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# Biosecurity research and development in Western Australia - report by the Biosecurity Council of Western Australia

Biosecurity Council of Western Australia

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## Background

Research and development (R&D) is crucial to managing Western Australia's biosecurity risks and threats. There is a perception, however, that these risks and threats could be better recognised nationally, which may result in greater levels of funding for biosecurity R&D activities relevant to Western Australia (WA).

The purpose of this work was to provide advice to the Minister for Agriculture and Food on the status of biosecurity R&D in WA and opportunities to enhance biosecurity R&D funding in the State.

## Method

Kevin Goss Consulting and Guilbridge Pty Ltd (the consultants) were engaged by Council to report on the status and gaps in biosecurity R&D in WA and opportunities to enhance its funding. A two-stage process was used:

1. A review of national- and State-level biosecurity R&D strategies and status reports; and
2. Consultation with a wide range of stakeholders involved in biosecurity in WA and interstate.

A total of 33 interviews were undertaken involving 48 people from relevant organisations. Participants were asked to consider biosecurity science, research and innovation from the perspective of status, gaps and opportunities.

The Biosecurity Council considered the consultant's report and interview transcripts and held two workshops with the consultants to discuss the contents of the report. From these discussions and analysis, the Council has prepared this advice on the status of biosecurity R&D in WA and opportunities to enhance its funding.

## Findings

*This section summarises and includes extracts from the findings from the consultant's report on 'Enhancing Research and Innovation Opportunities Relevant to Biosecurity in Western Australia'.*

### Biosecurity R&D status and gaps

The 2017 review of the Intergovernmental Agreement on Biosecurity (IGAB) observed that biosecurity R&D, nationally, was too heavily weighted to farm and paddock scale with insufficient R&D at a systems level. A review of biosecurity R&D strategies supports this observation — there are a number of sectoral biosecurity R&D strategies, or sectoral R&D strategies with biosecurity content, at the national level; however, they vary widely in currency and commitment. In particular, system-wide biosecurity R&D seems to be critical on paper, but lacking in practice.

This is, however, changing. In 2016 the National Biosecurity Committee (NBC) identified 22 priority areas for biosecurity research, development and extension (RD&E). This planning was taken to the next level by an NBC working group that, in 2018, identified a suite of technology-based projects from foundational work (e.g. virtual laboratories, data registry) to proof of concept (e.g. next generation DNA sequencing with machine learning) and over the horizon (e.g. blockchain for product traceability from 'farm to fork').

From a WA perspective, there are two R&D-related outcomes in The Western Australian Biosecurity Strategy (2016), but no direction on how the R&D outcomes will be achieved.

The status of, and gaps in, biosecurity R&D in WA can be categorised into five key areas:

1. Capability: Biosecurity R&D by the Department of Primary Industries and Regional Development (DPIRD) is minimal, although there are some areas of strength such as aquatic-based R&D. Whilst DPIRD has the capacity to meet its operational/ legislative responsibilities, there is inadequate capacity and capability to actively improve the biosecurity system through R&D. It should be noted that a measure of capability should be wider than just DPIRD.
2. Cooperation: There is a range of biosecurity R&D being undertaken by various research organisations and the commercial sector. Although there is collaboration between State Government agencies on some projects, there are no formal collaboration or cooperation agreements in place.
3. Surveillance and detection: There is a perception that surveillance strategies and methods are too static and not responsive to changing pathways and technologies. Coordination between agencies and industries can be improved, as can engagement with the broader community in the areas of surveillance/detection-related R&D.

4. Diagnostics: WA has good diagnostic R&D capabilities across a range of institutions, and there is some research being undertaken to improve diagnostic methods.
5. Disinfestation/eradication: R&D into the methodologies to use for disinfestation is limited by the time required to test alternatives. Further, there are insufficient resources for this to be done proactively.

## Opportunities for biosecurity science, research and innovation

Western Australia is part of the national biosecurity system bound by the IGAB and national biosecurity response deeds. This national collaborative approach extends to biosecurity R&D. Participating in this national endeavour with science expertise and financial resources 'on the table' is critical to delivering research and innovation benefits to WA.

In short, WA should identify how it can best leverage into the national system to provide benefits to the State. The focus should be on having the science excellence and financial resources to co-invest in and strategically lead R&D projects across State borders, where net benefits flow to WA.

Given this, WA should:

1. Understand the level of science capability and capacity that is required by State Government agencies to protect WA's environmental and economic assets from harm and to enhance trade growth and continuity, directly through legislated responsibilities and indirectly through national arrangements[1]. The discipline skills required are broad but include the core skills of entomology, pathology, microbiology, virology, ecology, epidemiology and taxonomy.
2. Identify the research and innovation areas where WA has a comparative advantage to concentrate work in this State. These areas should have national or even global reach and lead to collaboration.

In terms of point 1 above, past Council work identified a deficit in DPIRD's biosecurity science capability. DPIRD needs to establish a baseline for science capability that extends beyond response readiness to engaging in research and innovation across surveillance and detection, diagnostics, eradication and disinfestation, and across essential discipline skills. For WA to be perceived as an attractive partner, drawing more opportunities to the State and taking strategic leads on collaborative projects, it must attract and retain science excellence.

Conventionally and historically, plant and animal science disciplines, including botany and zoology, were critical to biosecurity competence. They are now in decline in WA, Australia and possibly overseas. Despite the promise of new technologies (such as gene sequencing as a substitute for traditional taxonomy), a science understanding of 'what makes invasive and endemic species tick' is still critical in threat (risk) assessments, in validating diagnostics and in prevention, eradication and containment.

[1] Note that this 'science capability and capacity' can be internal or external to State Government agencies.

There is a strong case for retaining or rebuilding a minimum viable cohort of discipline skills in DPIRD and the Department of Biodiversity Conservation and Attractions (DBCA), given its expertise relevant to environmental biosecurity. This rebuilding is to, at the least, meet legislated obligations to respond to biosecurity incidents and carry out necessary regulatory functions. For high-performing scientists to be attracted and retained in agencies, ongoing R&D as part of their jobs is necessary along with resourcing to engage externally, nationally and overseas.

In terms of point 2 above, the NBC working group's national list of biosecurity research and innovation priority projects is a good starting point to explore where WA might lead engagement — and resources should be allocated to undertake this task. Some areas of 'comparative advantage', consistent with the national priority projects, have been identified:

***Risk assessment and prioritisation:*** While priority pest lists might usefully serve a national purpose of focussing attention on where and how to mobilise interstate arrangements should an incursion occur, there is a widespread view that such lists have limited utility in WA. A better but not fully developed approach is to investigate and model categories of threats for a region, industry or the State.

The national biosecurity system is served in this space by the Centre of Excellence for Biosecurity Risk Analysis (CEBRA) at the University of Melbourne and by CSIRO. With the exception of a collaborative project with Murdoch University, CEBRA's work is not tailored to WA's needs. There is opportunity for a collaborative, multi-disciplinary biosecurity risk assessment entity to be established in WA. The entity can commit to an ongoing biosecurity risk assessment and prioritisation program suited to the State, its sectors and regions.

***Surveillance and detection technologies:*** There are many indications that biosecurity is on the cusp of a digital revolution that may result in a transition from surveillance being done in-house by biosecurity agencies to developed surveillance tools in the hands of private sector service providers. As such, there is an opportunity to create an 'industry science' model for surveillance, detection and reporting. Smart, low-cost technologies with real-time reporting in the hands of private sector providers, combined with devolved responsibility for surveillance (underpinned by auditing), may be the path to real 'shared responsibility' in biosecurity.

By engaging with the national endeavours in this space[2], taking initiative and leadership in technology development and drawing industry into this journey, WA may be able to pioneer 'industry science' in biosecurity and achieve a cultural shift to true shared responsibility.

Citizen science also has a significant role. Among the various tools and apps in the name of citizen science, DPIRD's MyPestGuide Reporter stands out. Plant Health Australia sees a larger, unfulfilled potential of the app where it is strategically applied

[2] For example, CSIRO Biosecurity and Health's global strategy of technology development in Australia's interest and NBC's initiative to identify and prove-up biosecurity research and innovation projects.

to industry objectives and perhaps rolled out nationally. An industry-targeted MyPestGuide could integrate with other surveillance tools and incorporate artificial intelligence (AI) and big data as they prove themselves.

***Diagnostics:*** In general, diagnostic capability is in good shape in DPIRD and DBCA. However, there are three areas of opportunity: 1) validation of new DNA taxonomic tools and application of environmental DNA (eDNA) sequencing[3]; 2) proof of concept for mobile and remote testing technologies and of virtual laboratories; and 3) engaging in national rationalisation and standardisation of diagnostic tests and laboratories.

Critically, with DNA sequencing now widespread and affordable as a research tool, there is an ongoing challenge of how it is applied in a regulatory and trade sensitive environment. The new frontier of eDNA is a challenge. Biosecurity agencies need to have the skills and resources to partner with researchers to validate and seek a high level of confidence that the DNA sequence identified is truly what it is interpreted to be. This means having the capacity to engage with bioinformatic expertise and to ground-truth with applied biological skills.

DPIRD, as the agency responsible for the *Biosecurity and Agriculture Management Act 2007*, needs to find the resources to engage nationally and with research partners to tailor application of next generation sequencing to its policy and regulatory responsibilities. Additional resources will be required to validate emerging eDNA use by third parties.

***Prevention, disinfestation and eradication techniques:*** Should an incursion occur, having control options, resources and necessary permits for rapid deployment is critical. Situations will arise where the best control option does not have a permit for that use or environmental impact considerations are paramount. Also, there may be trade sensitivities if that produce is destined for export or interstate markets. DPIRD, as the biosecurity combat agency, is responsible for meeting these regulatory requirements and negotiating special provisions. The science capability for these tasks is necessary for DPIRD to deliver its core business.

Over and above rapid response, there is ongoing research and innovation work to be done to 1) discover and assess new treatment options; 2) develop and apply new control options in processing and supply chain handling; and 3) facilitate re-design of production, processing and handling to reduce infestation risk. This applied research and engineering design is very much in industry's best interests and largely a private good. Larger enterprises and companies may well be able to finance it and capture the benefits, but smaller industries will likely not have the scale and resources to undertake research and technology development or partner in national R&D. This is another area where government-industry cooperation could be improved with the

[3] Sequencing of DNA that is collected from environmental samples (such as soil, water, air) rather than directly from an individual organism.

right incentives. A small grants program that partners industry with innovators in transformation of biosecurity hygiene and control options could be considered.

***Biodiversity protection and recovery in refugia:*** WA has a clear comparative advantage in environmental biosecurity — the eradication of invasive species from island refuges, captive breeding and relocation of fauna to refuges and protecting these island refuges from mainland incursions has been successfully demonstrated. This provides a strong foundation for the State, through DBCA, to explore a collaborative program with national reach for research and innovation in safekeeping threatened native species. National collaboration is critical because there are economies of scale, given the degree of specialised disciplines involved. Nevertheless, WA has a comparative advantage to lead nationally and engage globally, given the unique ecosystems and species that exist here.

## Conclusions and recommendations

Biosecurity in Australia is characterised by two major principles:

- It is a shared responsibility between the Commonwealth and the State jurisdictions
- It is a science-based system that requires ongoing R&D to underpin its integrity.

With these principles in mind, WA needs to strengthen its involvement in the national endeavour. It has the opportunity to engage nationally and lead research and innovation that will benefit the State. However, to successfully engage nationally, WA needs to be perceived as an attractive partner. Putting WA's science expertise and financial resources 'on the table' will draw in more opportunities.

**Recommendation 1. That Western Australia, through DPIRD, establish, coordinate and drive a biosecurity research and development network across Western Australia.**

DPIRD is in prime position to work with stakeholders to identify WA's biosecurity R&D priorities. With representatives on the NBC, it is also well-placed to incorporate national R&D priorities into WA's research agenda. Understanding the biosecurity R&D priorities will enable DPIRD to drive the R&D agenda and, therefore, ensure meaningful biosecurity research and innovation that will benefit the State. However, it will also be critical to actively engage externally to make use of the research facilities and infrastructure and R&D capabilities available within WA or even across borders.

One way to facilitate this is for the State Government to instigate a 'collaborative biosecurity R&D fund', whereby funding is made available for collaborative R&D that addresses the identified priorities

**Recommendation 2. That DPIRD establishes a baseline for its science capability that extends beyond response readiness to engaging in research and innovation across surveillance and detection, diagnostics, eradication and disinfestation, and across essential discipline skills.**

DPIRD needs science capability to deliver its regulatory functions and responsibilities, including in relation to forestry and environmental biosecurity. The discipline skills required are broad (e.g. entomology, pathology, microbiology, virology, ecology, epidemiology, taxonomy) and need to be readily available. Some of these skills may be outsourced; however, this cannot be at the expense of competent in-house agency expertise to serve the State's economic and environmental interests in regulation, policy and industry/community cooperation.

As stated by the Council in past advice to Government, an ongoing program of applied research and technology development is necessary for high-performing scientists to be attracted and retained in agencies, along with resourcing for them to engage externally, nationally and overseas. For WA to be perceived as an attractive partner, drawing more opportunities to the State and taking strategic leads on collaborative projects, it must attract and retain science excellence in-house.

Establishing a R&D network within WA (recommendation 1) will assist in providing opportunities for DPIRD scientists to engage in research.

*National projects that will deliver benefits to WA*

Engaging in biosecurity research and innovation nationally will help build and retain WA's science excellence. However, it is important to be strategic in where efforts are placed. The question is: 'what are the research and innovation areas where WA has a comparative advantage to concentrate work in this State?' These research and innovation areas should have national or even global reach and lead to collaboration. Seven opportunities are presented.

1. With DNA sequencing and 'omics' methodologies now widespread and affordable as a research tool, there is an ongoing challenge of how it is applied in a regulatory and trade sensitive environment. The new frontier of eDNA detection of invasive species is a particular challenge. **DPIRD, as the agency responsible for the Biosecurity and Agriculture Management Act, should proactively engage nationally and with research partners to tailor application of next generation sequencing to its policy and regulatory responsibilities, including validating emerging eDNA use by third parties.** WA has now opened the Australian National Phenome Centre, which is unmatched for capability in the southern hemisphere and arguably the world. The State needs to engage to determine how this resource can be effectively utilised for biosecurity.
2. While priority pest lists might usefully serve a national purpose of focussing attention on where and how to mobilise interstate arrangements should an incursion occur, there is a widespread view that such lists have limited utility in WA. A better but not fully developed approach is to investigate and model categories of threats for a region, industry or the State. **There is an opportunity for the State, through DPIRD, to explore the possibility of a new collaborative entity in biosecurity risk assessment that commits to an**

**ongoing risk assessment and prioritisation program suited to WA, its sectors and regions.**

3. Biosecurity is on the cusp of a digital revolution. DPIRD has the opportunity to join this technology unfolding. **Resources should be allocated to explore how it can engage with: the NBC working group's national list of biosecurity research and innovation priority projects; relevant 'innovation centres'; and with innovators in technology development.** This could be through direct partnerships, or it could be a role taken on by a State-based university. Alternatively, a CRC-P proposal could be initiated as a transitional program to a 'technology hub'.
4. Among the various tools and apps in the name of citizen science, DPIRD's MyPestGuide Reporter stands out. There is a larger, unfulfilled potential of the app. **MyPestGuide development should be put on a sound footing and its roll-out accelerated and consolidated with a vision for strategic and targeted application to priority pest pathways.**
5. There is ongoing research and innovation work to be done in the areas of prevention, disinfestation and eradication techniques. **Science and resources for ongoing applied research in these areas, for high priority biosecurity risks, is needed to help attract and retain quality scientists whilst also delivering positive biosecurity outcomes.**
6. Research and innovation in the areas of prevention, disinfestation and eradication is very much in the industry's best interest and largely a private good. **The Government should consider a small grants program that partners industry with innovators to transform biosecurity hygiene and control options.** This could be administered through the Industry Funding Schemes or as an 'innovation challenge program' modelled on New Zealand's Innovation Centre.
7. Western Australia's success at protecting native species from invasive plants and animals provides a strong foundation for **the State, through DBCA, to explore a collaborative program with national reach for research and innovation in safekeeping threatened native species.** WA has a comparative advantage to lead nationally and engage globally, given the unique ecosystems and species that exist here.

There is an essential case for expanded investment in science capability in WA, backed by resources for collaborative participation in research and innovation across borders. Not only will this improve net benefits to the State, but will also draw resources, skills and research institutions to WA where there is a comparative advantage to strategically lead programs and projects.

**Important disclaimer**

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