cebra
Centre of Excellence for Biosecurity Risk Analysis

E-UPDATE EDITION 05

MESSAGE FROM THE DIRECTOR

Welcome to the October edition of the CEBRA e-newsletter. This newsletter is coming off the back of a busy couple of months of workshops and conference events.

On 29 September CEBRA hosted a workshop at the School of Botany for Project 1402C – Estimation of national-level farm demographic data for preparedness of highly-infectious livestock disease epidemics. We were very pleased to have at the workshop representatives from Melbourne University (including CEBRA, the Faculty of Veterinary and Agricultural Science, and the School of Botany), the Australian Department of Agriculture, the NZ Ministry for Primary Industries and Massey University. The workshop explored methods to estimate farm-level animal demographic data using remotely sensed and survey data. These data are potentially immensely valuable in planning the initial stages of a response to an outbreak of a serious disease.

Earlier in September CEBRA hosted a Workshop for Project 1404D – Using decision support tools in emergency animal disease planning and response: Foot-and mouth disease. Held at the ANU in Canberra, the workshop was attended by CEBRA, Department of Agriculture and Ministry of Primary Industries NZ. At the end of the session the program had set a clear direction on defining and estimating the model parameters and an agreed work plan.

In August CEBRA was again very pleased to be a partner for the Society of Risk Analysis – Australia and New Zealand conference, held at Massey University. Several CEBRA staff and affiliates spoke at the conference and again my thanks go to the CEBRA administrative team

for helping the Society to put on a great event. Peter Sandman was the keynote speaker and his workshop following the conference was a sell-out.

I hope you enjoy this latest newsletter, and I look forward to providing you with final wrap of the year in the lead up to Christmas.

Mark Burgman
Managing Director, Centre of Excellence for Biosecurity Risk Analysis

Ebola Outbreak Puts Risk Planning on the Agenda

Never has the importance of effective risk planning and management been more evident than in relation to the current Ebola outbreak in West Africa.

Australia's border protection and infection control measures are firmly in the spot light. With a recent case in the United States, the issue serves to highlight the importance of understanding our risk exposure, disease pathways and effective response measures.

IN THIS EDITION

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PROJECT UPDATE

The following research projects have been endorsed by the BRSC on 10 September 2014:

- Final report for CEBRA project 1304B, Handling uncertainty in the RRRA model
- Final report for ACERA project 1106D, Evaluating the Qualitative Risk Model

SRA-ANZ CONFERENCE

CEBRA's Director Mark Burgman and Deputy Director, Andrew Robinson, presented at the annual SRA-ANZ Conference.

The conference theme was 'Risk beyond the numbers'. Andrew's presentation titled "When does poor governance presage biosecurity risks" focused on the importance of appropriately designed feedback data in guiding biosecurity investments. Mark's presentation, titled "Tips for policy makers to interpret scientific advice", focused on the importance of bridging the communication divide between researchers and policy makers, to ensure that research outcomes lead to better public policy and decision making.

PROJECT IN FOCUS

1304A Cost Effective Surveillance of Foot and Mouth Disease

Foot and Mouth Disease (FMD) is a great example of the tension that often exists in biosecurity management between available budgets, the cost of detection, the often low risk of incursion and the high economic and social consequences should an outbreak occur.

Led by Professor Tom Kompas, Dr Graeme Garner and their team, this project seeks to better understand FMD and support government to implement strategies that are cost effective. That is, recommending actions that are not only effective on the ground, but also balance the risks of exposure and the consequences of an outbreak with the costs of prevention.

This project was designed to provide practical outcomes for the Department in terms of:

(a) what specific active and passive surveillance measures against FMD are appropriate and cost effective for Australia, and

(b) the optimal level of surveillance expenditures on FMD for 'early detection' of a potential entry and spread.

It built on and further developed existing disease simulation and numerical modelling and optimizing approaches to evaluate the efficacy and cost-effectiveness of surveillance measures.

To date, relatively little has been done in terms of active surveillance for high consequence threats like FMD or for ways in which the passive surveillance system could be enhanced, and there is no well-developed economic case for the benefits of doing so.

In 2011, a commissioned review of Australia's preparedness and capacity to prevent and respond to an FMD outbreak (the 'Matthews Review') found that there is a strong possibility that an incursion of FMD may not be readily detected.

This project has provided a better understanding of the factors influencing early detection of an FMD incursion, the appropriate active surveillance measures and the amount of resources that should be devoted to surveillance activity.

Australia's live animal and meat exports total $6.9 billion annually, with a further $8 billion in other livestock products also traded annually (ABARE 2012). The industry employs 13,000 people across rural and regional Australia (MLA), and is critically important to Australia's economy and the social fabric of many rural communities.

"To date, relatively little has been done in terms of active surveillance for high consequence threats like FMD"

FMD is highly contagious and is regarded by some as the single greatest disease threat to Australia's livestock industry (Matthews 2011). Ensuring we protect the industry from disease incursions is central to protecting international and domestic market access and the overall economic and social contribution it makes to Australia.

The issue for policy makers is getting the balance right, because the right investment in early detection has potential to save millions of dollars in avoided losses.

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"RISKY WIDGETS"

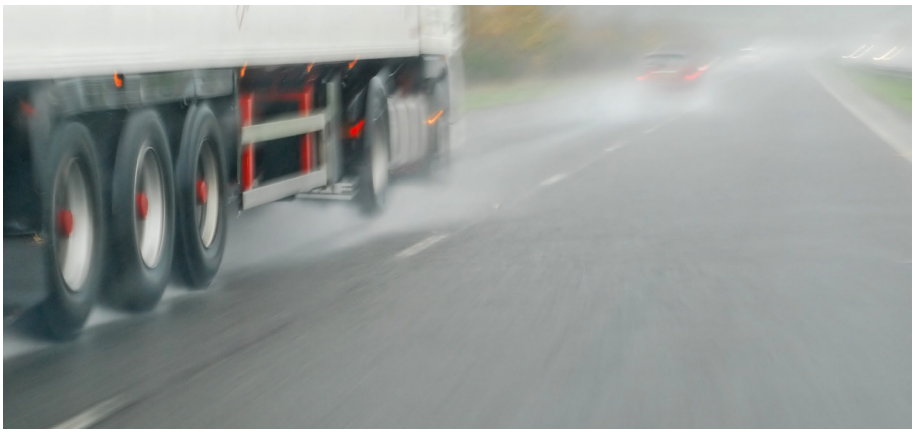
Risk-based fleet management demands timely and accurate decision-making for scheduling vehicle maintenance. Special statistical analysis of measured performance characteristics is used for setting these schedules. The statistical analysis commonly involves estimating the parameters for a function using observed failure times, and then the calculation of statistics that can be used to inform the decision of when to withdraw the fleet.

As Dr Andrew Robinson has found in his collaboration with the Defence Science and Technical Organisation on this project, when it comes to managing our defence force, optimising logistical efficiency is absolutely critical; and the science behind doing so is complex.

An example is fitting the Weibull distribution and computing the hazard cutoff, which is defined as the earliest hour at which the predicted hazard of failure exceeds a threshold, for example, 0.000001. This hour can be used as a guide for when the risk of failure becomes unacceptably high, and maintenance is necessary.

The failure data that has been observed by the decision time are incomplete (censored) because not all vehicles have failed. Two methods are commonly proposed for estimating the parameters of the Weibull distribution using the censored data, namely, median rank regression (MRR) and maximum likelihood (ML). The choice between the two is not straightforward; they have different relative performances depending on which performance metric is used, what the type of censoring is in the data, the number of vehicles being managed, and so on.

Dr Nicholas Armstrong of the Defense Science and Technology Organization (DSTO) began a collaboration on this topic with Drs Andrew Robinson and Joanne Potts of ACERA (now CEBRA) in 2012. The goal of the collaboration was to conduct simulation experiments



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that would compare these two different ways of estimating the parameters, MRR and ML. Robinson and Potts performed a suite of simulation experiments to assess the relative performance of the algorithms under a range of operationally realistic conditions. They compared the estimators' performance using a set of performance measures, but focused particularly on the hazard cutoff, and statistics about the risk that arose from using the hazard cutoff to guide maintenance.

The ML estimates showed considerable positive bias – meaning that the hazard cutoffs were too high, and intervention decisions would come too late – whereas the MRR estimates were negatively biased, meaning that intervention decisions would come too early, on average. Hence the realized risk for a decision made using ML estimates was substantially higher than the risk that was implied as acceptable by the policy, and that of MRR was lower. The statistical variability of the ML and MRR estimates were comparable.

ACERA recommended that MRR be used if the purpose of estimation is guide the decision of when to withdraw a fleet for maintenance. Further collaborative work between CEBRA and DSTO is planned to try to understand why the approaches are different, and possibly design better performing algorithms.