Adequacy of Australia's biosecurity measures and response preparedness, in particular with respect to foot-and-mouth disease and varroa mite

An inquiry by the
Senate Rural and Regional Affairs and Transport
References Committee

Submission by the
Invasive Species Council

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About the Invasive Species Council

The Invasive Species Council was formed in 2002 to advocate for stronger laws, policies and programs to keep Australian biodiversity safe from weeds, feral animals, exotic pathogens and other invaders. It is a not-for-profit charitable organisation, funded predominantly by donations from supporters and philanthropic organisations.

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Summary

The Invasive Species Council welcomes the opportunity to provide a submission to the inquiry into the adequacy of Australia's biosecurity measures and response preparedness. We support efforts to strengthen the national biosecurity system, with particular focus on prevention and early action to prevent detrimental impacts on the Australian environment from invasive plants, animals and diseases.

This submission will cover preparedness, elevation of environmental biosecurity based on an equivalent Appropriate Level of Protection (ALOP), implementation of strategy and review recommendations, and sustainable funding, including for biosecurity technologies and research and development (R&D) initiatives.

Additionally, the threat of foot-and-mouth disease (FMD) highlights a gap in our current preparedness for animal pathogens of concern - that of the populations of feral cloven-hoofed animals including deer, buffalo and goats. Early action to reduce the risks from these potential reservoir populations will not only provide greater certainty to industry that market access will be regained, but also will benefit the eradication and control efforts and save considerable amounts of funding and resources if done early and without time pressure of a disease outbreak. More controls and effort to eradicate these species will also benefit the Australian environment.

The adequacy of Australia's biosecurity measures and response cannot be properly assessed or improved by considering one threat or incursion alone. Any issues identified here are symptoms of the broader threats to the system, and will strengthen Australia's capability to respond to incursions such as FMD and varroa mite.

A significant gap in Australia's biosecurity system is that of environmental biosecurity. Australia has made progress to address the identified gap, but environmental biosecurity preparedness still considerably lags that for primary industries. The essential mechanisms have been in place for plant and health industries for at least 10–20 years longer than for the environmental sector and the industry sectors continue to be far better resourced.

For environmental biosecurity, there is also a lack of risk assessments and pest risk analyses relevant to environmental priorities, surveillance strategies, plans and programs, diagnostics strategies and standard operating procedures for emergency responses.

Although engagement with the environment sector has considerably improved since the appointment of the chief environmental biosecurity officer in 2018, there are no equivalent partnership arrangements and much less formal involvement of stakeholders in biosecurity arrangements.

We urge the committee to consider the questions and suggestions here, as the solutions and engagement required for threats such as FMD or outbreaks such as varroa mite must be addressed systemically, and not in isolation. However, if issues discussed here are deemed out of scope, we recommend that they be referred to the appropriate decision-making authority so they can be considered in the efforts to develop a modern, consistent and secure national biosecurity system – protecting not only high value industries, but the environmental values that are invaluable to our future.

Recommendations

Adequacy of Australia's biosecurity measures and response preparedness

1. Biosecurity preparedness as a whole must be elevated as a priority in order for Australia's biosecurity system to be ready for current and future risks, and not at the expense of either agricultural or environmental biosecurity: both are interlinked components and resilience to future pressure (including climate change) relies upon both.
2. The budget of the Chief Environmental Biosecurity Office (CEBO) should be tripled in the May 2023 budget to enable the office to perform its intended function and increase capability.
3. Expand the species listed on the national priority list of exotic environmental pests, weeds and diseases and commit resources to the implementation plan.
4. Develop as a priority a hitchhiker plant pest action plan.
5. Finalise INVASIPLAN, an overarching preparedness plan for invasive species that harm the environment.
6. Fully implement the national invasive ants biosecurity plan.
7. Accelerate the development of environmental biosecurity risk analyses and assessments by DAFF, in line with the rate and attention that is given to agricultural biosecurity risks.

FMD risk vectors in invasive hard-hoofed species

8. Fast-track existing vertebrate pest control of feral pigs, deer, goats, buffalo and camels in strategic locations and conduct a bait and control tool stockpile review and contingency planning in preparation for FMD or other major livestock and zoonotic diseases outbreak.
9. Investigate what actions would be taken in the event of an outbreak of FMD relating to feral host animals under the response frameworks of AUSVETPLAN.

Environmental biosecurity continues to lag behind primary industry

10. The Australian Government should use a consistent method to assess the risks and priorities across all invasive taxa – the Environmental Impact Classification of Alien Taxa (EICAT) method.

Information and transparency - implementation of recommendations from previous reports into biosecurity

11. The Australian Government should publish a report on the implementation of recommendations from the 2017 review of the Intergovernmental Agreement on Biosecurity (IGAB review) and the reports of the Inspector-General of Biosecurity, and communicate progress.
12. There must be a robust, transparent, repeatable and inclusive process as the basis for determining priorities for Australian environmental biosecurity. Develop consolidated lists of invasive species available for consistent and rapid national decision making.
13. There needs to be more frequent engagement on environmental biosecurity matters, including the Environmental Biosecurity Advisory Group (EBAG) should meet more frequently and present views to Environment and Invasives Committee members.
14. Ministerial meetings relating to biosecurity should occur at least twice a year, and all papers made public, as they were up until 2013 under previous COAG arrangements.

Implementation of the Biosecurity Strategy 2022-2032

15. Governments must prioritise the implementation of the Biosecurity Strategy 2022-2032.

Surveillance

16. There needs to be significantly more investment in establishing and promoting community supported (e.g. citizen science) surveillance programs for highest priority environmental biosecurity risks.

NEBRA & response deeds

17. Improve transparency around decision making and include environmental perspectives under the NEBRA and in line with the new Australian Biosecurity Strategy 2022-2032.

Research

18. Fully implementing the National Environment and Community Biosecurity Research, Development and Extension (RD&E) Strategy 2021-2026, with a strong focus on solving difficult high priority problems and applying emerging technologies.

19. Invest in Australia's capacity for rapid identification of exotic species including the maintenance of validated reference collections for biosecurity risk groups in Australia's national biological collections (CSIRO, state and territory museums and herbaria).
20. Ensure immediate and long-term funding mechanisms maintain research, development and innovation capacity of biosecurity technologies and deliver outcomes across primary industries and environmental biosecurity risks.
21. Specific consideration should be given to ensuring that the Centre for Invasive Species Solutions (CISS) has funding certainty and continuity.

Appropriate and targeted funding to strengthen preparedness and response capability

22. Double funding to Australia's biosecurity preparedness and response capacity in real terms, and ensure that it is sustainable, and continues to grow as risks grow.
23. Australia's biosecurity system requires sustainable, ongoing funding that should be collaborative and transparent.
24. The Australian Government should establish a Productivity Commission inquiry into the economic and environmental benefits of long-term control of feral animals.

Building a decade of biosecurity

25. The Australian Government must endorse the Decade of Biosecurity initiative as a way to strengthen partnerships and build broader community engagement and participation.

Adequacy of Australia's biosecurity measures and response preparedness

Australia is facing ever increasing threats from plant and animal pests and diseases, as the movement of goods, people and produce expands to fill growing markets and supply the modernising world. As a place of invaluable environmental heritage and biodiversity, and an exporter of premium produce to the world, Australia must adapt, improve and strengthen its biosecurity system to keep up with growing pressures. Recent global events such as COVID19 and geopolitical influence on trade have shown that Australia is part of an interconnected, complex and rapidly shifting network of goods, human movement, and environmental change, and requires dynamic, forward thinking and sustainable investment and commitment to minimise these threats.

The risks and pressures from invasive pests and diseases are increasing, and the consequences for economic, environmental and agricultural productivity are being better understood and predicted. However, Australia is arguably not matching these changes with guaranteed income streams that are sufficient to the task it faces and as the risk grows, nor implementing reform recommendations made by numerous government and independent reviews and reports. Continuing with the status quo or limiting reform to minor, stepwise improvements is not sufficient to reduce the number of serious incursions, environmental degradation and other impacts.

Between 2012 and 2017, the annual number of interceptions of biosecurity risk materials at Australian borders rose by almost 50%, to 37,014[1]. This figure is indicative of both increasing risk from growing movement of goods and people, as well as better capacity to detect them on the border.[2] The federal government recently increased funding in the Agriculture 2030 budget package, however this one-off investment fails to address the structural issue of providing sustainable long-term funding to match the level of risk and costs to Australia if priority pests are established. Economic analyses have consistently found that the return on investment in prevention and response to be extraordinarily high due to the extremely high costs of responding to outbreaks or, worse, establishment and shifting to long-term management. Sustainable long-term funding is needed. New funding models such as levies (based on a risk-creator pays model) must be considered.

Right now, the Western Australian government is working to contain an outbreak of polyphagous shot-hole borer, a serious pest of trees that is believed to have entered via wooden packaging materials, and has the potential to devastate native forests, horticulture production and amenity trees in urban landscapes. Outbreaks of PSHB internationally have shown the scale of damage that is possible (e.g., in Canada and Israel). NSW is currently working to contain and eradicate varroa mite, the world's most serious pest of honey bees, after an incursion through Newcastle port. This incursion brings with it a threat to the honey production industry and pollination services provided by bees to horticulture and nursery sectors.

A sobering case study is that of the failure to eradicate myrtle rust – a damaging fungal pathogen that is severely damaging many native Myrtaceae trees, leading to the predicted extinction of 16 species within one plant generation, as well as damaging horticultural and amenity trees. This pathogen spread slowly at first, largely confined to parts of NSW, but subsequently spread to

[1] Inspector General of Biosecurity, 2019, as cited in CSIRO, 2020m Australia's biosecurity future report
[2] Craik, Palmer & Sheldrake, 2017, Priorities for Australia's biosecurity system. An Independent review of the capacity of the National Biosecurity System and its underpinning intergovernmental agreement.

Queensland and Victoria. In 2015, myrtle rust was found in Tasmania and the Northern Territory[3] and in 2022, it was detected in the north of Western Australia. Other incursions that are still being actively targeted for eradication include red imported fire ant, which poses a major threat to wildlife, our economy and people.

The value of assets' that are being protected by investment into biosecurity has been estimated to be $251 billion per year, or $5.6 trillion over 50 years. In a study performed by the Centre of Excellence for Biosecurity Risk Analysis, a return-on-investment ratio was evaluated to be 30:1 over 50 years, if $10.45 billion was spent on biosecurity. It is clear then, that the more investment into the system, the greater the return over time. This calculation does not include environmental assets or its flow-on benefits and profits[4]. Priority pests that may be next include *Pseudogymnoascus destructans* (white-nose syndrome), crayfish plague, eucalyptus canker, rosy predator snails, and snakehead fish, among many others. The costs of eradication, control, or eventual management and losses caused by these future pests would be in the billions.

Australia operates in a balance of risk-based intervention and inspection, which is a necessity in order to facilitate the movement of people and goods in the quantities and scales that are required today. However, the costs to Australia from invasive species far outweigh the investment currently made by governments, and we believe that greater funding can only benefit the country, and will be a positive return on investment orders of magnitude above the cost. Investment and focus should be determined based on risk. The risk of a possible FMD outbreak remains very low, but there is substantially more investment than higher risk environmental threats. This disparity in investment between environmental and industry biosecurity preparedness applies across all industry sectors – animal health, plant health and marine (see Appendix 1 - Comparison of biosecurity preparedness across sectors).

The Australian biosecurity system relies on a science based and precautionary 'appropriate level of protection' (ALOP). Assessment of risk and appropriate protection and response must be elevated equally for environmental pests and diseases. Environmental biosecurity threats, while the subject to increased attention over recent years, have not been prioritised equally to agricultural pests. Environmental biosecurity must be further strengthened to reach a similar level of focus as agricultural biosecurity.

Recommendations:

1. Biosecurity preparedness as a whole must be elevated as a priority in order for Australia's biosecurity system to be ready for current and future risks, and not at the expense of either agricultural or environmental biosecurity: both are interlinked components and resilience to future pressure (including climate change) relies upon both.
2. The budget of the Chief Environmental Biosecurity Office (CEBO) should be tripled in the May 2023 budget to enable the office to perform its intended function and increase capability.
3. Expand the species listed on the national priority list of exotic environmental pests, weeds and diseases and commit resources to the implementation plan.
4. Develop as a priority a hitchhiker plant pest action plan
5. Finalise INVASIPLAN, an overarching preparedness plan for invasive species that harm the environment.

[3] Campos & Tobe, 2022. Myrtle Rust eDNA surveillance for early detection in Western Australia
[4] Dodd, Stoeckl, Baumgartner & Kompas, 2021, The value of biosecurity

6. Fully implement the national invasive ants biosecurity plan.
7. Accelerate the development of environmental biosecurity risk analyses and assessments by DAFF, in line with the rate and attention that is given to agricultural biosecurity risks.

FMD risk vectors in invasive hard-hoofed species

The current priority threat of foot-and-mouth disease (FMD) does pose a real threat to Australia's livestock industries. The disease is highly contagious, and affects all cloven-hoofed animals including cattle, buffalo, sheep, goats, camelids (llama, alpacas, camels), deer and pigs. FMD is a difficult disease to prepare for, as its large genetic variety means vaccination is difficult, costly, and potentially ineffective depending on which strain enters the country. Due to the spread of the disease in Indonesia (following an outbreak in May 2022 and spread to areas including Bali), Australia's preparedness involves higher risk profiling for passengers and goods arriving from Indonesia, surveillance across northern Australia, and public awareness in susceptible regions and industries[5].

FMD is endemic to most of the world, with approximately 77% of global herds carrying the virus. FMD positive countries manage disease free herds, keeping physical separation and demonstrating herd freedom to facilitate some export trade. The most likely source of an outbreak in Australia would be the importation of illegal high-risk material. While cloven-hoofed animals are hosts, pigs are the most problematic when it comes to spreading the virus. Wild pigs are also regarded as 'amplifying hosts' for FMD, because they can excrete very large quantities of the virus in their exhaled breath[6]. Pigs produce significantly more virus in their bodies, and there is evidence that they can spread the virus via breath up to 10kms away.[7]

Currently, Australia hosts large (and growing) populations of cloven-hoofed animals that will not fall under the above framework of response. Wild populations of feral deer, pigs and goats in particular may act as a reservoir for FMD in the environment. Efforts to improve control of these pests have been hampered due to lack of commitment, funding or agreement between jurisdictions, lack of prioritisation of the environmental impacts caused by them, and minority community groups that advocate for their protection or promotion (e.g., hunting interests introducing and protecting populations of deer to maintain the sport). These potential hosts pose a weakness to any preparedness and eventual eradication efforts, and the committee should consider this when analysing the adequacy of preparedness and response for FMD.

An economically measurable risk from feral populations of cloven-hoofed invasive animals in the event of an outbreak in Australia, is that of regaining area freedom, and subsequently regaining market access for Australian animal products. One of the key steps after eradication that will be required to return to normal trading is negotiating for market access (which will be an immense pressure to achieve from livestock industries). In order to do this, Australia will need to demonstrate area freedom from FMD. This will be extremely difficult, if not impossible, if there is a reservoir of FMD in wild feral populations posing an ongoing risk of re-infection into livestock.

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[5] Department of Agriculture, Fisheries and Forestry https://www.agriculture.gov.au/biosecurity-trade/pests-diseases-weeds/animal/fmd/governmentaction#biosecurity-education-and-awareness accessed 17/08/2022.

[6] Department of Agriculture, Fisheries and Forestry https://www.agriculture.gov.au/biosecurity-trade/pests-diseases-weeds/animal/fmd/governmentaction#biosecurity-education-and-awareness accessed 17/08/2022.

[7] Duthie, 2022, New Zealand's preparedness for FMD, TMBC Biosecurity Symposium, 30/08/2022

It is understood that currently the responsibility for identifying FMD within feral animal populations falls to the general public[8]. Other than the surveillance performed by the Northern Australia Quarantine Strategy (NAQS) in northern Australia, relying on livestock owners to be vigilant and observe feral pigs and buffalo near their properties for symptoms is not enough to adequately address this risk. It is understood that only following an observation of a feral animal with FMD symptoms and report by a member of the public, would these feral animals be tested for infection if required[9].

Cloven hoofed invasive animals can act as a disease reservoir of FMD. We recommend the committee consider improved management of cloven-hoofed invasive animals as a significant area to be addressed when determining the adequacy of Australia's preparedness and response capability.

New Zealand is also working closely with our Pacific neighbours, where wild roaming pig populations are extremely important to cultures and food security. While Australia has provided a $10 million package to assist Indonesia manage the outbreak, it is unclear what actions are being taken to support the preparedness of Pacific Island nations whose livelihoods would be critically damaged if FMD were to occur. The likelihood of an outbreak in Australia may have increased to approximately 9% - for the Pacific this may be significantly higher, due to unregulated trade and movement of high-risk material, porous marine borders, and lack of resources and experience in preparing a response.

Recommendations:

8. Fast-track existing vertebrate pest control of feral pigs, deer, goats, buffalo and camels in strategic locations and conduct a bait and control tool stockpile review and contingency planning in preparation for FMD or other major livestock and zoonotic diseases outbreak.
9. Investigate what actions would be taken in the event of an outbreak of FMD relating to feral host animals under the response frameworks of AUSVETPLAN.

Environmental biosecurity continues to lag behind primary industry

Australia has made substantial progress in environmental biosecurity preparedness over the past decade, particularly with the following:

- 2012: establishment of the National Environmental Biosecurity Response Agreement (NEBRA)
- 2018: appointment of a Chief Environmental Biosecurity Officer (CEBO)
- 2020: publication of a list of priority environmental invasive species to keep out of Australia (EEPL).

However, environmental biosecurity preparedness still considerably lags that for primary industries. Many essential mechanisms have been in place for plant and health industries for at least 10–20

[8] Animal Health Australia – Foot-and-mouth disease https://animalhealthaustralia.com.au/foot-and-mouth-disease/ accessed 26/08/2022

[9] Wildlife Health Australia – Exotic Foot-and-mouth disease factsheet https://wildlifehealthaustralia.com.au/Portals/0/Documents/FactSheets/Exotic/EXOTIC_-_Foot-and-Mouth_Disease_(General_Information).pdf

years longer than for the environmental sector and the industry sectors continue to be far better resourced.

There is a great deal of work needed to better prepare Australia to prevent more damaging environmental incursions. The comparative lack of preparedness is evident in the relative lack of contingency plans and incursion response plans: 6 relevant to environmental priorities vs >150 industry plans (see Appendix 1. Comparison of biosecurity preparedness across sectors). For environmental biosecurity, there is also a lack of risk assessments and pest risk analyses relevant to environmental priorities, surveillance strategies, plans and programs, diagnostics strategies and standard operating procedures for emergency responses.

The rate of new environmental incursions into Australia continues to be high and shows no sign of slowing down. Since 2000, there have been more than 100 incursions of species with potential environmental impacts (as shown in Appendix 2. Incursions since 2000, provided as a supplement), not counting many new weed species that have newly established in the wild. About 40 incursions have been of 21 species with the recognised potential to become serious invaders. They include well recognised threats such as red imported fire ants, yellow crazy ants and myrtle rust and less well recognised threats such as climbing perch, red-eared sliders and a new phytophthora species. There are many others for which there is insufficient information to determine the degree of threat, most of which are not being studied.

Some incursions have been eradicated or are under eradication or eradication was attempted and failed. All that are not currently under some form of management should be assessed for their risk and measures taken to mitigate the risks.

An outstanding element of agricultural biosecurity is the formal partnerships between industry and government with Plant Health Australia and Animal Health Australia. There is no equivalent for the environmental sector and much of the equivalent work is the responsibility of the office of the Chief Environmental Biosecurity Officer. The difference in capacity is stark, with just 5 staff members in the CEBO office compared to about 50 in Plant Health Australia and Animal Health Australia plus additional staff in the offices of the Chief Plant Protection Officer and the Chief Veterinary Officer. Given the enormous amount of work needed to strengthen environmental biosecurity preparedness, there is an urgent need to greatly increase the capacity of the CEBO. We recommend at least a 3-fold immediate increase in funding.

Although engagement with the environment sector has considerably improved since the appointment of the CEBO, there are no equivalent partnership arrangements and much less formal involvement of stakeholders in biosecurity arrangements. The Environmental Biosecurity Advisory Group (EBAG) is an important consultative mechanism, but only meets once per year.

Surveillance activities are critical to managing the risk of incursion by priority pests and disease. The Northern Australia Quarantine Strategy (NAQS) program and involvement of Indigenous ranger groups are a vital and integral part of surveillance in Australia. The importance of citizen science and general surveillance by the public must also play a role in a stronger system. It is good to see the CEBO funding new citizen science initiatives, such as the Biosecurity Bughunt biosecurity pilot project. However there remains a significant lack of focus on surveillance for the most high-priority environmental risks.

Broadly, there is a general lack of central information data compilation and sharing about invasive species. There are no consolidated lists of invasive species available for consistent and rapid national decision making and no comprehensive assessments of the risks of existing and emerging invasive

species. We recommend the use of a consistent method to assess the risks and priorities across all invasive taxa – the Environmental Impact Classification of Alien Taxa (EICAT) method. Endorsed by the IUCN, it is being adopted widely and facilitates sharing worldwide with compatible databases.

Recommendations:

10. The Australian Government should use a consistent method to assess the risks and priorities across all invasive taxa – the Environmental Impact Classification of Alien Taxa (EICAT) method.

Information and transparency - implementation of recommendations from previous reports into biosecurity

Prior to the outbreak of FMD in Indonesia, the risk of its incursion into Australia was assessed as very low, about 7% over the next five years. Following the outbreak, the risk has risen to 11.6%[10]. While the implications of an outbreak of the disease to Australia's livestock industries and regional communities cannot be understated, the cost of an eradication and damage to the economy high, it must be called into question whether a suitable level of risk, ALOP, and investment in preparedness is being applied to the whole range of biosecurity threats to, and already here in Australia. Of particular concern is the lack of preparedness, investment, and national priority responses to environmental biosecurity issues. Based on the investment to address the risk of a possible FMD incursion, this would logically extend to risks that are far more likely to occur, and have the same scale of implications for the already under pressure environment and biodiversity values that support Australia's food and fibre production, communities and health, tourism and ecosystem services. This does not include the intrinsic value of biodiversity that continues to be neglected when calculations of economic value are performed, but is what will provide resilience in the face of climate change, established invasive species, and continued habitat loss.

It is recognised that Australia has developed one of the world's leading biosecurity systems. However, as trade volumes increase and new pathways such as online trade expand, the system is falling behind. A principle of 'shared responsibility' has been developed. It can be argued that this principle has led to a scenario where accountability has become diminished[11].

While Australia can be proud of its success in maintaining freedom from many damaging pests of agriculture, contributing to our ongoing profitability and competitiveness as a producer, the same cannot be said about environmental invasive species. The Australian environment has not fared well in contrast, with invasive weeds, forest diseases, insects and feral vertebrates contributing to extinctions and declines of precious biodiversity, and remaining extremely expensive in terms of damage and loss. The 2017 IGAB review criticised the relative lack of attention given to environmental biosecurity, including for preparedness. Governments have long viewed environmental outcomes as subordinate to the needs of agriculture, due in large part to the obvious economic benefits.[12]

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[10]Dodd, A. 2022. Centre for Excellence in Biosecurity Risk Analysis - University of Melbourne

[11] Delane, 2022. Towards a more accountable biosecurity system, presentation at Biosecurity Symposium 2022 4 March 2022

[12] Craik, Palmer & Sheldrake, 2017, Priorities for Australia's biosecurity system. An Independent review of the capacity of the National Biosecurity System and its underpinning intergovernmental agreement.

In line with the new Australian Biosecurity Strategy 2022-2032, the governance and decision making frameworks under the NEBRA require more transparency around how decisions are made. Environmental perspectives continue to be a gap in decision making under existing arrangements.

While progress has been made in some areas of the biosecurity system by implementing the recommendations of past reviews and inquiries, there remains significant work to be done to achieve the many of the improvements needed. Environmental biosecurity has improved since the 2017 IGAB review, with the establishment of the Chief Environmental Biosecurity Officer (CEBO) to perform a national policy leadership role similar to the Chief Veterinary Officer and Chief Plant Protection Officer.

While the development of the national priority list of Exotic Environmental Pests, weeds and diseases (EEPL) is a positive step, it is not yet comprehensive and will require further listing of harmful species. The implementation plan currently has insufficient resources to complete effectively.

Australia experiences an extremely high number of exotic ant incursions and eradication brings high costs. The National Invasive Ant plan is not yet fully implemented, and must be supported as a priority.

With the establishment of the CEBO, it is also timely to address the lack of progress on environmental biosecurity planning, particularly the disparity between this and progress made on agricultural biosecurity plans and their implementation. Often when environmental biosecurity plans are completed, they are not immediately implemented (including the National Environment and Community Biosecurity Research, Development and Extension Strategy, National Invasive Ant Biosecurity Plan and the National Action Plan for Myrtle Rust). In 2021, agricultural biosecurity had a suite of documents, plans and assessments completed or under development (e.g., 41 animal disease strategies, 5 completed pest risk analysis, 12 pest risk assessments and 113 contingency plans). Environmental biosecurity priorities do not have the same equivalent documentation or planning being done to prepare for and support responses if required. The rate of environmental biosecurity plan development must be increased to match the rest of the system, and plans that are developed need to be implemented when they are completed.

The IGAB review, completed in 2017, was embraced in principle, however it remains unclear as to what actions are being undertaken to make the structural and cultural changes required to achieve the recommendations of the review. Governments were tasked with reporting progress to the National Biosecurity Committee and making these progress reports public. .

One small but important change was the IGAB review recommendation for the formation of an industry and community advisory committee, intended to improve involvement of these two critical sectors with the biosecurity system and community, has not occurred. The formation of the Biosecurity Futures group in November 2019 provides an inadequate alternative and nonetheless has not met in recent years.

We recommend the committee consider if the progress to date on implementation of these recommendations has been adequate, and whether the parties are demonstrating commitment and transparent communication of progress.

In the formal Agriculture Minister's response to the IGAB review, all ministers agreed that environmental biosecurity has not received the attention or resourcing that it should have, in comparison to that of agriculture. Ministers all agreed that it requires better resourcing, and committed to better collaboration between environment and agriculture agencies, through a formal agreement. The committee should seek whether or not any progress has been made to address this commitment from AGMIN 2018.

Recommendations:

11. The Australian Government should publish a report on the implementation of recommendations from the 2017 review of the Intergovernmental Agreement on Biosecurity (IGAB review) and the reports of the Inspector-General of Biosecurity, and communicate progress.
12. There must be a robust, transparent, repeatable and inclusive process as the basis for determining priorities for Australian environmental biosecurity. Develop consolidated lists of invasive species available for consistent and rapid national decision making.
13. There needs to be more frequent engagement on environmental biosecurity matters, including the Environmental Biosecurity Advisory Group (EBAG) should meet more frequently and present views to Environment and Invasives Committee members.
14. Ministerial meetings relating to biosecurity should occur at least twice a year, and all papers made public, as they were up until 2013 under previous COAG arrangements.

Implementation of the National Biosecurity Strategy 2022-2032

The Australian Government recently released the first ever Australian National Biosecurity Strategy. It is an important step towards a stronger biosecurity system. It is excellent to see a sustainable investment plan as one of the priority areas. It is vital that the strategy is implemented effectively, properly and collaboratively, with the funding that is needed to achieve its objectives. Implementing the strategy will be a significant task, and a collaborative approach is critical to its success in preparing Australia for 2030. The strategy will guide the work of governments, industry and the community for the next decade and will be reviewed in five years.

It is important that governments now begin the process of implementing the National Biosecurity Strategy 2022-2032 in pursuit of its overarching objectives. Changes to the national system include structural, cultural, funding, and governance reforms. The strategy outlines a shared culture for biosecurity collaboration and communication, which will drive positive behavioural change and solidify decision making into business planning. The six priority areas are:

- shared biosecurity culture,
- stronger partnerships,
- highly skilled workforce,
- coordinated preparedness and response,
- sustainable investment, and
- integration supported by technology, research and data.[13]

These areas of development will be critical measures of success for the strategy and implementation should be happening now.

[13] DAFF 2022, National Biosecurity Strategy, Department of Agriculture, Fisheries and Forestry

We recommend the committee advocate the implementation of the National Biosecurity Strategy 2022-2032, and a demonstrated commitment by the biosecurity community to transparently communicate their achieved progress towards the six priority areas.

Recommendations:

15. Governments must prioritise the implementation of the Biosecurity Strategy 2022-2032.

Surveillance

It is clear that the future of Australia's biosecurity relies on shared responsibility, and greater collaboration between governments,communities and industry. Many of the most high priority pest incursions have been detected by members of the general public. There needs to be significantly more investment in establishing and promoting community supported (e.g. citizen science) surveillance programs for highest priority environmental biosecurity risks.

A shared responsibility model or a true partnership in managing biosecurity threats will enhance our ability to prepare and respond to future incursions[14]. While we acknowledge that some aspects of the work of governments in this area are sensitive (including data for trade and market access, commercial confidence) this should not preclude a more transparent and open approach to surveillance, data sharing and decision-making if Australia is to maintain a strong and responsive biosecurity system into the future.

Recommendations:

16. There needs to be significantly more investment in establishing and promoting community supported (e.g. citizen science) surveillance programs for highest priority environmental biosecurity risks.

Research

The National Environment and Community Biosecurity Research, Development and Extension (RD&E) Strategy 2021-2026 was developed to provide a framework and actions to develop a national coordinated and strategic approach to biosecurity research, development, and extension (RD&E) for Australia's environment and community. The strategy contains a strong focus on solving difficult high priority problems and applying emerging technologies. The environment and community biosecurity sector is at a major funding disadvantage compared to the industry biosecurity sectors and needs to prosecute a strong public interest case for much greater government funding. We recommend the implementation of this strategy be an extremely high priority for the biosecurity system.

Particular high priority actions to be taken to enhance Australia's research capability include:

- Greater investment in Australia's capacity for rapid identification of exotic species including the maintenance of validated reference collections for biosecurity risk groups in Australia's national biological collections (CSIRO, state and territory museums and herbaria).

[14] Craik, Palmer & Sheldrake, 2017, Priorities for Australia's biosecurity system. An Independent review of the capacity of the National Biosecurity System and its underpinning intergovernmental agreement.

- Immediate and long-term funding mechanisms to maintain research, development and innovation capacity of biosecurity technologies and deliver outcomes across primary industries and environmental biosecurity risks.

The Centre for Invasive Species Solutions (CISS) currently has projects covering weeds management capability, pest response coordination, development of novel surveillance technologies (eDNA), new biocontrols and citizen science engagement.

We recommend the committee consider the benefits of an immediate and long-term funding mechanism to maintain research, development and innovation capacity of biosecurity technologies within established organisations such as CISS.

Recommendations:

17. Improve transparency around decision making and include environmental perspectives under the NEBRA and in line with the new Australian Biosecurity Strategy 2022-2032.
18. Fully implementing the National Environment and Community Biosecurity Research, Development and Extension (RD&E) Strategy 2021-2026, with a strong focus on solving difficult high priority problems and applying emerging technologies.
19. Invest in Australia's capacity for rapid identification of exotic species including the maintenance of validated reference collections for biosecurity risk groups in Australia's national biological collections (CSIRO, state and territory museums and herbaria).
20. Ensure immediate and long-term funding mechanisms maintain research, development and innovation capacity of biosecurity technologies and deliver outcomes across primary industries and environmental biosecurity risks.
21. Specific consideration should be given to ensuring that the Centre for Invasive Species Solutions (CISS) has funding certainty and continuity.

Appropriate and targeted funding to strengthen preparedness and response capability

Long-term sustainable funding for biosecurity is widely agreed to be of vital importance if Australia is to protect its agriculture, environment, communities and economy from the increasing risk of damaging invasive pests and diseases.

Effective implementation of preparedness plans and programs, along with a strong and responsive system will require adequate funding. These costs provide an extremely high return on investment. Funding for prevention and early response measures has been demonstrated to be more cost-effective (and often the only feasible approach) when compared to the costs and losses incurred from outbreak eradication and management programs, and resulting damage to environmental values and biodiversity.

While increased funding has been announced for biosecurity through the federal government Biosecurity 2030 budget measure, sustainable, long-term funding will be required for systemic improvement to address all the challenges we will be facing this decade – not just to address individual threat risks (such as emergency measures to address the risk of FMD in Indonesia).

In considering the terms of reference for this inquiry, we recommend the committee look at what sustainable funding is needed to properly prepare and reform Australia's biosecurity. A doubling of funding in real terms by 2030 will likely be required, sourced from a variety of government and non-government sources, at the federal and state/territory levels.

Investment in environmental biosecurity risks continues to lag behind agricultural risks. We recommend that the committee also look at the disparity between ongoing funding for the interlinked components of the national system, beyond the attention given to agricultural productivity and market access.

We recommend the committee also consider more collaborative and transparent approaches to long term funding, incorporating governments, industry and the community to assess and reset funding arrangements to be fit for purpose and prepared for a future that benefits participants equally. We recommend the identification of potential funding sources through a review of existing mechanisms, biosecurity beneficiaries and risk creators and other sources.

While environmental biosecurity has generally been funded a great deal less than that for agricultural risks, there have been some positive funding and program initiatives such as:

- establishment of the Chief Environment Biosecurity Officer (CEBO) within DAFF and operation of Environmental Biosecurity Project Fund at $825,000 a year[15]
- development of the National Priority List for Exotic Environmental Pests
- $9 million for the yellow crazy ant program with the Wet Tropics Management Authority

Current federal funding initiatives recently announced for the biosecurity system include:

- Biosecurity 2030 initiative providing $500 million additional funding for 2021-22 to 2024-25. This is split into:
    - $84.1 million to front line resources (border and airport staff and systems, faster clearance processes, primarily benefiting horticulture industries
    - $80.9 million to modernise Government ICT systems for biosecurity, focused on import clearance processes and screening of passengers and mail
    - $235.1 million to offshore threat detection and management, strengthening partnerships with industries such as importers, primary producers, protecting regional jobs and economies.[16]
- $10m for cooperative activities with Indonesia to reduce the risk of FMD and Lumpy skin disease.

In order for a response to be rapid and efficient, adequate and pre-arranged mechanisms for funding biosecurity responses must be established. The current system has in principle a mechanism to achieve this, however it is often thwarted by disagreement between jurisdictions and the Australian Government on whether a particular response should go ahead. A model based on levies or risk creator/beneficiary pays may be appropriate to gain the required amount of funding to support adequate and effective responses. A model based on the 'polluter pays' principle would be applicable – for example an entity that, by its actions, creates a biosecurity risk (such as importing or moving

[15] DAFF 2022, The Environmental Biosecurity Project Fund
https://www.agriculture.gov.au/biosecurity-trade/policy/environmental/projects
[16] DAFF 2021, Budget 2021-22
https://www.agriculture.gov.au/sites/default/files/documents/budget-2021-22-biosecurity-summary_0.pdf)

high risk goods) should be required to make contributions to offset this risk. Increasing the passenger movement charge, or applying a levy similar to that of the Biosecurity Imports Levy for shipping to air travel, are options that should be considered[17].

In considering the terms of reference for this inquiry, we recommend the committee look at what sustainable funding is needed to properly prepare and reform Australia's biosecurity system as a whole. A doubling of funding in real terms by 2030 will likely be required, sourced from a variety of government and non-government sources, at the federal and state/territory levels. We recommend that the committee also look at the disparity between ongoing funding for the interlinked components of the national system, beyond the attention given to agricultural productivity and market access.

We recommend the committee also consider more collaborative and transparent approaches to long term funding, incorporating governments, industry and the community to assess and reset funding arrangements to be fit for purpose and prepared for a future that benefits participants equally.

Funding from the Australian Government is provided to bodies to coordinate and manage biosecurity frameworks and activities, and link with relevant industries. These bodies, Animal Health Australia and Plant Health Australia, successfully use matched government funding along with industry contributions to perform these vital functions. There is a clear need for a similar body, an Environment Health Australia, to provide the same vital function focused on environmental biosecurity strategy, management and communication with the relevant sectors of the community. While the Australian Government did not support the recommendation from the 2015 senate committee inquiry into environmental biosecurity for the formation of an Environment Heath Australia, we see this as a logical means to address an ongoing gap that is damaging Australia's ability to protect its environment from invasive species.

To better understand the economics of management and control of feral animal populations, we recommend a productivity commission inquiry to assess the long-term funding needed to effectively abate major invasive animal threats to the environment. Such an inquiry should include established, emerging and potential invasive pests and disease, and assess the economic benefits of prevention and early action over later management. An inquiry by the productivity commission would provide an understanding of what level of future funding will be appropriate, and quantify the increase over current investment that should be sought to effectively mitigate impacts. It would also provide a means to explore appropriate avenues for delivering long-term sustainable funding for Australia's biosecurity system. The Senate Standing Committee on Environment and Communications inquiry of May 2021 included this recommendation in the final report[18].

Recommendations:

22. Double funding to Australia's biosecurity preparedness and response capacity in real terms, and ensure that it is sustainable, and continues to grow as risks grow.
23. Australia's biosecurity system requires sustainable, ongoing funding that should be collaborative and transparent.

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[17] Craik, Palmer & Sheldrake, 2017, Priorities for Australia's biosecurity system. An Independent review of the capacity of the National Biosecurity System and its underpinning intergovernmental agreement.
[18] The Senate - Environment and Communications Committee - https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/FeralDeerPigGoat2019

24. The Australian Government should establish a Productivity Commission inquiry into the economic and environmental benefits of long-term control of feral animals.

Building a decade of biosecurity

Biosecurity has traditionally been a domain of government, with the Australian Government taking responsibility for people and goods entering the country, and states and territories managing pest animals, weeds and pathogens within their borders.

Increasingly, it is recognised that effective biosecurity requires all Australians to take responsibility. Whether managing a property, moving goods or travelling around the country and beyond, everybody should play a part. Industries, businesses and the community can work to support government efforts. Each and every Australian should be regarded as a partner in our biosecurity system and encouraged to assist.

This was a strong theme in the Beale 2008 Biosecurity review and also emphasised in the 2017 IGAB review. This approach has been formally adopted through the updated 2019 Intergovernmental Agreement on Biosecurity and the National Biosecurity Strategy 2022-2032. Industry, businesses, Aboriginal and Torres Strait Islander peoples and community partners have immeasurable skills and resources, albeit some with limited capacity, and are willing and eager to be more involved.

To prevent further loss and harm, and ever-increasing costs, it is clear we need a sustained focus on biosecurity over the next 10 years to strengthen defences at all levels – from our national borders to every individual property.

The Decade of Biosecurity initiative seeks to ensure that by 2030 there is a strong understanding of biosecurity by all Australians and greater involvement in biosecurity surveillance across the country. There is a strong movement of sustainable investment mechanisms for essential biosecurity. It is modelled on the successful Decade of Landcare that inspired the growth of the Landcare movement and everyday Australians looking after the environment.

The goal of the initiative is to actively engage all Australians in building a stronger national biosecurity system. The objectives are:

1. Biosecurity is well understood by the entire Australian community.
2. Broad involvement in general biosecurity surveillance: all communities, sectors and regions.
3. A strong, connected biosecurity collective fosters a mission of shared biosecurity responsibility.
4. Major biosecurity participants agree to a set of priorities for sustaining biosecurity investments.
5. Establishment of sustainable investment mechanisms for essential biosecurity with funding contributions from government and non-government sources.

The focus for 2022-23 is communications and engagement, collaborations and partnerships and sustainable investment. A 3-year Decade of Biosecurity implementation plan is currently being developed, including consultation to seek the views of interested parties, and will be finalised by the end of 2022.

The Decade of Biosecurity 2021-2030 initiative is currently supported by all state and territory ministers, federal, state and territory biosecurity agencies and founding partners: the Invasive Species Council, Animal Health Australia, Centre for Invasives Species Solutions, Plant Health Australia, National Farmers' Federation, National Landcare Network, Landcare Australia and NRM Regions Australia.

We recommend the committee endorse the Decade of Biosecurity initiative as a way to strengthen partnerships and build broader community engagement and participation.

Recommendations:

25. The Australian Government must endorse the Decade of Biosecurity initiative as a way to strengthen partnerships and build broader community engagement and participation.

Conclusion

The threat from foot-and-mouth disease and varroa mite are just two serious biosecurity threats that Australia is facing. As our submission has demonstrated, there is an urgent need for systemic improvements to the national system to prepare for all potential risks that could impact our economy, environment and way of life. Many of the needed changes have been articulated in the new National Biosecurity Strategy 2022-2032, and past biosecurity system reviews.

Priority pests that may be next include *Pseudogymnoascus destructans* (white-nose syndrome), crayfish plague, eucalyptus canker, rosy predator snails, and snakehead fish, among many others. The costs of eradication, control, or eventual management and losses caused by these future pests and diseases will be in the tens if not hundreds of billions of dollars, along with the damage and loss to the environment and biodiversity. The threat of FMD and varroa mite are singular emergency issues that reflect the needs and gaps of Australia's biosecurity system as a whole, and require commitment and collaboration by all members of the biosecurity community to achieve.

The value of biosecurity for environmental outcomes can be seen in biodiversity, ecosystem services, intrinsic and economic value and supports the Australian public, food, fibre and tourism industries. It also plays a critical role in sustaining resilience against climate change. Both biodiversity and agriculture are important and the same risk-based prioritisation as applied for agricultural pests like FMD and varroa mite should be applied to equally severe environmental threats.

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Attachment 1. Comparison of biosecurity sector preparedness

Only very recently has environmental biosecurity been recognised as a distinctive sector within the federal biosecurity system. Prior to that, the biosecurity agency contended that environmental issues were adequately covered under existing arrangements, dispersed among industry priorities.

However, several reviews – the 2008 Beale review, the 2009 Hawke review of the EPBC Act, the 2015 senate report on environmental biosecurity, the 2017 Craik review of the Intergovernmental Agreement on Biosecurity (IGAB) – found that environmental preparedness lagged behind that for industry, and recommended a much stronger and more cohesive environmental focus.

In particular, the IGAB review found that environmental biosecurity had 'long been viewed as subordinate, including in funding terms, to agricultural biosecurity' and that environmental risks were 'yet to be fully defined and prioritised, and preparedness, surveillance and response arrangements are not yet mature'. It concluded that:

> *Environmental considerations should be comparable to human health and primary production with respect to biosecurity, and comprehensive national arrangements need to be explicitly developed (pre-border, at the border and post-border) to address environmental biosecurity risks.*

The increasing recognition of environmental biosecurity is evident in the following important advances:

- 2012: Signing of the National Environmental Biosecurity Response Agreement
- 2018: Appointment of the Chief Environmental Biosecurity Officer
- 2018: Establishment of the Environment and Invasives Committee
- 2018: Establishment of the Environmental Biosecurity Advisory Group
- 2020: Development of the National Priority List of Exotic Environmental Pests, Weeds and Diseases (EEPL)

Because these new arrangements and foci are recent, there is still much work to be done to strengthen the preparedness of the environmental sector.

The table below compares the preparedness of 4 sectors – plant health, animal health, environmental and marine (both industry and environmental) – in terms of leadership, coordination, partnerships, strategies, plans and capacity.

It shows that the environment sector has made great strides in recent times and also that there is considerable overlap and shared focus between the sectors. However, it is also clear that the environment sector still has much work to do to be 'comparable' with the industry sectors. This is understandable given:

(a) the many decades over which the industry sectors have developed and honed biosecurity preparedness
(b) the institutional arrangements that foster strong partnerships between governments and industry stakeholders (particularly Plant Health Australia and Animal Health Australia)

(c) the much greater capacity (staff and funding) of the industry sectors.

Priority species have been identified (the EEPL), but the work of developing and implementing strategies to prevent and respond to incursions has only just begun. Resources are needed to fully implement the EEPL implementation plan, and prepare contingency and response plans. The plant industry sector has developed more than 100 species-specific contingency plans. This degree of specificity isn't feasible for the environment, because too little is known about the species likely to invade, but broad response plans are needed.

Surveillance is a major weakness in environmental biosecurity. The sector as yet lacks a surveillance strategy and there is little active surveillance conducted. There is also a lack of centralised data compilation and reporting for the environment sector.

While there has been considerable progress in developing the plans and strategies that are essential elements of biosecurity preparedness, thanks to the establishment of the Office of Environmental Biosecurity, the critical factor will be the extent to which they can be implemented with the current level of resourcing. Progress can be made by ensuring that industry-led planning and programs fully include environmental priorities – such as has occurred with the recent development of the National Hitchhiker Action Plan. But for environment-specific work, more resources are needed. We have recommended an immediate tripling of investment in the Office of Environmental Biosecurity. This will go only part of the way to matching the resources dedicated to industry biosecurity (even if only federal funding is taken into account). Much more funding is needed if the environmental sector is to catch up with industry sectors and, more importantly, strengthen the systems needed to prevent the level of environmental incursions experienced in recent years (see Attachment 2).

Mechanism	Plant industry	Animal industry (terrestrial)	Environment (excluding marine)	Marine (industry/environment)	Aquatic animal health (industry/environment)
Institutional arrangements					
National leadership	Chief Plant Protection Officer	Chief Veterinary Officer	Chief Environmental Biosecurity Officer	No equivalent	Australian Chief Veterinary Officer
National coordination	Plant Health Committee	Animal Health Committee	Environment and Invasives Committee	Marine Pest Sectoral Committee (previously National Introduced Marine Pests Coordination Group)	Animal Health Committee
Formal cross-sectoral partnerships	Plant Health Australia	Animal Health Australia Wildlife Health Australia	No equivalent Wildlife Health Australia	No equivalent	No equivalent
Overarching biosecurity strategies					
Cross-sectoral biosecurity strategy	National Biosecurity Strategy 2022–2032	National Biosecurity Strategy 2022–2032	National Biosecurity Strategy 2022–2032	National Biosecurity Strategy 2022–2032	National Biosecurity Strategy 2022–2032
Sector-specific biosecurity strategies (with some cross-sectoral overlaps not indicated)	National Plant Biosecurity Strategy 2021–2031 National Plant Biosecurity Preparedness Strategy 2021–2031	Animalplan 2022 to 2027: Australia's National Action Plan for Terrestrial Agricultural Animal Health	No equivalent (but an intention)	National Strategic Plan for Marine Pest Biosecurity 2018–2023	Aquaplan 2014–2019: Australia's National Strategic Plan for Aquatic Animal Health (AQUAPLAN 2022-2027 in preparation).
Priority species and pathways					
Priority species lists / reportable diseases	National priority plant pests (42 species/species groups)	National List of Notifiable Animal Diseases of Terrestrial Animals (104 diseases)	National priority list of exotic environmental pests and diseases (117 species assessed as moderate to massive environmental impact)	Australian priority marine pest list (10 species) National priority list of exotic environmental pests and diseases (20 species)	National List of Reportable Diseases of Aquatic Animals 2021 (51 diseases)
Risk analyses / risk assessments (priority species)	Pest risk analyses: 5 complete, 2 in development Pest risk assessments: 12 complete or underway	?	?	?	?
Contingency plans / incursion response plans	Industry-specific contingency plans: 113	AUSVETPLAN plans: 30	Plant health contingency plans (prepared by PHA): 6 relevant to priority species Incursions response plans: 3 (snakes, didymo draft, Asian black-spined toad draft)	National control plans: 6	AQUAVETPLAN plans: 11

Other risk mitigation plans	National Hitchhiker (Contaminating) Plant Pest Action Plan 2022–2032 National Invasive Ant Biosecurity Plan 2018-2028 National Khapra Beetle Action Plan 2021-2031 National Xylella Action Plan 2019-2029 Environmental Risk Mitigation Plan for Acacia 2021 National Action Plan for Pests of Trees and Timber (in progress) National Action Plan for Fruit Flies (in progress) National Action Plan for Pests of Broadacre Crops (underway) National Action Plan for Pests of Horticultural Crops (underway)		National Hitchhiker (Contaminating) Plant Pest Action Plan 2022–2032 National Invasive Ant Biosecurity Plan 2018-2028 National Xylella Action Plan 2019-2029 Environmental Risk Mitigation Plan for Acacia 2021 National Action Plan for Pests of Trees and Timber (in progress)		
Surveillance and diagnostics					
Cross-sectoral strategy	The National Surveillance and Diagnostics Framework 2014	The National Surveillance and Diagnostics Framework 2014	The National Surveillance and Diagnostics Framework 2014	The National Surveillance and Diagnostics Framework 2014	The National Surveillance and Diagnostics Framework 2014
Sector-specific surveillance strategies	National Plant Biosecurity Surveillance Strategy 2021–2031	National Animal Health Surveillance Business Plan 2016–2020	No equivalent	National Marine Pest Surveillance Strategy 2019	No equivalent
Specific surveillance strategies and programs (some overlap between sectors)	117 programs (54% broadacre/horiticulture/nursery, 5% forestry, 9% honey bees, 3% urban/ natural environment, 28% multiple) National Forest Biosecurity Surveillance Strategy 2018–23 National Grain Biosecurity Surveillance Strategy 2019–29 National Tropical Plant Industries Biosecurity Surveillance Strategy 2020–25 National Potato Industry Biosecurity Surveillance Strategy 2020–25	National Arbovirus Monitoring Program National Significant Disease Investigation Program National Sheep Health Monitoring Project Transmissible Spongiform Encephalopathy Freedom Assurance Project Screw-Worm Fly Surveillance and Preparedness Program Australian Pork Limited Evidence of Absence Surveillance Project National Bee Pest Surveillance Program Cattle tick and tick fever	Northern Australia Quarantine Strategy National Forest Biosecurity Surveillance Strategy Wildlife health surveillance	Abalone Health Accreditation Program Primarily passive surveillance Aquatic Animal Diseases Significant to Australia: Identification Field Guide	

		Northern Australia Quarantine Strategy Wildlife health surveillance National Avian Influenza Wild Bird Surveillance Program Japanese encephalitis surveillance			
Diagnostics strategies	National Plant Biosecurity Diagnostic Strategy 2021-2031	National Animal Health Diagnostics Business Plan 2021 to 2026	No equivalent	No equivalent	No equivalent
Emergency responses					
Emergency response deeds	Emergency Plant Pest Response Deed	Emergency Animal Disease Response Agreement	National Environmental Biosecurity Response Agreement	National Environmental Biosecurity Response Agreement Marine-specific response deed under preparation	Under consideration
Emergency response technical plans	PLANTPLAN: Australian Emergency Plant Pest Response Plan 2021	AUSVETPLAN: Australian Veterinary Emergency Plan 2021	No equivalent: INVASIPLAN in preparation (2019)	EMPPlan: Emergency Marine Pest Plan	AQUAVETPLAN: Australian Aquatic Veterinary Emergency Plan (a series of manuals)
Consultative committees	Consultative Committee on Emergency Plant Pests	Consultative Committee on Emergency Animal Disease	Consultative Committee on Environmental Biosecurity Incidents	Consultative Committee on Introduced Marine Pest Emergencies	Aquatic Consultative Committee on Emergency Animal Diseases
Scientific advisory panels	Scientific Advisory Panel				
Data management and reporting					
Data compilation and management	Austpestcheck (Plant Health Australia)	National Animal Health Information System Wildlife Health Information System	No centralised information system	National Introduced Marine Pest Information System	
Reporting on sectoral status (including incursions)	Annual national plant biosecurity status reports	Annual animal health status reports	No equivalent	No equivalent	Quarterly Aquatic Animal Disease reports
Research and development					
Sectoral research strategies	National Plant Biosecurity RD&E Strategy 2013--2016	National Animal Biosecurity Research, Development and Extension Strategy 2017--2022	The National Environment and Community Biosecurity Research, Development and Extension Strategy 2021-26		

Sectoral capacity					
Sector-specific staff (including due to industry and state/territory government funding)	Plant Health Australia: 32 staff (2022) Office of Chief Plant Protection Officer: ?	Animal Health Australia: 28 staff (2022) Office of Chief Veterinary Officer: ?	Office of Chief Environmental Biosecurity Officer: 10 FTE	?	?

Attachment 2. Incursions of environmental concern detected since 2000

The following table lists 132 incursions of 106 species recorded since the year 2000. They are mostly species that have established in the wild and been assessed as environmental invaders or noted as potentially having an environmental impact. They include a few new island incursions. Compiled from a wide range of disparate sources, the list is far from comprehensive, particularly for plants, insects and pathogens. One reason is that there is no systematic public reporting in Australia of incursions of potential environmental significance.

Many or most species on the list are likely to have established years prior to being detected. And there are undoubtedly many more naturalised species not yet recorded. The often-long lag times between establishment and detection highlights one of the weakest links of Australian biosecurity – the difficulties of detecting new species in the environment and the limited surveillance effort in the environment. In contrast, farmers are able to often quickly detect a new disease or pest.

The list of incursions is dominated by plants (33 incursions, but many more are not included here), hymenopterans (19 ant incursions, 3 bees, 2 wasps) and fishes (12). Most of the insects, pathogens and marine species have been introduced accidentally or illegally from overseas. But most of the plants and aquarium fish have long been in Australia (in gardens and aquariums) and have only recently escaped into the wild. The list also includes a few species native to Australia shifted outside their native range.

More than 30 species, some with multiple incursions, are regarded as serious or potentially serious environmental invaders, including:

- myrtle rust (failed eradication)
- red imported fire ant (under eradication)
- yellow crazy ant (under eradication in the Wet Tropics)
- electric ant (under eradication)
- polyphagous shot-hole borer (under eradication)
- Miconia nervosa (under eradication)
- Miconia racemosa (under eradication)
- Limnocharis (under eradication)
- Koster's curse (failed eradication)
- peacock bass (maybe eradicated)
- jaguar cichlid
- climbing perch
- several cactus species listed as weeds of national significance
- Mexican feather grass
- mouse-ear hawkweed (under eradication)

But the likely impacts of many species are unknown, and for most there is no research effort. This is another major gap in environmental biosecurity – a lack of investment in research to investigate and monitor the impacts of recently established species.

Forty-two incursions (of 26 species) have been or are subject to eradication. This partly reflects the application of the National Environmental Biosecurity Response Agreement since 2012, a major advance in environmental biosecurity.

Currently, 18 incursions (of 14 species) are under eradication (at a national, state or island level). Of the 14 eradication programs under national cost-sharing arrangements, 8 are for ants.

There have been 15 eradication successes (of 7 species), 9 under national cost-sharing arrangements, of which 6 have been red imported fire ant incursions. There have been 9 failed eradication attempts of 9 species (5 under national cost-sharing arrangements), including significant species such as myrtle rust, jaguar cichlid, Koster's curse and Asian honey bees.

The effectiveness of Australia's environmental biosecurity system can best be judged by the number of new significant invaders and their potential degree of impact on the environment. Despite Australia's much improved approach to environmental incursions, the large number of significant new invaders attests to biosecurity gaps. As a high priority, we need to strengthen our national capacity to prevent, detect and eradicate new invaders.

The most concerning failed eradication attempt was myrtle rust, now a serious threat to native plants, including 16 species likely to be extinct within a generation. It is also concerning that there was no attempt to eradicate the smooth newt. There is also a limited focus on several other established species of potentially high environmental significance.

Year detected	LIfe form	Ecosystem type	Scientific name	Common name	Location detected	Biosecurity response	Potential environmental harm	Conservation significance	References
2000	Alga	Marine	Caulerpa taxifolia	Caulerpa	NSW (Port Hacking)	Impact monitoring	Native to northern Australia. Highly invasive elsewhere. Outcompetes native seaweeds and seagrasses.	Unknown	NSW Government 2020
2000	Bee	Terrestrial	Pseudoanthidium repetitum	African carder bee	Qld, NSW	No response	Unknown. Has rapidly expanded its range. Common in Sydney. May result in the proliferation and spread of environmental weeds.	Unknown	Baumann et al. 2016, Makinson et al. 2017,
2000	Rickettsia	Terrestrial	Ehrlichia platys	Canine ehrlichiosis	NT (Tanami Desert)	No response	Potential for infecting dingoes.	Unknown	Brown et al. 2001
2000	Plant	Terrestrial	Cleome rutidosperma	Fringed spider flower	NT (Darwin)	Unknown	Has had 'considerable environmental impacts'.	Potentially significant	Waterhouse 2003, CABI
2000	Plant	Terrestrial	Cylindropuntia kleiniae	Klein's cholla	NSW (Grawin)	Unknown	Listed as a weed of national significance, assessed as high risk in Victoria and a priority weed in Qld.	High	White et al. 2022, Osunkoya et al. 2019
2000	Plant	Terrestrial	Neurada procumbens	Neurada	NT	Unknown	Potential to become a weed of concern across the arid bioregion.	Potentially significant	NT Department of Environment and Natural Resources 2017, Friedel 2020
2000	Plant	Terrestrial	Hoheria populnea	New Zealand mallow	Vic	Unknown	Assessed as very high risk in Vic.	Potentially significant	White et al. 2022
2000	Plant	Terrestrial	Cylindropuntia leptocaulis	Pencil cactus	NSW	Unknown	Listed as a weed of national significance, assessed as a priority weed in Qld.	High	Osunkoya et al. 2019
2000	Tubeworm	Marine	Hydroides diramphus	Serpulid tubeworm	Qld	Unknown	Biofouling potential	Unknown	Hayes 2005
2000	Plant	Terrestrial	Cylindropuntia pallida	White-spined hudson pear	NSW	Unknown	Listed as a weed of national significance, assessed as a priority weed in Qld, high risk in Victoria and major impact in ACT.	High	White et al. 2022, Osunkoya et al. 2019
2000	Scallop	Marine	Scaeochlamys livida		WA (Cockburn Sound)	Unknown	Introduced from eastern Australia. May have displaced the .native scallop in the Swan River.	Unknown	Morrison and Wells 2008, McDonald and Wells 2009
2001	Bug	Terrestrial	Cardiaspina fiscella	Brown lace lerp	WA (Albany)	Assessed as not feasible to eradicate.	Introduced from eastern Australia. Known to outbreak on all its eucalypt hosts in NSW and Victoria. Can cause severe defoliation. Karri is a potential host.	Unknown	Farr 2017
2001	Plant	Terrestrial	Pilosella officinarum	Mouse-ear hawkweed	Tas	Eradicated	Heavy infestations form large swards which prevent regeneration and survival of native species and reduce productivity in grazing areas. In NZ, hawkweeds dominate >500,000 hectares of vegetation	High	Groves and Panetta 2002, Department of Natural Resources and Environment Tasmania nd, French 2021
2001	Ant	Terrestrial	Solenopsis invicta	Red imported fire ant	Qld (Port of Brisbane)	Eradicated (national cost-shared)	Forms super-colonies. Can reach extremely high densities of up to 2600 mounds a hectare. Highly aggressive, dominates areas, displaces native ants & other invertebrates, kills small vertebrates. Could threaten ground-dwelling animals.	High	Australian Government 2022
2001	Mollusc	Terrestrial	Arion ater	Black slug	Vic	No response	Omnivorous & large, could threaten native snails. One resident reported having collected >20,000 specimens.	Unknown	Zemanova et al. 2018
2001	Bug	Terrestrial	Thaumastocoris peregrinus	Bronze bug	NSW (Sydney)	No response	A sap-sucking bug that attacks at least 30 eucalypt species. Native to parts of Australia. Thought to have invaded Sydney. Has spread rapidly around the world and is an emerging pest of plantations. Can result in large-scale loss of leaves and canopy thinning, sometimes tree death.	Potentially significant	Lo et al. 2019, Machado et al. 2020

2001	Ant	Terrestrial	Solenopsis invicta	Red imported fire ant	Qld (Brisbane)	Under eradication (national cost-shared)	Forms super-colonies. Can reach extremely high densities of up to 2600 mounds a hectare. Highly aggressive, dominates areas, displaces native ants & other invertebrates, kills small vertebrates. Could threaten ground-dwelling animals.	High	Australian Government 2022
2001	Plant	Terrestrial	Limnocharis flava	Limnocharis	Qld	Under eradication (national cost-sharing)	An aquatic plant that could become a major weed of wetlands, slow-moving streams and dams in tropical and semi-tropical areas. Competes with native plants for space, light and nutrients, a threat to the environmental integrity of wetlands.	High	Australian Government 2022, Weeds Australia 2021
2001	Ant	Terrestrial	Anoplolepis gracilipes	Yellow crazy ant	Qld (Cairns)	Under eradication in north Qld	Forms super-colonies and can dominate large areas. Displaces native ants & other invertebrates, kills small vertebrate animals.	High	Cshures and Hankemer 2012, Wet Tropics Management Authority
2001	Plant	Terrestrial	Pinus muricata	Bishop pine	Vic	Unknown	Assessed as high risk in Vic.	Potentially significant	White et al. 2022
2001	Plant	Terrestrial	Carex pendula	Giant sedge	Vic	Unknown	Assessed as very high risk in Vic.	Potentially significant	White et al. 2022
2001	Fish	Freshwater	Labeotropheus/Pseudotropheus	Hybrid cichlid	Vic	Unknown	Unknown	Unknown	Corfiled et al. 2008
2001	Fish	Freshwater	Amphilophus labiatum	Red devil cichlid	Qld (Port Douglas)	Unknown	Unknown. They have become invasive and dominant in a lake in Papua, Indonesia.	Unknown	Ebner et al. 2020, Ohee et al. 2018
2001	Plant	Terrestrial	Pinus contorta	Twisted pine	Vic	Unknown	Assessed as major impact in the ACT and very high risk in Vic.	Potentially highly significant	White et al. 2022
2001	Plant	Terrestrial	Clidemia hirta	Koster's curse	Qld	Unsuccessful eradication (national cost-shared).	A serious environmental weed in humid tropical regions. Forms dense thickets that smother native vegetation.	High	Waterhouse 2003, Breadan et al. 2012, Comben et al. 2020
2002	Alga	Marine	Caulerpa taxifolia	Caulerpa	SA (Port River-Barker Inlet system)	Eradication attempts (1 successful, 1 unsuccessful), containment	Native to northern Australia. Highly invasive elsewhere. Outcompetes native seaweeds and seagrasses.	Potentially significant	Wiltshire and Deveney 2017
2002	Fish	Freshwater	Tanichthys albonubes	Mountain minnow	NSW (Green Point Creek)	Biological control unsuccessful.	Unknown	Unknown	Department of Primary Industries 2020
2002	Plant	Terrestrial	Miconia racemosa	Miconia	Qld	Under eradication (national cost-sharing)	Aggressive invader of rainforests. Displaces native plants and affect the habitat of native fauna. The tropical and sub-tropical rainforests of eastern Australia are at particular risk.	High	Australian Government 2022, Weeds of Australia 2016
2002	Plant	Terrestrial	Opuntia linguiformis	Cow's tongue prickly pear	SA	Unknown	Listed as a weed of national significance, assessed as a priority weed in Qld.	High	Osunkoya et al. 2019
2002	Plant	Terrestrial	Prunus yedoensis	Yoshino cherry	Vic	Unknown	Assessed as very high risk in Vic.	Potentially significant	White et al. 2022
2002	Plant	Terrestrial	Cotoneaster watereri		Unknown	Unknown	Assessed as very high risk in Vic.	Potentially significant	White et al. 2022
2002	Oomyctes	Terrestrial	Phytophthora niederhauseri i	WA/NT	Unknown	Unknown	Broad host range. Similar to *P. cinnamomi* in pathogenicity. Of 'major concern' for species in natural ecosystems. But assessed by Carnegie and Nahrung as medium impact.	Potentially highly significant	Belhaj et al. 2018, Carnegi and Nahrung 2019
2003	Ant	Terrestrial	Pheidole megacephala	African big-headed ant	Lord Howe Island	Eradicated (2018, NSW Government)	Forms supercolonies. Usually kills most other ants and other invertebrates where it is present.	High	Hoffman 2018

2003	Plant	Terrestrial	Nassella tenuissima	Mexican feather grass (Nassella tenuissima)	NSW, ACT	Removal from sale, some populations eradicated.	Potential to dominate woodlands and grasslands. Vic (very high risk), QLD (priority)	Potentially highly significant	McLaren et al. 1999
2003	Plant	Terrestrial	Cecropia petalta	Mexican bean tree	Qld (Mission Beach)	Unsuccessful eradication in Qld	Potential to invade and dominate moderately moist forest ecosystems in north Queensland, possibly causing serious and irreversible damage.	Potentially significant	Cshures 2018, Business Queensland 2022
2004	Bacterium	Terrestrial	Xanthomonas citri	Citrus canker	Qld (Emerald)	Eradicated (national cost-shared)	Causes a highly contagious disease that can affect all above-ground parts of citrus trees. Can lead to defoliation, dieback, premature fruit drop. Native Australian Rutaceae species are potential hosts.	Unknown	Department of Primary Industries 2017, IPPC 2009
2004	Ant	Terrestrial	Anoplolepis gracilipes	Yellow crazy ant	NSW (Goodwood Island)	Eradicated (NSW Government)	Forms super-colonies and can dominate large areas. Displaces native ants & other invertebrates, kills small vertebrate animals.	High	Dominiak et al. 2011, Cshures and Hankemer 2012
2004	Bee	Terrestrial	Seladonia hotoni	Emerald furrow bee	NSW	No response	Could have serious impacts due to its high relative abundance, long seasonal activity, and an apparent preference for weeds.	Unknown	Ashcroft et al. 2012, Invasive Species Council 2018
2004	Turtle	Freshwater	Trachemys scripta	Red-eared slider turtle	Qld	Probaby eradicated in Qld (Qld Government)	Can negatively impact native turtles and frogs – they mature quickly, are aggressive, have high fecundity. .	Potentially highly significant	Business Queensland 2016, Invasive Species Council 2017
2004	Plant	Terrestrial	Miconia nervosa	Miconia	Qld	Under eradication (national cost-sharing)	Aggressive invader of rainforests. Displaces native plants and affect the habitat of native fauna. The tropical and sub-tropical rainforests of eastern Australia are at particular risk.	High	Australian Government 2022, Weeds of Australia 2016
2004	Fish	Freshwater	Cryptoheros spilurus	Blue-eyed cichlid	Qld (Ayr)	Unknown	Unknown	Unknown	Ebner et al. 2020
2004	Plant	Terrestrial	Colophospermum mopane	Mopane	WA (Kimberley)	Unknown	Fast growing, can survive fires, forms dense monospecific stands. No native herbivores that would keep it in check.	Potentially significant	Keighery and Mitchell 2021
2004	Nudibranch	Marine	Godiva quadricolor	Sea slug	Qld (Pumicestone Passage)	Unknown	A voracious predator that feeds on native nudibranchs	Unknown	National Introduced Marine Pest Information System, Willan 2004
2004	Fish	Marine	Acentrogobius pflaumii	Streaked goby	WA (Cockburn Sound)	Unknown	Potential for competition for habitat with native gobids.	Unknown	Maddern and Morrison 2009
2004	Plant	Terrestrial	Piptochaetium uruguense	Uraguayan bunch-grass	Vic	Unknown	Assessed as very high risk in Vic.	Potentially significant	White et al. 2022
2004	Fish	Freshwater	Cichlasoma octofasciatum	Jack Dempsey cichlid	NSW	Unsuccessful eradication (3 attempts)	Highly aggressive. Potential for displacement of other fish and competition for food and space	Potentially significant	NSW Government 2020
2005	Fish	Freshwater	Anabas testudineus	Climbing perch	Torres Strait islands	Assessed as not feasible to eradicate.	A high risk for adverse environmental impacts. A predator with potential to rapidly outnumber native fish and dominate aquatic communities. Can survive out of water in moist conditions for several days or weeks and travel across land.	Potentially highly significant	Business Queensland 2018, East and Micke 2008, Roe 2015
2005	Fungus	Terrestrial	Mycosphaerella heimii		Qld	No response	Potentially an important pathogen of *Eucalyptus dunni* and other plantation eucalypts.	Unknown	Whyte et al. 2005
2005	Ant	Terrestrial	Linepithema humile	Argentine ant	Norfolk Island	Under eradication	Could threaten several rare birds.	High	CSIRO 2021, Invasive Species Council 2017
2005	Plant	Terrestrial	Austrocylindropuntia subulata	Eve's needle cactus	SA (Crystal Brook)	Unknown	Listed as a weed of national significance, assessed as high risk in Victoria	High	White et al. 2022

2005	Plant	Terrestrial	Opuntia phaeacantha	Rabbit-ears	SA	Unknown	Listed as a weed of national significance, assessed as a priority weed in Qld.	High	Osunkoya et al. 2019
2005 (approx.)	Beetle	Terrestrial	Paropsistern a m-fuscum	Leaf beetle	WA (south-west)	Unknown	Native to eastern Australia, introduced to south-western Australia. Initially caused significant damage to introduced eucalypts in plantations. Reduced severity now may be due to improved control by natural enemies (e.g. parasitic wasp).	Unknown	Nahrung et al. 2016
2006	Virus	Marine	Haliotid herpesvirus-1	Abalone herpes virus	Victoria (Taylor's Bay)	Decontamination of abalone farms.	Highly pathogenic. Between 2006 and 2010 caused severe decline in wild abalone on Victorian reefs. Mortality on some reefs up to 90%.	High	Conrad and Rondeau 2015, Corbeil 2020
2006	Ant	Terrestrial	Solenopsis invicta	Red imported fire ant	Qld (Yarwun)	Eradicated (national cost-shared)	Forms super-colonies. Can reach extremely high densities of up to 2600 mounds a hectare. Highly aggressive, dominates areas, displaces native ants & other invertebrates, kills small vertebrates. Could threaten ground-dwelling animals.	High	Australian Government 2022
2006	Alga	Marine	Grateloupia turuturu	Devil's tongue weed	Tas (Bicheno region)	No response	Can out-compete many native seaweeds in the low intertidal and shallow subtidal zones due to large size and ability to reproduce quickly.	Unknown	Saunders and Withall 2006, Department of Primary Industries 2020
2006	Ant	Terrestrial	Wasmannia auropunctata	Electric ant	Qld (Cairns)	Under eradication (national cost-sharing)	Can outcompete and displace native ants and other invertebrates. Can kill small vertebrates. Thought to have reduced reptile populations in New Caledonia and tortoise populations in Galapagos Archipelago, where ants eat hatchlings and attack eyes and cloacae of adult tortoises.	High	Business Queensland 2021
2006	Plant	Terrestrial	Opuntia leucotricha	Aaron's beard prickly-pear	SA	Unknown	Listed as a weed of national significance, assessed as a priority weed in Qld and high risk in Victoria.	High	White et al. 2022, Osunkoya et al. 2019
2006	Fish	Freshwater	Carassius carassius	Crucian carp	Vic (Campaspe River)	Unknown	Unknown	Unknown	Fishes of Australia
2007	Ascidian	Marine	Didemnum perlucidum	White colonial sea squirt	NT (Gove)	Unknown	Encrusts organisms, such as mussels, barnacles or tube worms. In WA, smothered seagrass, reducing biomass of seagrass and associated fauna, threatening ecological function in an impacted urban estuary.	Unknown	National Introduced Marine Pest Information System
2007	Plant	Terrestrial	Stevia ovate	Candyleaf	Qld (Ravenshoe)	Unknown.	Competition with native plants. Formed dense stands scattered along a powerline easement. Expected to colonise open, disturbed sites.	Unknown	Cshures 2008
2007	Bee	Terrestrial	Apis cerana	Asian honey bee	Qld	Unsuccessful eradication attempt (national cost sharing)	Have a broad floral appetite and compete with native species for pollen, nectar and tree crevices. In Asia they often exclude other pollinators by swamping flowers, also seen in north Queensland. A risk that native pollinator systems will collapse under the pressure of super-consumers of floral resources that perform poorly as pollinators.	Potentially significant	Gross 2015, Gross et al. 2019, Invasive Species Council 2018
2008	Beetle	Terrestrial	Gonipterus nov. sp. 2	Eucalyptus snout beetle	WA (south-west)	Unknown	Native to eastern Australia, introduced to south-western Australia. Initially caused significant damage to introduced eucalypts in plantations. Reduced severity now may be due to improved control by natural enemies (e.g. parasitic wasp).	Unknown	Nahrung et al. 2016, Mapondera et al. 2012
2008	Plant	Terrestrial	Blechum pyramidatum	Green shrimp plant	Qld (Torres Strait islands)	Unknown.	Competition with native plants. Has the potential to become locally abundant in certain habitats.	Unknown	Cshures 2010

2009	Mollusc	Terrestrial	Arion ater	Black slug	Tas	No response	Omnivorous & large, could threaten native snails. One resident reported having collected >20,000 specimens.	Unknown	Zemanova et al. 2018
2009	Plant	Terrestrial	Carex tribuloides	Blunt broom sedge	Vic	Unknown	Assessed as very high risk in Vic.	Potentially significant	White et al. 2022
2009	Turtle	Freshwater	Trachemys scripta	Red-eared slider turtle	NSW	Unknown	Can negatively impact native turtles and frogs – they mature quickly, are aggressive, have high fecundity. Show 'hallmarks of being the reptile equivalent to the carp'.	Potentially highly significant	Invasive Species Council 2017
2010	Virus	Marine	Ostreid herpes virus 1	Oyster virus	NSW	Containment	Unknown. Detected in native oysters, mussels, whelks and barnacles.	Unknown	Evans et al. 2017, Department of Agriculture and Department of the Environment 2014, Fuhrmann et al. 2021
2010	Virus	Terrestrial	Impatiens necrotic spot virus		NSW	Eradicated	Known to infect more than 648 species globally. Plants are susceptible at all growth stages, with infected younger plants more likely to die than those infected at a later growth stage.wn	Unknown	IPPC 2018, Department of Agriculture and Department of the Environment 2014
2010	Fungus	Terrestrial	Hemileia wrightiae	Hemileia rust	NT, Qld	No response	Infects plants in Hemieia genus. 4 Hemieia species in Australia. Rust detected on native plants. No reports on damage.	Unknown	Liberato and Shivas 2011, Anderson et al. 2017
2010	Fish	Freshwater	Labeo chrysophekadion	Black sharkminnow	Qld (Ross River)	Unknown	Unknown	Unknown	Ebner et al. 2020
2010	Fungus	Terrestrial	Austropuccinia psidii	Myrtle rust	NSW	Unsuccessful eradication (national cost sharing)	16 species at high risk of extinction within 1 plant generation. Can infect >350 Australian Myrtaceae species.	High	Fensham and Radford-Smith 2021
2010	Fungus	Terrestrial	Cryphonectria parasitica	Chestnut blight	Vic	Unsuccessful eradication (national cost-shared)	Unknown. Causes cankers that can kill trees. Eucalypts tested in greenhouses in Japan were susceptible, but has not yet been observed in Australia.	Unknown	Agriculture Victoria 2022, Old and Kobayashi 1988
2011	Virus	Terrestrial	Avian Paramyxovirus type 1	Pigeon paramyxovirus	Vic	Containment actions	Causes an often-fatal disease in many bird species worldwide, including raptors, swans, cockatoos and budgerigars. >230 species known to be susceptible. So far in Australia the virus has mainly infected racing, show and feral pigeons.	Unknown	Wildlife Health Australia 2016, Invasive Species Council 2017
2011	Plant	Terrestrial	Pilosella officinarum	Mouse-ear hawkweed	Vic (Bogong High Plains)	Eradicated	Heavy infestations form large swards which prevent regeneration and survival of native species and reduce productivity in grazing areas. In NZ, hawkweeds dominate >500,000 hectares of vegetation	High	Ohlsen 2018, French 2021, Hamilton et al. 2015
2011	Plant	Freshwater	Limnobium laevigatum	Amazon frogbit	Qld (Redlands)	No response	Highly invasive water weed. Can grow explosively and form large mats across the water surface. High potential to result in significant environmental and economic costs.	Potentially highly significant	Business Queensland 2022, Weerasinghe 2020, Howard et al. 2016
2011	Beetle	Terrestrial	Xylosandrus crassiusculus	Granulate ambrosia beetle	Qld (SEQ)	No response	Attacks over 200 species of plants in 41 families, mainly hardwood. Outbreaks could severely affect native trees and forests.	Potentially significant	Business Queensland 2016
2011	Virus	Terrestrial	Fig mosaic virus		SA	No response	Unknown. May have an impact on native plants	Unknown	Department of Agriculture and Department of the Environment 2014
2011	Reptile	Terrestrial	Hemidactylus garnotii	Indo-Pacific gecko	WA (Barrow Island)	Unknown	Unknown. Will move from houses into adjacent natural habitats. Parthenogenic species.	Unknown	Boylan 2014

2011	Plant	Terrestrial	Pinus jeffreyi	Jeffrey pine	Vic	Unknown	Assessed as high risk in Vic.	Potentially significant	White et al. 2022
2012	Thrips	Terrestrial	Echinothrips americanus	Poinsietta thrips	Qld (Daintree)	Assessed as not feasible to eradicate	Unknown. Wide host range of ~24 families, including many wild-growing plants. 'Because of the damage it causes, its rapid spread, wide host range, and an ability to change the duration of its development ..., this species has the potential to become a major pest'. May transmit viruses.	Unknown	Krueger et al. 2016, Department of Agriculture and Department of the Environment 2014
2012	Butterfly	Terrestrial	Acraea terpsicore	Tawny coster	NT	Assessed as not feasible to eradicate.	May pose a threat to the native *Acraea andromacha* because the larvae severely deplete one of its larval food plants (*Hybanthus enneaspermus*).	Unknown	Department of Agriculture and Department of the Environment 2014, Braby et al. 2014
2012	Ascidian	Marine	Didemnum pelucidum	White colonial sea squirt	WA	No response	Can overgrow native species. Observed in WA forming extensive mats up to 900 cm2, occupying over 90% of available space. Has the potential to contribute to loss of seagrass in Swan River estuary.	Unknown	Dias et al. 2021, Simpson et al. 2016, Department of Agriculture and Department of the Environment 2014
2012	Oomyctes	Terrestrial	Pythium camurandrum		Vic	No response	May have an impact on native plants.	Unknown	Department of Agriculture and Department of the Environment 2014
2012	Oomyctes	Terrestrial	Pythium rostratifingens		Vic	No response	May have an impact on native plants.	Unknown	Department of Agriculture and Department of the Environment 2014
2013	Mite	Terrestrial	Tetranychus evansi	Tomato red spider mite	NSW (Sydney)	Assessed as not feasible to eradicate.	Hosts include native Solanaceae. Feeding from the mite can result in death of the host plant within 3-5 weeks. Observed death of many kangaroo apple shrubs.	Unknown	PIRSA 2019, Kearney and Kearney 2014
2013	Wasp	Terrestrial	Quadrastichus erythrinae	Eythrina gall wasp	Qld (Torres Strait islands)	Assessed as not feasible to eradicate. Under containment.	Causes severe damage to coral trees (Erythrina species) by inducing galls, often killing them. In Hawaii, within 2 years it reduced populations of 2 endemic species by 95%. Eliminates most Erythrina trees in invaded regions. Australia has 5 native Erythrina species.	Potentially highly significant	Rubinoff et al. 2010, Department of Agriculture and Department of the Environment 2014, Global Invasive Species Database
2013	Ant	Terrestrial	Solenopsis invicta	Red imported fire ant	Qld (Port of Gladstone)	Eradicated (national cost-shared)	Forms super-colonies. Can reach extremely high densities of up to 2600 mounds a hectare. Highly aggressive, dominates areas, displaces native ants & other invertebrates, kills small vertebrates. Could threaten ground-dwelling animals.	High	Australian Government 2022
2013	Fungus	Terrestrial	Phyllosticta cavendishii	Banana freckle	NT (Howard Springs)	Eradicated, 2019 (national cost-shared)	May affect native banana (Musa) species.	Unknown	Department of Agriculture and Department of the Environment 2014
2013	Amphibian	Freshwater	Lissotriton vulgaris	Smooth newt	Vic (Melbourne)	No response..	Able to live in a wide range of habitats. Potential impacts from predation, competition, toxicity and disease spread. The only salamander in the wild in Australia, so hard to predict likely impacts. Native species probably lack co-evolved defences against them.	Potentially highly significant	Tingley et al. 2015, Invasive Species Council 2017
2013	Plant	Freshwater	Limnobium laevigatum	Amazon frogbit	WA (Canning)	No response	Highly invasive water weed. Can grow explosively and form large mats across the water surface. High potential to result in significant environmental and economic costs.	Potentially highly significant	Weerasinghe 2020, Howard et al. 2016

2013	Crustacean	Freshwater	Caridina indistincta	Indistinct river shrimp	WA (south-west)	No response	Introduced from eastern Australia. Of significant conservation concern due to potential competition with the endemic glass shrimp *Palaemon australis*	Potentially significant	Harris et al. 2017
2013	Ant	Terrestrial	Lepisiota frauenfeldi	Browsing ant	WA (Perth Airport)	Under eradication (national cost-sharing)	Forms super-colonies, tends sap-sucking insects and can damage native vegetation. Displaces native ants and other invertebrates.	High	Department of Agriculture and Department of the Environment 2014, Australian Government 2022
2014	Ant	Terrestrial	Solenopsis invicta	Red imported fire ant	NSW (Port Botany, Sydney)	Eradicated (national cost-shared)	Forms super-colonies. Can reach extremely high densities of up to 2600 mounds a hectare. Highly aggressive, dominates areas, displaces native ants & other invertebrates, kills small vertebrates. Could threaten ground-dwelling animals.	High	Australian Government 2022
2014	Reptile	Terrestrial	Hemidactylus garnotii	Indo-Pacific gecko	NSW (Sydney)	No response	Unknown. Will move from houses into adjacent natural habitats. Parthenogenetic species.	Unknown	Boylan 2014
2014	Fish	Freshwater	Betta splendens	Siamese fighting fish	NT (Adelaide River)	No response	Rapidly expanding population. Aggressive interactions and competition with native fish and tadpoles for space and food is likely and tadpoles in local concentrated refuges.	Unknown	Hammer et al. 2019
2014	Crustacean	Freshwater	Daphnia galeata	Waterflea	SA (Lower Lakes)	No response	Large-bodied, fast-growing species. Could have a 'strong negative impact'. More resistant than other species to fish predation and the toxic effect of the cyanobacteria. Might out-compete native species, especially in eutrophic conditions.	Potentially significant	Karabanov et al. 2018
2014	Plant	Terrestrial	Pilosella officinarum	Mouse-ear hawkweed	NSW (Kosciuszko NP)	Under eradication	Heavy infestations form large swards which prevent regeneration and survival of native species and reduce productivity in grazing areas. In NZ, hawkweeds dominate >500,000 hectares of vegetation	High	NSW Environment and Heritage 2021, French 2021, Hamilton et al. 2015
2014	Reptile	Terrestrial	Hemidactylus platyurus	Flat-tailed house gecko	Cocos (Keeling) Island	Unknown	Unknown	Unknown	Cogger 2018
2014	Bug	Terrestrial	Bactericera cockerelli	Tomato potato psyllid	Norfolk Island	Unknown	Unknown potential to impact on native Solanaceae and Convolvulaceae species.	Unknown	Taylor 2017, CABI
2014	Fish	Freshwater	Parachromis managuensis	Jaguar cichlid	Qld (Mackay)	Unsuccessful eradication..	Large, highly aggressive, fecund cichlid.	Potentially highly significant	Holmes et al. 2020
2015	Ant	Terrestrial	Solenopsis invicta	Red imported fire ant	Qld (Brisbane Airport)	Eradicated (national cost-shared)	Forms super-colonies. Can reach extremely high densities of up to 2600 mounds a hectare. Highly aggressive, dominates areas, displaces native ants & other invertebrates, kills small vertebrates. Could threaten ground-dwelling animals.	High	Australian Government 2022
2015	Ant	Terrestrial	Lepisiota frauenfeldi	Browsing ant	NT (Darwin)	Under eradication (national cost-sharing)	Forms super-colonies, tends sap-sucking insects and can damage native vegetation. Displaces native ants and other invertebrates.	High	Department of Agriculture and Department of the Environment 2014, Australian Government 2022
2015	Wasp	Terrestrial	Polistes olivaceus	Macao paper wasp	Cocos (Keeling) islands	Unsuccessful eradication (Commonwealth funded)	Polistes wasps can reach very high densities. May affect local biodiversity through predation or competition for food or space.	Potentially significant	Beggs et al. 2011, Howlett 2018
2016	Ant	Terrestrial	Solenopsis invicta	Red imported fire ant	Qld (Port of Brisbane)	Eradicated (national cost-shared)	Forms super-colonies. Can reach extremely high densities of up to 2600 mounds a hectare. Highly aggressive, dominates areas, displaces native ants &	High	Australian Government 2022

							other invertebrates, kills small vertebrates. Could threaten ground-dwelling animals.		
2016	Virus	Terrestrial	Pigeon rotavirus A genotype G18		WA	No response	High morbidity and mortality in loft pigeons (15-45% infected birds died). Has infected feral pigeons. No reports of native pigeons affected. 'Investigation of its cross- species pathogenicity may be warranted'.	Unknown	McCowan et al. 2018, Agriculture Victoria 2021
2016	Sponge	Marine	Terpios hoshinota	Cyanobacterios ponge	WA (Kimberley reef)	No response	Encrusts live coral, giant clams, and other benthos and can be a threat to benthic communities on coral reefs.	Unknown	Fromont et al. 2019
2016	Reptile	Terrestrial	Hemidactylus parvimaculatus	Spotted house gecko	Cocos (Keeling) Island	Unknown	Unknown	Unknown	Cogger 2018
2016	Virus	Marine/freshwater	White spot syndrome virus	White spot disease	Qld (Logan River prawn farms)	Unsuccessful eradication, now under containment	Can cause white spot disease when susceptible crustaceans are exposed to stress or infected with very high levels of virus. Occurs in wild invertebrates, but the prevalence is generally low and largely related to the extent of shrimp farming in the area.	Unknown	Australian Government 2022, Prayitno et al. 2022, Kibb 2018
2017	Bug	Terrestrial	Bactericera cockerelli	Tomato potato psyllid	WA (Perth)	Assessed as not feasible to eradicate.	Unknown potential to impact on native Solanaceae and Convolvulaceae species.	Unknown	Taylor 2017, CABI
2017	Bacterium	Terrestrial	Candidatus Phytoplasma dypsidis		Qld (Cairns)	Disease investigation	Caused the death of several ornamental palms in Cairns. Uncertain whether it is a new incursion or indigenous. Potential impacts on native palms need to be investigated	Unknown	Jones et al. 2021
2017	Plant	Freshwater	Limnobium laevigatum	Amazon frogbit	NSW (Forster)	Under eradication	Highly invasive water weed. Can grow explosively and form large mats across the water surface. High potential to result in significant environmental and economic costs.	Potentially highly significant	Mifsud and Inkson 2018, Weerasinghe 2020, Howard et al. 2016
2018	Clam	Marine	Mya japonica	Japanese soft-shelled clam	Tas (Prosser River)	Assessed as not feasible to eradicate	Potential to outcompete native species for habitat.	Unknown	Dann et al. 2020, Department of Natural Resources and Environment Tasmania 2022
2018	Fish	Freshwater	Cichla sp	Peacock bass	Qld (Pioneer River)	Electrofishing in 2018 and 2019. May have been eradicated.	Large predatory fish. Can have serious impacts -- changes of aquatic food webs, competition with native fish, extirpation of small fish. In a Brazilian reservoir caused collapse of native fish fauna, with density reduced by 95%.	Potentially highly significant	Pelicice and Agostinho 2009, Franco et al. 2022, Catchment Solutions 2019
2018	Bacterium	Terrestrial	Xanthomonas citri	Citrus canker	WA	Eradicated (national cost-shared)	Causes a highly contagious disease that can affect all above-ground parts of citrus trees. Can lead to defoliation, dieback, premature fruit drop. Native Australian Rutaceae species are potential hosts.	Unknown	Department of Primary Industries 2017, IPPC 2021
2018	Ant	Terrestrial	Anoplolepis gracilipes	Yellow crazy ant	NSW (Lismore)	Eradicated by NSW Government	Forms super-colonies and can dominate large areas. Displaces native ants & other invertebrates, kills small vertebrate animals.	High	Charlton et al. 2022, Cshures and Hankemer 2012
2018	Virus	Terrestrial	Impatiens necrotic spot virus		NSW	Unknown	Unknown. Known to infect more than 648 species globally. Plants are susceptible at all growth stages, with infected younger plants more likely to die than those infected at a later growth stage.	Unknown.	IPPC 2018, Department of Agriculture and Department of the Environment 2014
2019	Alga	Marine	Grateloupia turuturu	Devil's tongue weed	NSW (Botany Bay)	No response	Can out-compete many native seaweeds in the low intertidal and shallow subtidal zones due to large size and ability to reproduce quickly.	Unknown	Department of Primary Industries 2020, Department of Primary Industries 2022

2019	Ant	Terrestrial	Solenopsis invicta	Red imported fire ant	WA (Fremantle Port)	Under eradication (national cost-shared)	Forms super-colonies. Can reach extremely high densities of up to 2600 mounds a hectare. Highly aggressive, dominates areas, displaces native ants & other invertebrates, kills small vertebrates. Could threaten ground-dwelling animals.	High	Australian Government 2022
2019	Ant	Terrestrial	Lepisiota frauenfeldi	Browsing ant	Qld (Brisbane)	Under eradication (national cost-sharing)	Forms super-colonies, tends sap-sucking insects and can damage native vegetation. Displaces native ants and other invertebrates.	High	Department of Agriculture and Department of the Environment 2014, Australian Government 2022
2019	Oyster	Marine	Magallana bilineata	Black scar oyster	Qld (north of Cairns)	Unknown	Unknown. Biofouling potential. A vector for a number of oyster pathogens and parasites.	Unknown	Wilan et al. 2021, National Introduced Marine Pest Information System
2019	Ascidian	Marine	Didemnum perlucidum	White colonial sea squirt	Qld	Unknown	Encrusts organisms, such as mussels, barnacles or tube worms. In WA, smothered seagrass, reducing biomass of seagrass and associated fauna, threatening ecological function in an impacted urban estuary.	Unknown	National Introduced Marine Pest Information System
2020	Bacterium	Terrestrial	Ehrlichia canis		WA (Kimberley)	Assessed as not feasible to eradicate	Causes canine monocytic ehrlichiosis. Transmitted by tick bites. Has had a devastating impact on dogs in remote Indigenous communities, Prevalence up to 100% and mortalities up to 30%. The risk of dingoes being infected has been assessed by WHA as low because they are not known to host the vector brown dog tick. But the impacts if established in dingo populations are assessed as major.	Unknown	Wildlife Health Australia 2022, Animal Health Australia 2022
2020	Fly	Terrestrial	Liriomyza huidobrensis	Serpentine leaf miner	NSW (Sydney)	Assessed as not feasible to eradicate from Australia	Knowledge of potential Australian native host species is poor and requires further investigation.	Unknown	Mulholland et al. 2022
2020	Moth	Terrestrial	Spodoptera frugiperda	Fall armyworm	Torres Strait islands	Assessed as not feasible to eradicate.	A highly voracious polyphagous species. Could put at risk indigenous plant species and outcompete native Insects. >350 known plant hosts from 76 families. When the population is large, larvae disperse en masse in search of food.	Unknown	Ayra-Pardo et al. 2021, Department of Primary Industries 2021
2020	Mite	Terrestrial	Ophionyssus natricis	Snake mite	SA	No response	Can cause serious disease in captive snakes -- dermatitis, irritation, anaemia and transmission of Aeromonas spp. and inclusion body disease. Recently recorded on sleepy lizards in the wild.	Of potential significance	Norval et al. 2020
2020	Ant	Terrestrial	Lepisiota incisa	African black sugar ant	WA	Under eradication (national cost-shared)	Has the ability to form super colonies covering hundreds of square kilometres. Aggressive towards other ant species, known to outcompete native ants.	High	Australian Government 2022
2020	Crab	Marine	Hemigrapsus sanguineus	Asian shore crab	Vic (Port Phillip Bay)	Unknown	Invasion in NW USA resulted in widespread displacement of native crabs. Average abundances in New York peaked at 120 crabs per m2. Has the potential to affect crabs, fish and shellfish by disrupting the food web by predation or competition.	Potentially significant	National Introduced Marine Pest Information System
2020	Alga	Marine	Pachymeniopsis lanceolata		NSW (Botany Bay)	.Unknown	Can outcompete many native seaweeds in the low intertidal and shallow subtidal zones due to large size and ability to reproduce quickly	Unknown	Department of Primary Industries 2020
2021	Beetle	Terrestrial	Euwallacea fornicatus	Polyphagous shot-hole borer	WA (Perth)	Under eradication (national cost-shared)	Has a very wide host range (>400 known species, including Australian natives) and cultivates fungi that can kill trees. Assessed as potentially having a major environmental impact in Australia. Has killed a	Potentially highly significant	Australian Government 2022, EEPL 2020, Umeda et al. 2016

							substantial proportion of trees in some Californian forests.		
2021	Ant	Terrestrial	Solenopsis invicta	Red imported fire ant	Qld (Port of Brisbane)	Under eradication (national cost-shared)	Forms super-colonies. Can reach extremely high densities of up to 2600 mounds a hectare. Highly aggressive, dominates areas, displaces native ants & other invertebrates, kills small vertebrates. Could threaten ground-dwelling animals.	High	Australian Government 2022
2022	Fungus	Terrestrial	Phyllosticta cavendishii	Banana freckle	NT	Under eradication (national cost-shared)	May affect native banana (Musa) species.	Unknown	Australian Government 2022, Department of Agriculture and Department of the Environment 2014
2022	Mite	Terrestrial	Varroa destructor	Varroa mite	NSW	Under eradication (national cost-shared)	May benefit the environment by reducing the impacts of feral honey bees. But may also transmit diseases that affect native bees.	Unknown	Australian Government 2022, O'Connor 2022, Graystock et al. 2016

Note: References can be provided on request.