Day 1

Transforming Australia's biosecurity system: insights from the health system

Rob Grenfell

No abstract provided

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A multi-stakeholder approach to improve biosecurity in Mexico

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Since the end of 2014 the Mexican government is executing the multi-stakeholder Project "Enhancing National Capacities to Manage Invasive Alien Species (IAS) by Implementing the National Strategy on IAS", financed by GEF and implemented by UNDP. The project is carrying out actions at the national level as well as at 15 pilot sites in collaboration with more than 15 institutions -mostly governmental -but also NGO and academics. This has resulted in a remarkable increase in management capacity. Especially visible is this within the cooperation of agencies in the environmental sector with those in agriculture, aquaculture and forestry, as well as other productive sectors. Establishing interinstitutional committees have led to raise awareness for biosecurity aspects during production and to develop and apply best practices to reduce escapes. The project has established a continuous dialogue with the general public and a wide range of stakeholders through several means of communication such as: capacity building for management in natural protected areas, education for nearby communities, journalists, legislators, ornamental fish producers, teachers and children, complemented by a variety of dissemination materials.

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Using social sciences to better understand biosecurity challenges in the egg industry

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Devolving biosecurity management has meant roles and responsibilities within biosecurity systems have undergone changes. Within the Australian egg industry, these changes occur within a context of industry structural change, as the free-range production sector expands. Little is known how these disruptions are impacting on biosecurity management for small-to-medium size producers across free-range, cage and barn production systems.

This study1 aims to understand the implication of this in terms of producer practices, focusing on behavioural changes required to strengthen producer engagement with biosecurity. Firstly, the study investigated institutional factors influencing biosecurity behaviour, through interviews with government agencies, animal health professionals and industry associations. Secondly, egg producers were interviewed, gathering information on technical knowledge and practices, understanding of devolved responsibilities and sources of technical information.

Findings suggest there is a mix of understanding and engagement with biosecurity among egg producers, with a general belief that shared responsibility is placing burdens on their production. Some producers have considerable experience in the sector, well-developed biosecurity management systems and make well-informed decisions. For others, biosecurity and flock health management tends to be more reactive and less of a priority. Producers across production systems report a complex regulatory environment within which they operate. Although this is seen as an industry reality, many are concerned about this complexity and how is impacting on their decision-making. Some producers, highlight the difficulties in managing audit requirements (e.g. production and fire/building regulatory audits), whilst others would prefer to 'fly under the radar' to avoid regulations they see as impacting on both, time and profitability.

This research highlights multiple social, economic and historical factors influencing producer decision-making on biosecurity and how these are occurring within policy and management contexts of devolved responsibilities. This information will be used for developing strategic, tactical and operational recommendations for improving biosecurity engagement within the industry.

[1] This research project is funded by Australian Eggs

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Can trans-disciplinary approaches future proof Australia's biosecurity?

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The future of biosecurity, from an understanding of the risks posed by diseases and pests, to strong surveillance and implementation of effective systems control, involves questions touching multiple disciplines of natural and social sciences and strong partnership with stakeholders. This panel will present animal health examples of interdisciplinary questions asked to motivate a discussion of successes and failures of current biosecurity efforts and implications for future proofing investments in biosecurity. We will present lessons learned from a transdisciplinary project that looks at transboundary animal disease (TAD) control from early recognition and diagnosis to providing tools that could be used to ensure rapid control and eradication, and fast return to trade. This project brings together biologists, economists, social scientists, modellers, epidemiologists and stakeholders who are responsible for policy. In addition, livestock industry stakeholders are involved as they play a role not only at farm level regarding biosecurity and surveillance, but also because they would be impacted by a disease incursion. The team initially found communicating across the disciplines challenging and meeting face to face was an important way to ensure a holistic approach. In doing so, they discovered surprising areas of interlinks where the different disciplines could strengthen the research outputs. The time necessary to use more collaborative approaches was also evident, especially where producers were involved. The panel will share their learnings while working in an interdisciplinary team and demonstrate how this approach has the potential to ensure Australia will be able to eradicate an incursion of a TAD in a much more rapid way.

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Using technology and computational science to improve pest animal detection and identification in biosecurity monitoring

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Foxes (*Vulpes vulpes*), feral cats (*Felis catus*) and wild dogs (*Canis familiaris*) impact on agricultural production and biodiversity throughout Australia. Reducing these threats, damage and impacts requires an integrated and long term effort by stakeholders across large landscapes using a plethora of techniques to drive down abundance-density and the rate of increase of these populations. At the theoretical and policy level, there have been concerted efforts to move towards developing codes of practice and other instruments to improve detection and population management. Concurrently, many scientists and practitioners have been working towards best practice standards through innovative research and development. In this presentation, we describe new innovations aimed at improving or value adding to existing pest management methods. Our R&D team has built new technology that enables real-time detection of pest animals using either existing telecommunication infrastructure or the Iridium Satellite network. These systems use deep learning algorithms to automate recognition of target species and initiate alerts. We have integrated detection and recognition technology into new and existing tools such as feral cat lures and automatic closing devices to improve the capacity of existing tools like feral pig traps. The incorporation of technology into biosecurity tools has vast implication for improving efficiencies of pest management but also in facilitating greater detection capabilities for new incursions and disease outbreaks.

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Integrating passive and active surveillance tools for biosecurity surveillance

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Incursions of invasive exotic vertebrate pests need to be detected early for there to be any chance of cost-effective containment and eradication. With the diverse array of exotic species of concern and the wide array of possible introduction points, there is insufficient public funding available for structured, human-based, agency delivered surveillance to meet this need. However, advances in sensor and genetic sampling technology may enable more cost-effective surveillance by industry and government, and harnessing the observational powers of community surveillance activities can potentially increase the scale and sensitivity of surveillance efforts dramatically.

There has been little evaluation of vertebrate pest biosecurity information content of community surveillance data streams, and how they could contribute to the timely detection of incursions of invasive exotic vertebrates into Australia. This presentation describes the surveillance information content that is contained within streams of citizen-generated data being uploaded to online portals (e.g. The Atlas of Living Australia). Factors driving the content of passive citizen surveillance are presented, along with analysis of what exotic vertebrate pests are most likely to be detected. As part of the CISS Incursions program, this research will ultimately develop guidelines for how to best combine passive and active surveillance tools with community surveillance in a complementary manner to enable the timely detection of invasive vertebrates and hence prevent the establishment of further vertebrate pests.

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Automating Field Monitoring and Deterring Systems for Enhanced Wildlife Pest Management Practices

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We are at a turning point in applying technology to challenging and repetitive tasks. Already semi-intelligent autonomous systems and drone technologies are becoming more prevalent in many agricultural sectors for pest and disease detection as well as crop health analysis, yield prediction, planting and field maintenance tasks. The full potential of these autonomous systems is yet to be realised as both researchers and end-users need to overcome transformation and logistical issues along with addressing the engineering challenges of long term reliable and robust integration. Wildlife pest management can also benefit from leveraging advances in technology, particularly for automating monitoring and deterring tasks in the field. Typically, field operations relating to these activities requires substantial manual and logistical effort to be effective, which can be prohibitive over long periods of time.

We are undertaking research and development (R&D) into autonomous, intelligent technology to aid land- and invasive pest- managers in receiving online and real-time wildlife activity information from the in-field systems, rather than having to obtain or process data manually. The systems provide significant enhancements to the benefits of camera trapping (via hardware) with the interpretation skills of a human analysing the data (via software). This allows only relevant data and information to be recorded and reported with a further potential of identifying individual animals, behaviours, and number estimation. Commercial efforts have also included autonomous deterring from orchards and plantations with additional autonomous adaptive hardware we are developing. Field trials have been undertaken in remote and sometimes harsh environments for detecting wildlife for a variety of purposes, including biodiversity analysis, pest animal recognition and deterring. In this talk, we will summarise our R&D, field trials to date and applications to assisting with Integrated Vertebrate Pest Management practices, as well as the rationale and motivations for our approach.

CropSafe: Victoria's 'eyes in the field' surveillance system for the grains industry

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CropSafe is Agriculture Victoria's general pest and disease surveillance program for the grains industry. The program partners with a voluntary network of 188-member private agronomists (approximately 85% of Victoria's agronomists), who have been trained to identify threats to Victoria grains industry.

During the growing season, agronomists submit plant samples to CropSafe that have been collected during routine crop inspections where the causal agent cannot be identified. Diagnosis of these samples generates surveillance data and real-time industry intelligence.

During a recent incursion (Russian wheat aphid, 2016) an agronomist in the CropSafe network made the first detection in Victoria and submitted a sample through the CropSafe program.

During an average or wet season between 100-200 samples are received by Agriculture Victoria's CropSafe program. Most of these samples are sent in between June and November each year reflecting the growing season of winter broadacre crops in the region.

The exception to this was 2014 when an outbreak of turnip yellows virus (TuYV) caused a large spike in the number of brassica samples submitted to CropSafe. CropSafe has been generating data since 2007.

One of the key aspects of the program's success is the training provided to agronomists. The program has close links to local and interstate pathologists who help train advisors regularly in the identification of endemic and exotic crop diseases. This increases the chance of something exotic being detected as well as maintaining stakeholder relationships.

CropSafe also helps to assure domestic and international markets of Victoria's Area of Freedom (AoF) status, providing the Chief Plant Health Officer with general surveillance data collected using the CropSafe agronomist network for market access-related claims. These claims are supported by data and underpinning methodological research.

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Mexico's bottom-up approach to formulate Island Biosecurity Protocols

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Over 20 years of island restoration actions, Mexico has come halfway on having all islands free of invasive mammals, with the ambitious goal of completing it by 2030. Therefore, island biosecurity has become a priority. With funding from the Global Environment Facility (GEF) through the United Nations Development Program (UNDP), and private donors, the Grupo de Ecología y Conservación de Islas, A.C. (GECI), together with the National Comission for Knowledge and Use of Biodiversity (CONABIO) and the National Commission for Natural Protected Areas (CONANP) has integrated a participatory programme to develop the country's capacities for management of invasive alien species. While working simultaneously on analyzing and adapting legal instruments to support island biosecurity measures, we began engaging island communities and stakeholders to create awareness of the root causes and problems associated with biodiversity loss. We decided on a bottom-up approach to create site-specific island biosecurity protocols in an adaptive and participatory manner. By involving every sector in protocol design, we gathered all information needed to make risk analysis and determine which measures best apply. Furthermore, by being involved in their conception, the communities have approved and adopted preventions measures that need to be carried out in everyday life with a long-term vision. We have also sought different ways to communicate and promote a proactive attitude toward biosecurity measures, particularly through environmental education with island communities and inter-institutional cooperation. The experience to date shows that community engagement has been key to detect incursions and respond, allowing all cleared islands to remain free on invasive mammals through time.

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One Biosecurity – the South Australian approach to addressing the challenges of market access assurance and equipping producers to meet 21st century biosecurity demands.

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Export based trade is highly competitive and countries are expected to have an edge to justify their position particularly in premium markets. Importing countries depend on the certification by officials in the country of origin to protect themselves from inadvertent introduction of diseases, pests or contaminants through imported products. In the face of decreasing resources, certifying authorities have to ensure that they have access to data which allows them to certify products with the integrity that is assumed by the importer. The failure to meet export certification requirements is one of the biggest threats to international market access.

Producers in Australia are faced with an increasing number of challenges which include compliance with market specific standards, plant pests, on-farm production targets, traceability and reporting obligations; and the ever-present threat of exotic diseases and pests with the potential to cause havoc to the local industry. Technologies and policies which address these challenges in a holistic manner have the best chance of acceptance and sustainability along the production chain.

One Biosecurity is an on-line farm biosecurity risk management program which was developed by PIRSA in close collaboration with Livestock SA. It is aimed at increasing transparency in livestock trading through open communication. The program assists with compliance with various legal obligations and industry standards whilst providing tools for continuous biosecurity improvement and the ability to make good biosecurity decisions. This is imperative in the absence of government or industry funded programs,

The voluntary program offers participating producers the opportunity to manage a wide range of biosecurity risks and facilitates risk-based trading. The One Biosecurity program provides a platform for producers in the state to contribute to the shared biosecurity obligations. It has the potential to create a community of producers with known favourable biosecurity and industry standard practices and thus form a credible basis for market differentiation in the event of an emergency disease outbreak.

The focus on biosecurity strengthens partnerships along the production chain and the collective biosecurity capabilities, risk awareness and preparedness will lead to greater industry resilience. The approach is applicable to other sectors such as plant health, invasive species and environment where a community approach yields the best results and sustainability.

The One Biosecurity approach is likely to become the new standard for export certification to meet consumer demands and the minimum level of assurance demanded by importing countries well into the 21st century.

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The Plant Biosecurity Research Initiative: Collaboration across plant sectors for enhanced biosecurity RD&E

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Coordinated and targeted investment in plant biosecurity RD&E is vital in reducing the impact to our food, fibre, wine and forest industries (worth $29.9 B). The PBRI www.pbri.com.au plays an important role in developing and maintaining the scientific capacity of Australia's biosecurity system. The partnership between plant industries and government harnesses significant investment power, creating efficiencies for the common goal of supporting plant biosecurity research.

The PBRI aims to drive the coordination of cross-sectoral RD&E to ensure national plant biosecurity needs are met in accordance with the national biosecurity agenda. It will have an ongoing role in providing biosecurity leadership across the sectors, providing a continuum of cross-sectoral RD&E benefits that generates a mix of short, medium and long-term benefits to industry. It also aims to promote and facilitate collaboration for better plant biosecurity outcomes and to build and retain RD&E capability in plant biosecurity, based on a strong culture of innovation and science.

The PBRI strategy includes six key focus areas for investment; 1. Preparedness, 2. Diagnostics, 3. Surveillance, 4. Sustainable management, 5. Capability building and 6. Industry resilience. To implement the strategy, an investment plan has been drafted for cross-sectoral and collaborative projects for 2019-2023. The PBRI members are interested in developing strategic partnerships to collaborate on common biosecurity issues, from a regional through to global level. Capability building is also a central pillar of the PBRI strategy, addressing the need to build a future generation of plant

biosecurity experts. Attracting and retaining plant biosecurity specialists is a high priority to support our future plant productivity.

The PBRI has been active for two years and has some significant milestones which will be outlined. For example, a partnership has been formalised with Better Border Biosecurity (B3) in New Zealand and an inaugural Plant Biosecurity Research Symposium has been planned for 15&16 August 2019 to showcase RDC and PBRI plant biosecurity research projects.

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No Super Hero Wanted to Prevent Invasive Species (Updated)

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No Super Hero needed! What is needed is a team of passionate leaders from government, industry, community and others working together to implement biosecurity against new invasive species. For over 10 years, the concern of highly destructive aquatic invasive species such as zebra and quagga mussels galvanized changes in the Pacific Northwest region (United States and Canada). With many aquatic species spread by boaters, the first step was building a collaborative biosecurity approach across governments, community and boaters to change boating practices. Implementing the largest behaviour change research project on invasive species in Canada, the Invasive Species Council of BC worked with partners to build an effective 'behaviour change' program identifying barriers, building 'peer recognition' and establishing tools to ensure boats, marinas and equipment are 'Clean Drain Dry'.

Economic threats of invasive mussels galvanized government leaders, industry and others across the Pacific Northwest Economic Region to work together. Across two countries (10 states/provinces), there was agreement for a coordinated 'perimeter defense system' against invasive mussels. One key outcome, developed in partnership, is the *Invasive Mussel Prevention Framework for Western Canada* identifying biosecurity actions at all levels- from regulatory authorities, industry and others.

This presentation looks at lessons learned on practical tools developed across the Pacific Northwest, across borders, in partnerships across governments, industry and others to prevent introduction of invasive mussels. Examples from different jurisdictions include mandatory boat inspection, online tracking, training, reporting protocols and more. In addition, successes from the inaugural 'Invasive Wise Marina' program to engage boaters and local stewardship groups to prevent introductions will be highlighted.

Closing pathways, working together and ensuring regulatory and non-regulatory approaches are all cornerstones for successful prevention. Rather than the power of one Super Hero, harnessing the power, tools and passion of leaders across all sectors is vital to prevent invasive species!

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Environmental DNA technologies for biosecurity

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Advances in DNA related technology hold significant potential for application to biosecurity, in particular the use of environmental DNA (eDNA), which is the DNA shed by organisms and finds its way into the environment. This provides a non-invasive approach to surveillance and holds considerable promise for applications such as the detection of high-risk organisms of biosecurity concern and of invasive species in the early phase of the invasion curve. Developments in technologies has the potential to transform a range of surveillance operations, such as at the border testing of commodities and for post-border monitoring. Challenges in the uptake of this technology is predominantly the development of standards and guidelines that are required in order for the provision of adequate quality assurance. In order to overcome some of the implicit challenges, we have developed a framework to estimate the sensitivity of both the field and laboratory components eDNA survey methods, and we have been able to demonstrate how these can be used to estimate the overall sensitivity of these methods for real-time applications. We have applied this framework to species-specific eDNA surveys to estimate the sensitivity, or probability of detection, for invasive aquatic species present in Australia in both freshwater and marine settings. Examples from each of these applications will be presented, along with the current advances in eDNA technology such as real-time monitoring and point-of-site delivery that have the potential to transform biosecurity outcomes.

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Implementation of molecular detection methods in marine pest surveillance

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Shipping is a major vector for marine pest introductions and in an environment of increased global trade and connectivity, the rate of species introductions into high risk port areas is rising. To manage risk of these introductions consistent with international standards, Australia ratified the *International Convention for the Control and Management of Ships' Ballast Water and Sediments* in 2017.

To control the spread of established invasive species in Australia, ballast water management requirements of the Convention have also been applied to all domestic movements of ballast water under the *Biosecurity Act 2015*. The *Act*, however, allows exemptions from ballast water management where the risk is deemed to be acceptable. To evaluate the risk for domestic ballast water movements a Ballast Water Risk Assessment (BWRA) has been developed. The BWRA considers the risk of transporting seven key species that are established in some parts of Australia, and may demonstrate invasive qualities if introduced to other areas of Australia.

To provide a risk based exemption, accurate knowledge of the occurrence of the seven key pest species within port areas is required. Few Australian ports, however, have been adequately surveyed for marine pests, including the seven key species. This is due to traditional surveys being expensive, logistically difficult, and time consuming to implement. A DNA-based method for pest detection has been developed which is faster, cheaper, and provides high confidence in pest species identification, but still required field validation before use.

The department commissioned a project to assess the performance of the molecular surveillance method in comparison to traditional techniques in four Australian ports. Results demonstrated that the molecular approach is more sensitive than traditional surveillance, fit-for-purpose for marine pest surveillance and can be used to inform the BWRA.

The department's approach to implementing DNA-based surveillance methods into the BWRA will be discussed.

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Pet or pest? New application of stable isotope methods for the early detection of invasive alien species

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Introduction:

The wildlife trade facilitates the movement of alien species worldwide, creating novel introduction pathways for invasive alien species (IAS) to establish. Australia is experiencing an increase in at-large incursions of high-risk alien species, particularly reptiles; however, there are a lack of methods for determining if these are recently escaped pets, or if wild populations have established. Detecting an established population as soon as possible is essential for effective prevention and eradication of IAS, indicating an urgent need for forensic methods to quickly identify established populations.

Aims:

This project aims to create a forensic toolbox to identify, track, and quantify the risk of highly invasive pet species. Here, we present the new application of existing stable isotope technology to distinguish between wild and captive incursions of the red-eared slider turtle (*Trachemys scripta elegans*).

Methods:

Twelve historical *T.s.elegans* incursions with putative environmental histories were used to develop a set of best-practice methods. The non-invasive sampling of scute keratin from *T.s.elegans* incursions provides information on the animal's diet during its last active season, and thus its potential to have survived in a wild-state.

Results:

Nitrogen stable isotope ratios responded to changes in *T.s.elegans* trophic levels, allowing for effective differentiation between captive and wild environmental histories. Captive turtles exhibited much higher trophic levels (δ^{15}N‰ ≥ 9.7‰) than their wild counterparts, suggesting captive turtles are provided higher volumes of meat products. Statistical models effectively separate wild and captive histories with a success rate of 96%.

Conclusion:

Stable isotopes are an intuitive and repeatable biosecurity forensic technique to provide biosecurity staff and decision makers with the tools to quickly identify and manage future red-eared slider incursions in Australia. This study will inform the expansion of stable isotope methods across several high-risk reptile pet species.

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DiagamiRs – Detecting Disease by Targeting the Host

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Timely and accurate diagnosis is to key limiting the economic and social impacts of infectious diseases. Alarmingly, tests that diagnose disease by assaying for the disease-causing pathogen may have several limitations. Disease-causing pathogens may not present or exist in undetectable levels in diagnostic samples, especially during the early incubation period of disease. Furthermore, pathogens may be shed intermittently during the different phases of diseases or replication of the pathogen may occur in inaccessible locations. These scenarios may result false negative results and highlights the need to "bridge the gap" by developing technologies that detect disease when targeting the pathogen fails.

An emerging approach to disease detection involves measuring the host immune response to infection. By identifying the archetypal response to a typical class of pathogen then harnessing this information to develop biomarker-based diagnostics for that specific pathogen. This innovative approach has resulted in breakthroughs in human health, with products now on the market that help doctors guide the disease management process by "reading" the body's immune system to enable better and faster decisions.

Our group has expertise in the study of a class of host biomarker called microRNAs, small RNA molecules expressed in most organisms including plants, animals and humans. Our work to date shows that levels of circulating microRNAs are characteristically altered during the early stages of viral infections and measuring these changes can enable earlier disease detection for early intervention. This platform technology has multiple applications in biosecurity, with the potential to identify "hidden" infections and expediate the disease monitoring processes and support containment and exclusion strategies.

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Moving to Action to Prevent the Spread of Invasive Species

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Education and awareness on impacts of invasive species to our environment is not enough- unless followed by action. More than 50% of invasive plants are intentionally planted and many invasive species are intentionally released. As people move invasive species, the solution is to shift attitudes and action of high priority groups.

Using behaviour change science, the Invasive Species Council of British Columbia and Canadian Council on Invasive Species are applying new approaches to preventing the spread of invasive species. Shifting from specific species to pathways, enabled a more successful approach in reducing the spread of new species. Based on behaviour change science, it is important to identify how invasive species are introduced and moved, followed by research on critical barriers and then identify benefits for key 'partners'. This research-based approach provides the template for 'behaviour change' programs focused on pathways as the foundation to preventing the spread. Each program is developed in partnership with governments, business, indigenous and others to define the 'desired' outcome and/or desired best practice. Often, shifting behaviours requires a multi-faceted approach such as working with the horticulture industry on Voluntary Codes of Conduct and gardeners to adopt 'Plantwise'. Recreationists can ensure that they 'PlayCleanGo' to avoid spreading invasive species along roads and fields. Campers can 'Buy Local Burn Local' to avoid moving unwanted forest invasive pests and the firewood industry can ensure firewood is invasive wise and/or certified invasive free.

This presentation will overview the research used in developing practical and effective 'behaviour change' programs along with building programs through collaboration. All programs have specifically designed steps including establishing a baseline, identifying barriers, benefits and promoting and supporting desired behaviours or 'best practices'. By working together, key partners adopt and implement best practices that prevent the spread of invasive species to new natural environments.

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Biosecurity communications - driving behaviour change to minimise risk

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NSW Department of Primary Industries Aquatic Biosecurity, in collaboration with Behaviourworks at Monash University, conducted a social research project to identify the best ways to; communicate with our stakeholders, identify what drives their behavior and to come up with some strategies to encourage behavior change. The project was focused on the behavior we most want the recreational fishing community to adopt, washing boats and equipment after use and between waterways to minimize the spread of aquatic pests and diseases.

The project had four components, a literature review, a review of current communication tools, a telephone interview and a state-wide online survey.

The survey results have been analysed and a subsequent project will be delivered to implement the learnings on recreational fishing behavior and preferred communication methods. The presentation will describe the challenges faced in the social research project and next steps including an intention to review all current communication tools, develop new materials where gaps currently exist and discuss other ways that have been shown as best strategies to drive behavior change, including face to face education and online tools.

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Transforming Biosecurity Queensland's engagement capabilities through digital targeting

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In early 2018, Biosecurity Queensland set the ambitious target of growing its Facebook following from 20,000 to 100,000 people by the year 2020. This goal is one example of Biosecurity Queensland's exploration of digital engagement options to help every Queenslander play their part in the biosecurity system.

With a need to reach and influence large mainstream audiences, Biosecurity Queensland have fine-tuned the delivery of cost-effective marketing strategies for broad community-oriented behaviour change campaigns. By harnessing data available through social media and psychographic profiling, Biosecurity Queensland has established a cost-effective approach to delivering online social change interventions complimenting traditional communication and engagement activities.

Digital marketing strategies investigated by the team have focused on mining data available through digital channels such as Facebook, Google and YouTube and creating change interventions pinpointed to key audience segments. Building an understanding of social media algorithms has enabled improved targeting based on geographic location, interests, employment, education and language.

This approach to broader community education has been applied across a range of recent biosecurity programs in Queensland including: the fire ant and electric ant eradication programs, the white spot disease program, the panama tropical race 4 disease program, and is increasingly being used as a strategic tool for building biosecurity preparedness.

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The benefits and challenges of effective community engagement: moving beyond surveillance

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Community engagement and public education are often promoted as key components of effective biosecurity, particularly for increasing passive surveillance and preventing spread. However, benefits of strong community engagement can be multi-fold. The Yellow Crazy Ant Eradication Program led by the Wet Tropics Management Authority has benefitted enormously in multiple areas of the program from its engagement with the community. In its first two years, the program secured $3.3 million of in-kind support from the community, which was more than 150% of its federal government funding. The residents of one infested suburb created a task force of volunteers that, following training, took on the treatment and monitoring of their neighbourhood for the ants. They also ran a crowd-funding campaign to raise funds for research into the ant's biology and effectiveness of treatments. The community's support for the program and testimonials about the effects of yellow crazy ants on their quality of life was cited as a motivation for a subsequent $7.5 million in federal government funding. Passionate and engaged community members have also been pivotal in gaining trust of and access to key industries and properties. Engagement with indigenous ranger groups has enabled the program to incorporate traditional ecological knowledge of the area into management considerations and has also improved capacity of rangers to address biosecurity threats. The continued effort to educate industry and the broader community about the threats posed by this invasive ant has paid off with several recent significant infestations being reported by industry or the public. However, achieving these successes has not been without challenges. The most fundamental challenge will likely continue to be overcoming the complacency that comes with the reduction of yellow crazy ant numbers long before they are actually eradicated.

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Estimating the monetary value of Australia's biosecurity 'system'

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Biosecurity is a risk-based pursuit. Regulators are charged with maximising the benefits of burgeoning trade connectivity whilst simultaneously minimising the risk that harmful pests and diseases are introduced in the process. The prevailing paradigm is that a well-designed set of biosecurity interventions will yield large positive benefits, however, this contention is almost completely untested at the system-scale. Research into the relative effectiveness of risk reduction measures typically evaluate either multiple interventions targeting a single pest or, conversely, a single intervention targeting multiple pests – only a handful of analyses have examined the potential effectiveness of multiple interventions targeting multiple pests simultaneously, as they do in practice. Consequently, it is unclear exactly how much monetary 'value' one could expect to be generated by a comprehensive biosecurity system, such as Australia's. Without a clear understanding of the net benefits obtained from the existing investment in biosecurity activities it is difficult to determine the extent to which the system is achieving its desired objectives (its 'health') and also whether there is scope to increase either the value or health of the system by altering the allocation of resources. In this presentation we will present an update on our progress towards estimating the value generated by Australia's biosecurity system and discuss the challenges faced by the team as part of this complex and ambitious project.

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Growing agricultural export markets by modernising biosecurity

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Australian agricultural productivity growth over the past 100 years has been mainly at the farm-scale - through breeding, technology and management. The Australian Government has publicly backed the National Farmer Federation's strategy for agriculture to grow to a $100 billion industry by 2030. Given Australia already produces more food than it consumes, access to export markets needs to factor strongly in any strategy, of which meeting biosecurity requirements is a key element. We provide an overview of a multi-disciplinary portfolio of research seeking to help improve market access in order to make Australian agriculture more globally competitive. New emerging technologies such as block-chain, crypto-anchors, sensing technologies, and emerging applications of big-data can all help modernise supply chains. Helping to develop the Australian brand can be supported by tools that prove province. Market access though needs to be the precursor to brand value. Yet both market access and product value are deeply related. Harnessing sensor and other digital data establishes both the provenance of goods, and concurrently can be incorporated into compliance and regulatory reports needed for export protocols. The capacity and efficiency of government's compliance obligations can also be boosted where "biosecurity" can be automated. Overall, whole of supply-chain data and technology systems can also be used to test new and more flexible approaches to meet phytosanitary requirements that are less reliant on harmful chemicals and result in better quality produce (e.g. "systems approach protocols"). Such integrated strategies will be required to drive the next transformation of agricultural productivity.

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More than just pulling weeds: the essential role of civil society in biosecurity

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'The community' is often seen merely as the mass of people to be educated to comply with biosecurity laws and as a volunteer workforce to assist with control efforts – weeding as part of bushland rehabilitation programs, for example.

However, this diverse sector also offers significant resources and expertise for biosecurity efforts traditionally not open to public involvement, in particular for prevention and early action. Examples of community contributions include surveillance, monitoring of illegal trade, identifying and responding to incursions and developing innovative policy.

To optimise the contribution of the community sector to biosecurity requires identifying opportunities for more meaningful community involvement and overcoming institutional barriers. We review some opportunities and propose reforms to better support community involvement, particularly in prevention and early responses, drawing on this sector's strengths and new technologies.

The whole community bears the costs when biosecurity fails. There is every reason why it should be enabled to play a greater role in making biosecurity more effective.

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The Biosecurity Plan Builder: promoting uptake of biosecurity planning amongst dairy farmers

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Changes to biosecurity obligations mean that individual farms need to improve the documentation of their management approach to biosecurity risks. For dairy farmers, the creation of a biosecurity plan is voluntary, unlike for beef producers where it is compulsory so as to be able to access the NLIS program.

Even for those livestock producers who have a written biosecurity plan, biosecurity practice is not yet a routine management procedure for most farms, and dairy producers may still be confused and over-whelmed about how to develop a farm biosecurity plan. Whilst a number of biosecurity plan templates exist, a need was identified for plans to be tailored to each farm's particular context, to be practical and to accommodate variation in risk appetite. It was proposed that a user-driven and user-friendly plan builder tool would promote adoption of biosecurity planning amongst dairy farmers.

The Biosecurity Plan Builder is a responsive, 'smart' online tool which assists users to create, store, update and share a customised biosecurity plan. It is designed to help users answer the broad question 'how is biosecurity risk managed on this farm?' The farm's specific animal health risks are identified and scientifically valid options control actions are suggested. The plan is secure, yet can easily be reviewed, improved, and shared.

A workshop setting has been designed to introduce and promote uptake of the Biosecurity Plan Builder tool and ensure that managing biosecurity risk becomes an active management practice for dairy producers, with the aim of increasing awareness and knowledge of animal health risks. Dairy producers will be encouraged to discuss animal health risks that they perceive as relevant and, taking a risk management approach, broaden their perspective to include other relevant and important animal health risks.

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Weed Prevention and Eradication: Mobilizing action at the 'pointy end' of the invasion curve.

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In weed biosecurity, current dogma purports that return on investment is greater at the 'pointy' end (prevention/eradication) of the invasion curve. However, prevention activities are often government-run, and the community does not have an easy entry point into prevention or eradication. This presentation posits ideas to use existing initiatives and tools to involve regional and local communities in biosecurity prevention. The wider community normally focus efforts on 'backyard' biosecurity (e.g. widespread weeds/pest animals). How do governments provide them with tangible reasons to engage in 'greater good' prevention efforts?

One mechanism could be to 'scale-down' national and state-level initiatives to garner public (and hence, political) support and engagement. Prevention examples include: a) horizon scanning exercises and developing high-risk lists (e.g. 'most un-wanted') with regional engagement strategies, b) preparedness research targeted to community values, c) sector-targeted hygiene programs. In eradications, there is scope to engage the public in surveillance, delimitation and other components to improve national and jurisdictional eradication attempts.

Concepts such as eradication are currently aimed at state or national scale, and don't always translate easily to a local one. However, we can use behavioural science, marketing, citizen science and other tools to regionalise prevention activities. We can mainstream biosecurity messaging with other sectors, such as regional tourism campaigns or iconic wildlife programs (e.g. NSW No Space for Weeeeeeeds campaign promotes values and their protection, rather than weeds 'scare' messages). To succeed, these initiatives must be established and led by national and state governments – and jointly coordinated with regional and local groups. They will be coupled with cross-sector behaviour change and marketing strategies: We must know what people value to understand their entry points to biosecurity. Opportunities abound to work with social scientists, marketing experts, and national data infrastructure to improve community engagement in preventative biosecurity.

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Tools for developing cost-effective decisions for managing invasive pest eradications

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Early intervention against new pest incursions that eradicates the pest before it becomes established represents some of the highest benefit/cost ratio for investments in biosecurity policy. Once a decision is made to initiate eradication of a pest, managers are then faced with decisions about how and when to proceed. Similarly, once eradication appears to be successful and the pest is no longer being detected, a decision must be made about whether to stop the eradication program and declare success. In practice, these decisions about how to manage an eradication response are usually based on subjective reasoning rather than scientific evidence.

This project aims to develop an evidence-based approach for managing invasive pest eradications. We propose to develop tools, based on decision theory, to help managers develop optimal (cost-effective) decisions during an eradication response. These tools will provide near real-time analysis of data collected during an eradication program, which can then used to make optimal (cost-effective) decisions regarding the deployment of resources. A key outcome of the research will be the development of a suite of decision tools that will be packaged in a user-friendly software interface and will be flexible enough to be applied to any invasive pest eradication response. More specifically, the decision tool software will be designed to address the following types of decisions:

a) Estimate the feasibility of eradication (probability the response will fail)
b) Cost-effective removal and surveillance strategies (decisions around which tools to use)
c) Progress towards eradication, including estimates of future resources required for completion
d) Cost-effective “stopping rules” (when to declare successful eradication)

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Weed eradication – a history of adaptive management combined with innovative game-changers are poised to improve success rates

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A raft of innovative technology and approaches are currently emerging that are expected to dramatically improve not only detection timeliness but also delimitation confidence. This paper outlines the evolution of strategic decision-making behind several major weed eradication programs in Queensland over the past 25 years and predicts that several key areas of science will yield significant improvements in success-rate. Techniques such as eDNA detection and DNA microsatellite analysis can now be used to reverse-engineer the dispersal architecture of invasive populations, revealing powerful insights into population development and, ultimately, radically improve delimitation confidence. Unmanned aerial vehicles (UAVs), combined with machine learning to automate image processing, have the potential to significantly improve detection of isolated targets over large areas. Moreover, targeted, pre-emptive surveillance using coordinated and trained volunteer-networks, in combination with sentinel sites and improved pathways analysis, are expected to detect targets much earlier, making populations more vulnerable to eradication. Data analysis will continue to evolve, guiding smarter decisions. A greater emphasis on pest risk assessment, information on basic ecology, and intelligence generally, will allow us to pre-emptively "understand the enemy", much like the military's ISR approach (intelligence, surveillance and reconnaissance) placing us on the "front foot" rather than responding reactively. In summary, there is exciting scope to improve the probability of successful early detection and eradication of high-risk biosecurity targets.

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Quantifying environmental benefits of eradication and biosecurity actions

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Biosecurity policies and actions mainly focus on protection of Australian industries from the negative impacts of pests and diseases, but they may also deliver positive environmental outcomes. However, environmental outcomes are often ignored in the decision process as values of the environmental benefits are not readily available. The omission of environmental benefits from assessment processes can lead to suboptimal outcomes or even have severe environmental consequences.

As most environmental benefits are non-market in nature, that is, they are not traded in markets and have no price they are difficult to quantify. Moreover, the complexity of ecological systems makes the scale and nature of environmental impacts difficult to predict. There is a need for environmental values to be easily available to make more efficient and timely eradication decisions. Non-market valuation techniques can be used to obtain the value of environmental benefits arising from a potential eradication or other biosecurity actions. An example of an application of a non-market valuation technique is presented based on a case study of potential new marine pest incursions in Australia.

The study was designed to assist the Department of Agriculture and Water Resources in analysing biosecurity policy interventions. The results showed that Australians place substantial value on the protection of the Australian environment from potential impacts of new marine pests and emphasise the need for environmental benefits to be considered when estimating the benefits of potential eradication to the Australian community.

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The race is on - managing Panama disease tropical race 4 in Far North Queensland

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Department of Agriculture and Fisheries' (DAF) management of the Panama disease tropical race 4 (TR4) in Far North Queensland (FNQ) is gaining international interest. With slow disease progression across three infested farms over four years, the world is watching to see how Australia's industry is adjusting.

Panama TR4 is one of the greatest threats to worldwide banana production. Deemed not eradicable, there's no cure and its rapid spread overseas through commercial banana growing regions has devastated industries and livelihoods.

First discovered in Australia in 1997 in the Northern Territory TR4 wiped out commercial banana production there. In FNQ, it was discovered on a farm in 2015, then two nearby additional farms in 2017 and 2018. FNQ produces 94% of Australia's bananas and with an annual farm gate value of over $600M is the region's main economic driver.

Since 2015, DAF committed to a collaborative approach with the Australian Banana Growers' Council ensuring key stakeholders all work towards protecting the banana industry. DAF ensured all the elements worked together – biosecurity, research and development, diagnostics, and Panama TR4 education.

DAF encouraged stakeholders' active participation to facilitate industry resilience, recovery and sustainability. Growers are now 'leaning in' to the TR4 conversation to learn how they can be better prepared. The situation is dynamic and DAF's biosecurity practices rely upon rigorous scientific knowledge that helps us to manage the disease in response to regulatory, grower and industry needs. The strong partnership between government and industry, with committed stakeholders, is giving Queensland a fighting chance to live sustainably with Panama TR4 and minimise its impact.

In this presentation Panama TR4 Program Leader, Rhiannon Evans will share DAF's experiences in the containment of Panama TR4 - the why and how, and lessons learned as we break new ground in the management of the disease in Australia.

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Inferring outbreak transmission networks

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Central questions early in emergency animal disease outbreak responses are 'who infected whom?', 'who will be infected next?' and 'how and where should we intervene?'. Answering these questions in time to inform decision-makers can lead to large potential savings through better targeting who to investigate and which farms to quarantine, and/or depopulate or vaccinate.

Several transmission network models are available that combine genomic and epidemiological data to infer the network of who infected whom during outbreaks. This study involved comparison of the fitness for purpose of transmission network models for making real-time inferences in a foot-and-mouth disease outbreak in Australia. The best-performing model was then extended to incorporate farm-level covariates and to handle animal movement data with verification based on simulated datasets, and then application to the real outbreak dataset from the 2010 outbreak of FMD in Japan.

The modified model achieved marked improvements in overall accuracy. When implemented on the actual outbreak data from Japan, infected farms that held predominantly pigs were estimated to have higher transmissibility of infected cattle farms and be less susceptible. The primary seeding event that initiated the outbreak in Japan was inferred and all key linkages between clusters and features characterising important farms in widespread dissemination of this outbreak were elucidated. Inferences of key epidemiological parameters included the farm-level incubation, latent and infectious periods, the number of infected premises at the point of detection, the time back to the seeding event into the population and the number of primary sources.

To improve accessibility the modified model is soon to be made available as an R package. Following planned training, adoption by epidemiologists in Government Departments will lead to its utilisation informing decision-making in future outbreaks.

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Intercepting animal disease risks approaching Australia

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Ever-increasing global trade volumes and international travel numbers increase the pressure of a vast array of potential pathogens and pests approaching Australia. While Australia tries to manage as many risks as possible offshore, many pests and biosecurity risk materials that could carry pathogens are intercepted at the border while inevitably some get through. A review of pest and biosecurity risk material border interceptions by the Department of Agriculture and Water Resources included a case study of meat interceptions at the border. Meat that has not been sourced or treated according to prescribed import conditions could introduce foot-and-mouth disease, African swine fever or other serious diseases—with major economic consequences for Australia's livestock industries and exports. This study found that the air passenger pathway presents significant challenges for the department. Between 2012 and 2017 the department intercepted over 272 tonnes of meat products at the border, over 80 per cent at airports. Over 62 per cent of this meat came from countries which were not free of foot-and-mouth disease. More recently, around ten per cent of intercepted pork sampled was found to be carrying African swine fever virus, while one per cent contained traces of FMD virus.

The effectiveness of the department's measures to intercept and manage this and other major biosecurity risks, and possible system improvements, will be discussed.

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From Go to Woe: Would a Rabies Incursion Spread in Northern Australia?

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Introduction

Northern Australia faces an increasing risk of a canine rabies incursion due to the eastwards spread of rabies across the Indonesian archipelago. Remote Indigenous communities in northern Australia are situated within complex ecosystems containing large populations of free-roaming domestic dogs, surrounded by widely dispersed wild dog populations. Managing the response to a rabies incursion within this ecosystem presents enormous challenges.

Aims

The aim of this research program has been to facilitate decision-support for rabies surveillance, control and response strategies in northern Australia.

Methods

In-depth field studies and data collection were used to inform risk assessments and disease models. These included collaring domestic dogs with GPS collars and video cameras; questionnaires, interviews and deliberative panels with residents (including hunters); canine scat DNA analysis; and motion-activated cameras. Three different agent-based, stochastic models were developed and used to assess options such as the most effective and efficient approach to vaccination.

Results

Within the Indigenous communities studied, most dogs remain close to their residence, but a substantial number roam widely – including areas of bush surrounding these communities. DNA and camera trap analysis and resident and hunter surveys demonstrate that a domestic–wild dog interface exists. Models predict that if rabies were introduced, it is likely to spread. Delayed detection of an incursion would require a substantial control effort if relying on vaccination. Infrastructure (e.g. fencing) and behavioural (e.g. domestic dog roaming, wild dog cultural significance) barriers were identified. A major issue that remains is the practicality of surveillance of wild dog populations, and disease control strategies in the case of populations that hold cultural significance.

Conclusions

Tools for robust decision-support for a rabies incursion in northern Australia now exist. But this also highlights that exotic disease preparedness goes beyond technical disease issues: infrastructure, behavioural, social and cultural issues need to be addressed.

Climate change implications for biosecurity

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Climate affects biosecurity in many ways. It influences the species involved, the frequency, severity and spatial distribution of events, the systems affected and the degree of impact, the response measures available and their ability to be implemented, amongst other things. It follows that if climate changes, then all of these will also change. Sometimes a little and sometimes a lot. Sometimes for the better and sometimes for worse. The evidence that global and regional climates are changing is increasingly clear as is the human influence on these changes. This has already resulted in significant poleward shifts for many important groups of crop pests and pathogens as well as various vector-borne diseases (with most increasing in severity but a few decreasing). This has occurred because of changes in temperature (particularly minimum temperature) and humidity and increasing frequency of extreme weather events. Pests, disease and weeds will likely become more problematic and their management more costly with climate changes due to further range expansions and increases in impacts. For example, many weeds respond more positively to elevated temperature and CO2 levels than crops or native plant species. The prospects for control appear challenging, including because higher temperatures and elevated CO2 tend to reduce the effectiveness of control measures for various pests and weeds, increasing the amount of herbicide, pesticide and fungicide needed. The current capacity to predict and hence plan for improved biosecurity under climate change is also limited in part because of the difficulties in assessing the interactions of multiple abiotic and biotic factors but also because of the inherent surprises that climate change is already bringing and that are likely to increase in the future. Enhancement of monitoring systems including early warning systems and pro-active preparation including R&D on adaptation options is likely to help.

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How will climate change impact biosecurity in NSW?

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The NSW Department of Primary Industries Climate Change Strategy contains a portfolio of targeted measures to help NSW primary industries meet the challenge of a changing climate and enable the sector to capitalise on potential opportunities. Part of the strategy is a cross-sector, whole of NSW vulnerability assessment for primary industries (for more details please visit https://www.dpi.nsw.gov.au/climate-and-emergencies/climate-change-research-strategy/vulnerability-assessment).

The objectives of the vulnerability assessment are to:

1. enable key NSW primary industries to better plan and respond to a changing climate through effective adaptation; and
2. provide the evidence base to support NSW government policies and plans in areas influenced by the effects of climate change on primary industries.

The analyses within the vulnerability assessment will consider a spectrum of risks across the biosecurity continuum and how these could change with changing climate. A more holistic picture of the risks posed by climate change to primary industries will result, subsequent to integrating these biosecurity risks with the separate analyses of production sector-based risks. The outcome will be a more realistic picture of the risks, threats and opportunities across the primary production sectors. This integration has not been conducted in any Australian state.

Assessment of the biosecurity risks for the vulnerability assessment commenced in February 2019. Looking at the work that has been done in the past, broad outcomes have already been observed. Predictably, research has generally focused on what is easy to study. This has included: foliar, wind-dispersed plant pathogens; environmental weeds; and insect pests with well-characterised environmental tolerances. Further, the climate change scenarios considered have mostly focused on geographical mean temperature increases rather than variability and climatic extremes. Many studies investigated the poleward shifts in pest distributions, which is an obvious outcome of global warming on invertebrates and pathogens. Impact studies based on sound biophysical processes underlying the interactions between environmental factors and biosecurity targets are scarce. No information has been published modelling the effects of climate change on non-vectored livestock diseases.

Overall, we aim to provide economic and production assessments to demonstrate the value (or not) of actions and/or adaptation plans to respond to changing biosecurity threats as we head towards 2050. The foundational information delivered from this project will inform strategic investment and planning and set future research priorities.

Climate Change Panel

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Salmonella Enteritidis - its importance to business and public health

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Salmonella Enteritidis is a bacterial disease of poultry, and consumption of contaminated eggs can present a risk of causing foodborne illness. This can be particularly severe for people who are elderly (over the age of 65), young children, and those with a weakened immune system. *S.* Enteritidis is different to other *Salmonella* serotypes as it contaminates the eggs before the shells are formed. This results in *Salmonella* inside the egg, which can increase the human salmonellosis risk associated with these eggs particularly if coupled with poor handling and storage practices from farm-to-table.

A poultry flock infected with *S.* Enteritidis may present clinically with depression, poor growth, weakness, diarrhoea, and dehydration. Generally, the birds recover; however, they may harbour the bacteria in their guts for months. *S.* Enteritidis is not generally regarded as being present in Australian poultry. It is present in many overseas countries. Human cases reported in Australia typically occur in people who travelled overseas and were infected there before returning home.

In 2018-19, clusters of human cases with no obvious history of overseas travel or other high-risk exposure was identified by health authorities. These cases seemed most likely to be locally acquired. Epidemiological information coupled with animal, food, environmental testing and whole genome sequencing enabled the vehicle of human infection to be traced back to eggs from specific farms. A voluntary recall of eggs was initiated by one business, and biosecurity directions and orders were used to control the organism on-farms. Restaurants and a grading facility also implicated were found wanting in their food safety practices and prohibited to operate until rectified. This presentation will outline the investigation, highlight existing risk-reduction approaches that are successfully reducing the rates of human salmonellosis and consider what more needs to be done if *S.* Enteritidis were to establish in commercial layers here.

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Lessons from international settings for Australian biosecurity: the case of a multi-sectoral one-health approach to zoonotic diseases

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Zoonotic diseases pose a threat to human and animal health security. The impact of zoonotic disease outbreaks also reaches across many other aspects of society including economy, environment, culture and social amenity.

The capacity to respond to these disease outbreaks varies greatly across the globe, influenced by resources, social structure, political stability and geography. Whilst many countries have both the knowledge and resources to respond to a zoonotic disease outbreak, the emergence of new diseases and re-emergence of neglected zoonotic diseases, often occurs in regions where resources and support for response is limited.

In responding to disease from a one-health perspective, even regions with higher levels of resourcing often lack administrative and technical collaboration between key stakeholders. In an effort to address this lack of collaboration, the FAO, OIE and WHO implemented a tripartite collaboration to achieve a multi-sectoral, multi-disciplinary risk-based approach to address the issue of zoonotic disease in countries.

The collaborative approach to the development of the guide, which outlines non-prescriptive mechanisms for zoonotic disease response, enables biosecurity and biosafety outcomes in the management of an outbreak. The need for such a coordinated one health approach became apparent during the major health security events of Highly Pathogenic Avian Influenza (HPAI) and and Severe Acute Respiratory Syndrome (SARS) outbreaks in the Asia-Pacific region. Since then, progression of the development of such one-health response structures have had further reaching benefits for many sectors.

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Are we prepared for a Q fever outbreak?

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Q fever is a zoonotic disease caused by the bacterium *Coxiella burnetii* that can result in severe negative human health outcomes. A large outbreak in the Netherlands that commenced in 2007 led to over 4000 human cases, of which more than 75 died as a result of Q fever and complications. Understanding is improving regarding species of animals that can be infected with this organism and consequently act as sources of infection for humans, but large gaps in knowledge still exist. The clinical signs resulting from infection with *C. burnetii* in animals vary and range from inconsequential with no apparent signs to abortions and weakened young animals. Knowledge surrounding Q fever is expanding and we are aware that the risk factors for infection with this pathogen are more diverse than originally thought. We are also aware, through national and international experience, that large outbreaks of human disease may occur quickly and are more likely if effective control measures and appropriate communication networks are not in place between stakeholders.

This panel session will explore the question “Are we prepared for a Q fever outbreak?”. It will use the cross-sectoral expertise of the panel members, along with interactive audience discussion, to focus on the known sources of Q fever, clinical signs and production losses that might alert farmers or veterinarians to the pathogen’s presence, routes of exposure, and the potential for reporting (or missing) Q fever in animals and people. We will outline the control strategies available in Australia and discuss the routes of communication between farmers, veterinarians and doctors that currently exist and challenge the panel and participants to explore how we can improve our ability to prevent, mitigate and respond to outbreaks in the future.

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Science-based economic analysis and biosecurity policy in Australia

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This paper identifies how economics and science can be combined to estimate the risk profiles and consequent potential impacts associated with biosecurity incursions in Australia, and inform the Australian Government's biosecurity policy decisions.

Using a range of ecological/epidemiological decision modelling, land and spatial analytics, and economic modelling techniques, ABARES will present the methodology and potential impact of several biosecurity threats:

- Citrus canker - a highly contagious bacterial disease that affects all above-ground parts of citrus trees, reducing the vigour, quality and yield of the fruit
- Ug99 Wheat stem rust - a fungal disease that can reduce grain yield by up to 90 per cent in wheat when seasonal conditions are favourable
- Scrapie - a progressive neurodegenerative disease affecting sheep and goats, similar to BSE in cattle (but without known human health impacts if infected meat is consumed)
- *Xylella fastidiosa* - one of the world's most damaging bacterial diseases that affects a large number of common plant species, and is Australia's number one priority plant pest.

The economic impacts considered comprised yield and/or stock losses, increased production costs, eradication or mitigation costs and potential trade impacts—for a range of disease-spread scenarios, including controlled and uncontrolled spread. Scientific analysis comprised spatial mapping and modelling of climatic suitability, varietal susceptibility, likelihood of incursion, and rate of spread.

The paper emphasises the important role economics plays in identifying cost-effective policy decisions. Through the integration of science and economics, the ABARES findings provides important information to the Department of Agriculture and Water Resources that underpin resouce allocation decisions in biosecurity prevention, eradication and containment.

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Economic value of freedom from Equine Influenza

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This paper presents the methodology and results of a joint ABARES and NSW DPI study that estimates the *ex-post* economic value of Australian government biosecurity control measures, which have been effective in maintaining Australia's Equine Influenza (EI) free status for the last 10 years.

The EI virus was detected at Centennial Park on 24 August 2007 and officially confirmed in horses at two premises in the Sydney region the following day. The Australian Horse Industry Council estimated that by December 2007, the outbreak had cost Australia in excess of $522 million. The financial hardships to the horse industry continued even after Australia was declared free of EI in March 2008. Australia has since retained of its EI-free status.

EI is now endemic in most of the world except Australia, New Zealand and Iceland.

Without Australian government biosecurity control measures in place, it is likely that the virus would have entered and also become endemic in Australia, resulting in significant costs to horse racing, equine sports and recreational industries, which contribute significantly to Australia's economy and the social life of its residents.

The estimated *value of* EI freedom since the 2007 outbreak is calculated as the difference in total costs *with* and *without* government-funded EI biosecurity arrangements. The "*with*" scenario comprised pre- and at-border prevention measures and post-border eradication in the event the virus entered. The "*without*" scenario (the counterfactual) assumes that the horse industry would have relied solely on self-regulation against EI, and that once EI had entered, the virus would have spread throughout Australia and become endemic.

The results of this study concluded that Australia's EI biosecurity arrangements have been effective in avoiding significant costs to the Australian horse industry, at a very small cost to government.

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Interactive dashboards for effective biosecurity monitoring, reporting and evaluation

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In the face of unprecedented challenges and limited resources, Australia's biosecurity system must increasingly adopt a strategic approach focused on outcomes rather than a reactive one focused on mitigation activities. This is particularly important in the context of biosecurity being a 'shared responsibility', where multiple stakeholders with overlapping jurisdictions must interact to achieve results. Outcome-focused biosecurity management requires desired outcomes to be defined, evidence to be gathered and management to be adapted accordingly. The monitoring, evaluation, reporting and improvement (MERI) framework has been increasingly adopted by biosecurity stakeholders to allow such feedback loops for adaptive, outcome-based management to occur. In order to better embed the MERI framework into practice, we propose greater transfer of 'business intelligence (BI)', and related 'location intelligence (LI)', principles and tools into the biosecurity realm.

Broadly, BI translates historical data into timely insights that inform future business decisions. BI technology is used to drive this process via automated data integration, analysis and visualization. LI uses GIS technology to place the BI framework (data, insights and decisions) into a spatial context. We present case studies on using interactive BI/LI 'dashboard' tools to evaluate and report on biosecurity and natural resource management programs. We work with stakeholders to clearly define indicators of success (i.e. desired outcomes) and link these to a range of monitoring data sets via interactive, graph- and map-based visualizations. Modern dashboard tools are highly customizable and allow for real-time, cloud-based analyses and information sharing. They provide a clear technology pathway for implementing MERI feedback loops. BI dashboards enable data to be utilized for multiple purposes, including on-ground adaptive management, strategic planning, or high-level reporting and policy formation. The main challenges lie in defining indicators that can meaningfully inform decisions, and establishing robust, standardized processes for collecting consistent and accurate monitoring data.

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Measuring biosecurity system effectiveness

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The Invasive Species Council has developed a set of indicators to determine the effectiveness of a biosecurity system. The 24 proposed indicators allow you to determine performance at the introduction, establishment and impact phases of the invasion curve. The indicators allow you to measure a baseline of information about invasive species to determine the biosecurity challenge, the nature of the biosecurity effort in place and the level of success at achieving biosecurity goals. They are to be applied to six broad categories of exotic invasive species: plants, vertebrates, invertebrates, freshwater organisms, marine organisms and pathogens. Where data is difficult to collect or access, the adoption of this system is expected to drive improvements in data collection and availability. A simplified form of these indicators was used in the 2017 NSW State of Biosecurity Report. This report use this data to create a 'rubric assessment of invasive species management, which gave an overall measure of performance of the NSW biosecurity system in managing risks from invasive species.

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Prioritising environmental pests and diseases – Finalising the process and next steps

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The National priority exotic environmental pests and diseases project is a collaborative process drawing together more than 100 experts across the community from Commonwealth and state and territory governments, NZ Government, universities and other organisations. Collectively they are developing a national priority list of exotic pests and diseases that could harm Australia's environment and social amenity. The list includes consideration of exotic pests and diseases across terrestrial and freshwater vertebrates, terrestrial and aquatic invertebrates, marine pests, plants, plant pathogens, wildlife diseases and aquatic animal diseases.

The Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) and the Department of Agriculture and Water Resources is leading the project. The project is driven by recommendations from the 2017 independent review of the national biosecurity system. The review's report, *Priorities for Australia's biosecurity system*, recommended a national priority list for environmental pests and diseases be developed in partnership with system participants.

The development of the priority list has occurred over several stages. A review of prioritisation processes, both in Australia and internationally, provided the base for the prioritisation methodology. Technical experts were brought together for several workshops, which enabled agreement on the most appropriate prioritisation method. A semi-quantitative method and structured modified Delphi was developed and tested across thematic taxa groups. The robust workshop discussions also resulted in a shared vision on the purpose and functions of the list.

There has not previously been an attempt made at such a broad prioritisation process across all taxonomic groups. Pivotal to the success of this project is cross-sectoral collaboration. Feedback from participants involved has been overwhelmingly positive highlighting transparency, inclusiveness, trust, fairness and collaborative spirit as key features of the project. Here, we will highlight the uniqueness of the process and current status of the project, with the inaugural priority list close to being finalised.

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What should we be looking for? Prioritizing insect pests and pathways to Australia

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The Insect Pest Prioritisation Project is a joint project conducted by Monash University and the Invasive Species Council. It seeks to identify priority pests and pathways for any insect that could come to Australia and harm the environment. It uses an open source impact assessment tool, developed by the IUCN through its Species Survival Commission Invasive Species Specialist Group, and a strategic foresighting exercise.

Using this approach the research identified over 2000 species with evidence of causing environmental harm globally, over 200 species of significant concern, of which 17 currently negatively impact the environment in Australia. Ants were identified as the highest priority concern, not only because they already cause significant damage in Australia, but because the family is reported almost three times as often in association with virtually all main pathways of introduction. The results will assist in informing priorities for Australia's biosecurity preparedness and surveillance.

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What does the Global Burden of Animal Diseases program mean to biosecurity in Australia?

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Due to its geographic remoteness, Australia has historically seen a low risk of importation and establishment of many infectious animal diseases. With increases in the movement of people, animals and goods to and from Australia, there is a significant and ongoing threat of infectious disease incursions. Successful biosecurity risk management systems require the management of large volumes of data, coming from a variety sources, all with different functions, formats, and semantics. Efficient and effective approaches are needed to process and analyse such data, whilst the results need to be communicated in a timely manner so users can make sound biosecurity decisions. Therefore, a system is required that regularly collects, validates, analyses, and disseminates information on diseases, livestock production and economic effects to achieve evidence-based biosecurity policy.

The Global Burden of Animal Diseases (GBADs) program was initiated in 2018 to address this problem. The program will establish where livestock diseases are occurring, estimate the losses attributable to diseases, as well as expenditure on disease mitigation; providing a total cost estimate of animal disease. This will be achieved by establishing standards and methods for disease statistics, data collection and data analysis, as well as the development of an integrated animal health database that is regularly updated and freely available. Australia, as a leading country in the development and implementation of the program, will benefit from the output from GBADs. It will be immediately applicable for the improvement of biosecurity, knowing what diseases present the most threat from neighbouring countries and trading partners.

The panel will present the GBADs program and discuss the legacy of an integrated animal health information system. The challenges associated with open data policies and principles will be explored, and some solutions proposed.

Optimising Biosecurity Investment and Effort

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Invasive species can be highly damaging to primary production but also by altering the ecosystem they invade. Keeping invaders out through effective pathway risk management is a noble goal, but this is just one part of a successful biosecurity system. It is important to also consider investment in surveillance, to detect any invaders that may slip through preventative measures, and through readiness for incursion response, such as an eradication or containment plan. Investment in each of these activities must also be weighed against the costs of managing a pest, should it become established, as well as the direct and indirect damages attributable to an invader with various levels of control. Previous research has used various approaches to assess only one or two aspects of biosecurity at a time. Our aim is to optimise investment in each stage of the biosecurity system, from pathway risk management though surveillance and eradication expenditure to costs of long-term management and control. We initially parameterise our model for several case study insects, with the overall goal of extending this to optimise for all insect pests that affect plants in New Zealand.

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From broadcast to narrowcast: Tailoring information for our audience

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How do we continue to drive practice change, and what do we need to provide to facilitate this process? Farm Biosecurity has created a 'one-stop shop' for biosecurity information, with information covering some forty industry sectors, attracting tens of thousands of visitors every year. As things change, however, we must adapt to ensure that we continue to meet the needs of our audience.

Over the decade we've been operating, communication has evolved. Speaking broadly, the focus has moved to communication platforms and techniques in which the audience determines what information they want to see – and signs up to channels which will provide that information in a way which suits them – rather than being told what they need to see.

We've seen through our own survey research a shift in what information our audience wants to see, as well as changes in their preferences for receiving information. Survey responses indicated that our audience values communication which is actionable, timely, and tailored to their specific needs. We've also seen a change in the role of advisors, whose knowledge is yet another resource for our audience and for whom de-risking biosecurity is yet another service to offer.

With such a diverse audience, we must provide each participant with a more tailored offering, giving them the right push at the right time to encourage action. However, we must do so without tipping the delicate balance between meeting the needs of our audience and contributing to the information overload.

How do we build trust as a source of information, securing us a privileged place in newsfeeds and inboxes? How do we equip consultants, trainers and advocacy groups with tools and information to inspire change among producers? We're eager to discuss what the future might hold for our Program and consult widely to find the best way forward, in order to achieve our goal of better post-border biosecurity nationwide.

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The new Biosecurity Act 2014 – what have we learned? What needs to change?

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The Queensland Biosecurity Act 2014 commenced On 1 July 2016, introducing fundamental changes to how biosecurity risk is managed in Queensland. The general biosecurity obligation now requires everyone to take all reasonable and practical steps to prevent or minimise biosecurity risks.

Three years on, Queensland has just completed a review of the efficacy and efficiency of the new provisions covering:

- how the shared responsibility function has been applied
- how the risk based decision making function has been utilised
- experiences under the emergency powers
- how the performance of compliance and enforcement has faired
- where the third party accreditation has been utilised
- how has the administrative functions under the Act faired

This presentation will explain key results from the review including policy questions around what Local Governments can manage under the Act, flexibility in the use of emergency powers, improved communications around the general biosecurity obligation and consistency in risk based decision making methods. It will also outline the process from here.

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Immunising biosecurity policy, research and practice in a post-truth world

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Biosecurity policy, management and practice integrally deal with risk. As such, they are well accustomed to science and research playing a key role in evidence-based policy development and risk management. However, neither are immune to the broader social and political milieu in which now more than ever the nature, validity and ethics of evidence, and the rights, welfare implications and trade-offs associated with decision making and management are debated. This milieu is increasingly associated with the term post-truth, described by the Oxford dictionary as the phenomena in which objective facts are less influential in shaping public opinion than appeals to emotion and personal belief. On an island continent like Australia where biosecurity policy is a mandatory component of any government's policy portfolio, the increasing risks associated with the post-truth phenomena need to be considered in the way in which policy calls upon science and research, in which science and research communicate to policy, in which both influence practice, and in which all not only work together but are seen to work together for the benefit of most if not all within a democratic framework. These risks will only intensify as environmental biosecurity becomes a more conspicuous element of the overall biosecurity agenda. This paper identifies post truth risks to Australian biosecurity and offers some potential ways in which it can help immunize itself from these risks.

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Understanding stakeholder motivation to better influence their behaviour

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Behaviour change is a complex notion, with many underlying challenges. However, to endeavour change among stakeholders or a sector of the community it is imperative to firstly understand the motivating factors behind their behaviour.

When white spot disease (WSD) hit South East Queensland it was critical to determine who the stakeholders were quickly and how they were affected by the outbreak. Although disease control activities are designed to minimise long-term impacts they can be perceived as having negative social, economic and environmental impacts. By understanding stakeholder attitudes, beliefs and motivations in relation to these impacts we were better able to manage expectations and outcomes.

Throughout the white spot disease response a cross section of the community were affected by the movement restrictions that had been enforced (mainly commercial and recreational fishers). Their cooperation in disease containment, spread and introduction was crucial. Therefore, to effectively communicate important information and messaging to them social marketing techniques such as psychographic segmentation and concept testing were employed, allowing us to ascertain the motivating factors behind their actions. By doing this we were able to deliver more effective education and engagement campaigns directly to them.

For example, through concept testing in focus groups with recreational fishers it became clear that a single, logical approach to messaging would not be successful. Therefore, a dual approach was needed that delivered both rational and emotional messaging. The dual messaging could connect with people motivated to action in different ways, enabling our messages to reach the target audience more effectively.

In the presentation I will take you through the processes we undertook to understand our audience. We'll look at the how decisions and habits are formed by subconscious and conscious behaviour, and how this causes us to respond differently to certain information. I will then show you how we applied this to our dual messaging approach and look at the results.

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Improving biosecurity surveillance in plant industries: Case-study of the production nursery industry

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Improving biosecurity surveillance practices of producers in the plant industries is crucial for increasing the chances of early detection and eradication of emergency plant pests. Prior research suggests that producers typically engage in the control of existing pests and diseases, rather than practices that could prevent new pests and diseases. In this project we sought to investigate the various factors affecting the plant surveillance practices in the production nursery industry, in order to identify ideas for actions, at a range of levels. We conducted interviews with a range of growers and other stakeholders (n=22) before conducting a larger quantitative survey of growers across Australia (n=213). Overall, we found that monitoring (inspection and detection) practices appeared variable, while record-keeping and reporting of unusual signs of plant pests were quite limited. Industry efforts to improve general grower practices through its best-management-practice program (NIASA), as well as its specific biosecurity management program (BioSecure HACCP), face significant challenges, partly due to changing funding priorities. While significant effort has already been invested in providing pest and biosecurity information and tools, it was evident that growers rarely use these materials. However, a quarter of the survey respondents indicated that no further support was required. Where further information was requested, it was for easier-to-use tools, real-time alerts, more frequent staff training programs and accessible local pest specialists. Other ideas to support improved grower practices related to increasing membership of industry associations, supporting the uptake of NIASA and BioSecure HACCP, registration of 'backyard' operations, strengthening communications, and the development of a genuine partnership approach for shared responsibility. In consulting widely and investigating the various social and institutional aspects important to facilitating improved practice, this research provides useful guidance to industry on designing and implementing a grower-led surveillance system.

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Evaluation of social media engagement strategies relevant to Australian biosecurity and alien wildlife trade

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Introduction: Social Networking Sites (SNS) allow rapid, near real-time connectivity between billions of users, a large proportion of which engage in social media on a daily bases. As such, SNS platforms provide a valuable opportunity to aid biosecurity through increased reporting and dissemination of information regarding the illegal trade of alien wildlife. However, the effects of SNS communication on public engagement and anti-illegal wildlife trade (IWT) behaviour remain poorly understood.

Proposed Aims: To evaluate public engagement strategies using existing SNS content pertaining to IWT, with particular emphasis on Australian biosecurity.

Proposed Methods: We intend to identify public SNS posts pertaining to IWT on popular platforms such as Twitter and Facebook using automated data collection techniques. Posts will be categorised based on media type (e.g., text, image, video) and content theme (e.g., biosecurity risks, animal welfare concerns, legal consequences). We will collect de-identified data of user response to selected posts, in order to conduct engagement, sentiment and social network analyses commonly used to measure stakeholder engagement with local government and private business. This data will enable us to address the following research questions prompted by preliminary results:

- Is there an optimum SNS strategy for maximising content popularity, engagement and dissemination of information with relevance to IWT and biosecurity?
- Do compositional differences exist in the social networks of individuals who respond to different content themes?

Intended Implications: By identifying SNS strategies that optimise user engagement for specific target audiences, we intend to improve the efficacy of future biosecurity initiatives, such as Crime Stoppers Victoria's recent Trafficked, Traded and Traumatised campaign. Furthermore, quantifying the degree of social network overlap between content themes may help determine the number of strategies necessary to reach a sufficiently diverse audience.

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Is anybody listening? How to rise above the uproar in the digital era

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With the inception of the digital age and the 24/7 news cycle, the biosecurity system has seen a switch in how biosecurity-related information, guidelines and regulations are delivered to the public and key stakeholders.

Couple this with the increasing frequency of serious and far-reaching incidents stemming from the impacts of: 1) climate change; 2) shifting consumer expectations; and 3) increased global movement that have seen an intensifying range of one-health and biosecurity implications, it has never been more important to have biosecurity information heard.

As biosecurity 'advocates' we know that a strong and sustainable biosecurity system enables Australia to maintain our enviable status as one of the few countries free from the world's most severe pests and diseases. The overarching theme of this session is how do we, the converted, encourage producers, landholders and custodians to practice proactive and preventative biosecurity practices? And how do we encourage them to take preventative steps before an outbreak, imminent threat or the 'big stick' of compliance comes their way?

Our panel of communication specialists will explore these issues and share first-hand experiences of what's worked using one slide to provide an overview of how they are currently using digital innovation to rise above the noise.

- The panel will then discuss additional questions including:
- Are we delivering too much, too much quickly, causing information overload?
- How well are digital products being utilised?
- What does the future have in store for new digital products?
- What role do those with public platforms play in defining the line between discussion and uproar on digital media?

The ultimate outcome of this interactive session is to develop a series of recommendations and future directions for promoting biosecurity information in the digital age, which can then inform the full range of government, NGO and industry biosecurity strategies into the future.

Day 2

The Doorway into Australia

Fred Gela

Mayor of Torres Straight Islands Regional Council

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Making Biosecurity more Meaningful for Indigenous Communities

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In 2016 a project was initiated to review historical plant biosecurity incursions in Torres Strait and the Northern Peninsula Area to identify the challenges in responding to pests and explore options for improvement. Some broader issues were revealed, particularly that the biosecurity system was viewed locally as primarily benefiting mainland Australia, with only limited benefits to local communities but significant impediments. For example, existing laws focus mainly on restricting movement of goods from north to south to prevent introductions of pests and diseases. This has disrupted some traditional practices, yet many invasive species that directly impact on local communities (for example, weeds and cane toads) had originated from the mainland.

In 2017 a regional, multi-agency Biosecurity Working Group was established to find practical solutions to improving biosecurity risk management. An over-arching regional biosecurity strategy was developed, which has been endorsed by the three tiers of government responsible for biosecurity. There are six key themes that include principles such as collaborative governance, understanding priority threats, building awareness, improving responsiveness and improving capability and capacity.

A range of actions developed under these themes are interlinked and remain a work in progress. To demonstrate how the principles can work together in a way that is more meaningful to local indigenous communities, a series of community response workshops were conducted during 2017-18. The Aboriginal Indigenous Engagement Model developed by the Plant Biosecurity Cooperative Research Centre helped inform workshop design. Communities welcomed the opportunity to plan a local biosecurity response in partnership with government responders. Guidelines for establishing responses that are a true partnership, are culturally sensitive and recognise local expertise have been developed from the workshop learnings.

To make biosecurity more meaningful for frontline communities, future work will include identifying control options to minimise the risk of pest spread from south to north.

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One Health-focused companion animal veterinary services assist in mitigating biosecurity threats in remote Indigenous communities

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Dogs and cats are valued pets in remote Indigenous communities across Australia and bring a variety of benefits to their owners and broader communities. From a biosecurity perspective however, un-managed free-roaming companion animals in remote Indigenous communities represent a risk to Australia's excellent biosecurity status. This is particularly the case for those communities on the Northern coastline of Australia where modelling indicates a higher risk of the incursion of exotic disease (e.g. for rabies).

Companion animal populations across the globe require regular access to veterinary services to maintain adequate health and welfare. The Australian Government promotes the importance of companion animal vet services to maintaining Australia's biosecurity status. However, geographic, socio-economic, cultural and historic factors impact the accessibility of veterinary services for many remote Indigenous communities.

Without veterinary services, companion animal populations become overpopulated due to uncontrolled breeding. This in turn leads to large numbers of animals, many of which may be unwanted. As competition for finite resources increases, animal health deteriorates. In these situations, the risks of potential zoonotic disease transmission are likely to be increased, both for endemic and exotic zoonoses. Community safety is also reduced due to the increased frequency of dog attack. When poor animal health and frequent dog bites are the norm, communities may become complacent in reporting biosecurity threats. Management of biosecurity incursions in these circumstances is also likely to be hampered by a lack of animal population data that would otherwise be readily available where regular vet services are being delivered.

AMRRIC is a national not-for-profit organisation that works with local partners to deliver veterinary and education services in remote Indigenous communities. AMRRIC's One Health-focused companion animal health and management programs, through a variety of mechanisms explored in this presentation, assist in mitigating biosecurity risks in Australia's remote Indigenous communities.

Wayne See Kee

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Moving towards a national sterile insect technique future for fruit fly control in Australia: policy considerations, research and extension

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Sterile Insect Technique (SIT) is a proven effective method of control for fruit fly in many countries. SIT has been used sporadically in Australia for the control and eradication of Mediterranean Fruit Fly, Ceratitis capitata (Medfly) and Queensland Fruit Fly, Bactrocera tryoni (Qfly), with success. Challenges in moving SIT from a limited control strategy to routine landscape scale area-wide management are significant. A strategic national investment by Horticulture Innovation Ltd, in partnership with South Australia, Victoria and New South Wales, CSIRO, Plant & Food Research NZ, and Macquarie University, has resulted in major increases in sterile Qfly production and establishment of demonstration sites. Research in production technology, including new innovations using a gel diet, has reduced costs and supported quality control in the factory. To fulfil the potential application of fruit fly SIT in Australia requires additional research investment; regulatory changes to support the technology; negotiated market acceptance by trading partners and extension to industry to demonstrate proof of concept at a landscape scale compared to chemical solutions.

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Risks to Australia's biosecurity from the trade of ornamental fish

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The ornamental fish industry presents a high risk to Australia for introducing exotic aquatic pathogens of international significance with several documented occurrences. Notably, these include the megalocytivirus, Infectious spleen, and kidney necrosis virus (ISKNV), cyprinid herpesvirus 2 (CyHV-2) and Edwardsiella ictaluri, with the latter two now considered endemic in some wild fish populations. Nearly 18 million ornamental fish are imported annually to Australia under a policy based on an Import Risk Analysis published in 1999. Recently, there has been particular interest in the risk associated with imported ornamental fish infected with the megalocytiviruses, ISKNV and red sea bream iridoviurs (RSIV). The objective of this project was to determine if aquatic pathogens of potential biosecurity concern are entering Australia through the trade in ornamental fish. Repeated cross sectional surveys were completed in imported ornamental fish under quarantine. They were tested for the presence of nationally listed aquatic viral and bacterial pathogens and to identify parasites. Design prevalence of 2% to 10% was used depending on pathogen and diagnostic test. Fish were prioritized based on prior knowledge of infection and volumes of importation. Testing was completed on 62 populations of fish representing 12 consignments received from five different countries. We detected viruses of biosecurity concern, including ISKNV and viral nervous necrosis viruses (NNV). About 52% (24/46) of the populations tested for ISKNV were positive, which included five species of marine fish. NNV was detected in 13% (3/23) of marine fish, with all positive populations received from Indonesia. There was no evidence of koi herpesvirus (CyHV-3), spring viremia of carp virus, viral hemorrhagic septicemia virus, Aeromonas salmonicida or E. ictaluri. The parasite assemblages found on pre-import ornamental fish were diverse and abundant. Despite the import conditions requiring freedom, many fish, in particular goldfish (Carassius auratus) from several countries were heavily infected with freshwater dactylogyrid gill monogeneans. The risk imported ornamental fish present to Australian aquatic animal industries and natural resources was high with respect to megalocytiviruses and parasitic agents.

Insect farming is here, but are we ready for it?

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Insect farming is emerging as a significantly fast moving industry globally, and Australian insect farms are commencing commercialisation. Insect protein for both human consumption and livestock feed are expected to see 100% growth over the next two years. And the Insect Protein Association of Australia has seen a 500% growth of companies and retailers entering the space over the last 2 years. With both markets predicted to be valued at +1 Billion globally by 2020. Rapid growth and development of this industry is creating biosecurity and quality assurance challenges that warrant attention. As this industry continues to grow, the regulations and best practices that underpin any new industry are also emerging. Insect farms attempting to scale production without cohesive industry or governmental guidance relative to best practice or quality assurance are experiencing challenges meeting government and other stakeholders' questions.

The IPAA has begun work with other international associations to develop a global best practice of farming insects for human food and livestock feed. Furthermore the IPAA is creating comprehensive Best Practice, Production Guidelines and Biosecurity management plans for Australian based insect farms. These plans and guidance are informed through work with relevant state and federal bodies, Animal Health Australia and several international research bodies.

There are inherent challenges in identifying potential issues in such a new industry. To help mitigate this, the Association has taken meaningful steps to deliver on biosecurity and quality assurance questions. Of note, the Association has submitted samples of Black Soldier Fly (BSF) to an international DNA sequencing project. This data and subsequent sequenced DNA, will provide opportunities to detect incursions and discourage illegal imports of BSF.

How the IPAA delivers on its mission of creating biosecurity best practice for the Australian insect protein industry will be pivotal to its ability to meet the ever growing demand for insect proteins in Australia. Our work is relevant to the continued protection of Australia's biosecurity and the future proofing of an industry's integrity.

Verification of irradiation treatment on fresh horticultural produce and insect pests.

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Irradiation of certain tropical fruits and some other foods is an Australian biosecurity requirement to prevent the introduction of exotic pests, weeds and diseases. Unfortunately however, validating importers' compliance with food irradiation standards is difficult. There is no easy technical means to decide, at the port of entry, whether tropical fruit has been irradiated to the correct standard. Food Standards Australia and New Zealand (FSANZ) recommends validating compliance of food irradiation in accordance with the Codex Alimentarius Commission, which requires highly specialised laboratory based testing, which is not practical at the point of entry. Compliance is therefore generally assessed using paper based certification, which cannot be readily audited or validated.

A fast, reliable and user-friendly method is needed to determine irradiation compliance, for imported mangoes and other fruit and vegetables. Such a method could also be applied to provide irradiation assurance for overseas markets as part of building international acceptance of irradiation technology.

CSIRO has developed a platform detection technology that offers point of use laboratory standard results for a range of applications. This collaborative project between CSIRO, DAWR and Steritech will assess and validate biomarkers that are present in irradiated produce and insects and develop biosensors compatible with CSIROs point of use platform technology to detect these biomarkers at the point of entry.

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Two steps forward, no steps back: growing our industry through collaboration

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Aquaculture is a relatively young industry, and like those working in many emerging disciplines farmers are learning the hard way what pitfalls may lay ahead. Overcoming those challenges is a matter of working together.

A recent survey of aquaculture farmers, fishers, supply chain participants and government and environment authorities, focusing on the industry across Northern Australia, highlighted a growing awareness of biosecurity, driven by both efforts to educate and inform the industry about the risks, and by high-profile disease outbreaks and pest incursions such as white spot disease and Asian green mussels.

The survey aimed to discover what the industry knew about biosecurity, what practices they put in place, and what barriers stood in the way of widespread adoption.

What we discovered is that aquaculture farmers are more likely to place responsibility for a biosecurity incident on state and federal governments, especially when compared to farmers in terrestrial livestock and cropping, for whom the concept of a shared responsibility has become widely accepted. They also report practical and operational limitations on carrying out their biosecurity plan.

With two-thirds of surveyed farmers anticipating a major outbreak in their sector in the near future, driven by concerns around quarantine measures, as well as uncertainty around liability, financial assistance for recovery and available technical support, it has never been more important to equip the industry with the tools, information and resources they need to meet both on-farm needs and regulatory requirements. We cannot rely on the status quo; what has worked up to now will not sustain us into the future.

We're eager to share our research and engage with our counterparts across terrestrial livestock and cropping, in order to understand how we can collaborate across our industry and with others to best secure aquaculture's long-term, sustainable future.

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Biosecurity learnings from a Queensland Commercial Fishing Perspective

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Introduction

Biosecurity future proofing the Queensland commercial fisheries is an ongoing endeavour. The Queensland Seafood Industry Association (QSIA) with funding from the Fisheries Research and Development Corporation (FRDC) was the development of information and education needs amongst the Queensland commercial fishing sector through the production of video materials.

The standout video clip was titled 'Biosecurity 101' as it was fully animated – taking a complex subject area and identifying the core elements of biosecurity from a commercial fishing industry perspective.

Aims

The video production process had the following aims:

- Increase the Queensland and national wild capture fisheries preparedness in the event of biosecurity emergencies.
- Provide an information and education platform to industry.
- Provide video biosecurity material to industry to enhance biosecurity material.
- Deliver biosecurity information developed by industry, government and biosecurity experts.

Methods

QSIA and Millstream Productions in consultation with commercial fishers developed a series of video clip production plans based on detailed scripts. The focus of the scripts was the production of three video clips – a harvest, post-harvest and biosecurity 101 video package.

Results

From a QSIA perspective the expected benefits can be grouped as follows:

- Current understanding and basic knowledge of biosecurity from a wild and post-harvest perspective is limited. The production of videos has provided knowledge across three areas (importance of biosecurity at the wild harvest and post-harvest sectors and an overview of biosecurity terminology).
- Increased awareness and education of commercial fishers allows industry to respond quickly to potential biosecurity threats.
- Through increased biosecurity awareness of commercial fishers, will be enhanced passive surveillance capability from commercial fishing industries. Australia's biosecurity systems rely heavily on passive surveillance for early detection of pathogens and health issues particularly in wild stocks.

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Wildlife Drones: translating innovative sensor technology into an advanced animal tracking tool for land managers

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Every year billions of dollars are invested in controlling invasive species, protecting threatened species and restoring degraded production lands. One key element underpinning these issues is the need to be able to track, understand and better manage animal movements.

Despite recent advances in satellite and GPS tag technology, they remain unsuitable for more than 70% of the world's wildlife as they are too large and heavy, or they simply don't work within the animal's habitat. Therefore, very high frequency (VHF) radio tags continue to be relied upon as the only way to track movements for many animal species globally. However, tracking radio tags is a labour intensive, time consuming and expensive process that has been limited to finding one animal at a time.

To address this issue, Wildlife Drones' has developed innovative sensor technology and advanced signal processing algorithms that revolutionise animal tracking. This cutting-edge technology can track up to 100 animals simultaneously and display their estimated locations live on a map. By tracking from the air instead of the ground, radio-signal detectability is maximised and animals within even the most rugged or remote landscapes can be located with minimal effort. Such technology may also be used in agriculture to improve livestock management by tracking cattle movements. This provides a cost effective and efficient surveillance solution for anyone needing to locate and track animals.

As this technology continues to rapidly evolve, together with increasingly sophisticated Artificial Intelligence and Machine Learning capabilities, we envisage Wildlife Drones' system as part of a broader network of integrated sensors with autonomous environmental monitoring across vast landscapes. This could include integrating knowledge from across a variety of land use types, including natural and production landscapes, and gaining unprecedented information on environmental conditions and ecosystem processes for improved land management.

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Using behaviour science to maintain resilience of Queensland's biosecurity system

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Across our biosecurity system, we have limited data to predict people's attitudes to biosecurity, their likely behaviours, whether they feel empowered to act and whether our messaging is effective.

There has been a seismic shift in how news is broadcast and how people consume information and opinions, in real time. Online continues to explode and social media audiences crave real stories, on their mobile devices, 24X7. Competition to connect with, and influence, an audience will continue to become more intense.

During the development of the *Queensland Biosecurity Strategy 2018-2013,* stakeholders unanimously agreed "Every Queenslander must play their part" and the first area of focus must be a *"clear understanding of the beliefs, attitudes, intentions and behaviors of key players in the biosecurity system'* to provide the evidence-base to guide future policy, project decision making and engagement strategies.

Biosecurity Queensland is tackling this issue with the development of a Behavioural Insights Framework.

Globally, there has been significant shift over the last decade on how to segment and understand the behavioural drivers of stakeholders in the agricultural sector. We will articulate key insights from this research and provide a way forward for application in the Queensland setting.

We will hone in on outcomes from behavioural research projects to understand goals, drivers, objectives and characteristics of stakeholders in a response setting, and its application to grow our social media channels and stakeholder interaction within these channels.

This year, we are validating the international research in Queensland with two projects to provide an evidence-base for future policy and project decision making:

- Baseline survey of stakeholders and their attitudes and behaviours towards their General Biosecurity Obligation.
- Detailed stakeholder segmentation analysis of farmers in Queensland

We will share early learnings from this research and identify opportunities for others to benefit.

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Is this pest established or not? Non-traditional diagnostics inform incursion responses about immediate risk.

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Incursion responses to post-border detections of high risk pests are expensive. Responses have to be implemented quickly to favour eradication success and avoid the far more costly prospect of long term pest management. When New Zealand and Australia's plant health biosecurity is challenged by detection of an exotic high risk pest, such as fruit fly or brown marmorated stink bug, rapid responses may be initiated even in the absence of evidence of a breeding population. Indication of a breeding population means finding immature life stages or many individuals at the same locality. Both are time and resource consuming, and for new threats can be obstructed by poorly developed surveillance systems. A breeding population can therefore remain undetected until it emerges as a problem and eradication is much harder to achieve.

Here we outline our use of biogeochemical technology for provenancing, to gain evidence of establishment (local origins) or non-establishment (exotic origins) from the first specimen(s) detected. This is centred on discriminating geographic places by their environmental stable isotope signatures. These signatures are then acquired by organisms through their diet where they grew up, and by inference where they bred. Although a new discipline to biosecurity, and used here in the context of exotic pests of plants, we posit that the same could be applied to vertebrate pests for foreign species as well as management of pest free areas. Suitability of this approach for invertebrate pests of animals or sources of aquatic invaders is also worth investigating.

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Essential biodiversity informatics for evidence-based decisions on biological invasions

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Information essential to preventing the arrival and spread of invasive species includes species distributions and pathways of spread. Because biological invasion is an inherently transboundary problem, this information needs to be available at multiple spatial scales, within and across countries, and in a form that is readily accessible, comparable and current. Working with the *Invasive Species Council*, we are developing and populating an information platform for invasive insects as a model for sustainable knowledge management for biological invasions. Our approach builds on developments in biodiversity informatics, Essential Biodiversity Variables (EBVs) for species populations and with the Global Register of Introduced and Invasive Species (GRIIS). Using results from our work with the *Invasive Species Council* I will outline how these recent developments mean that sustainable knowledge systems for biological invasions are achievable.

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Plant invasive biogeography, or the need to study invasives in their native and non-native ranges.

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Most studies on invasive species are developed exclusively in the areas where they are invasive, but very little attention is given to comparisons between native and non-native ranges. Consequently, we know surprisingly little about the ecology, distribution, or even the abundance of invasive plants in their native ranges. However, that information is critical to understand invasive processes, and to support control and eradication plans. Evolution in response to invasion occurs surprisingly rapidly. Non-native ranges are often geographically isolated from the original native range, and after populations are isolated, gene flow between them ceases and founder effects, genetic drift, and adaptation to different environments, leads to genetic divergence. Rapid evolutionary change turns some species into serious pests in their invaded ranges, which dominate and alter ecosystems to the detriment of native species and human needs such as agricultural food security. Understanding which evolutionary changes are operating across distant biogeographical regions of invasive species has proved to be of great value in studying plants native to Europe (*Centaurea spp.*) and Australia (*Acacia spp.*, *Eucalyptus globulus*)~~,~~ that are invasive in each other's native ranges, and also in the Americas.

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En garde: biosecurity begins with fencing

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Waratah fencing provides premium Australian made fencing products, creating innovative solutions to reduce the severity of biosecurity threats in the environment. The Australian Government has listed more than 1,700 species of animals and plants as being at risk of extinction. The European red fox, feral cats, goats, rabbits, and pigs, are an extreme threat to Australia's native flora and fauna through predation, competition, land degradation and disease transmission. A single feral cat kills between 5 to 30 animals per day, which results in millions of native animals being killed every day. Waratah understands that fencing is an essential part to protecting Australia's wildlife and is dedicated to reducing the risk to these animals.

Waratah has successfully demonstrated a range of fencing solution across many areas of Australia, for example the wildlife sanctuaries of Scotia, Newhaven, Secret Rocks, Mallee Cliffs, and The Pilliga. Recently there has been a major success within these sanctuaries with the first Mallefowl chick discovered in Secret Rocks.

According to the Natural Heritage Trust, a conservation fence design must be specific to the animals it aims to exclude and encloses, as well as any landscape features which needs to be considered. In the conservation sector, in the past, fences have been erected using previous experiences as a basis for design. Our technical team are dedicated to the creation and design of fencing solutions to best fit the needs of our customers.

Waratah's involvement with these conservation groups nationally, provides a platform for knowledge that should be shared with others to improve Australia's wildlife and conservation protection strategies.

Using science and technology to futureproof biosecurity on Barrow Island

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Chevron Australia's management of Barrow Island – an A Class Nature Reserve located approximately 60 kilometres off the northwest coast of Western Australia – is demonstrating that with the right management, industry and the environment can coexist.

Home to the Chevron-operated Gorgon Liquified Natural Gas Project and WA Oil facility, Barrow Island is a secure habitat for a variety of rare or endemic species plants and animals.

Providing an unprecedented level of quarantine intervention, the rigorous Barrow Island Quarantine Management System (QMS) is the largest non-government system of its kind and sets new benchmarks in environmental protection and biodiversity conservation.

Integrated with a strong culture of environmental stewardship and commitment to workforce education, the QMS demonstrates 'zero is possible' as it continues to successfully prevent the introduction of non-indigenous species to the island and its surrounding waters.

Chevron Australia's management of Barrow Island is recognised as 'best-practice' locally and internationally, and remains a world-class legacy of innovation, expertise and sustainable development.

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Bad biosecurity behaviour or rational reaction to rules? Aligning stakeholder incentives through insurance

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The objective of Australia's biosecurity system is to expose Australia to a very low biosecurity risk, where risk reflects both likelihood of incursion and economic damage. Import regulations prescribe the level, type and distribution of effort that should be invested in biosecurity mitigation activities if the import is to occur. Objectives are defined only in terms of *physical* risks.

While the biosecurity status of Australia clearly relies on a deep understanding of how pests and diseases spread and respond to interventions, it should be noted that pests and diseases are transmitted to Australia as a result of decisions made by humans. This means the way that humans respond to rules and incentives created by the biosecurity agency must be explicitly considered if biosecurity objectives are to be met. This is not currently the case. Existing biosecurity mechanisms are unlikely to result in the optimal level, type and distribution of biosecurity effort by stakeholders. Given the large investment in, and potential economic and environmental implications of, biosecurity activities, there are likely to be substantial welfare gains from improvements allocation of biosecurity effort.

Economic theory suggests cost and effectiveness biosecurity systems could be improved if biosecurity risk were managed through financial risk markets rather than managed as physical risks through regulated interventions at the border. This paper explores an alternative policy mechanism for managing biosecurity risk – '*biosecurity risk insurance*' – in which importers pay insurance premiums that are actuarially determined. Physical biosecurity risks are thus monetised. Insurance premiums are informed not only by the riskiness of the import but by the degree to which biodiversity risk can be diversified through risk markets. If feasible, this approach would reduce the cost of biosecurity risk and create incentives for importers to seek-out goods that reduce insurance premiums in turn reducing the likelihood of new incursions.

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Stopping the Spread of Invasive Species with Behavioural Psychology

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Many invasive species spread through pathways involving human behaviour. Many people, such as gardeners, anglers, hunters, campers, teachers and field workers can spread invasive species, often unintentionally, through their everyday activities. Traditional communication efforts (i.e. signs, adverts and leaflets) have proven to be effective in raising widespread awareness about invasive species but less effective in creating the behaviour changes needed to disrupt pathways. In Canada and the United States of America, some government and non-government organizations have employed behavioural psychology to change behaviour within specific target audiences. The presentation identifies important behavioural research findings for some specific pathways, and a framework for developing effective approaches to nurture and sustain lasting, effective behaviours that disrupt invasive species pathways.

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Managing translocation risk for aquatic animals in NSW

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For aquatic animals, the risk of disease introduction has always been complicated but never more so than now with our increasingly connected world. Live aquatic animals are translocated for aquaculture, for sale as food, for ornamental purposes, for recreational stock enhancement or for research, and while existing risks are becoming better understood, new risks keep emerging. Risk management techniques need to continually evolve in an effort to keep up with this changing risk environment, and there has been an increasing recognition of the role of industry in biosecurity planning and risk mitigation.

This presentation will focus on current risk management techniques in NSW for aquatic animal translocation, and what the future of risk management will look like for inter and intra state translocations. This will include enhanced government and industry partnerships and programs that facilitate improved knowledge sharing, building resilience and development of new workable solutions.

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No swimming allowed: preventing the spread of invasive fishes in western Canada

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Preventing the introduction and spread of invasive fishes requires a combination of good scientific and social research, behaviour change on the part of resource users, and strong partnerships among governments and various non-governmental organizations. The first key step in preventing the spread of fishes to contiguous water bodies is the use of non-physical barriers (e.g., electrical fields) and better management of boat locks at dams. The initial detection of a new species can be done economically using environmental DNA (eDNA). Once an invasive fish is established eradication is very difficult, but possible. A number of tools are used in BC for population eradication or suppression depending on the size of the water body, including the natural piscicide rotenone, and gill netting of fish during the spawning season. Involving the research community is critical in developing a range of tools for successful prevention. These tools include otolith microchemistry and acoustic telemetry to provide evidence of where invasive fish have come from, which is critical information when working with partners in adjoining jurisdictions.

Social marketing and behaviour change is required to stop the initial introduction of invasive fishes. The “Don’t Let It Loose” program is aimed at the pet and aquarium trade, and reduces the release of unwanted pets into local water bodies. The “Clean Drain Dry” program encourages boaters to remove plants and animals from their watercraft, and provincial regulations ban the use of live bait in fishing. There is also an extensive network of government boat inspections at provincial and international borders.

Looking at lessons learned through research and collaboration are key to keeping aquatic invasive species out of BC. Innovative projects and outcomes from across the Pacific Northwest Economic Region (western US and Canada), including trans-boundary committees, provides practical outcomes that complement and build on work done by governments.

Bay of Plenty Regional Council's approach to freshwater biosecurity in the Rotorua Lakes, New Zealand

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The Rotorua Lakes, in the Bay of Plenty Region in New Zealand comprise of 18 lakes in close proximity to one another with a high volume of visitors to the district (>3.3million/year). The high amount of visitors from local, domestic and international markets makes the lakes highly susceptible to human assisted transfer of aquatic pests. The Bay of Plenty Regional Council invests significantly in freshwater biosecurity across the Rotorua Lakes. This presentation will focus on two of our current ongoing projects:

The management of an incursion of Brown Bullhead Catfish which was discovered in 2016 generated significant public and political interest in the Bay of Plenty. To date, Bay of Plenty Regional Council has removed over 55,000 catfish from Lake Rotoiti and more recently, Lake Rotorua. This project has invested in operations to remove the catfish, research options to disrupt the population and a communications program using conventional and unconventional methods to engage the community.

Bay of Plenty Regional Council and partner agencies have managed weed control in the Rotorua Lakes for incursion response, amenity values and nutrient management purposes over the past several decades. The primary control method is herbicide application along with weed cordons installed at high risk vector areas to reduce the chance of aquatic pests being transferred into, or out of the lakes. In a highly regulated environment, the aquatic weed control program at Bay of Plenty Regional Council has achieved significant results over previous years and is on track to eradicate Ceratophyllum demersum (Hornwort) from Lake Okataina in the next 5 years.

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New kids on the block: A Chief Environmental Biosecurity Office and an InvasivesPlan to balance our environmental and economic priorities

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Preventing and responding to incursions of potentially harmful pest and disease species that impact Australia's environment is important. However, we are not as well-placed to address this threat as we could be. Our current response capabilities reflect their origin in agricultural and trade concerns, which leaves gaps. Within the animal, aquatic and plant sectors, detailed frameworks outlining nationally agreed approaches for incursion response to pests and diseases of plants and animals have been implemented. These frameworks have been extended to the environmental sector and in the case of marine and plant pests and diseases have been tested for incursions of production and environmental significance. But their implementation is not smooth. In particular, the emergency response framework that can be applied to the invasive animal and plant pests with no agricultural impacts are poorly developed.

The Chief Environmental Biosecurity Officer position was established in 2018 with the support of all state and territory governments to provide national policy leadership on national environmental biosecurity issues aimed at ensuring Australia's environment and amenity is safeguarded from the impacts of exotic pests and diseases. Key priorities include enhancing understanding and oversight of environmental biosecurity risks, ensuring Australia's environmental and community biosecurity risks are better defined and prioritised, improving the maturity of Australia's environmental biosecurity preparedness, surveillance and response capacity and supporting effective responses to detections and incursions of environmental pests and diseases.

Australia's government agencies, through Environmental and Invasives Committee (EIC), are developing InvasivesPlan to fill gaps in existing animal and plant arrangements for pest species and to decrease potential threats to Australia's environment and social amenity. When complete, the InvasivePlan will provide coordination of scientific, operational and managerial resources necessary to prepare for, and respond to, an invasive pest species incursions.

Here we explore how the Chief Environmental Biosecurity Officer is planning to improve approaches to environmental biosecurity broadly and how InvasivePlan can be used to strengthen incursion management, and facilitate support, collaboration, and engagement.

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Insights from global interception data for predicting establishment risk

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Many countries collect data on insects that are intercepted at their country's border. The datasets of each individual country represent small, biased samples of the insects moving via international trade. However, by sharing data between countries we can increase our awareness of the potential threats. Establishment risk can be modelled as a stochastic process based on arrival rates reflected in the interception data, and on establishment probabilities influenced by family level characteristics. The usefulness of a model grounded in this framework is dependent on the variability in interception probabilities and on the variability in establishment probability between species upon arrival. Combining interception data from multiple countries may average out some of the variability in interception probability due to the different sampling methodology of each country. For example, focusing on specific pathways or groups of taxa. Pooling establishment data from different countries would likewise average out the variability in establishment probabilities due to factors such as variation in climate suitability and niche availability. Often though, we are interested in modelling the establishment risk for a single country. In this case, climate suitability estimates can be incorporated into the model. We will discuss the usefulness of interception data for predicting establishment risk for different insect families based on preliminary analysis of historical interception data collected from several countries.

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Principles of probabilistic risk assessment for novel biocontrol technology

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Novel genetic-biocontrol methods, particularly those involving gene drive mechanisms, are being discussed as a possible cost-effective way to suppress populations of pest species. Risk assessments for the release of biological control agents or genetically modified organisms typically use of qualitative methods. The advent of gene drives, however, have led some agencies to question the adequacy of qualitative risk assessments methods, and The United States National Academies of Science Engineering and Medicine (NASEM) and the Australian Academy of Sciences (AAS) have recently recommended quantitative probabilistic risk assessments in this context. This presentation provides an overview of the principles of probabilistic risk assessment for novel genetic biocontrol techniques, whilst briefly highlighting a range of methods that enable these principles to be applied. The presentation will draw on examples of hazard analysis and risk assessments completed by the CSIRO DEERA team for real (malaria vector control) and hypothetical (eradication of non-native populations of mice and carp) situations.

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Biosecurity: Managing the Mental Game

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Biosecurity is as much about managing psychological and sociocultural factors on the ground as it is about promoting best practice behaviours and facilitating uptake of novel technologies. In this presentation, we explore 'the mental game' that is central to effective and enduring biosecurity, highlighting psychological and social influences on both farmers and the general public. We focus on motivational drivers for action in a biosecurity context and ways to support farmer and public participation. We present evidence and insights from social and behavioural science research on Panama TR4, QLD fruit fly, and biocontrol of carp to illustrate the role of 'the mental game' in biosecurity. Using social data obtained at the height of the Panama TR4 incursion, we show the influence of social identity and culture on farmer coping styles during a biosecurity emergency and how social groups influence biosecurity action and uptake. Our social research into the barriers and facilitators of area-wide management for the control of QLD fruit fly reveals how a collective community mindset can be a powerful driver of behavioural change amongst farmers and general public. In particular, knowledge of the problem and self-confidence in carrying out biosecurity activities appear critical to action. Our third case study examines proposed carp biocontrol using carp CyHV-3 herpesvirus, and we identify psychological factors underpinning public risk perception and acceptance of biological solutions. Trust, perceived technology efficacy, and uncertainty are often key considerations that influence social license of novel biosecurity tools. Importantly, underlying each of these biosecurity case studies is the enduring and pervasive influence of basic psychological needs on biosecurity action: feelings of competence, relatedness towards others, and the desire for autonomy to drive one's own behaviour.

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Zoos and aquariums – we speak to the world!

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Australian zoos have an incredible opportunity to connect with millions of visitors each year. Almost 20 million people visited an Australian zoo in the past 12 months. Around a quarter of these were overseas visitors. Australian zoos run education programs for over 900, 000 students annually.

One of the most important achievements of zoos as conservation organisations is the ability to develop meaningful connections between people and nature. Zoos alone can't save the planet, but the people who visit zoos **can**.

People visit zoos to be entertained, to learn and to share an emotional connection with animals and the natural world. We can share important messages with people during their visit, because they are relaxed, engaged and motivated to learn.

Australian zoos work closely with social scientists to run education campaigns on key conservation issues, with a focus on driving motivated behaviour change in members of the public. Successful examples are "Don't palm us off" – awareness and behaviour change around sustainable use of palm oil, "Fish for good" – promoting sustainable use of seafood and "Wipe for wildlife" – promoting use of recycled paper products.

Our successful education campaigns combine clear messaging with a simple "call to action" for behaviour change. The visitor, emotionally motivated by their interaction with wild animals in the zoo setting, is educated on how their individual choices in daily life can make a difference to the "big picture".

We believe zoos can be "game changers" in how we communicate biosecurity messages to the Australian public. With carefully crafted stories about biosecurity, together we can educate our "captive audience" (20 million visitors) on what biosecurity is, why it's important for Australia (and the planet) and what they, as individuals, can do in their personal lives to ensure better biosecurity for Australia.

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Do truckies care about bugs? A human-centred design approach to influencing biosecurity behaviours in transporters

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Introduction:

DPI's biosecurity team were looking along the supply chain for opportunities to increase reporting and interception of invasive species, and identified a gap. That gap was their understanding around the potential role of freight and logistics workers in reporting biosecurity concerns related to the goods they handle. Historically, very limited reports of potential biosecurity threats had been provided by this group despite their position in the supply chain and close handling of goods in transit. Initial investigations found no existing relevant research.

There was an opportunity identified to understand current behaviours and influence change for better biosecurity in this important group in the supply chain.

Aim:

To uncover behaviours, mindsets and attitudes in the freight and transport sector, in order to influence them to play a more active role in the biosecurity system.

Methods:

A human-centred design approach was taken. This includes:

- Discovery research involving one-on-one interviews and observation of freight and logistics workers;
- Insights gathered from the data collected to draw out key behaviours, motivitations, attitudes and opportunities;
- Targeted strategies and communications towards the freight & logistics sector tapping directly into known motivations in order to influence behaviour change.

Conclusion

In order to influence a more active role in the biosecurity system for industry and the community current experience, behaviours, motivations and pain points must be understood. Targeting campaigns and strategies around these known influencing factors provides a significantly stronger chance of success in influencing behaviour change. Human-centred design provides an excellent methodology for designing approaches to biosecurity around various 'actors' in the supply chain and their specific needs.

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Citizen scientists as early detectors of priority exotic plant pests in urban environments

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Ports of entry are a growing risk to Australia's biosecurity. By the time an agricultural pest is found in a growing region it has often had time to establish in urban environments, which are rich in both host diversity and transmission pathways. The risk posed by challenges in urban exotic plant pest surveillance was recently highlighted by incursion and establishment of the tomato potato psyllid in the Perth metro area and, subsequently, surrounding production regions. Early detection of this psyllid in the metro zone would have increased the chance of eradication or provided agricultural industries with buffer time to prepare for this pest.

Running over 2019/20 this project aims to establish best approaches for developing and coordinating early detector networks for exotic plant pests in cities. The project will use innovation principles to test methods to attract citizen scientists to such a network. It will also investigate how an early detector network could achieve greatest impact as an addition to the existing national biosecurity surveillance system.

A coordinated, citizen scientist based early detector network for urban areas would ensure consistency of information and training to urban dwellers interested in being an early detector. It would give governments access to an established network of surveyors in urban environments, and a single point of contact for dissemination of exotic pest and incursion response information. It will develop closer linkages between agriculturalists and urban dwellers. Activation of such a surveillance network will support faster and more confident decision-making during Emergency Plant Pest Responses.

Outcomes will include a proven approach for engaging and maintaining citizen scientists in an early detector network, and an early detector network design ready for Australia-wide launch. Findings will support establishment of the first national, urban focused, citizen scientist-based early detector system for exotic plant pests in Australia.

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"Tools of engagement" for positive biosecurity behaviour change in peri-urban areas

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The urban/peri-urban interface is a dynamic area that has long been considered a potentially high biosecurity risk. Smallholders with poor agricultural knowledge and communication networks, informal trading of livestock, absentee landholders, cultural and language barriers, increased urbanisation, globalisation, proximity to air and sea ports and the increased movement of people and goods contribute to this increased risk.

The NSW Peri Urban Biosecurity Program, led by NSW Department of Primary Industries (NSW DPI) and piloted in partnership with Greater Sydney Local Land Services (LLS) seeks to address these key biosecurity risks within the state's largest peri-urban area – Greater Sydney. This multi-dimensional Program continues to address animal and plant pest and disease, weed and new incursion risks through a collaborative and coordinated approach.

Tools of engagement

Through a series of targeted projects, workshops, activities and collaborations, the Program has laid the foundation for improved community and stakeholder partnerships, advocating biosecurity as a shared responsibility and promoting improved disease surveillance and reporting.

White Paper and Industry opportunities facilitated better understanding of the motivations, practices and attitudes of peri-urban landholders for improved engagement to initiate positive biosecurity behaviour change. These opportunities form part of a toolset for other regions and jurisdictions to utilise. The approaches and outcomes to be presented including engaging with:

- Smallholders using livestock champions, small farms networks and co-ops
- Vets with smallholder clients or whose livestock have names
- Producers of non-English speaking background (NESB)
- Supply chain and logistics networks
- Local Government Environmental Health Officers for post-border and food waste surveillance
- Celebrity biosecurity champions (garden gnomes)
- Community Biosecurity Warriors
- City Livin' Ferals

Moving forward, the Program aims to maintain its current momentum, continuing to focus on landholders and industry biosecurity attitudes and behaviours while focussing on the development of training and engagement packages for regional and jurisdictional outreach.

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Biosecurity Risk of Smallholder Pigs in Peri-urban Sydney

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Sydney's region has a several hundred domestic pigs on small holdings in the urban and peri-urban area. Ownership is highly mobile with an increasing number of animals traded online. Owners typically hold small numbers, moving in and out of production. Many hold pigs for cultural or lifestyle rather than commercial reasons. Most owners have limited knowledge of pig health, husbandry and regulatory requirements, including the need for a Property Identification Code (PIC), ban of swill feeding, prohibition on private selling of pig meat and on keeping feral pigs.

With the high volume of international people and product movements into the Sydney region this pig population represents a serious biosecurity risk for a range of diseases, with Foot and Mouth Disease and African Swine Fever considered key risks. A mix of educational and regulatory tools are used to deal with this risk. Current information on the level of pig ownership, pig trading, feral pig introductions and associated biosecurity risk within the peri-urban interface will be presented. Current approaches being used to engage peri-urban pig owners and new approaches being trialled to reduce associated biosecurity risks are discussed.

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Adelaide's Urban Animal and Plant Control Program – Keeping Authorised Officers abreast of preventative biosecurity trends

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In 2006 the Adelaide and Mount Lofty Ranges Natural Resources Management Board formally established the Urban Animal and Plant Control Program with Adelaide's metropolitan and peri-urban Councils. The primary purpose of the program is to empower Authorised Officers employed by 16 Councils to pursue voluntary compliance for declared pests under the NRM Act 2004, in line with state, regional and local policies and plans. Over 12 years Council and regional NRM staff have coordinated pest management across administrative boundaries and uniformly presented 'as Government' ensuring landholders are provided with best practice control advice across all land tenures.

As the program has evolved staff have built confidence in their skills to identify alert pests, respond to e-trade of declared pests, champion best practice vehicle hygiene, escalate serious non-compliance matters, and prioritise surveillance for high risk pathways. The value of the program has become 'greater than the sum of its parts'. Some of the recent success stories for preventing the establishment of pests in Adelaide include: disposal and traceback of water hyacinth and invasive cacti plants, coordination of an amnesty to hand in red-whiskered bulbuls and facilitating a coordinated approach to the management of Coolatai grass across a number of councils areas. Regular meetings, training sessions and workshops are integral to knowledge sharing and continuous improvement. As new Authorised Officers are welcomed to the program they are provided with support and guidance from experienced staff.

Peri-urban panel

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Undelivered risk: A counter-factual analysis of the biosecurity risk avoided by inspecting international mail

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Introduction

International mail articles present an important potential vector for biosecurity and other regulatory risk. Border intervention is a key element in Australia's biosecurity strategy. Arriving international mail articles are inspected and those that are intercepted with biosecurity risk material are documented, including the address to which the article was to be delivered. Knowledge about patterns in the intended destinations of mail article permits more detailed biosecurity intervention.

Methods

We used geo-location software to identify the delivery address of mail articles intercepted with biosecurity risk material from 2008–2011. We matched these addresses with demographic data that were recorded at a regional level from the Australian Bureau of Statistics 2011 Census and used random forest statistical analyses to correlate various demographic fields at the regional level with the counts of seized mail articles.

Results

The analysis of the seizure counts against demographic characteristics suggests a high correlation between having higher numbers of university students that speak a particular language in a region and higher quantities of intercepted mail articles destined for that region. We also explore metropolitan and regional patterns in the destinations of seized materials.

Conclusions

These results have be used to inform policy and operational actions to try to reduce the rate at which international travellers and mail articles that carry biosecurity risk material are arriving in Australia. The Department of Agriculture and Water Resources is currently working with foreign-student onboarding groups at various Universities to help manage the biosecurity risk, with a dedicated website for international students:

http://www.agriculture.gov.au/travelling/to-australia/studying-in-australia

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Smarter Border Biosecurity: a Strategic Risk-based Approach to Allocating Effort.

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Decisions about how to allocate resources to maximise risk reduction are particularly challenging in biosecurity because of the wide range of potential risks across many sectors, pests and diseases. The effectiveness of risk management pre-border and border and the extent of surveillance all influence residual risks and the cost of incursion management. A strategic risk-based approach to hazard identification and the allocation of risk management resources to risk can lead to material gains in risk reduction and cost effectiveness across the biosecurity system as a whole.

This session will explore some of the risk assessment tools and approaches developed in New Zealand and Australia to more strategically support biosecurity investment and policy development. How and where do we prioritise organisms and pathways of concern for management and how do we measure risk and risk reduction across sectors as a result?

Christine Reed: New Zealand have developed three risk-based tools supporting: prioritisation of biosecurity pests and diseases; the allocation of resources to risk; and the management of new and emerging risks for early intervention. Use of these tools to keep risk offshore depends on the provision of high quality information, gathered globally, around highly interconnected trade where pest distributions, pathway volumes and human behaviours are rapidly changing.

Robyn Martin & Ian Thompson: The Department of Agriculture and Water Resources is focused on preparing Australia's biosecurity system for the challenges of the future. This includes a broad range of initiatives aimed at helping to create and optimise a modern, flexible and responsive biosecurity system. To do this, we guide biosecurity research and innovation investment and adoption across all levels of government through initiatives such as the Biosecurity Innovation Program and collaboration with the Centre of Excellence in Biosecurity Risk Analysis (CEBRA). We also work collaboratively to deliver national biosecurity policy based on evidence through tools such as the Risk Return Resource Allocation (RRRA) model.

The management of risks to the natural environment and to social amenity, of pests and diseases entering, emerging, establishing or spreading in Australia is particularly challenging. In response to this challenge, the Chief Environmental Biosecurity Officer position was established to assist in minimising the risks to Australia's environment and amenity from the impacts of exotic pests and diseases.

Andrew Robinson: CEBRA has been working closely with federal regulators on risk-based tools for more than 10 years. Risk-based regulation is an attractive idea with many advantages, but significant obstacles must be overcome. Furthermore, there is a wide diversity of approaches, ranging from data mining and deep learning to simple bespoke algorithms that can be run from a spreadsheet. Andrew will briefly cover CEBRA work in this area.

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Engaging Farmers in Biosecurity Practices: Challenges and Pathways

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On-farm biosecurity is crucial for the prevention of disease introductions and spread and to minimize the impact of disease outbreaks. However, research continues to find that while farmers are overwhelmingly committed to animal health and have a high concern for disease threats, this concern does not necessarily translate into on-farm practices. Explanations for why farmers show low adoption rates of biosecurity practices focus on factors that are internal and external to the individual. Knowledge of disease transmission, perception of risks, sense of self-responsibility in preventing disease and attitudes towards biosecurity are considered internal factors. These are in turn affected by external social, cultural, economic and institutional factors, such as the level of information and support for producers, the available networks, business and market arrangements, the regulatory context and the media. Research identifies a perception among producers that biosecurity originates externally and as such, should be managed by government.

Individual behaviour and practices around biosecurity are the result of complex interaction of internal and external factors and any program developed to improve biosecurity engagement needs to consider this complexity. In complex systems such as this one, solutions are not simple and approaches for improvement must consider different perspectives and components part of the system and how they interact with each other.

The panel will consider how to make sense of this complexity in a way that enables industry and policy-makers to engage farmers more effectively in biosecurity practices. A key aim of the panel is to begin to identify pathways to biosecurity adoption that respect and build on producers' existing animal, plant and herd health practices.

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Unlocking the key to better biosecurity practices: are we getting it right?

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Producers play a key role in partnering with governments to raise biosecurity awareness, prevent incursions of pests, weeds and diseases that threaten our industry's livelihood, and manage outbreaks if they occur.

A number of governments have recently modernised legislation in their jurisdictions to 'enforce' a duty of biosecurity care on individuals within agriculture. This is an important step forward, but will only succeed if there is a clear understanding (and commitment) by producers of how to apply preventative biosecurity practices to their own operations.

Moderated by Jackie Poyser from Animal Health Australia this panel provides the unique opportunity for delegates to hear insights from livestock producers (extensive and intensive industries) about how 'biosecurity' policy decisions and associated messaging is perceived on the ground and the challenges and obstacles they face in, firstly, creating awareness and, secondly, bringing about practice change for better biosecurity outcomes.

The panel of producers will also share their first-hand experiences of achieving good results from preventative biosecurity measures. They will also share the obstacles they, and their fellow producers, face in times of crisis (i.e. floods, droughts, outbreaks) in maintaining their biosecurity practices.

The session will allow open and robust discussion between panellists and delegates with a forward-focus. Importantly, learnings, solutions and outcomes from this session could be shared across the biosecurity collective to improve Australia's high biosecurity standards from 2020 and beyond.

Discussion questions will include:

- What does 'biosecurity' mean to the average producer? Do we need to need to change the messaging to have greater buy-in?
- Is industry promoting awareness and importance of biosecurity effectively? If not, what are the impediments?
- How can preventative biosecurity practices benefit producers and their businesses? Conversely, are their biosecurity practices/initiatives that producers may consider an impediment?

- Biosecurity threats come in different forms. How does industry ensure cross pollination of preparedness between and within sectors?

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LAMP in Victoria – Footrot lights the way

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Loop mediated isothermal amplification (LAMP) is a molecular method of pathogen detection commonly reported as field capable. It is a nucleic acid amplification technology that identifies specific DNA or RNA sequences found in target organisms, much like a polymerase chain reaction that is performed in the laboratory. The robustness of LAMP, and the molecular nature of the testing, have identified it as a technology suitable for the improvement of biosecurity in a range of situations, such as on farm. In order to develop the technology for use in Victoria, an on-farm test for *aprV2* positive *Dichelobacter nodosus* was developed. *D. nodosus* possessing this gene, with the right conditions, causes severe footrot in sheep. Footrot a highly contagious, easily spread and debilitating disease. A crude yet reliable sampling method that can be performed with minimal training was developed, and alongside on farm identification of the bacteria on 19 farms in Victoria, has provided evidence that LAMP is suitable for on-farm use. LAMP technology is now being expanded to additional animal and plant pathogens and undergoing commercialisation in Victoria, making it a valuable resource for on-site testing for pathogens. In the future, with ongoing training, LAMP technology will be able to increase the surveillance and the speed of response to disease incursions in the agricultural industry for both livestock and horticulture.

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International Emergency Animal Disease Training – what have we learnt and where to from here?'

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Since 2012, the European Commission for the Control of Foot-and-Mouth Disease (EuFMD) and the Food and Agriculture Organisation of the United Nations (FAO) have had an agreement with Australia, through the Australian Government Department of Agriculture and Water Resources (DAWR) to deliver real-time foot-and-mouth disease training courses in Nepal. As of February 2019, a total of 273 Australians have been trained under the program and a further 45 positions are planned by the end of 2019.

This unique training initiative has benefits to a wide variety of stakeholders. This panel discussion will hear the following stakeholders discuss their role in, and benefits from the program including;

- The Department of Agriculture and Water Resources – objectives of the program, funding arrangements and benefits of the program to Australia and Nepal.
- Animal Health Australia – how individuals' participation in programs like this contributes to EAD preparedness and response
- Livestock industries –agents, brokers, farmers and transporters see and work with FMD-susceptible species every day. As well as being the frontline for spotting something unusual along with veterinarians, they also provide a skills-base and large communication network that can be leveraged in an EAD response.
- Veterinarians – enhancement of technical skills related to the identification of FMD, submission of samples and reporting.

All four speakers will then discuss with the audience next steps for international EAD training, including:

- What are the emerging threats and how do we better prepare for them from a training perspective?
- What would complement the program and contribute to ongoing engagement and cascade training?

Posters

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Developing and implementing biosecurity legislation compliance and enforcement training program

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Introduction

To adequately prepare Authorised Officers (AO's) tasked with compliance and enforcement duties under the NSW *Biosecurity Act 2015* (the Act), a comprehensive training and implementation program was developed and delivered by the NSW DPI Biosecurity & Food Safety (BFS) Compliance Training unit, with the assistance of Local Land Services (LLS), Local Control Authorities, NSW Fisheries, and Invasive Species Officer knowledge champions and delivered through a combination of on-line, and classroom learning. This training program was delivered from mid-2017 covering AO powers, identifying legislative breaches, management of biosecurity risks and impacts using management tools, investigation preparation and emergency response.

Aims

The primary aims of this program were to:

- increase compliance through education,
- Increase the skills and knowledge of Authorised Officers,
- enable consistency of Authorised Officers through resource development, and
- increase biosecurity awareness across NSW

Methods

Ten on-line educational modules were developed through the DPIs emergency management portal, EMTrain. These modules focus on key components of the Act and were designed to address not only the base level of knowledge required for an AO to undertake their compliance and enforcement duties, but drive consistency with respect to proportionate and risk-based decision making and compliance and enforcement response.

The content of the modules was further designed to enable the understanding the theme of the general biosecurity duty, risk-based decision making, and the interaction of biosecurity legislation instruments, AO powers, the use of management, enforcement and compliance tools and to determine when there is a breach of the legislation, what offences and accompanying penalties apply.

These themes and outcomes were reinforced through working scenarios across two phases of full-day, classroom delivery.

Results

From May 2017 to February 2019, over 1000 officers attended an intensive face to face training program delivered at 35 locations across NSW. Over 100 training sessions were held complementing over 1,000 people who have completed the EMTrain on-line learning modules.

Conclusion

Whilst the on-line modules and face to face training program serve as resources for AO's, they can also be used as an educational resource for industry and other stakeholders. The training enables stakeholders to increase knowledge and awareness of their roles and responsibilities under the Act, helping them to adequately prepare their business, operation systems and themselves for the prevention, elimination, minimisation and management of biosecurity risks or biosecurity impacts.

By successfully delivering this project, the BFS Compliance Training unit has assisted the Department in delivering on a major commitment of the NSW Biosecurity Strategy and NSW State Government priorities. The EMTrain system can be accessed at www.emtrain.dpi.nsw.gov.au

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Bee initiatives Shake-Up Awareness of Varroa Mite and American Foulbrood

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Sugar Shake month (April) and AFB Awareness month (October) are relatively new joint Government and Industry initiatives designed to increase beekeeper preparedness to quickly respond to an incursion of varroa mite or better manage American foulbrood (AFB) disease. The aim of these programs is to increase cohesion between government and industry and to work together to improve biosecurity.

The highly invasive varroa mite is the number one exotic threat to the Australian apiary industry. This parasitic mite is not present in Australia, however the threat of incursion is ever present. The crucial first line of biosecurity defence is ongoing education and training on how to detect and identify Varroa mite, and report all suspect pest mites. Sugar Shake month is a joint initiative between NSW DPI and the Amateur Beekeepers' Association (ABA). The program is based at encouraging beekeepers to periodically test their bees for varroa and report their results to NSW DPI.

American foulbrood is the 'foot and mouth' equivalent of the beekeeping industry. Early diagnosis and intervention is crucial in managing AFB, which is why the Amateur Beekeepers' Association (ABA), North Shore Beekeepers' Association and the NSW Apiarists' Association work with NSW DPI to promote AFB Awareness Month. Participation in AFB Awareness Month encourages responsible beekeeping and provides an opportunity to inspect hives for a health check prior to summer. ABA clubs run information sessions and practical activities examining brood frames. Free laboratory diagnostic tests are provided to registered beekeepers. NSW DPI provides diagnostic kits to allow users to analyse suspicious brood samples themselves, this skill is useful for early detection and management of AFB.

NSW DPI's ongoing work with the community and NSW beekeeping industry ensures continuous improvement of biosecurity best practice both now and in the future.

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Horse owners' behaviour: suspecting and reporting of Hendra virus cases

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Hendra virus infection is a zoonotic disease which spreads from bats to horses and from horses to people. Transmission spillovers are rare events, but can be fatal to horses and people when they do occur. To date, HeV cases have only occurred in Queensland and northern New South Wales with a total of 83 confirmed cases in horses up to September 2018.

The National Hendra Virus Research Program (NHeVRP) was funded by Commonwealth, NSW and Qld governments after a spike in Hendra virus infections in 2011. The "Horse owners and Hendra virus: a longitudinal cohort study to evaluate risk" (HHALTER) project was a component of the NHeVRP and involved collection of survey information from horse owners from 2012 to 2014. The fourth survey in a series of five included questions about owners' attitudes to reporting a suspected Hendra case.

The data are presented here using categorical analysis techniques to explore the relationships between attitudes towards reporting of a case and risk perception and demographic information. Of a total cohort of 1,449 responders, there were 613 (42%) participants responding to some or all of survey four. There were 592 responses to the question "If you saw unusual signs of disease (muscle twitching, nasal discharge etc) in one of your horses, how likely do you think you would be to... consider Hendra virus as a possibility". Of these 81 said they would not think of Hendra as a possibility at all and 191 thought that Hendra was very or extremely likely.

The findings of this study reinforce the importance of an existing/good relationships between horse owners and veterinarians and also identify that the presence of severe or unusual signs of disease would be 'drivers' for reporting a suspect HeV case. Data presented here are likely to represent a 'best case'.

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Abandoned and neglected orchard biosecurity management in NSW

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Introduction

Abandoned and neglected orchards have the potential to be breeding grounds for pests and diseases, which may spread to other growers and impact a wide range of horticultural industries.

The *Biosecurity Act 2015* allows DPI to take compliance and enforcement action against the owners of abandoned and neglected orchards to ensure biosecurity threats are managed and risks are mitigated.

Aims

Operation Orange was conducted in May 2017 and was developed to assess the biosecurity risk to working commercial horticultural enterprises posed by neighbouring abandoned and neglected orchards in and around Orange in Central West NSW.

Methods

A total of 79 properties were inspected as part of Operation Orange. Compliance Officers assessed the following key biosecurity indicators during on-site inspections to determine if there was a biosecurity risk present:

- Was there any disease or pests present at the property?
- Did the property pose a biosecurity risk to surrounding orchard growers?
- Where surrounding orchards in a state of neglect or abandonment, or were they being managed appropriately to minimise and manage a biosecurity risk?

After the inspection, properties where deemed as either posing or not posing a biosecurity risk.

Results

Of the 79 properties inspected 57 (72%) posed no biosecurity risk and 22 (28%) posed a biosecurity risk. Properties inspected that were deemed **not** to pose a biosecurity risk was due to the following reasons:

- a management plan was already in place;
- the properties were used for grazing only and did not have fruit trees;
- the proprieties were small house blocks with non-commercial fruit trees only;
- the properties were well maintained and do not require intervention.

Of the 22 properties identified as posing a biosecurity risk, 6 voluntarily completed mitigation works which included:

- ongoing spraying programs;
- regular pruning and slashing;
- removing rotting fruit;
- bulldozing and removal of trees and/or vines;
- compilation of management plans;
- providing educational material to assist with identification of pests.

Of the remaining 16 properties, Compliance Officers issued 14 Biosecurity Directions and 2 Biosecurity Undertakings to enforce mitigation works.

It was noted that the primary reasons that properties fell into neglect or abandonment were:

- industry downturn;
- financial issues; or
- absent landowners.

Conclusions

Operation Orange was successful in identifying several biosecurity risks associated with orchards that had at some stage been operated in a commercial capacity. In some circumstances, inspections by DPI provided sufficient motivation for remedial work to be undertaken by property owners to satisfy the requirements of minimising a biosecurity risk. In other cases, enforcement sanctions were issued to assist in addressing biosecurity risks. Due to the success of this operation, a similar operation is planned for the Bilpin region in 2019.

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Achieving biosecurity change through technology – the One Biosecurity online platform as an educational tool

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One Biosecurity provides a web-based platform where producers can assess their biosecurity practices, develop a biosecurity plan and share it with interested parties. As well as supporting risk based trading of livestock, it offers producers pathways for improvement of general on-farm biosecurity and risk management of specific diseases of interest. The program's philosophy is about raising the general level of biosecurity practice in the livestock industry to a minimum standard, while rewarding those who have good practices.

The core component of the program is a biosecurity questionnaire with in-built educational tools that allows producers to assess and record their enterprise biosecurity practices, determine if there are any gaps or areas that should be addressed, then work towards achieving or maintaining the most appropriate level of biosecurity for their enterprise. The star rating can be shared and used as a marketing tool.

Producers can then choose to complete questionnaires on management practices for various diseases of interest to them or their clients. The information embedded in the disease questionnaires provide a risk management pathway for maintaining and improving disease status and provide a starting point for conversations about risk-based trading.

Additional aspects of the program include the ability for producers to share information on any already existing assurance programs being implemented on-farm, routine animal health management practices such as treatments, vaccinations and parasite control, and upload documents such as certificates or laboratory testing results to support premium disease status.

Producers are encouraged to contact their local animal health officer if they need assistance with sign up or technical content, or to assist in identifying areas for potential improvement. The program is underpinned by a verification process, and data can be extracted from the program, both of which enable animal health staff to identify areas of focus for extension activities. This can be delivered to individuals or groups, and have a regional focus depending on local production practices and/or disease risk.

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The future: horses and traceability

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Horse identification, registration and traceability is lacking in most Australian jurisdictions. Only a few breed societies and the Australian Stud Book require identification of horses by microchip and registration in their own databases. Some of these databases are not maintained.

NSW has no legislation requiring individual horse identification or registration. Horse owners are required to obtain a property identification code (PIC) for the land on which horses are kept, however many do not.

Little horse identification and location reporting across Australia creates biosecurity and welfare risks and poses difficulties in:

- identifying where at risk horses are in local natural emergencies or potential emergency animal disease outbreaks
- communicating with horses' owners
- locating, identifying and rehoming lost and / or stolen horses

These biosecurity and welfare risks could be mitigated by the introduction of a simple national identification and traceability scheme for horses. The broad benefits from such a scheme include:

- assisting with disease control and emergency preparedness
- increased biosecurity capacity of government and industry
- providing a repository for recording crucial veterinarian treatments, e.g. Hendra vaccination
- recording of history of horse ownership, location, and more.

Horse Survey

In 2017, NSW DPI used an online survey to gauge horse industry support for a horse identification and traceability scheme. The survey generated more than 2,200 responses with respondents collectively owning or managing more than 42,800 horses.

The survey results indicated strong support for mandatory horse identification by microchip, or other form of identification, recording of all horse details in a central (national database), and traceability of horses through owner updates to the database (change of ownership, primary place of residence, and death, for each horse).

Overseas jurisdictions including Canada, the EU and Ireland, are progressing with individual horse identification and registration schemes. Should Australia be following their lead?

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Operationalising general surveillance for biosecurity - What does it take?

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General surveillance – involving citizens and other non-officials in monitoring and reporting potential invasive events – is making a valuable contribution in different sectors, such as plant, human and animal health. However it remains seen as an 'untapped resource' that is widely acknowledged as challenging to instigate and maintain. Further, on-ground general surveillance efforts to date have been predominantly fragmented, both between jurisdictions and sectors with limited sharing of lessons learnt.

While there is a growing body of literature on general surveillance, much of it focuses on individual components, such as the contribution that fortuitous detections make to a country's biosecurity system, the role of technology in fields like syndromic surveillance in animal and public health and approaches towards stakeholder engagement. There has been less consideration of the best ways to design, implement and manage general surveillance initiatives. Therefore, there is a need for a systems thinking approach towards what it takes to operationalise general surveillance within and across different sectors and scales. This is essential given the complexity around engaging and motivating non-officials in data collection, management and voluntary reporting of potential invasive species.

This project investigates current knowledge and applications of general surveillance initiatives in the field of biosecurity, with a focus on lessons learnt, gaps and opportunities. With a framework adapted from Agricultural Innovation Systems, we are structuring the study around the actors, institutions (formal and informal rules) and their relationships within and across scales in the general surveillance 'system', as well as infrastructure and biophysical components. This holistic perspective allows us to understand the dynamics between these systemic components and how to harness these dynamics to propose ways to improve outcomes from general surveillance. The outcome of the project is a set of guidelines and recommendations on implementing general surveillance in biosecurity context.

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NSW Bee Biosecurity Officer promotes better disease management and regular surveillance of exotic bee pests.

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The Australian Honey Bee Industry Biosecurity Code of Practice (the Code) is nationally endorsed by industry to assist beekeepers with engaging in best-practice biosecurity. The Code underpins the National Bee Biosecurity Program and is based on the principles of good biosecurity. Most states now have Bee Biosecurity Officers and Rod Bourke has operated in NSW since May 2017.

The main part of Rod's position is to promote the Code and increase the number of NSW beekeepers participating in better beekeeping practices. Bee Pest and Disease Training, Industry articles promoting better disease and hive management and engaging with beekeepers are important aspects of this job.

Almonds is one of many plant industries in Australia reliant on bee pollination to achieve commercial production, and this area receives regular attention from Rod through industry articles, stakeholder engagement and as an observer on compliance operations looking at pollinating beehives. The Almond pollination events in NSW, VIC and SA brought together around 215 000 beehives in 2018 and that number will rise in coming years to over 300 000. This is a $22 million economic opportunity for beekeepers to pollinate these orchards and also a large biosecurity risk at the same time, as the potential spread of American Foulbrood (AFB) is high risk during this type of intensive pollination.

The need to improve the strength and health of pollinating bee hives is therefore a critical job to address now, as the unwanted introduction of Varroa to Australia would be more successfully combatted if this aim had been achieved already.

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Institutional innovations for effective biosecurity action in peri-urban Australia

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Over the last two decades, Australia's biosecurity policy has consistently noted 'peri-urban' as a higher biosecurity risk area. With an objective to understand the complexity of institutions responsible for managing invasive species biosecurity risk in peri-urban area, a doctoral research project (jointly pursued under the Centre for Invasive Species Solutions and the University of New England, Australia) was undertaken during 2015 to 2018. Using the evidence-based approach and institutional analysis, the research identified institutional impediments that constrain effective management of invasive species, despite the peri-urban specific innovations in technologies and managerial practices in Australia.

This research poster illustrates institutional innovations for implementation of shared responsibility mandate to achieve effective invasive species management in peri-urban Australia.

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Baiting invasive ants using Australia's largest drone

Benjamin Hoffman

CSIRO

We report the first use of drone treatments in an ant eradication using Australia's largest non-military drone, *The Fazer*. We treated a Yellow crazy ant (*Anoplolepis gracilipes*) infestation in November 2017 at Elliot Springs, south of Townsville, Qld. *The Fazer* is a prototype autonomous drone currently being tested in Australia. Most drones carry loads <10 kg and are too small to be viable for this work. This drone can carry 30 kg and deliver a wide array of pay loads from liquid sprays to large granules. Granular ant bait and experimental water crystal ant baits were aerially applied. The baiting was as successful as previous treatments conducted by helicopter or hand dispersals in other eradication programs. Pre-treatment, Yellow crazy ant abundance was extremely high. Most individuals were killed 12 hours post-treatment, in line with expectations. The drone flight paths were computer controlled, more precise than helicopter operations and bait flow monitored live by camera. The use of this drone was highly successful. It's envisaged that drone technology will revolutionise our ability to conduct many eradication attempts, especially in remote locations with difficult terrain.

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Potential of dual-view multi-energy X-ray to detect animal health problems automatically and in real time

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Introduction:

The use of dual-view X-ray attenuation has been trialled and adopted recently in screening of airline baggage for biosecurity threats. Positive results have been found using medical-grade dual-energy X-ray in meat processing industries for composite analysis of lamb carcasses and beef sections to assess saleable meat yield proportion, eating quality (intramuscular fat content), and presence of abnormalities due to differences in density between bone, lean and fat tissue. There exists an opportunity for X-ray scanning of internal organs and viscera both *post-mortem* and *in vivo* to detect abnormalities due to diseases and parasites.

Aims:

The aim is to introduce an automated procedure for extracting information on organs (type and size) and abnormalities (presence, type, spread and severity) from multi-energy X-ray images. Semantic segmentation of a number of predefined classes is achieved following the development of deep learning algorithms and marking of DICOM images based on veterinary anatomy, histopathology and examination.

Methods:

This project will scan internal organs and viscera from beef cattle at abattoirs for automatic real-time detection of past and present health issues in both live and slaughtered animals using dual view multi-energy X-ray attenuation (6040 DV-MEXA). Abnormalities include liver abscesses and fluke worms, lung abscesses and tissue consolidation, heart pericarditis and tapeworm, and damage to the gastrointestinal tract.

Conclusion:

The 6040 DV-MEXA can be used to improve speed and detection of animal health and biosecurity issues, and thus save veterinary and labour costs. Data generated can be of particular interest to all

stakeholders involved in the meat trade by preventing disease spread and thereby strengthening Australia's position within the international trade sector. Rapid feedback regarding herd health can be provided to producers, leading to better on-farm veterinary protocols. MEXA shows great potential for objective, accurate and cheap detection of health issues in both live and dead animals.

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Online trading of biosecurity matter and associated risks - a pilot study

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Introduction

Electronic trading of livestock in Australia began in the mid-1980s, before the internet and mobile phones made livestock exchange easily accessible[1]. Since the early 2000's, the number of online platforms trading equipment, books, fashion, vehicles, plants and animals and the number of people using these platforms has skyrocketed.

Aims

Identify the risks associated with online trade of biosecurity matter within the Greater Sydney region and more broadly, NSW.

Methodology

The online trade of biosecurity matter plant and animal materials was investigated over a 5-month period from July to November 2018. A list of target biosecurity matter for surveillance, a review of backend search solutions for automated surveillance and alerts for manual surveillance was developed over two-months. Sale data of biosecurity matter detected on 12 online platforms via manual digital surveillance were recorded over the following 3-month period. Data collected sought to quantify the trading of biosecurity matter by online platform, date of advertisement, biosecurity matter category (eg livestock) and type being sold (eg pig), location, quantity sold in transaction (number or weight), frequency of trade by seller. Compliance gaps and biosecurity risks were identified with recommendations offered to counter potential introduction and spread of pests and diseases state-wide.

Results and conclusions

All interrogated online platforms traded either within or into the Greater Sydney region of NSW. A number of smallholder livestock sales were non-compliant with NLIS requirements and plants misidentified with traders selling weeds as legitimate garden plants. Meat products and exotic species, such as snakes and arachnids could be sourced from Asia and the United States of America, increasing the risk of exotic diseases and potential escape of exotic species, placing additional burden on our border control efforts. Further work is required to develop an automated system that includes intelligence to breakdown advert descriptions and pictures to verify correctness for compliance with Biosecurity legislation.

1. AuctionsPlus 2018. AuctionsPlus About Us, https://auctionsplus.com.au/auctionsplus.aboutus Accessed 11 February 2019

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How prepared are your staff?

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Introduction

Staff who are trained and prepared to respond to an incident are essential for Australia's biosecurity. Tocal College has partnered with Animal Health Australia for the past 15 years to support the delivery of Emergency preparedness training across all jurisdictions, working towards a consistent national standard and building response capability.

Aims

Over the past two years The Commonwealth, Animal Health Australia, Plant Health Australia, all jurisdictions and Tocal College, have developed a new nationally consistent suite of accredited training products to increase access to quality training through the Biosecurity Emergency Response Training Australia (BERTA) project.

Methods

A key feature in the development of the BERTA training materials has been extensive consultation with stakeholders. The journey of development began with a decision at the National Animal Health Training Reference Group (NAHTRG) to have one nationally consistent set of training resources.

This presented a major challenge to develop resources for three qualifications and eight skill sets with full consultation with the jurisdictions and the Commonwealth who jointly provided funding. Experienced practitioners and subject matter experts from all jurisdictions have been closely involved in the development and review of training material. Case studies, photographs, templates and a range of other resources have been provided by the partners in the project.

BERTA training materials provide a flexible package, which allows response staff to access training appropriate for their role. The blended learning approach uses online modules that introduce the theory on the topic, followed by face-to-face workshops where jurisdictions can ensure their specific requirements and context are presented while undertaking practical activities. Participants are then assessed against the nationally recognised units of competency.

To assist the jurisdictional trainers, "train the trainer" activities and support from Tocal College are essential in ensuring consistent adoption. The material can be used flexibly offering skill sets, "just in time" training, skill sets and full qualifications in a way that meets the needs of jurisdictions.

Results

Workshops for the first skill set available have been offered in several jurisdictions with trainers working together to support each other. Feedback from participants has been very positive with a noticeable spike in interest from staff to continue on to full qualifications. These training material will be continuously reviewed and updated so as to continue to meet the needs of all stakeholders.

Conclusions

Investment in training is a critical element of preparedness and capacity building. How prepared are your staff?

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The biosecurity net is set in NSW

Nathan Cutter

NSWDPI

In Australia, non-native vertebrate animals are a feature of everyday life for many people. They include most of our pets, agricultural animals and a range of amphibians, reptiles, birds and mammals that are part of conservation programs within zoos.

Today, factors such as globalisation and expansion of overseas travel and trade, changing land use and demography, climate variability as well as changing consumer preferences and expectations have the potential to result in the introduction of greater numbers of species that are presently known to exist in small numbers within Australia as well as new non-indigenous vertebrates that aren't currently present in Australia. Such introductions can present a significant biosecurity risk due to the potential for harm agricultural enterprises, the environment and in some cases, even threaten human health and safety.

In order to minimise the negative impacts of non-native animals which presently exist here as well as to prevent additions to the current list of pest species living within Australia, NSW Department of Primary Industries has implemented a range of regulatory, reporting and surveillance programs under the NSW Biosecurity Act 2015. This presentation will provide an overview of the legislation, regulatory tools and biosecurity systems in use in New South Wales as well as some of the successes and challenges in managing the biosecurity impacts of widespread and new pest animal incursions.

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Communicating biosecurity information to Australian-registered veterinary practitioners

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There are more than 24 million domestic animals living within 9.2 million Australian households. With just over 11,000 registered veterinarians currently practising in Australia, vets are on the front line of needing to know the latest disease threats and biosecurity information that might be threatening both animal and human health.

I undertook a study aimed at understanding how and where communication professionals can effectively target biosecurity information and disease alerts to reach vets in practice.

To answer this question an online survey was created and promoted to registered veterinary practitioners within Australia asking them to tell us about their current and future communication preferences for biosecurity information, and their levels of trust of this information.

A total of 213 respondents took part in the survey, with a 76% completion rate, only those who completed the survey (n=158) were analysed as part of the results.

Current understanding by veterinary practitioners of biosecurity issues are sound, however, there is no one communication medium which is regularly accessed by a large subset of veterinarians. Government and State and Territory based vet surgeon board communication resources and the scientific literature had the highest level of trust by vets but these resources were not regularly checked, if ever. Social media was most commonly checked but had the lowest level of trust, along with traditional media.

This survey has concluded that current communication with vets is irregular and reactive, results from this survey suggest that registered vets would sign up to a national biosecurity alert database and text message alerts as a source of information on this subject matter.

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The pros and cons of cross-sectoral RD&E strategies

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Biosecurity RD&E is conducted by a wide range of organisations across Australia, where previously, there was no overarching framework to coordinate this work. In 2009, the Primary Industries Ministerial Council (now AGMIN) endorsed the National Primary Industries RD&E Framework, which includes 14 sectoral and seven cross-sectoral strategies including the National Plant and Animal Biosecurity RD&E strategies. The strength in the Framework and through the Strategies is a better harmonisation of roles between organisations delivering biosecurity RD&E, facilitating greater collaboration, reducing duplication, and maximising benefits for Australia. This is achieved by having cross-sectoral representation on implementation committees including members from Government, industry and research funders/providers that drive outputs within the priority areas outlined within the strategies.

The Plant Biosecurity RD&E Strategy has been active since 2014 and is currently being reviewed for a new five-year plan. As a part of implementing the strategy, a series of workshops have been held including a workshop on whiteflies and the policy implications of diagnostic research. The revised Animal Biosecurity RD&E Strategy was endorsed in August 2018 and aims to deliver outputs/outcomes within priority areas of futureproofing biosecurity, technological solutions, development and implementation of national standards and benchmarking public and private sector investment. These two strategies are well positioned to promote greater cross-sectoral collaboration in RD&E to improve resource utilisation efficiency, however, this is challenged by not having a clear line of sight to an individual funding source to work between multiple organisations. The poster will highlight strengths and ways to tackle challenges of managing a cross-sectoral strategy and will also explore the mechanisms that other cross sectoral investors have used to solve complex problems with a view to futureproofing Australia's biosecurity needs.

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Improving detection, investigation and management of Emergency Animal Diseases

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Veterinarians play an important role in detection, surveillance and management of Emergency Animal Diseases (EADs). Early detection and immediate reporting of an emergency disease increases the chance of effective response. Surveillance for the early detection of EADs requires veterinarians in the field to be able to recognise the signs that point to a disease incursion. Lack of exposure of Australian veterinarians to EADs influences response times when these diseases emerge. In anticipation of such events, veterinarians should be trained and prepared to respond to outbreaks, minimizing its impacts and future-proofing Australia's biosecurity.

An Emergency Animal Disease Training Package has been developed collaboratively by Australian Veterinary Schools and funded by the Australian Government, Department of Agriculture and Water Resources (DAWR) to improve recognition of EADs and response times by veterinarians when confronted with EADs. The package uses open access training materials to educate practicing veterinarians and veterinary students on technical aspects of EADs and their roles and responsibilities with regards to detection, investigation, management and reporting. The package is structured as four 20-minute online modules with an introductory component and three veterinary clinician-focussed case studies. The package has been peer reviewed by veterinarians from academia, government and private practice to ensure scenarios are consistent with real-life situations.

Case studies (including neurological disease in horses, respiratory distress and death in poultry and reproductive disorders in goats) are designed to link to relevant EADs resources such as the Field Guide for Veterinarians in Emergency Animal Disease Diagnosis and Investigation, existing content from the Universities' teaching programs and online information from Animal Health Australia and Australian Veterinary Association. Materials from the training package are flexible enough to be integrated into veterinary science degree curricula and developed into workshops in collaboration with government veterinary agencies.

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Australia's recent history of vertebrate alien interceptions and the implications for emergent alien threats

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Introduction: Transnational human activities continue to increase the rate of transportation, introduction, and establishment of new alien vertebrates in Australia, to the detriment of environmental and socio-economic services. Eradication of invasive vertebrates is often costly and without guarantee of success; therefore, methods for detecting, intercepting and preventing the transport of alien species earlier in the invasion pathway provide substantial benefit.

Aim: To anticipate emergent threats to Australian biosecurity posed by the transport and introduction of new alien vertebrates over time.

Methods: We collated vertebrate interception data from various Australian State, Territory and Commonwealth government reporting agencies, including data from a previously published study, at both pre-border and post-border stages from 1999 to 2016. Using Generalised Linear and Generalised Additive Modelling, we predicted trends in interception frequency using predictors such as vertebrate taxa, detection category and alien status.

Key results: Interception frequency increased over time for all vertebrate classes, for pre-border stowaways and for post-border interceptions, with no saturation in the accumulation of new species over time. Five species were responsible for almost half of all incidents, three of which are prominent in Australia's illegal alien pet trade and commonly intercepted at post-border stages. Most stowaway incidents originated from Southeast Asia, particularly Indonesia, via shipping. Finally, we detected concerning temporal increases in data deficiency for stowaway provenance and associated commodity information.

Conclusions: Australia is subject to a persistent and increasing risk of alien vertebrate introductions and incursions over time, due partly to emergent trends in the alien pet trade as well as increased global trade and tourism. The future of Australia's biosecurity is dependent on stringent border security to prevent the arrival of novel species, but our findings also highlight the importance of ongoing management and control of high-risk species already present, often illegally, within Australia.

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Producer motivations for and against engagement in surveillance

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Aim

A Queensland pilot project aims to explore financial rewards to sustain animal health surveillance.

Background

General or passive surveillance systems depend on producers to monitor, recognise, investigate, refer and/or report instances of unusual health

Current industry frameworks for biosecurity focus more on risk prevention, impact mitigation and response preparedness than surveillance. Initiatives in surveillance typically fail to address the motivations for producer engagement.

Producers perceive insufficient direct benefit from surveillance to invest significant resources. The greatest benefit is in diagnosing enzootic conditions to enhance cost-effective mitigation, but that is offset by a perceived risk of adverse consequences to detection of an emergency disease. Many producers believe that local knowledge and networks can support mitigation of recurrent biosecurity threats without engagement in formal surveillance systems.

Market incentives were demonstrably effective in the adoption of National Vendor Declarations in the late 1990s. In contrast, there are no market incentives for producer engagement in surveillance; in fact there are significant disincentives perceived for investigating or reporting disease incidents, such as the legacy sentiment from regulatory control programs for Johne's disease. Paradoxically, perceived disincentives are largely social or emotive whereas effective incentives are largely financial.

Until rewarded with higher prices or preferred supply status, meaningful surveillance is unlikely to be sustained beyond the short-term enhancement projects that create interest from time to time.

Method

A motivated and networked local producer group is piloting a quality assurance program based on surveillance performance and outcomes that are relevant to the group and promoted as enhanced quality cattle and beef to the market chain.

Biosecurity Queensland provides support for the project, but the planning and activities are led by the group.

Results

This system is trialling direct market reward for meaningful surveillance, and due to conclude in late 2019. Interim findings will be presented.

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Producer perspectives on initiative to reward engagement in surveillance in the market chain

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The South Burnett Grazing Network is trialling a market mechanism to drive meaningful and sustained producer engagement in surveillance.

In partnership with the Queensland Department of Agriculture and Fisheries, SBGN is developing and promoting a quality assurance program branded *Healthy Beef Burnett*. The program is based on monitoring key health indicators on-farm, responding appropriately to issues as they arise, recording the monitoring and responses, and reporting of significant incidents.

Activities are customised to the context and operations of each farm. Certification is dependent on demonstrated participation in surveillance, assessed by a program coordinator, rather than actual health outcomes.

Members of the SBGN recognise the value of surveillance for market access, biosecurity protection and economic success. They also see that market incentives are necessary to drive participation in surveillance, but that there is presently no effective market driver.

Producer attitudes and actions to support the implementation of the program will be presented.

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Biocheck® - is the biosecurity conversation as important as the written plan?

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Recent changes to LPA (Australia's livestock industry on-farm assurance program) require all red-meat producing farms to have a formal biosecurity plan. Recent changes to Australia's management of Bovine Johne's Disease require producers wishing to demonstrate a high level of assurance to have their biosecurity plan overseen by a veterinarian.

There are many resources available for creating biosecurity plans at www.farmbiosecurity.com.au. Most of these are available as downloadable templates that can be customised to suit individual enterprises.

It is important for Australia's biosecurity that producers not only create biosecurity plans, but also that there is behavioural change such that producers follow the plans and understand the biosecurity risks peculiar to their circumstances.

There are many theories about what is necessary to induce behavioural change, but there is general agreement that for adults, engaging with a topic and understanding the need for action is important.

Veterinarians are well placed to advise producers about biosecurity, particularly as it pertains to their stock, but in the past most have not been well trained to create biosecurity plans.

Biocheck® is a tool developed for use by members of the Australian Cattle Veterinarians. It incorporates the standard biosecurity principles and risks from www.farmbiosecurity.com.au. A guided conversation looks at each principle, the major risks and the actions that are undertaken to mitigate those risks. Each risk is then assessed as either controlled, partially controlled, or uncontrolled and agreed actions are documented.

It is an important feature that farmers do not pass or fail such a plan. Veterinarians are there as coaches and advisors, not as auditors. Plans are reviewed and updated annually to encourage continuous improvement. Feedback thus far has generally been very positive.

It is hoped that engaging producers in meaningful conversations about biosecurity will bring about behavioural change more effectively than filling in downloadable templates.

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National Sheep Health Monitoring Project – shifting from surveillance to a biosecurity and value chain productivity tool

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The National Sheep Health Monitoring Project (NSHMP) has been collecting animal health surveillance data for 12 years and is now poised to become a significant tool in improving productivity and biosecurity for the sheep industry. The inspection of nearly 50 million sheep in that time has provided a significant amount of national surveillance information, demonstrating the high quality of Australian sheep meat product and potentially supporting market access.

However, nationally there is approximately $110 million in lost production caused annually by the diseases and conditions inspected for, and there are substantial production benefits to be made. Some conditions can be a result of biosecurity or invasive animal issues on the property and require action, e.g. hydatids.

NSHMP data has recently been included in the Integrity Systems Company's Livestock Data Link (LDL), allowing producers to access it soon after it is collected. However, this needs to be bolstered by tools and information that empower producers to make a decision about what to do about any diseases or conditions that may be found in their sheep. Provision of the data benchmarked against other flocks in the region as well as previously submitted lines will allow a producer to know how their biosecurity and disease management programs are faring. Extension will also allow them to better understand the conditions in their sheep and management options they may have.

Processors are starting to see value in participating through improving their supply quality. Development of easier data collection and transfer technology for inspection staff has become a focus for the project, and voice recognition software and hardware has been developed to help facilitate this.

The pork and beef industries are also now focused on developing this health data collection and feedback to producers through projects like the Rural R&D for Profit 'Health for Wealth' Project.