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Centre of Excellence for Biosecurity Risk Analysis

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MESSAGE FROM THE DIRECTOR

Welcome to 2016! Already March and another promising and exciting year is ahead of us.

As I foreshadowed at the end of last year I have taken a leadership role during 2016 at the University as Head of the School of Biosciences. Prof. Andrew Robinson and I are working together to provide leadership for CEBRA during the year. Unfortunately, I've had to cut back on the amount of technical input I previously provided on our projects and would like to warmly welcome Dr Edith Arndt and Dr Steve Lane who are capably providing this technical input. Dr Arndt recently worked at the Department of Environment, Land, Water and Planning on a range of topics such as activity and outcome reporting, environmental monitoring, fire severity mapping and developing a database for monitoring data.

Dr Lane is a data scientist and research fellow at the University of Melbourne. His interests are in effective data communication, and in the preparation, collation and management of complex data sets.

Dr Lane

Dr Arndt

The CEBRA Board also welcomes a new member. Dr Marion Healy has replaced Ms Louise Van Meurs as the Department of Agriculture and Water Resources (DAWR), Biosecurity Plant Division representative. I look forward to meeting Dr Healy at our next Board meeting. A big thanks to Ms Van Meurs for her valuable input. Her passion and dedication for CEBRA's work has been appreciated.

There have been opportunities to speak at a number of conferences already this year. The 9th International Conference on Marine Bioinvasions was held in Sydney in January where I discussed 'The science of expert judgement for biosecurity'. Two CEBRA investigators from the CSIRO, Drs Peter Caley and Simon Barry, also reported on work conducted for DAWR on behalf of CEBRA. Two of our Chief Investigators, Dr Susie Hester and Prof. Tom Kompas represented CEBRA at the AARES and ABARES Outlook Conferences. More detail on this is in the newsletter.

Prof. Robinson has also been busy; where he presented at a pest risk analysis workshop in Antigua, Guatemala organised by Organismo Internacional Regional de Sanidad Agropecuaria (OIRSA), which is the peak biosecurity regulatory body for nine Central-American countries. He also presented at the Workshop by Monash Business Analytics Team (WOMBAT) held at the Melbourne Zoo and in Canberra at the inaugural NZ-AUS Plant Forum organised by DAWR, Australia and the Ministry for Primary Industries (MPI), New Zealand. Dr Tim van Gelder has been assisting both MPI and DAWR in developing structured reasoning tools for use in import risk analyses (IRAs).

I mentioned last year that CEBRA is working on establishing a research consultancy arm under the School of Biosciences. Prof. Kompas is taking a strong leadership role in developing this and is continuing discussions on governance arrangements.

We have almost finalised our 2016-17 work plan. After developing and preparing submissions for project ideas we held a workshop mid March with our DAWR and MPI colleagues. Once again our research is focussed and sharpened by the needs of our policy makers.

Mark Burgman

Managing Director,

Centre of Excellence for Biosecurity Risk Analysis

IN THIS EDITION

AARES & ABARES Outlook Conferences

CEBRA has been represented by two of our Chief Investigators, Dr Susie Hester and Prof. Tom Kompas, at recent conferences held in Canberra, namely AARES and ABARES Outlook.

The 2016 AARES Conference was the 60th Annual Conference of the Australian Agricultural and Resource Economics Society. The theme was 'Feeding and Energising Emerging Asia and the Pacific: Opportunities for Australia and New Zealand'. It offered a forum for applied and theoretical economists, industry and policymakers to share ideas.

It is a testament to Dr Hester and her team that she was asked to not only chair the 'Advances in Biosecurity' session but also to speak on 'Introducing compliance-based inspection protocols to Australia's biosecurity system' and 'Compliance-Based Regulatory Regimes for Biosecurity Border Inspections: An Experimental Investigation'.

'It's vital that CEBRA is represented at these forums. We need to be closely involved in compliance thinking in the Biosecurity space to ensure our work is as effective as possible', said Dr Hester.

Prof. Kompas was also asked to speak at AARES. He presented on 'Budgeting and Portfolio Allocation for Biosecurity Measures' and presented on 'Optimal Local Surveillance Measures for an Exotic Pest in Heterogeneous Spaces over Time' and 'Increasing the robustness of Invasive Species Eradication Programs'.

The ABARES Outlook 2016 Conference hosted by the Department of Agriculture and Water Resources (DAWR) is the premier information and networking forum for public and private sector decision makers in the agriculture sector. The theme was 'Investing in agriculture – growing our future'. The conference was opened by the Hon Barnaby Joyce MP, Deputy Prime Minister and Minister for Agriculture and Water Resources.

Prof. Kompas was a member of the panel titled 'Biosecurity – what does the future hold and are we ready' which was chaired by Mr Daryl Quinlivan, Secretary of DAWR. Prof. Kompas spoke about 'Best investments in biosecurity and the limits to cost benefit analysis' where he discussed the Portfolio Allocation Rule and how money should be shifted to improve overall results.

'It really indicates the strength of our partnership with the Department, especially on approaches to biosecurity risk, that CEBRA was asked to present at Outlook again this year. It was a great opportunity,' said Prof. Kompas.

Dr Hester

'We need to be closely involved in compliance thinking in the Biosecurity space to ensure our work is as effective as possible'

Prof. Tom Kompas
ABARES Outlook 2016

Species distribution modelling protocols developed

Biosecurity Agencies are called on to make risk-based surveillance and eradication decisions based on predicted distributions of species of biosecurity concern. This is not an exact science; there are many methods available and today parts of the jigsaw are still missing. This makes it difficult for managers to make informed decisions about which method to use to predict the best place to locate surveillance equipment or to look for established populations.

Species distribution models (SDMs) are spatial models depicting the potential habitat of species of concern. A SDM can be used for a variety of purposes:

- by predicting the possible extent of an incursion it can underpin the estimation of potential economic, environmental and human health costs.
- by combining a SDM with pathway analysis it can assist in prioritising where surveillance effort should be expended to maximize the likelihood of early detection.
- by predicting the potential habitats the species can establish in, it can support eradication campaigns.

A challenge in developing SDMs is the diversity of techniques and opinion in the scientific literature. No single modelling technique has emerged as being suitable for all applications.

"It was important to bring a team together with strong statistical and modelling experience. It was great to be part of the collaboration between the CSIRO and CEBRA and to work with Associate Prof. Jane Elith and Dr Jan Carey, both CEBRA Research fellows. We targeted a subset of biosecurity issues that helped clarify the evidence for existing assertions made in SDMs and develop new protocols" said Dr Simon Barry, CSIRO.

"This project has developed structured guidelines and protocols to assist decision makers to identify the most appropriate tools and approaches for specific biosecurity applications" said Prof. Mark Burgman, Managing Director, CEBRA. While the importance of basing models on good predictive variables is understood there has been little attempt to review this or develop concrete protocols to identify these variables.

The project reviewed the available environmental data and explored the information in the literature defining proximal variables, which are variables that are "close" to the biological process and therefore better predictors of potential distribution. The review identified that there is no consistent approach in ecology to defining proximal variables. While a variable may appear strongly predictive, its performance in other locations cannot be unambiguously predicted.

Based on this review, the project then explored other approaches to developing predictive models.

One approach was the use of climate envelopes. The team developed methods to statistically identify proximal variables using small two variable models to guard against over-fitting. These methods where then applied to five case studies using pests that have or could establish in Australia and/or New Zealand.

The analyses led the team to conclude that there is no single, clearly preferred approach suitable for all circumstances. They used simulation analysis and real data to explore a range of options and approaches. This analysis demonstrated that variables could be strongly predictive in the native range but weakly predictive when projected to new locations. This demonstrated a fundamental limitation in our ability to accurately perform these projections. Based on this analysis a protocol was developed that reflects this inherent uncertainty. This protocol recommends expert-based assessment of proximal variables and incorporation of uncertainty into the analysis. It recommends the use of envelopes rather than probability methods when projecting to new locations. Another piece of the jigsaw puzzle found!

Text Mining

Passengers, mail and cargo can all bring biosecurity risk material (BRM) into Australia. The Department of Agriculture and Water Resources has the critical and substantial responsibility of enforcing biosecurity import legislation at Australia's international borders. The scale of this task, and the imperfect nature of border processes, together make it impossible to capture all arriving BRM.

For imported cargo, the department relies on two computer systems, the AIMS and SAC databases. The information on these databases is originally provided by importers and brokers when declaring their consignment to the Department of Immigration and Border Protection. The recorded information is assessed against profiling rules that indicate if BRM is likely to be present. Further action such as presentation of documents, physical inspection or treatment is then determined. All actions by departmental staff are recorded in the systems, with reasons for action usually entered as free text.

CEBRA Research fellows Matthew Chisholm and Dr Aidan Lyon conducted a preliminary investigation of these free text data. They found that much of these data contain valuable information that cannot be otherwise obtained from the structured fields in the databases.

The free text, if analysed, can assist in categorising results that are ambiguous. These more robust results will improve tactical and strategic measures taken for targeting and profiling, and reduce future non-compliance. This analysis can also inform future enhancements and design of the databases, which should improve the efficiency and accuracy of data entry and reporting, making future analysis much simpler.

The Department of Agriculture and Water Resources has the critical and substantial responsibility of enforcing biosecurity import legislation at Australia's international borders.

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