



MESSAGE FROM THE DIRECTOR

I've been busy over the last three months juggling my role as Head of the School of Biosciences with my role as Managing Director, CEBRA. I wouldn't have been able to achieve so much without the strong leadership and support from my very able deputy director Andrew Robinson. Together we have been able to achieve some important milestones!

After very fruitful discussions and workshops with our colleagues at the Australian government's Department of Agriculture and Water Resources (DAWR) and New Zealand government's Ministry for Primary Industries (MPI), next year's 2016/17 themes and projects have been agreed and approved. We used the Australian Government's Agriculture Competitiveness White Paper to position and guide our themes and projects. The White Paper outlines the initiatives and commitments by the Australian Government for agriculture. Our three focussing themes are; Strengthening Surveillance, Building Scientific Capabilities and Data and Information.

The CEBRA Advisory Board met on Friday 3 June and it was great to meet our new board member Dr. Marion Healey, who heads up DAWR's Plant Division. The board meeting was followed by a Roundtable on Science and Policy. One of our board members, Prof. Helen Sullivan was a panel member. It was fantastic to hear Helen talk about how successful CEBRA is as an example of collaboration between a university and policy makers.

Andrew, Tom Kompas, Susie Hester and I have been championing biosecurity risk analysis both here and abroad. As I write this Andrew is currently in Alberta, Canada where he has been invited to Andina, which is an international invasive weeds workshop. He presented "Data! Data! Data!" at the

2016 Quarantine Regulator's meeting held in Melbourne last month. Also last month he gave presentations about CEBRA to the B3 (Better Border Biosecurity) conference in Wellington and at the Australian – New Zealand Plant Health Forum in Canberra in early February.

Tom has been investigating the best approach to vaccination of animal stocks should an outbreak of foot-and-mouth disease (FMD) occur. The idea is to find a vaccination strategy that balances the cost of the vaccination program and the losses that go with a further spread of the disease and delay in return to international markets. Our results confirm the effectiveness of ring vaccination as an effective tool for the control of FMD outbreaks in Australia. The optimum ring vaccination radius for Australia is approximately 3km around an infected premise. This establishes an important protocol for dealing with an incursion, should it occur.

Susie continues implementing field trials of new inspection protocols as part of the 'Carrots and Sticks' series of projects. New inspection protocols will be trialed by DAWR on selected peat imports and on a selection of vegetable seeds. The trials will involve reduced inspection requirements once an importer has established a sufficient history of compliance with import conditions.

Susie also spoke recently about her plant-pest prioritisation project (CEBRA 1502D) at the National Plant Health Surveillance workshop in Melbourne. At this workshop, members and observers of the Subcommittee on National Plant Health Surveillance (SNPHS) discussed general surveillance systems and preparedness needs in the Australian grains industry. Edith Arndt attended with her.

I spent three weeks in April in the United Kingdom. I presented on the science of expert judgement at seminars at the Department of Biological Science, Durham University and at the Department of Zoology at Oxford University. It was great to see such interest in this emerging topic, and to develop new collaborations on this and on risk analysis more generally. While in the UK I also presented "How to make science work for government" at the British Ecological Society Symposium at the Cambridge Conservative Initiative (CCI) meeting on the interface between policy and science. CCI is a unique collaboration between the University of Cambridge and leading internationally-focused biodiversity conservation organisations clustered in and around Cambridge. My take on the presentations at this meeting is that the governance systems that support the relationships between CEBRA, DAWR and MPI are world-leading and quite unique.

Stay warm!

Mark Burgman

Managing Director,

Centre of Excellence for Biosecurity Risk Analysis

IN THIS EDITION

- 1 MESSAGE FROM THE DIRECTOR
- 2 NZ FARM DATA
- 3 WHAT'S THE BUZZ
- 4 ANDREW ROBINSON
- 4 WEBSITE & FACEBOOK
- 5 16/17 PROJECTS

Review of data sources in New Zealand, approach to modelling populations and the effect of population uncertainty on disease modelling.

New Zealand and Australia's isolation and strict biosecurity measures have prevented the incursion of many pests, diseases and weeds of biosecurity concern. The agricultural industry is a key part of New Zealand and Australia's economies, and preventing the arrival of diseases of concern, including foot-and-mouth disease, is crucial to maintaining access to international markets, reputation, and protecting the economy and industry. Early detection of, and a rapid, effective response to such diseases have a large impact on limiting the economic damage caused by epidemics. An acknowledged weakness of biosecurity preparedness and response to agricultural diseases in both countries is the lack of a single source of accurate, up-to-date farm livestock demographics information.

Working with New Zealand government's Ministry for Primary Industries (MPI) CEBRA examined the integrity of available national level farm data, both for animal movements and animal counts and developed methodologies and tools to estimate national-level farm demographic data and the use of modelled and inaccurate data in disease simulation models.

The team reviewed the uses of animal counts for investigation of, preparedness for and response to exotic animal disease outbreaks and analysed the available New Zealand datasets in depth. Once gaps in the available data were identified and interaction between the datasets understood, the project reviewed ways to model animal populations at the farm level.

The project team found that:

- random forest models provide the best solution for modelling counts of Livestock Units (LSUs) and cattle and that these models are able to predict with reliable results.
- herd level heterogeneity was important when herd size was regarded as a significant risk factor for infectivity and susceptibility to disease.
- the silent spread phase, estimation of distributions for herd sizes (rather than estimation of point estimates for herds) provided results that did not differ from those simulations that used point estimates.
- national level animal demographic databases need to be aligned so that they are fully interoperable to avoid duplication of effort and wasted resources.

This project has also provided MPI an understanding of the available national level data sets that contribute to the competent authority's knowledge of farm animal populations. It has allowed users of these population level datasets to fulfil their responsibility to understand the strengths, weaknesses, alternatives to and biases of the datasets that are used to provide technical advice for biosecurity response and preparedness planning.

"It is important and exciting that these findings and tools can be used in both Australia and New Zealand. By working closely with MPI's biosecurity staff we have built their knowledge in the data available and how to apply it. They now have the ability to generate input data for use in epidemic modelling for preparedness work for infectious disease outbreaks where complete demographic data are unavailable" said Dr. Tracey Hollings CEBRA's Research Fellow.



Dr Tracey Hollings,
Research Fellow - CEBRA



Mary van Anandel,
Veterinary Epidemiologist – MPI

What's the BUZZ?!

Dr Anca Hanea, CEBRA Research Fellow, and her collaborators are aiming to identify and develop strategies to halt and reverse the dramatic decline in honey bee numbers through the innovative use of expert opinion elicitation to fill critical knowledge gaps in bee ecology.

The world supply of food depends on honey bees and other pollinators so there is justified concern over the decline of insect pollinators (Potts 2010). The reasons for the decline in pollinators are believed to include: the loss and fragmentation of habitat, loss of forage, intensification of agriculture (especially monocultures), increasing incidence of disease and pests, imports of non-native species and the use of pesticides.

The reasons for decline in bee populations are not proven and the data that would help to clarify the situation are difficult to gather. The lack of sufficient data is due in part to the difficulty of conducting experiments on natural bee behaviour. The challenges presented by insufficient experimental data has prompted the use of expert elicitation to attempt to fill the knowledge gaps.

In May, Dr Hanea travelled to Warwick University in the United Kingdom to collaborate with 12 experts from academia, industry and government with expertise in pollinators, government, crops, policy, biosciences, and statistics. Their collaboration involved a one day expert elicitation



workshop using a recently developed structured expert judgement protocol called IDEA. The IDEA protocol has emerged from a considerable stream of research, conducted mostly by CEBRA researchers, showing that interactions among group members/experts, properly managed, can substantially improve group quantitative judgement (Burgman, 2016).

Dr Martine Barons, who organised and hosted the event at the University of Warwick, UK said that "It was a really productive day." The expert elicitation workshop was a great success and attracted extensive media coverage including a special report on BBC news

(<https://www.youtube.com/watch?v=y5liMe1-yj4&feature=youtu.be>).

When asked by BBC news if the expert judgements were just a guess Dr Hanea replied "It's not guessing because they are experts; to some extent it is a guess, but a very, very educated guess, and it's the best guess we can get [...] as close as possible to hard data."

Eliciting judgments from experts at the workshop was conducted over two 'rounds', each of which was facilitated by Dr Hanea. Private first round subjective estimates to a set of pre-prepared questions set by the project team were gathered, anonymised and the range of opinions was shown to the group.

A group discussion then followed during which time the experts' reasoning behind their estimates were discussed and shared. Discussion was especially encouraged when spread of opinion was vast. This is one of the most important steps in the entire process. At the close of the discussions, the experts gave a second set of private, subjective estimates for the same questions.

The results showed more agreement and less uncertainty for the questions related to honey bees and a higher degree of

uncertainty for the other pollinators. A weighted combination of opinions will be used to quantify some aspects of a decision-making model.

"I was very impressed by the way everybody worked together, and by the degree of consensus shown in the results" said Simon Potts, University of Reading, Reading Ecology, Entomology, Zoology.

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Staff profile – Associate Professor Andrew Robinson



Andrew is the Deputy Director of the Centre of Excellence for Biosecurity Risk Analysis (CEBRA) and Reader and Associate Professor of Applied Statistics in the School of Biosciences. He has been seconded full time from the School of Mathematics and Statistics since 2009 to work on statistical modelling to support risk analysis. He has been Deputy Director of CEBRA (formerly ACERA) since 2011.

This year has provided Andrew the opportunity to accept a broader leadership role within CEBRA while Mark Burgman, the Managing Director of CEBRA, temporarily heads up the School of Biosciences. "I've been very fortunate to gain this invaluable experience in leading CEBRA over the past year while receiving Mark's close mentoring and generous support," said Andrew.

Andrew has played a pivotal role in engaging with the Australian Federal Department of Agriculture and Water Resources (DAWR) and New Zealand's Ministry for Primary Industries (MPI) to address challenges of national and international biosecurity importance. He has engaged vigorously with biosecurity regulators and inspectorates globally to help protect economies, agriculture and the environment from invasive pests.

In December last year Andrew was awarded the University of Melbourne's inaugural Excellence in Engagement Award. The award recognises Andrew's achievement in advancing the University's engagement priorities through his biosecurity work with CEBRA. "Working with CEBRA has been and continues to be a perfect platform for developing and delivering creative and useful solutions to important biosecurity challenges that face the Australian and New Zealand governments, which are world leaders in science-based biosecurity regulation," said Andrew.

Andrew's CEBRA work has focussed on developing more efficient and more reliable interventions at national borders, as well as better protection outside the border and more efficient capture of critical information inside the border. These undertakings have required team leadership and project management, data science, mathematical modelling, statistical design, risk analysis and critical problem solving.

Andrew has co-authored three books, namely *Introduction to Scientific Programming and Simulation Using R*, *Forest Analytics with R*, and *Methods of Statistical Model Estimation*, and more than 65 peer-reviewed journal articles. He has authored or co-authored 30 peer-reviewed technical reports that outline and implement a range of practical statistical tools that have been deployed by DAWR to substantially reduce biosecurity risk.

Andrew's success can be attributed to his balance of relationship skills with analytical skills. He works very closely with DAWR and MPI staff, formulating research project ideas, identifying

collaborators, carrying out analysis, reporting, implementing, and reviewing outcomes. "The keystone to the relationship between DAWR, MPI, and CEBRA, is our joint focus on developing a problem-based research program. Everything has a purpose, and we know where it is – and where it's going," said Andrew.

Andrew's interests include applied statistics, sampling theory, environmental and ecological statistics, forest biometrics, mixed-effects models, model uncertainty and drinking red wine.

New look for CEBRA

CEBRA has launched a new Facebook page.

Please follow us and you will receive regular updates.



<https://www.facebook.com/cebrauom/>

The new look CEBRA website is under construction and is progressing well.

The layout is a more modern and streamlined design which allows for easier use with mobile phones and tablets.

CEBRA 2016/2017 Research Proposals

CEBRA's Research priorities address the challenges facing Australia and New Zealand governments, business and community and are focussed by themes.

- Strengthening Surveillance – surveillance and analysis reduces the risk of new entry of pests, diseases and weeds and to better target the risks that matter most.
- Building Scientific Capabilities – science remains effective and cutting-edge in an increasingly complex biosecurity environment by building our capacity and developing professional networks and collaborations.
- Data and Information – optimise the use of data and information in biosecurity risk analysis.

Strengthening Surveillance

Project ID 1601G	Development of a generic sample size tool for the importation of small seed lots
Project ID 1601H	Operational imports analysis on compliance
Project ID 1601I	Risk-mapping import pathways for risk return opportunities
Project ID 1602F	Quantifying evidence of a plant pest's status of absence
Project ID 1605F	Use of interception data to inform biosecurity system effectiveness. Proportional value of interventions across pathways and layers of the biosecurity system

Building Scientific Capabilities

Project ID 1604G	Value of the biosecurity system
Project ID 1604I	Measuring the health of the biosecurity system

Data and Information

Project ID 1602G	Defensible resource allocation for plant health surveillance based on risk
Project ID 1604C(1504C)	Testing incentive-based drivers for importer compliance
Project ID 1604D	Incorporating real-time economic components in Australia's FMD modelling
Project ID 1604E	Decision support tools for vector spread animal diseases
Project ID 1604F	Development of benefit: cost tools for use during a response to a marine pest incursion
Project ID 1604H	Biosecurity response decision support framework