwin, E. and Walshe, T. (2013) Using structured decision making to manage disease risk for Montana wildlife. **Wildlife Society Bulletin**, 37: 107–114.	n/a	1
Phillips, S.J. and Elith, J. (2013) On estimating probability of presence from use-availability or presence-background data. **Ecology**, 94: 1409-1419.	5.175	8
Potts, J.M., Cox, M.J., Barkley, P., Christian, R., Telford, G. and Burgman, M.A. (2013) Model-based search strategies for plant diseases: a case study using citrus canker (Xanthomonas citri). **Diversity and Distributions**, 19:590-602.	6.122	5
Rout, T. and Walshe, T. (2013) Accounting for time preference in management decisions: an application to invasive species. **Journal of Multi-Criteria Decision Analysis**, 20: 197 – 211.	n/a	-
Sinden, J.A., Downey, P., Cacho, O. and Hester, S. (2013) Cost effectiveness in site selection to protect native plant communities from the weed, bitou bush, in Australia, **Journal of Environmental Management**, 128: 1071-1080.	3.057	1
Sutherland, W.J., Spiegelhalter, D. and Burgman, M.A. (2013) Twenty tips for interpreting scientific claims. **Nature (Comments)**, 503: 335-337	38.59	12
Thompson, C.J., Lee, T.E., Stone, L., McCarthy, M.A., and Burgman, M.A. (2013) Inferring extinction risks from sighting records. **Journal of Theoretical Biology**, 338: 16-22.	2.351	1

Presentations

CEBRA technical staff have been invited to make Keynote, Plenary and Session Chair Representations of their research findings. The academics are also regularly invited to make presentations at national and international conferences and attend workshops to keep up to date with the latest research and issues within the industry. A summary of these representations is as follows:

TABLE 6 DOCUMENT AND COMMUNICATE FINDINGS

EVENT DATES	TOPIC / EVENT	LOCATION	ORGANISATION	FACILITATOR NAME
		2013		
1-5 July	Winter School in Mathematical and Computational Biology	University of Queensland, Brisbane	ARC Centre of Excellence in Bioinformatics	Dr Jane Elith
8-12 July	Experts, judgement and the intelligence game / Mathematics of Planet Earth Australia 2013	Melbourne	Australian Mathematical Sciences Institute (AMSI)	Prof Mark Burgman
11-12 July	Symposium: New Opportunities at the Interface between Ecology and Statistics	University of NSW	Ecological Statistics Research Group	Dr Jane Elith
11-15 July	Models for Spatial, Temporal and Network Data - A UAI Application Workshop at the Conference of Uncertainty in Artificial Intelligence	Bellevue, Washington USA	The Association for Uncertainty in Artificial Intelligence	Dr Ann Nicholson Dr Yung En Chee
18-26 July	Workshops	Florida, USA	University of Central Florida USA	Dr Ann Nicholson Dr Yung En Chee Pedro Quintana-Ascencio John Fauth
12 August	Using Border Information in Smarter Ways for Identifying Risks and Monitoring Performance of Risk Management / New Zealand Plant Protection Society Symposium: Risk Analysis for Imports and Exports.	Napier, New Zealand	New Zealand Plant Protection Society	Dr Andrew Robinson
3 September	Making Science Work for Government / CEED Annual Conference (Plenary)	University of Queensland	Centre of Excellence for Environmental Decisions (CEED)	Prof Mark Burgman
4 September	TESS Seminar: Making science work: effective environmental science for regulators and policy makers	Cairns	James Cook University	Prof Mark Burgman
11 September	Making Science Work for Government / 1st Global Conference on Research Integration	Manning Clarke Centre, Australian National University	ARC Centre of Excellence in Policing and Security	Prof Mark Burgman

TABLE 6 DOCUMENT AND COMMUNICATE FINDINGS CONT.

EVENT DATES	TOPIC / EVENT	LOCATION	ORGANISATION	FACILITATOR NAME
11-12 September	The contribution of passive surveillance to biosecurity outcomes	Crawford School of Public Policy, ANU, Canberra	Society for Risk Analysis – Australia and New Zealand	Dr Susie Hester
12 September	Performance Indicators for Regulatory Inspectorates / SRA ANZ 7th Annual Conference	Canberra	Society for Risk Analysis (SRA ANZ)	Dr Andrew Robinson
12 September	Using Inspection Information to Identify and Ameliorate Risks, and Monitor Performance of Risk Management / Maths of Planet Earth Biosecurity and Bioinvasion Workshop	Canberra	Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Dr. Andrew Robinson
12 September	The Intelligence Game / Australian and New Zealand Society for Risk Analysis Conference Zealand	Crawford School, Australian National University	Society for Risk Analysis (SRA ANZ)	Prof Mark Burgman
17 September	Strategic Risk Workshop	Rydges, Melbourne	Defence Science Institute	Prof Mark Burgman Dr Ann Nicholson
23-27 September	NIMBioS working group on linking species interactions and inferences about species distributions	USA	National Institute of Mathematical and Biological Synthesis (NIMBios)	Dr Jane Elith
7-11 October	Species Distribution Modelling	University of Queensland, Brisbane	Centre of Excellence for Environmental Decisions (CEED)	Dr Jane Elith
22 October	Intelligence and Uncertainty in Risk Analysis	Melbourne	Food Standards Australia New Zealand (FSANZ)	Prof Mark Burgman Dr Andrew Robinson
11 November	How to win friends and influence people: automatically assigning resources based on risk / Department of Agriculture Public Seminar	Canberra	Department of Agriculture	Dr Andrew Robinson
26 November	Uncertainty in Expert Judgement: implications for Risk Communication / Australain Government Regulators' Scientific Network. Science Communication Workshop (Key Note)	Canberra	Department of Agriculture	Prof Mark Burgman
1-6 December	When is it optimal to eradicate? A decision tool applied to Siam weed	Adelaide	MODSIM 2013 – 20th International congress on Modelling and Simulation	Dr Susie Hester

TABLE 6 DOCUMENT AND COMMUNICATE FINDINGS CONT.

EVENT DATES	TOPIC / EVENT	LOCATION	ORGANISATION	FACILITATOR NAME
		2014		
1 January	Species Distribution Modelling / International Biogeography Early Career Conference	ANU Canberra	International Biogeography Society	Dr Jane Elith
2 February	Estimation of the Approach Rate From Border Inspection Data / Australian and New Zealand Industrial and Applied Mathematics (ANZIAM) 2014 Conference	Rotorua, New Zealand	Australian and New Zealand Industrial and Applied Mathematics (ANZIAM)	Dr Geoffrey Decrouez
5 March	Approaches to Targeting Biosecurity Risk: Adding Value to Valued Biosecurity/ ABARES National Outlook Conference	Canberra	Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)	Dr Andrew Robinson
4 April	Approaches to Targeting Biosecurity Risk / Department of Agriculture 2014 Biosecurity Round Table	Canberra	Department of Agriculture	Dr Andrew Robinson
7 April	Species Distribution Modelling (5 day workshop)	Melbourne	Centre of Excellence for Environmental Decisions (CEED)	Dr Jane Elith
8 July	International Biosecurity Intelligence System: a collection and analysis tool for early warning, better planning and rapid response / AMSA National Convention 2014	Adelaide	Australian Maritime Safety Authority (AMSA)	Geoffrey Grossel
2013 / 2014	Fenner Conference on the Environment Selection Committee		Australian Academy of Science	Prof Mark Burgman

05 GOVERNANCE

Chair's Report – CEBRA Advisory Board

CEBRA came into being as the direct offspring of ACERA; it was the result of a competitive process commissioned by the Department of Agriculture (DA). The successful evolution of ACERA in coming to terms with the Department's key research challenges in national biosecurity led the Department to recommission a centre of excellence in biosecurity risk analysis. This time the funding and planning of the new centre was enhanced by the participation of the New Zealand Ministry of Primary Industries (MPI).

ACERA's development was based on a recommendation of the Nairn Report on Biosecurity in Australia. Over its lifetime, the Centre fully justified the philosophy that led to its creation: by assembling the highest level of scientific capability available through a competitive process, biosecurity stewards might obtain significant operational benefits

The University of Melbourne was again successful in its rebid to host the Centre under the continuing leadership of Professor Mark Burgman and this has enabled CEBRA to make a flying start in developing and delivering on its research projects. The competitive process straddled a period in which there was a change in the Australian Government. It is gratifying that with

> "It is gratifying that with significant changes in the machinery of Government the commitment to research excellence in biosecurity risk has remained intact."

significant changes in the machinery of Government the commitment to research excellence in biosecurity risk has remained intact.

CEBRA's establishment required very significant effort both within ACERA/CEBRA management and the Department of Agriculture / Ministry of Primary Industries.

On behalf of the CEBRA Advisory Board I would like to thank all those involved in getting through an enormous volume of work in the very limited time that was available.

A significant amount of work was involved in the competitive process adopted by DA in the establishment of CEBRA but this was essential to justify the term "Centre of Excellence" and the continuing benefits associated with such centres in the national academic research framework.

Pictured Above: Dr Ron Sandland, Chair, CEBRA Advisory Board

It also enabled the Centre's Advisory Board to be refreshed although there has been significant continuity.

The involvement of the New Zealand Ministry of Primary Industries in planning CEBRA's research agenda brings another lens to bear in defining the most important biosecurity risk research challenges.

Refining the research agenda, based on a true collaboration and dialogue between the CEBRA researchers and the DA/MPI managers, has continued apace. The Advisory Board has noted a very high degree of engagement by the latter group and we continue to insist that the relevance of the research is matched by its intellectual challenge. The Science Advisory Committee (SAC) provides invaluable advice to the Board in this area.

Research in CEBRA is now focused on five key areas: Data Mining; Spatial Analysis; Intelligence; Benefit Cost, and; Pathways. This concentration of effort is designed to ensure the research outcomes will result in genuine translation to practice, a critical feature of this trailblazing initiative between Government and the research community. I am sure that I can say on behalf of the Advisory Board that under Professor Burgman's continuing leadership we are confident that CEBRA's challenging goals will be met.

"Refining the research agenda, based on a true collaboration and dialogue between the CEBRA researchers and DA/MPI managers, has continued apace."

On behalf of my colleagues on the CEBRA Advisory Board we are delighted that the University of Melbourne has again been chosen to host the Centre of Excellence and look forward to continuing success.

Dr Ron Sandland AM FTSE
Chair, CEBRA Advisory Board

TABLE 7 CEBRA ADVISORY BOARD MEMBERS

NAME	POSITION	ORGANISATION
Dr Ron Sandland AM FTSE	Chair	Independent
Dr Vanessa Findlay	Board Member (Cth)	Department of Agriculture, Plant Division
Karen Schneider	Board Member (Cth)	Department of Agriculture, ABARES
Prof. Peter Bardsley	Board Member (Host)	University of Melbourne, Economics
Prof. Aleks Owczarek	Board Member (Host)	University of Melbourne, Maths and Stats
Prof. Pauline Ladiges AO FAA	Board Member (Host)	University of Melbourne, Botany
Prof. Colin Wilks	Board Member	University of Melbourne, Veterinary Science
Dr Roger Paskin	Board Member	Primary Industries and Regions South Australia (PIRSA)
Christine Reed	Board Member	Ministry of Primary Industries
Prof. Mark Burgman FAA	Board Member (Ex Officio)	University of Melbourne, ex offico
Dr Andrew Robinson	Board Member (Ex Officio)	University of Melbourne, ex offico

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 will be to:

- Assist the Director in evaluating research proposals based on criteria of:
  - Scientific and practical merit for risk analysis;
  - Capacity/capability to deliver; and
  - Budget viability.
- Obtain peer reviews of final reports prior to submission to Department of Agriculture for endorsement.
- Provide relevant advice to researchers conducting CEBRA projects, as requested by the Director.

The composition of the SAC will be:

- Chair; Professor Colin Wilks
- A broad committee of members (20 or so) covering relevant fields of Environmental, Animal and Plant Sciences, Biosecurity, Physical, Mathematical and Social Sciences, Psychology, Philosophy and Statistics.

The responsibilities of SAC members will be:

- Chair will seek advice and peer reviews from appropriate SAC members and other colleagues on proposals 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.
- Chairs 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.

TABLE 8 SAC MEMBERSHIP

NAME	ORGANISATION
Dr Bill Roberts	CRC Plant Biosecurity
Dr Graeme Inglis	NIWA NZ
Dr Grant Rawlin	Department of Environment and Primary Industries
Professor Mark Stevenson	University of Melbourne
Professor Michael Ward	University of Sydney
Dr Naomi Cogger	Massey University
Dr Neil Tweddle	Retired Veterinarian
Dr Oliver Floerl	Cawthron Institute (NZ)
Professor Oscar Cacho	University of New England
Associate Professor Phill Cassey	University of Adelaide
Dr Rieks Van Klinken	CSIRO
Dr Simon Barry	CSIRO
Mr Rob Cannon	Retired Statistician
Dr Simon Firestone	University of Melbourne
Dr Terry Walshe	University of Melbourne
Professor Tim Carpenter	Massey University
Dr Tim Payn	Scion Research

Key Performance Indicators

CEBRA's objectives and outcomes against KPIs are summarised in the following table. In all cases, KPIs were achieved and many cases they were surpassed.

TABLE 9 KEY PERFORMANCE INDICATORS

GOVERNANCE				
STRATEGIC OBJECTIVE	**KEY PERFORMANCE INDICATOR**	**MEASURES**	**OFFICER**	**PROGRESS / OUTCOME**
CEBRA governance to offer quality actionable advice to the CEBRA Director and the Management Executive on the quality of research outputs, the direction of research, Government priorities, strategic business development and the quality and utility of research outputs.	The Advisory Board provides input to the Centre and Biosecurity Research Steering Committee (BRSC) on broad direction setting for risk analysis research through Advisory Board meetings 4 times per year	• 4 meetings per year, minimum attendance of 80% (max of two members missing) of members • Breadth, balance and experience of members of the Advisory Board	Director, Board Chair	The key issues addressed this year included: • Succession planning • DA / MPI future research priorities. • KPIs with an emphasis on adoption, uptake and implementation • Evidence based contribution to policy development • Selection process of the new research agenda • Need for a communication strategy • Business development
	Scientific Advisory Committee – approve all draft project plans and provide an assessment on all final reports	Committee successfully reviews and oversees revision of all project reports	Director, SAC Chair	The SAC reviewed all submitted business cases and provided constructive feedback to proponents to improve proposals.
	Director attends BRSC meetings to provide context and details of the research projects undertaken by CEBRA and engages with Department of Agriculture (DA) and Ministry for Primary Industries (MPI).	4 meetings per year	Director	The Centre's Executive Management have been represented at each BRSC meeting to report on Centre activities and to foster engagement with funding bodies
	Evaluation of Board Performance, will follow the following three step process; 1. Annual Review Questionnaire completed by all Board Members 2. Chair to discuss individual perceptions of the quality of advice with Managing Director and Board Members 3. Session to evaluate performance – explicit agenda item following questionnaire to evaluate performance	Once per year	Board Chair	Annual review completed in May. Evaluation of performance completed at CAB Mtg # 5.

TABLE 9 KEY PERFORMANCE INDICATORS CONT.

BUSINESS OPERATIONS AND COMMUNICATION				
STRATEGIC OBJECTIVE	**KEY PERFORMANCE INDICATOR**	**MEASURES**	**OFFICER**	**PROGRESS / OUTCOME**
Manage the Centre and ensure that the Core Activities are undertaken in accordance with objectives and key performance indicators and relevant industry standards and best practice guidelines.	CEBRA plays key role with BRSC in project planning and delivery	Meets with collaborators, project proponents and attend workshops	Director / DA / MPI	CEBRA's core research team continue to meet with collaborators and project proponents to ensure successful project delivery
	Budget and workplan developed and approved	Submit to DA and MPI a budget for the expenditure of the funding and workplan for research projects each financial year	Business Manager	The budget and workplan was submitted to DA and MPI on July 14, 2014.
		Review budget and workplan and approve (subject to amendments)	DA / MPI	DA and MPI approved the budget and workplan on August 7, 2014.
		Advise Centre of any KPIs to be included or core activities to be treated as specified core activities in the workplan	DA / MPI	No additional KPIs have been included in the workplan. Project 1404C remains specified core material.
	Payment of Funding	DA and MPI to pay the Centre Funding Payments by six monthly instalments	DA / MPI	MPI paid invoice 685879 on August 15, 2014 and DA paid invoice 685474 on August 7, 2014.
	Provision of quarterly Progress Report on Centre activities	Centre supplies DA and MPI with progress reports as set out in Schedule 3 of the Funding Agreement	Business Manager	• PR # 1 was submitted to DA / MPI on November 26, 2013. • PR # 2 was submitted to DA / MPI on March 27, 2014 • PR # 3 was submitted to DA / MPI on July 30, 2014
	Provision of Financial Report for the previous six months setting out the funding expended or committed	Centre supplies DA and MPI with a financial report for the preceding six months biannualy as set out in Schedule 3 of the Funding Agreement.	Business Manager	• FR # 1 was submitted to DA / MPI on January 14, 2014 • FR # 2 was submitted to DA / MPI on July 14, 2014
	Provision of Annual Report for each financial year	Host supplies DA and MPI with an annual report for the preceding financial year as set out in Schedule 4 of the Funding Agreement	Business Manager	The annual report is on track for submission prior to September 30, 2014

TABLE 9 KEY PERFORMANCE INDICATORS CONT.

STRATEGIC OBJECTIVE	KEY PERFORMANCE INDICATOR	MEASURES	OFFICER	PROGRESS / OUTCOME
	Auditor's Report confirming the Recipient has managed the Funding and kept accounts and records in respect of this Deed	Host supplies DA and MPI with an auditor's report for the preceding financial year as set out in Schedule 4 of the Funding Agreement	Business Manager	The auditor's report was submitted to DA / MPI on August 14, 2014
	Provision of Final Report on Centre activities at the completion of the term	Host supplies DA and MPI with a final report for the term of the agreement as set out in Schedule 4 of the Funding Agreement	Business Manager	Not required in the reporting period
	Recipient Contribution	The Recipient will contribute cash contributions of $537,900 and in-kind contributions of $500,000 per annum being support for Centre Staff including space for the Centre, IT system and support, financial systems, operational support, contract management and purchasing	Business Manager	The recipient contribution was received in full in May 2014.
	Level and quality of operational support and infrastructure provided to the Centre	The Centre will be supported by an Administrator and Business Manager, who will subject to the UoM performance development framework (PDF).	Business Manager, Director	The business manager and administrator continue to offer operational support to the Centre in line with UoM policies and procedures.

TABLE 9 KEY PERFORMANCE INDICATORS CONT.

COMMUNICATIONS				
STRATEGIC OBJECTIVE	KEY PERFORMANCE INDICATOR	MEASURES	OFFICER	PROGRESS / OUTCOME
• Document and communicate research findings to governments and others engaged in biosecurity decision making; • Work to promote excellence in risk analysis;	Effective media communication	At least 2 informative media stories per year (Quality press, The Age / Sydney Morning Herald, Australian Higher Education or The Conversation)	Director, Business Manager, Communications PR	Communication strategy to be developed during 2014/2015.
	Influence over national and international developments	At least 12 national presentations by Centre participants (badged as CEBRA work); per year	Director	CEBRA staff have made at least 18 presentations badged as CEBRA work. Details are available in Table 6.
		At least 2 international presentations by Centre participants (badged as CEBRA work); per year	Director	CEBRA staff have made at least four international presentations badged as CEBRA work.Details are available in Table 6.
	Recognition	At least 3 invitations to chair, host conferences, participate in key advisory forums, or similar	Director	• Prof. Burgman was awarded the Royal Society of Victoria 2013 Medal for Excellence in Biological Sciences. • Prof. Burgman was a member of the Environment Selection Committee for the Australian Academy of Science.
	Collaborations: Development of research opportunities and the funding base	At least 3 substantial collaborations with research organizations; per year	Director	Collaboration agreements have been executed with: • Australian National University • University of New England • ABARES • Bayesian Intelligence
		At least 1 new work with Government agencies other than the funding agency (DA); per year	Director	• CEBRA staff have become involved in a continuation of the Tasmanian Forests Agreement. • CEBRA staff contributed a critical assessment of a risk analysis for the Northern Prawn Fishery • CEBRA staff have commenced a project to develop a screening tool for Australian Pesticides and Veterinary Medicines Authority (APVMA).

TABLE 9 KEY PERFORMANCE INDICATORS CONT.

STRATEGIC OBJECTIVE	KEY PERFORMANCE INDICATOR	MEASURES	OFFICER	PROGRESS / OUTCOME
	International links and networks	At least 1 International Visitor per year	Director	CEBRA hosted Sabine Knapp from AMSA and Lewi Stone from Tel Aviv University
		At least 1 visit to international laboratories by Centre personnel per year		Dr Yung En Chee and Prof Ann Nicholson were invited to present at the St Johns River Water Management District (SJRWMD) seminar series in Central Florida. This has led to a collaborative research called "Evaluation of the Role of Transpiration by Carolina Willow (Salix caroliniana) in the Water Budget of Upper St Johns River Marshes"
	Generate an effective flow of information and publicity about the objectives and results of the Centre	Effective use of website, blogs and social media to increase brand awareness	Director / Business Manager	A new website for CEBRA has been developed and has received positive feedback from stakeholders. Enterprise search facility will form part of the 2014/2015 development.

TABLE 9 KEY PERFORMANCE INDICATORS CONT.

RESEARCH				
STRATEGIC OBJECTIVE	KEY PERFORMANCE INDICATOR	MEASURES	OFFICER	PROGRESS / OUTCOME
• Research and develop new and existing methods relevant to biosecurity risk; • Engage the range of disciplinary skills relevant to the analysis of biosecurity risk, to ensure Australian and New Zealand governments remain at the forefront of practical risk assessment; • Collaborate and engage with end users to improve adoption of methods and increase the impact of research findings;	Project Approvals	At least 90% of Project Proposals submitted for approval are approved, pending budget allocations	Director, Biosecurity Research Team, SAC	The ten project proposals submitted to the steering committee as part of the 2013/2014 workplan and the nine in the 2014/2015 workplan were approved.
	Project Milestones and completions	At least 90% of Output (milestones, reports, systems, software. Guidelines etc) completed satisfactorily; per year	Director, Business Manager	The satisfactory completion of outputs continues to track above 90%.
		At least 80% outputs completed on time per year	Director	The on time completion of outputs continues to track above 80%.
		At least 3 Working groups conducted and summaries completed per year	Director	CEBRA staff have completed at least three workshops in the reporting period. Detailed information is provided in Table 6.
	Project Management	At least 90% of projects to be on time, delivered against milestones and on budget	Director, Business Manager	Project continue to track on or below budget.
	Adoption – Use of Centre materials in routine Government activities	CEBRA to provide a summary of completed research findings/outputs to the BRSC and CAB each quarter.	Director, Business Manager	Director provides summary of completed research findings at each BRSC meeting.
		Each CEBRA project has a clearly articulated and measurable adoption/ extension strategy in place (one page).	Biosecurity Research Section (DA) and MPI	Each business case in the workplan has a clearly articulated Expected Adoption / Uptake section
		Provision of progress report towards adoption, checking alignment with the original adoption strategy, providing clear rationale for any move from the original adoption strategy to be reported to the CAB and BRSC.	Biosecurity Research Section (DA) and MPI	Biosecurity Research Section confirms progress towards adoption reporting is on track

TABLE 9 KEY PERFORMANCE INDICATORS CONT.

STRATEGIC OBJECTIVE	KEY PERFORMANCE INDICATOR	MEASURES	OFFICER	PROGRESS / OUTCOME
		Provide an update against the adoption strategy given the outcomes of the research project with an indication of DA and MPI intention and pathway to adoption.	CEBRA, MPI and DA Project Leaders	Biosecurity Research Section confirms progress towards adoption reporting is on track
	Endorsement	At least 90% Project outputs submitted for endorsement per year	Director	There were no CEBRA reports due for endorsement in the first year of operation.
		At least 90% Submitted project outputs endorsed by Government per year	Director, BRSC	There were no CEBRA reports due for endorsement in the first year of operation.
	Contribute positively to the University's ERA by achieving quality research outputs based on standard measures	Organizational H-Index	Director	• CEBRA's H index is 7 • CEBRA/ACERA's combined H index is 30.
		Number of Publications per year by Centre staff	Director	CEBRA staff have published several journal articles badged as CEBRA work. Details are available in Table 5.
		Other Research Income	Director	CEBRA has undertaken additional research contracts for other agencies including: • PEQ project – $114,000 • APVMA project – $240,000
	Build biosecurity risk analysis capacity in Australia and New Zealand	Number of research higher degree students enrolled	Director	CEBRA is currently supporting eight higher degree students.
		Number of research higher degree students graduated	Director	Bonnie Wintle, Rodrigo Estevez, Marissa McBride and Prue Addison completed their PHDs.
		Number of post-doctoral research fellows employed	Director	Jane Elith, Terry Walshe, Bonnie Wintle, Frith Jarrad, Jan Carey and Yung En Chee provided in-kind support to the Centre.

06 FINANCIAL STATEMENTS

Financial Report Summary

TABLE 10 CEBRA GRANT FINANCIAL STATEMENT 2013/2014

INCOME	$
Department of Agriculture	1,784,000
Ministry for Primary Industries (NZ)	261,720
Host Contribution	532,675
Interest	11,754
SUB-TOTAL	2,590,149
TOTAL	2,590,149

LESS EXPENDITURE	
Salaries	277,928
Operations	19,709
Business Development	131,305
Research Contracts	1,694,263
SUB-TOTAL	2,123,204

BALANCE	466,945

CEBRA In-Kind Statement

TABLE 11 CEBRA IN-KIND STATEMENT 2013/2014

	%	$
A/Prof. B. Wintle (RF)	10%	17,865
Dr. J. Elith (RF)	25%	24,472
Dr. J. Carey (RF)	25%	22,850
A/Prof. M. McCarthy (RF)	10%	19,834
SUB-TOTAL		**91.020**
Infrastructure Costs – Staff (On Campus Laboratory) $86,490/FTER per annum		
GRANT FUNDED		
Prof M. Burgman (Director)	100%	86,490
Dr A. Robinson (RF)	100%	86,490
Ms J. Holliday (RA)	50%	43,245
Dr T. Hollings (RA)	50%	43,245
MELB UNI FUNDED		
A/Prof. B. Wintle (RF)	10%	8,649
Dr. J. Elith (RF)	25%	21,623
Dr. J. Carey (RF)	25%	21,623
A/Prof. M. McCarthy (RF)	10%	8,649
SUB-TOTAL		**320,013**
Infrastructure Costs - RHD Student (On Campus Laboratory) $39,000/FTER per annum		
M. Malishev	100%	39,000
L. Rose	25%	975
S. Jones	50%	19,500
R. Estevez	50%	19,500
R. Ashton	50%	19,500
E. Pryde	100%	39,000
S. Bau	100%	39,000
P. Addison	100%	39,000
SUB-TOTAL		**215,475**
TOTAL		**626,508**

Auditors Report

The terms of the agreement between the Commonwealth and the University of Melbourne require an independent audit opinion to be provided on the financial statements and core activities of the centre.

Consulting Technology

oakton

INDEPENDENT AUDIT REPORT

TO COMMONWEALTH OF AUSTRALIA – DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY 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 Excellence for Biosecurity Risk Analysis the period 1 July 2013 to 30 June 2014.

AUDIT OBJECTIVE

The objective of the audit was to provide an auditor's report in accordance with clause 20.4 of the Funding Agreement. 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 $2,123,204 in expenditure on the Project; and
- the contributions of the University is $532,675 in cash and $626,508 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 Australian Centre of Excellence for Biosecurity Risk Analysis, and a report from the Director certifying that the Centre has undertaken the Core Activities in accordance with the Agreement are attached.

John Phillips
Partner and Chief Financial Officer

Date: 12 August 2014

07 OUTLOOK

Future Outlook

A large number of research projects for 2014/15 have now been confirmed across all of our Core Activity areas. The next 12 months will be a critical period for CEBRA as we start to see the outcomes from a diverse research agenda and from the last year of hard work transitioning into the new organisation.

> "we can also look forward to a strengthening of our regional relationships and expect to see some exciting outcomes"

With our focus on helping biosecurity managers make better and more effective decisions, we look forward to continuing a collaborative approach to shaping the biosecurity agenda with our valued research, government and frontline stakeholders.

Not only can we look forward to our research agenda delivering results across a range of biosecurity policy and management areas; we can also look forward to a strengthening of our regional relationships and expect to see some exciting outcomes from our collaborative research efforts with our international research partners.

Confirmed Research Projects for 2014/2015

DATA MINING

- 1301A Data Mining to Improve Biosecurity Risk Profiling
- 1301B Analytical Assessment of Leakage Surveys
- 1401D Scoping Study: AIMS and SAC Text Mining

SPATIAL ANALYSIS

- 1402A Development of a marine spatial analysis model for improved biofouling risk assessment
- 1402B Tools and approaches for invasive species distribution modelling for surveillance
- 1402C Estimation of National-Level Farm Demographic Data for Preparedness of Highly-Infectious Livestock Disease Epidemics

INTELLIGENCE

- 1403A Intelligence Gathering and Analysis: International Biosecurity Intelligence

SYSTEM BENEFIT COST

- 1304A Cost-Effective Surveillance for Foot-and-Mouth Disease
- 1404C Testing Incentive-Based Inspection Protocols
- 1404D Using Decision Support Tools for Emergency Animal Disease Planning and Response (Vaccination and FMD Case Study)

PATHWAYS

- 1305A Ornamental Fish Import Reform Surveillance Systems
- 1305B Plant-Product Pathways and the Continuous Sampling Plan
- 1405C Torres Strait Risk and Resource Allocation Project
- 1405D Illegal Logging Sampling Strategy
- 1405E Scoping Study: Use of Unmanned Aerial Vehicles for Biosecurity Surveillance, Incursions and Response

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