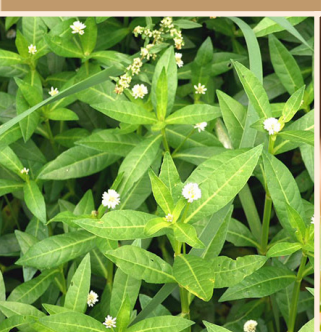
NSW GOVERNMENT | Natural Resources Commission

Reducing Risk, Securing the Future

NSW Invasive Species Management Review

Final Report
November 2024





Acknowledgement of Country

The Commission acknowledges and pays respect to traditional owners and Aboriginal people. The Commission recognises and acknowledges that Aboriginal people have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters. We value and respect their knowledge in natural resource management and the contributions of many generations, including Elders, to this understanding and connection.

The Commission has worked with key Aboriginal stakeholders involved directly in invasive species management to inform this Review – their voices and values have been included in this report. The core message is:

> *'We care about invasive species because it impacts our connection to Country … we want to, and have an obligation to, be involved in that space'.*[1]

The principle of shared responsibility that underlies NSW invasive species management fits with the inherently shared cultural obligations of Aboriginal people to sustaining healthy Country. Invasive species are viewed as a direct and increasing threat to healthy Country, which needs to be addressed in a collective way that acknowledges many years of degradation and mismanagement:

> *'Country has had enough … give us the opportunity and come on the journey with us … We weren't given lore of healing Country after 200 plus years of mismanagement, that's why we have to do this together'.*[2]

The Commission hopes that the involvement of Aboriginal peoples in this Review will give voice to Aboriginal knowledge and values that shape truly collaborative invasive species management into the future.

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1 Aboriginal Stakeholder Forum (2023) 'Improving Aboriginal involvement in NSW Invasive Species Management', held on Dharug Country, Tuesday 28 November.

2 *Ibid.*

List of acronyms and abbreviations

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
Agriculture and Biosecurity	Agriculture and Biosecurity Division of the NSW Department of Primary Industries and Regional Development[3]
BCS	Biodiversity Conservation and Science Group of the NSW Department of Climate Change, Energy, the Environment and Water
BCT	Biodiversity Conservation Trust
BIS	Biosecurity Information System
CEBRA	Centre of Excellence for Biosecurity Risk Analysis
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
DPIRD	NSW Department of Primary Industries and Regional Development
EADRA	Emergency Animal Disease Response Agreement
EPA	NSW Environment Protection Authority
EPPRD	Emergency Plant Pest Response Deed
FCNSW	Forestry Corporation of NSW
IGAB	Intergovernmental Agreement on Biosecurity
LCA	Local Control Authority
LLS	Local Land Services
MERI	Monitoring, Evaluation, Reporting and Improvement
MOU	Memorandum of Understanding
NARCliM	NSW and Australian Regional Climate Modelling
NEBRA	National Environmental Biosecurity Response Agreement
NPWS	NSW National Parks and Wildlife Service
The Commission	NSW Natural Resources Commission
WAP	Weeds Action Program

[3] Machinery of Government changes occurred during the period of this Review in which the original Department of Primary Industries became Agriculture and Biosecurity within DPIRD on 1 July 2024. The Review refers to this agency as Agriculture and Biosecurity throughout the analysis and reporting.

Key Terms

Key Terms	Definitions
Authorised officer	Government agency staff (primarily Agriculture and Biosecurity, LLS and LCAs) appointed in writing by the Secretary as an authorised officer under the *Biosecurity Act 2015*, after completing the requisite authorised officer training.
Beneficiaries	A person, industry or organisation that derives an advantage from the operation of the NSW Invasive Management System.
Biosecurity direction	A direction given by an authorised officer, which has legal force. It specifies what the person or class of persons are required to do to prevent, eliminate or minimise a particular biosecurity risk or to enforce the requirements of the *Biosecurity Act 2015*.
Biosecurity Information System (BIS)	A standardised data capture system for NSW local and regional biosecurity activities, allowing real time reporting and analysis of consolidated information at a state level.
Biosecurity matter	Defined under *Biosecurity Act 2015* as any living thing, part of a living thing or product of a living thing (other than a human), or a disease, prion or contaminant, or a disease agent that can cause disease in a living thing (other than a human) or that can cause disease in a human via transmission from a non-human host.
Biosecurity risk	Anything that could increase the impacts of pests, diseases, weeds or contaminants on the economy, environment or community.
Biosecurity undertaking	An undertaking (generally in writing) given by a person to an authorised officer to take action to remedy the contravention, or suspected contravention of a requirement of the *Biosecurity Act 2015*.
Biosecurity zones	Areas of NSW that have legal movement restrictions placed on them under the *Biosecurity Act 2015* to limit the spread of pests and diseases within the state.
Control order	An order made by the Minister (or delegate) under the *Biosecurity Act 2015* that establishes one or more zones to prevent, eliminate, minimise or otherwise manage a biosecurity risk or biosecurity impact.
Cross-tenure	Describes coordination undertaken jointly by land managers across their respective lands, regardless of tenure boundaries.
General biosecurity duty	Requirement under the *Biosecurity Act 2015* that any person who deals with biosecurity matter or a carrier and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter, carrier or dealing has a biosecurity duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised.
High-risk pathways	Routes by which invasive species are more easily transferred from one ecosystem to another.
NSW Biosecurity and Food Safety Strategy 2020–2030	The NSW Government's framework for delivering biosecurity and food safety outcomes.

Key Terms	Definitions
NSW Invasive Species Plan	The *NSW Invasive Species Plan 2023–2028* is an update of the *NSW Invasive Species Plan 2018-2021*. It supports the *NSW Biosecurity and Food Safety Strategy 2020–2030*. It is NSW's current framework for pest animal and weed management.
NSW invasive species management system	Government, industry and community working together to manage the risks of pests entering, establishing, and spreading, and causing harm to human, animal and plant health, the environment and the economy.
Permitted activities	Activities listed under the *Biosecurity Orders (Permitted Activities) 2017*. An order approved by the Secretary (or delegate) that would otherwise be prohibited under the *Biosecurity Act 2015* by a mandatory measure or a regulatory measure implemented in relation to a biosecurity zone.
Pest	A plant or animal (other than a human) that has an adverse effect on (or is suspected of having an adverse effect on) the environment, the economy or the community.
Potential risk creators	Those individuals, businesses, organisations, or industry groups that through their activities have the potential to create or exacerbate invasive species risks.
Prohibited matter	Biosecurity matter (such as a plant, animal, disease, virus or parasite) that is not found in NSW but is listed as prohibited matter under the *Biosecurity Act 2015* as it would have a significant adverse impact on the health, way of life, the economy or the environment if entered into the state.
Reasonably practicable	Used in relation to the prevention, elimination or minimisation of biosecurity risks. What is reasonably practicable means that which is reasonably able to be done, taking into account and weighing up all relevant matters including the nature of the biosecurity risk concerned, the availability and suitability of ways to manage the biosecurity risk concerned, and the cost involved.
Shared responsibility	An objective of the *Biosecurity Act 2015*, shared responsibility means everyone takes responsibility for biosecurity matters under their control. Everyone has an obligation to take action to protect NSW from pests and diseases.
State priority weeds	Weeds that pose a high risk to the entire state of NSW and are regulated under the *Biosecurity Act 2015* and *Biosecurity Regulation 2017* through the listing of either prohibited matter, control orders, biosecurity zones or mandatory measures.
Weed	A plant that has an adverse effect on (or is suspected of having an adverse effect on) the environment, the economy or the community
Weeds Action Program (WAP)	A weed management program based on a partnership between NSW and local government.
Weed Risk Management System	A qualitative process adopted in NSW for determining the potential impact of weed species on the environment economy and society.

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Executive Summary

Invasive species affect our way of life in many ways. They impact farmers' livelihoods, spread disease, damage the economy and biodiversity and disrupt Aboriginal connections to Country. The current risks from weeds, and vertebrate and invertebrate pest animals are significant, and the costs are accumulating rapidly. It is time for a step change in invasive species management, focused on risk reduction and coordination of shared responsibilities to secure the future of NSW's communities, environment and industries.

More than 340 weed and 40 pest animal species cause extensive impacts to the NSW economy, environment, and communities. The Commission estimates the financial cost of invasive species in NSW is at least $1.9 billion per year, having increased from approximately $26 million in the 1970s. These are conservative estimates based on limited and inconsistent reported data, particularly for non-monetary social and environmental impacts.

Expanding urban areas, agricultural intensification, increasing trade, climate change and natural disasters all have the potential to increase the future severity of invasive species impacts, including the speed at which some species spread. Failing to effectively manage new incursions could result in an estimated worst case annual cost of $29.7 billion by 2030. This worst-case estimate includes market and non-market impacts across all sectors, including agriculture, environment, health, social amenity and infrastructure.

Invasive species management in NSW and Australia is underpinned by the concept of 'shared responsibility'. Everyone has a part to play in protecting the economy, environment and community from the negative impacts of invasive species. Land managers (both private and public) are the majority investors in, and greatest beneficiaries of, invasive species management. However, protecting agricultural and environmental land from invasive species also greatly benefits the broader community (both rural and urban). Partnerships between government agencies, industry, and the broader community will therefore be critical to success.

Invasive species are everywhere across NSW and not all their impacts can be effectively managed. As such, the NSW Government must lead a strategic, risk-based, collaborative approach, supported by a robust system of integrated policy, planning, and regulation. NSW Government agencies play two key roles in the management of more established invasive species: funding and undertaking the management activities of public land managers; and providing leadership and coordination with all relevant land managers at a state and regional scale. As well as the requirements under the *Biosecurity Act 2015* and *Biodiversity Conservation Act 2015*, invasive species management activities by public land managers are driven by different requirements under their respective legislation and internal policies. The different outcomes they are trying to achieve can be complementary but require the leadership and coordination of all relevant land managers (public and private) to maximise the effectiveness of the shared responsibility approach.

The *Biosecurity Act 2015* introduced significant reforms in invasive species management, aligned with well-evidenced principles and national commitments. The reforms are sound and there are many examples of effective programs and practice that have improved parts of the system over time. The NSW Government has also undertaken recent initiatives and investment for invasive species management to drive further improvements, including appointing an Independent Biosecurity Commissioner and establishing statewide invasive species management programs. These are all welcome but are not enough to address the obvious and growing impacts on NSW – more must be done.

While the foundations of good management exist, the NSW invasive species management system is not yet cohesive. State and regional planning does not guide strategic investment of limited funds, and gaps in management exist around key risk areas. Siloed governance structures mean key players are not working together to tackle shared challenges. Despite having shared legislation and regulations, there is significant variation in the management of weeds and pest animals. Variable enforcement of regulations undermines the legitimacy of the system.

The Commission has identified six areas in which key issues pose the greatest risk to the success of NSW's invasive species management system (see **Table 1**). For each area, the report proposes a suite of integrated recommendations targeting risk reduction and system-wide improvement (see **Table 2**). The changes needed will take time – the Commission anticipates that it will take at least three years to properly implement all recommendations. The Commission has provided a staged roadmap to implement the recommendations over this period (see **Figure 27** and **Figure 28** in **Chapter 11**).

The Commission acknowledges the significant body of existing research, reviews and audits that focus on the NSW invasive species management system. This Review has extended on this work with targeted research and stakeholder engagement to design specific actions to achieve strategic improvements rapidly in core parts of the system.

As part of the Review, the Commission assessed the performance of the system as a whole, considering existing programs and how they interact to deliver invasive species management outcomes. The report highlights key programs where possible to illustrate best practice and areas for improvement.

Importantly, this Review has focused on improving the involvement of system partners to deliver improved and coordinated invasive species management outcomes at a landscape scale. This recognises the diverse range of values that should be protected in NSW, including social, environmental, Aboriginal, economic, industry, and cultural values.

Table 1: Summary of key findings

Prioritising strategic planning for risk reduction 	✓ While LLS and Agriculture and Biosecurity have been effective in delivering specific programs and on-ground projects for weed and pest animal management, there has been little improvement in the implementation of shared responsibilities for planning and resourcing introduced under the *Biosecurity Act 2015*. ✓ The *NSW Invasive Species Plan* only provides high-level guidance, not an actionable plan to tackle invasive species based on clear priorities and responsibilities. ✓ Regional plans do not consistently prioritise high risk pathways or identify and map responses to target sites. Planning processes do not adequately consider key risks and assets outside primary production, and are implemented inconsistently across pest animals and weeds, as well as different types of species. ✓ Regional strategic weed management plans use a risk-based approach to identify new and emerging weeds but more work is needed around widespread weeds listed for asset protection, as well as vertebrate and invertebrate pest animals. ✓ Complex NSW Government structures create the potential for confusion, overlaps and gaps in roles. Siloed management without consistent leadership from Agriculture and Biosecurity means the operation and understanding of responsibilities varies significantly between organisations, weed and pest animal functions, and new/emerging and widespread species. ✓ Without clear authority or lines of communication, the State Weeds Committee and State Pest Animal Committee did not ensure a consistent, coordinated and strategic approach to invasive species management across the state. ✓ State-level leadership and coordination by Agriculture and Biosecurity has worked for surveillance and incursion management of state priority weeds because of the contractual requirements of the WAP. Statewide policies, processes and response plans developed by Agriculture and Biosecurity are implemented at a regional level by LLS and LCAs, leading to a consistent and documented approach to surveillance and incursion management. However, there is no equivalent program for vertebrate and invertebrate pest animal management.
Identifying resourcing requirements and maximising value for money 	✓ Increasing threats from invasive species coupled with limited government funding means that the NSW Government must ensure public resources are targeted to actions that most effectively reduce risk and maximise the rate of return on investment or 'value for money'. However, this has not been the case. Driven by a lack of a statewide risk-based approach or resourcing strategy, funding is often instead allocated based on existing program maintenance, public visibility of invasive species or pressure from interest groups. ✓ Without specific regional planning and coordination, engagement and resource allocation across NSW Government organisations varies significantly. Across NSW public land managers, expenditure per hectare on invasive species management ranges from $1.79 by the Forestry Corporation of NSW (FCNSW) up to $8.64 by LLS on travelling stock reserves. ✓ Non-land management government agencies such as the NSW Environmental Trust, BCT and BCS fund various invasive species management programs and have the potential to contribute more to collaborative approaches, but currently are not effectively engaged with Agriculture and Biosecurity, LLS and LCAs. ✓ NSW investment focusses on the short-term management of species and incidents rather than the development of biosecurity management system capacity as a whole.

Supporting regional coordination and local delivery for improved outcomes

- ✓ Regional coordinators are a critical component of the system and key to delivering consistent and coordinated risk reduction through partnerships between government, industry and community. However, the pest animal roles are inconsistently defined and have not been filled in all regions, and the weed roles are hindered by limited and short-term funding, lack of consistent institutional support, gaps in local delivery partner responsibilities, and inadequate engagement of key stakeholders.
- ✓ Regional committees represent a lost opportunity to effectively prioritise and coordinate collaborative cross-tenure management. Committee engagement and attendance has diminished over time, as the collective needs of key stakeholders have not been prioritised.
- ✓ As land managers, traditional owners and knowledge holders, Aboriginal communities are a valuable component of the invasive species management system but have not been effectively engaged to date.
- ✓ There are formal arrangements for surveillance and incursion responses implemented by Agriculture and Biosecurity, LLS and LCAs for weeds, but not for vertebrate and invertebrate pest animals.
- ✓ Incursion responses are primarily implemented by Agriculture and Biosecurity, LLS and LCA staff, taking them away from everyday duties. Staff from other agencies (such as the National Parks and Wildlife Service (NPWS), NSW Environment Protection Authority and DCCEEW) have assisted in responses but this has not been supported by formal agreements. The general public can also play an important role in identifying incursions, but more can be done to build public understanding and capacity in this area.

Strengthening regulation, compliance and enforcement for a more reliable system

- ✓ Previous regulatory barriers to effective biosecurity management were largely removed by the introduction of the *Biosecurity Act 2015*. The Act brought weed and pest animal management under the same legislative and regulatory tools, and introduced a more flexible, outcomes-focused framework.
- ✓ Enforcement of compliance is relatively straightforward for species specifically identified under the legislation. However, compliance for species managed under the general biosecurity duty requires supporting detail in regional planning documents, which is currently inadequate.
- ✓ The regulatory approaches of Agriculture and Biosecurity, LLS and LCAs are siloed and differ significantly. There is also a perception among stakeholders that regulatory processes do not apply equally to everyone, eroding the legitimacy of the system.
- ✓ Compliance and enforcement provisions in the *Biosecurity Act 2015* have not been well-defined or resourced as part of the policy or institutional arrangements of the NSW invasive species management system and there is a lack of support, resourcing and tools to encourage enforcement cases.
- ✓ While some successful compliance activities have been implemented by LCAs, Agriculture and Biosecurity and LLS, a lack of consistency and public visibility opens the system up to inadvertent and deliberate non-compliance, and scepticism from land managers. Where possible, compliance provisions should be consistent, easy to understand and based on risk.
- ✓ Despite the risks that cats pose to conservation, production and human health, their status as a companion animal complicates their management and the *Companion Animals Act 1998* is ineffective at managing these biosecurity risks. In comparison to other Australian jurisdictions, NSW legislation is more permissive and allows almost unrestricted access of cats to the outdoors.

Communicating invasive species risks and impacts to expand reach of the system

- ✓ The public does not have an adequate awareness of the risks surrounding invasive species, the importance of invasive species management or the concept of shared responsibility.
- ✓ A lack of well-resourced public education is holding back public awareness of the risks and importance of biosecurity. Education efforts to date have only resulted in short-term increases in public awareness.
- ✓ Key gaps in awareness-raising and education campaigns include around high-risk pathways and peak risk creators and among stakeholders in urban and peri-urban areas. Several organisations who undertake invasive species management as part of everyday activities could also be better engaged, such as Landcare NSW, Aboriginal landowners and managers, bush regenerators, industry groups and universities.
- ✓ Key gaps in public awareness include around how to participate in invasive species management and what the benefits are, the links between invasive species and native species extinction and the acceptance of lethal methods of pest animal control. There is also no single reliable source of public information about invasive species and agricultural peer networks remain underused.
- ✓ The public can also be engaged to reduce the risks of invasive species by modifying their potentially high-risk activities. However, information needs to be more widely available about these activities and how to reduce their potential risk.

Integrating knowledge and oversight to safeguard the system

- ✓ Integrating monitoring, evaluation, reporting and improvement (MERI) in invasive species management is critical to ensure objectives are being achieved and to support continuous improvement. While there are provisions for MERI in the *NSW Invasive Species Plan* and associated regional plans, these are not being enacted in a consistent and rigorous way to support the NSW system.
- ✓ There is no overarching knowledge strategy identifying key research priorities to drive coordinated and resourced research, data and technology for NSW invasive species management. Monitoring and evaluation are instead driven by short-term funding and management programs, resulting in sporadic, fragmented and short-term programs.
- ✓ There is a disconnect between researchers and managers that limits the application of new approaches on-ground. Current links between researchers and land managers are through previous relationships and opportunistic engagement. While this works well for the parties involved, greater collaborative opportunities across the system are missed because researchers are unaware of key sites and activities that could be used to help answer priority research questions. Researchers also have limited involvement in statewide monitoring design and management.
- ✓ Effective linkages need to be developed and coordinated between research organisations and land managers to ensure efficient uptake of research and development as well as establishing effective feedback mechanisms.
- ✓ Recent advances in technologies such as gene editing techniques, remote sensing technology and artificial intelligence have the potential to address key challenges in invasive species management. These should be considered where their use is appropriate to address key priorities, with their implementation guided by researchers.
- ✓ Existing statewide MERI frameworks only provide high-level guidance and do not specify clear, consistent reporting requirements. As a result, each of the 11 regional committees for both weeds and pest animals has developed different approaches to MERI.
- ✓ There is inadequate focus on outcomes in MERI frameworks, leading to data collection on management activities and not their effectiveness.
- ✓ There is insufficient accountability and independent oversight built into the system to enable transparency and ongoing improvement.

Table 2: Recommendations

Prioritising strategic planning for risk reduction

DPIRD:

1. **Develop a NSW Invasive Species Planning Framework that consistently prioritises and resources risk reduction to manage current and future invasive species risks that is:**
   a) applied in the *NSW Invasive Species Plan* and aligned regional plans
   b) supported by guidance and training for NSW Government agencies and partners to consistently prioritise risk reduction and high rate of return on investment (including market and non-market values) across:
      - pathways of new incursions and established species' spread at a range of geographic scales
      - key landscape assets and values (economic, social, Aboriginal, environmental)
      - core invasive species management components (for example, prevention, surveillance, eradication/ emergency response, containment, management, data and research, MERI, education and training)
      - requirements for invasive species management under both the *Biosecurity Act 2015* and the *Biodiversity Conservation Act 2016.*

2. **Redesign the *NSW Invasive Species Plan* to focus on strategic risk reduction and outcomes through defined roles, responsibilities, investment priorities and actions to:**
   a) be outcomes driven, rather than activity driven, with associated targets (this needs to include Aboriginal values and outcomes, and biodiversity outcomes, with input from DCCEEW)
   b) identify priority risk pathways (incursions and spread) and include requirements to develop component strategies to mitigate these risks to achieve agreed outcomes
   c) embed a partnership model with system-wide involvement across scales and management components
   d) align requirements for invasive species management under both the *Biosecurity Act 2015* and the *Biodiversity Conservation Act 2016*
   e) identify emergency response planning, training and resourcing protocols for incursions of priority new or high-risk established species, including:
      - leadership from DPIRD to deliver coordinated emergency responses and plans following the state and national protocols
      - provisions for drawing on a broader pool of agencies, staff and authorised officers
   f) establish coordinated state response plans led by DPIRD Agriculture and Biosecurity for priority invasive species with specific objectives and targets for inspection, containment and eradication (where possible) and asset protection (where appropriate). This would include:
      - invasive species identified through control orders or biosecurity zones (for example, cane toads, tropical soda apple)
      - widespread species with escalating risk profiles (for example, feral pig, deer)
   g) detail specific commitments for state-level programs for compliance and enforcement, prevention and surveillance, eradication and containment, communication, research, MERI, and training
   h) include a plan for resourcing intense reduction of pest animals and weeds from high conservation value regions
   i) detail specific commitments for regional coordination and local delivery
   j) include guidance for more active and targeted use of the existing legislative and regulatory toolkit (for example, general biosecurity directions, authorised officers)
   k) be adapted as a 'living plan' and monitored and reported on through the knowledge strategy (see **Recommendation 12**)
   l) be approved by the Minister for Agriculture in consultation with the Minister for the Environment.

3. **Redesign regional-scale plans for invasive species management as cross-tenure partnership agreements to deliver risk reduction through management, surveillance, compliance and emergency responses. They need to:**
   a) align with and further detail the *NSW Invasive Species Plan* at regional scales, including priority risk pathways, statewide programs and targets
   b) be co-designed with partner organisations and regional committees in each region as 'living' agreements. This needs to include organisation wide commitment as well as endorsed support at local levels (for example, LCAs) and agreement to collaborate in delivery
   c) identify how Aboriginal people will be engaged in the implementation of the plan
   d) describe how funding will be allocated at the regional scale by partners to achieve risk reduction and asset protection across environmental, economic, social and cultural interests – this needs to consider existing and planned funding commitments and allocating funding at scales and times when programs are most likely to achieve the desired outcomes

e) identify and map regional priority pathways and programs across both vertebrate and invertebrate pest animals and weeds for:
   - surveillance and incursion responses – inspections and other surveillance and compliance activities based on risk, with detailed response plans for how new incursions will be managed
   - new and emerging species – management priorities for containment and eradication of priority new and emerging species already present in the region
   - widespread species – management priorities for widespread species based on identified high-value assets.

DCCEEW:

4. **Develop relevant contributions for inclusion in the state and regional plans to ensure biodiversity and Aboriginal cultural values are prioritised, including:**
   a) key actions for environmental stakeholders and potential risk creators to undertake to prevent the spread of priority invasive species in high value conservation areas, such as hygiene protocols or other mechanisms to combat high risk pathways
   b) key management actions at the state level to reduce the risk of priority invasive species with potentially high environmental impacts, such as cane toads and bitou bush
   c) mapped priority areas for collaborative cross-tenure pest animal and weed programs at the regional level to collectively protect threatened species, other important biodiversity and important Aboriginal cultural sites.

5. **Support Aboriginal staff engaged in activities related to invasive species management, both to connect with each other, and with Aboriginal communities by:**
   a) providing ongoing support for the development of a network of Aboriginal staff across agencies to drive change, identify and share opportunities, and provide a representative forum to engage with communities and decision makers
   b) including references to invasive species management in the development of initiatives supporting Aboriginal involvement in the NSW plan for nature
   c) supporting the establishment of a First Nations Land and Sea Country Commissioner to represent Aboriginal people working in natural resource management, including invasive species management, at relevant senior levels of the NSW Government.

The NSW Independent Biosecurity Commissioner:

6. **Review and make recommendations on state and regional committee functioning and membership to improve leadership, strategic decision making and accountability, including considering options for:**
   a) an overarching NSW Invasive Species Management Committee with decision-making powers
   b) oversight and influence from senior executives of key agencies (for example, DPIRD, DCCEEW, the Department of Planning, Housing and Infrastructure and Transport for NSW) on the state committee who have authority to make decisions on behalf of their agencies, with an appropriate Chair (for example, the Independent Biosecurity Commissioner) and secretariat (for example, DPIRD).
   c) the participation of key stakeholder groups outside of government
   d) well-defined core functions to ensure consistent, coordinated, strategic planning and resourcing of invasive species management across the state
   e) support from interagency pest animal and weed technical specialist working groups
   f) associated regional-level pest animal and weed committees, coordinated by LLS, which align with state committee roles and functions
   g) clear escalation pathways for when consensus cannot be met, and accountability lines for when agency partners do not meet their commitments
   h) transparency and reporting requirements, including transparent minute taking and annual reporting
   i) independent oversight by the Independent Biosecurity Commissioner.

Identifying resourcing requirements and maximising value for money

DPIRD:

7. **Propose a NSW Invasive Species Investment Program to NSW Treasury that includes:**
   a) a five-year program, as in the current WAP, but with funding allocated in five-year terms
   b) additional funding for aligned pest animal (vertebrate and invertebrate) monitoring and surveillance functions, to be undertaken by LCAs and coordinated by LLS
   c) contractual arrangements for regional coordination and local delivery requirements as in the current WAP
   d) dedicated funding for statewide leadership, regional coordination, and local implementation of core management components (prevention, surveillance, emergency response, containment, data and research, MERI, education and training)
   e) a review of existing and planned expenditure against the framework to understand and communicate rate of return and value for money investment.
   f) a review of potential additional funds, including cost-recovery tools.

Supporting regional coordination and local delivery for improved outcomes

DPIRD:

8. **Resource regional coordinators to deliver regional planning and collaborative programs. These roles must:**
   a) be resourced with dedicated funding from the NSW Invasive Species Investment Program (**Recommendation 7**) for full-time, five-year roles for weed and pest animal functions in each LLS region
   b) be solely focused on invasive species coordination
   c) operate as the secretariat for respective cross-tenure regional committees
   d) lead and coordinate surveillance and inspection programs with LCAs as local delivery partners (for both weeds and vertebrate and invertebrate pest animals)
   e) support the extension activities of local delivery partners (LLS and LCAs)
   f) coordinate high priority collaborative programs for incursion response, containment, eradication and asset protection
   g) work with Landcare NSW and other relevant community groups to maximise the effectiveness of their contribution to priority regional projects
   h) engage relevant stakeholders across the region (public and private land managers, service providers and potential risk creators), including in relevant training
   i) facilitate engagement and collaboration with invasive species researchers
   j) contribute to the delivery of statewide programs.

Strengthening regulation, compliance and enforcement for a more reliable system

DPIRD:

9. **Establish a dedicated invasive species management compliance and enforcement function in NSW Government to:**
   a) support Agriculture and Biosecurity, LLS and LCA staff to deliver a standardised approach across the full spectrum of invasive species management compliance and enforcement actions
   b) assist authorised officers in developing materials for enforcement such as Biosecurity Directions
   c) develop the underlying investigation procedures and evidence collection protocols required to undertake enforcement and deliver associated training for regional and local staff
   d) implement a targeted engagement program with public land managers
   e) support legal cases for prosecution against the *Biosecurity Act 2015*
   f) support and test more active and targeted use of the existing legislative and regulatory toolkit (for example, Biosecurity Directions, control orders, and biosecurity zones), including advice to regional coordinators and local delivery partners
   g) provide transparent public reporting on investigations, directions, enforcement actions and prosecutions, including upcoming priority programs
   h) explore and identify options for a supporting compliance and enforcement 'toolkit' to implement with landholders (for example, property lees, loans, cost recovery).

NSW Government:

10. **Remove regulatory barriers to improve biosecurity outcomes, including to:**
    a) strengthen the enforceability of the *Biosecurity Act 2015*, including but not limited to issues surrounding the enforceability of the general biosecurity duty
    b) enable the powers of Local Government authorised officers to include pest animals as well as weeds and allow for other biosecurity functions in emergency situations
    c) amend the *Companion Animals Act 1998* to enable councils to introduce cat containment policies in their local government area.

Communicating invasive species risks and impacts to expand reach of the system

DPIRD:

11. **Deliver a risk-based awareness and education program to increase public understanding of the importance of invasive species management, shared responsibilities, and how to participate. This must target:**
    a) high-risk pathways and hotspots (for example, the NSW/Qld border, major ports) and potential risk creators (for example, importers, online traders, aquariums, horticulturalists, plant nurseries, developers)
    b) 'how' the public can deliver their biosecurity duty responsibilities and participate in partnerships (for example, individually/collectively, methods of surveillance, community reporting apps and online/helpline reporting of high priority incursion species)
    c) socially-smart long and short-term campaigns (for example, quick response campaigns for emergency incursions in specific 'hot spots', well-designed and targeted social media, education on technologies, school-based campaigns)
    d) Aboriginal connections to Country, and the importance of managing the land and water holistically for it to be healthy
    e) social and behaviour change research to tailor, monitor and prioritise this investment to align with the risk reduction and value for money framework
    f) delivery through a 'one-stop shop' NSW Government portal on invasive species management and supporting regional coordination and local delivery functions.

Integrating knowledge and oversight to safeguard the system

DPIRD:

12. **Develop a NSW Invasive Species Knowledge System that is smart and responsive, including:**
    a) a dynamic research strategy developed by DPIRD in collaboration with universities, other research partners and end users, and reviewed annually by the NSW Invasive Species Committee, to:
        - identify priority research questions for investment over the next three years, focusing on incursions, risk pathways, monitoring, control methods, and future risk (for example, climate change)
        - detail requirements and standards for research, data and technology
        - improve accessibility, commercialisation and adoption of research outcomes
    b) consistent and standardised data/research collection, mapping and reporting as part of a transparent and connected system to:
        - draw together existing data platforms where possible
        - provide appropriate access to information, including mapping, on current status of key invasive species, associated management actions and their outcomes
        - include financial planning and expenditure data.
    c) an outcomes-based MERI framework that links to the *NSW Invasive Species Plan* and regional plans, including provisions to:
        - assess and identify feasible MERI methods to achieve the outcomes
        - detail how MERI outcomes will inform decision-making and adaptation
        - include metrics to value changes in environmental, cultural and social impacts of invasive species, as well as economic costs
        - guide and train staff across NSW Government agencies and partners to embed consistent outcomes-focused MERI across the system
        - identify transparent reporting requirements on outcomes
        - provide accessible data and reporting (via the NSW invasive species portal)
        - ensure oversight by state leadership
    d) independent evaluation requirements, including that the Natural Resources Commission conducts regular independent evaluations and audits of NSW invasive species management system plans, performance, MERI and outcomes.

1 The Review

1.1 Background

The NSW Premier requested through a Terms of Reference that the Commission independently review the current extent and impacts of pest animals and weeds in NSW, as well as the effectiveness of existing management strategies. This is part of the NSW Government's commitment to improve biosecurity management, including through the establishment of an Independent Biosecurity Commissioner[4] and investment in a '*strong biosecurity system to prepare and respond to threats*'.[5] The purpose of this Review is to advise the Minister for Agriculture and the Minister for the Environment on strategic opportunities to improve invasive species management, including providing advice to the Independent Biosecurity Commissioner on potential barriers to effective invasive species management that require further investigation.

1.2 Terms of Reference and scope

The Commission will advise the Minister for Agriculture and the Minister for the Environment of strategic opportunities to improve the management of invasive species in NSW across all land tenures for environmental, economic, social and cultural benefits.

The Commission has addressed the following Terms of Reference for the Review:

1 Quantify the current extent and impacts of invasive species on NSW industry, environment, and communities.

2 Identify future risks posed to NSW industry, environment, and communities by invasive species, including any which are driven by climate change impacts and impacts from natural disaster.

3 Consider existing programs and how they could better contribute to improved invasive species management outcomes in the future.

4 Audit implementation of state and regional invasive species management plans.

5 Provide advice to the Independent Biosecurity Commission on areas for further investigation regarding potential barriers to effective invasive species management.

The Review included non-native weeds and terrestrial vertebrate and invertebrate pest animals and excluded:

- native species that have pest-like impacts
- marine species
- diseases

[4] The *Biosecurity Amendment (Independent Biosecurity Commissioner) Bill 2023* was passed in November 2023 to deliver on an election commitment of the NSW Government. The Independent Biosecurity Commissioner will provide independent and impartial advice to the NSW Government to strengthen the impact and accountability of biosecurity programs for pests and weeds. They will consult with a wide range of stakeholders from across government, industry and the broader community and promote their coordination and collaboration to address the challenges of pests and weeds management. The initial priority areas of the Commissioner are enforcement approaches, communications to landholders on biosecurity obligations, involvement of Aboriginal communities, reviewing governance arrangements and structure of the state and regional committee system.

[5] NSW Government (2023) *NSW Budget 2023-24: Our plan for Regional NSW*

- governance arrangements, roles and responsibilities of regulators and public land managers
- national intergovernmental agreements.

In undertaking the Review, the Commission has collated and analysed data and existing evidence and undertaken consultation with key stakeholders, including:

- **A review of existing evidence:** including previous relevant reviews, audits and status of implementation of recommendations, current research, policy and program context, and interjurisdictional approaches.[6]
- **Stakeholder consultation:**
  - *Public submissions:* the Commission called for public submissions on the Terms of Reference in October 2023 and received 127 submissions.
  - *Key stakeholder interviews/forums:*[7] 33 interviews were conducted with 127 key identified stakeholders, with an additional four organisational briefings and an Aboriginal stakeholder forum.
- **Research and analysis:** including cost, extent and impact data analysis (current and future),[8] assessment of landscape-scale cross-tenure collective action on invasive species management,[9] NSW results of the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) national survey of land managers,[10] invasive species management program data analysis.

The approach was informed by key review questions aligned with the Terms of Reference. Key review questions comprised:

- To what extent are the NSW environment, industries and communities currently impacted by invasive species?
- To what extent do you think existing programs in NSW are effectively managing invasive species?
- What, if any, are the key barriers to effective management of invasive species?
- How has invasive species management changed since the introduction of the *Biosecurity Act 2015* legislation and associated programs and plans?
- What are the future risks posed by invasive species to the NSW environment, industries and communities?

6 This report identified contemporary strategies and highlights innovative practices for invasive species management across Australia and globally (Eco Logical Australia (2023) *Interjurisdictional analysis - invasive species management*, report prepared for the Commission).

7 Interviews carried out as part of targeted consultation were documented in comprehensive notes, but not recorded and transcribed, hence quotes are reported as 'indirect' rather than "direct" quotes.

8 Hanea, A., Moran, N., Wang, L., Li, C., Baumgartner, J., Palma, E., Camac, J., Bell, J. and Kompas, T. (2024) *Invasive Species Cost Assessment for New South Wales*, report prepared by CEBRA for the Commission.

9 This report was prepared by the University of Wollongong and presents an assessment of landscape-scale collective management actions for invasive species from the perspective of local councils and managers of utilities and infrastructure (Graham, S., Height, K. and Smart, J. (2023) *Assessment of landscape-scale cross-tenure collective action on the management of widespread invasive species*, the University of Wollongong, report prepared for the Commission).

10 This report presents custom survey results for NSW, derived from ABARES national survey of land managers. The ABARES survey focuses on pest animal and weed problems, impacts and management on agricultural land managers' properties and in their local area, and was undertaken in 2016, 2019 and 2022 (Stenekes, N., Ticehurst, J. and Arthur, T. (2024) *Pest Animal and Weed Management Survey 2016/2019/2022*, NSW land manager survey custom results, report prepared by ABARES for the Commission).

- What opportunities do you see to improve the outcomes of invasive species management in the future?

1.3 Previous reviews

The Review builds on previous statewide reviews undertaken by the Commission at the request of the NSW Government, including the:

- *Review of weed management in NSW* (2014)[11]
- *State-wide review of pest animal management* (2016).[12]

The recommendations in these reviews focused on the principle of shared responsibility and improving coordinated and evidence-based prevention, surveillance and incursion responses through a combination of state-level governance and leadership aligned with regional planning and delivery, risk-based decision-making and accountability.

These reviews helped to inform the introduction of the *Biosecurity Act 2015*[13] and *Biosecurity Regulation 2017*,[14] which initiated modernised biosecurity reforms in NSW intended to improve coordination with the national system, simplify existing policies and procedures and facilitate greater flexibility in the management of biosecurity risks.[15] The extent to which these strategic reforms have been implemented has been considered as part of this Review.

The Review has also considered recent reviews, audits and analysis of the NSW biosecurity system conducted by other agencies, including, but not limited to:

- The NSW Audit Office's performance audit on biosecurity risk management[16]
- The Department of Regional NSW's Statutory Review of the *Biosecurity Act 2015*[17]
- *NSW State of the Environment 2021* report produced by the NSW Environment Protection Authority[18]
- An independent panel review of the *Biodiversity Conservation Act 2016.*[19]

11 Natural Resources Commission (2014) *Weeds – Time to get serious: Review of weed management in NSW*
12 Natural Resources Commission (2016) *Shared Problem, Shared Solutions: State-wide review of pest animal management*
13 *Biosecurity Act 2015*
14 *Biosecurity Regulation 2017*
15 Previously, weed species were declared under the *Noxious Weeds Act 1993* (repealed), and pest animals were declared under the *Rural Lands Protection Act 1998* (repealed). Declaration of pest animal and weed species under the previous legislative approach was slow and difficult to achieve, as was making any corrections or updates once invasive species were listed. The requirements for controlling declared species were also impractical, which hampered management actions and enforcement.
16 Audit Office of NSW (2019) *NSW Auditor-General's Report to Parliament - Biosecurity risk management*
17 Department of Regional NSW (2023) *Statutory Review of the Biosecurity Act 2015*
18 NSW Environment Protection Authority (2021) *NSW State of the Environment 2021*
19 Department of Planning and Environment (2023) *Independent Review of the Biodiversity Conservation Act 2016*

2 The NSW invasive species management system

2.1 National legislative and policy settings

NSW invasive species management is integrated into a broader national biosecurity system that consists of combined federal, state and territory government legislative frameworks and responsibilities. This is underpinned by collaboration between Australian organisations, industries and communities as biosecurity partners.

The national system is underpinned by an ethos of 'shared responsibility' — where everyone, including biosecurity risk creators and beneficiaries, has a responsibility to support surveillance, prevention and responses. This ethos has been driven by national agreements, plans and governance arrangements over the past decade. The most foundational element of the national biosecurity system is the Intergovernmental Agreement on Biosecurity (IGAB), which is a formal agreement between the federal, state and territory governments on shared goals, objectives, and key biosecurity principles (see **Figure 1**).[20] The IGAB commenced in 2012 and was revised in 2019 to drive national consistency, information and knowledge sharing, engagement and partnerships with stakeholders, and continuous improvement.

i. Biosecurity is a shared responsibility between all system participants.

ii. In practical terms, zero biosecurity risk is unattainable.

iii. Biosecurity investment prioritises the allocation of resources to the areas of greatest return, in terms of risk mitigation and return on investment.

iv. Biosecurity activities are undertaken according to a cost-effective, science-based and risk-managed approach.

v. Governments contribute to the cost of risk management measures in proportion to the public good accruing from them. Other system participants contribute in proportion to the risks created and/or benefits gained.

vi. System participants are involved in planning and decision making according to their roles, responsibilities and contributions.

vii. Decisions governments make in further developing and operating our national biosecurity system should be clear and, wherever possible, made publicly available.

viii. The Australian community and our trading partners should be informed about the status, quality and performance of our national biosecurity system.

ix. Australia's biosecurity arrangements comply with its international rights and obligations and with the principle of ecologically sustainable development.

Figure 1: IGAB principles (clauses 12-20)[21]

Under the IGAB, the Australian Government is responsible for biosecurity measures before and at Australia's international border, which are managed under the Commonwealth *Biosecurity Act 2015*.[22] States and territories are responsible for domestic measures to prevent entry of pest animals, weeds and diseases from other parts of Australia,

20 Department of Prime Minister and Cabinet (2019) *Intergovernmental Agreement on Biosecurity*
21 *Ibid.*
22 *Biosecurity Act 2015*, Commonwealth.

responding to incursions in their jurisdictions, and regulating the management of pest animals, weeds and diseases established within their own borders and under their respective legislation.

The *National Biosecurity Strategy 2022-2032* provides the broader strategic roadmap for the IGAB across all government, industry and community stakeholders with the aim of building a connected and resilient national biosecurity system.[23] The strategy describes national and global pressures driving increased and changing biosecurity risks, including:

- climate change
- changing land use
- expanding global trade
- tourism and migration
- e-commerce
- loss of biodiversity
- reduced effectiveness of pesticides due to evolving resistance.

The *National Biosecurity Strategy* reinforces biosecurity management as a shared responsibility, encouraging industry, research, government partners and the community to work together to meet four strategic objectives:

1 **Prepare and prevent** – adopt innovative solutions to effectively manage future and emerging threats through improved prediction, early detection and better understanding of risk pathways.

2 **Timely and risk proportionate responses** – make informed and risk-based decisions to proportionately respond to biosecurity and food safety threats.

3 **Rapid and efficient containment** – minimise the adverse impacts of biosecurity and food safety threats on the economy, environment, and community, while also maximising product integrity and market access opportunities.

4 **Partnerships to minimise impacts** – engage stakeholders and share responsibility to minimise the impact of biosecurity and food safety threats, including exotic and endemic pests, diseases and weeds, and foodborne illness.

The *National Biosecurity Strategy* also includes six priority improvement areas:

1 Fostering a shared biosecurity culture

2 Having stronger stakeholder partnerships from local to international levels

3 Developing and sustaining a highly skilled biosecurity workforce

4 Continuing to improve coordinated emergency preparedness and response

5 Sustainable co-investment in biosecurity

6 Timely, risk-based decisions supported by integrated technology, research and data.

The National Biosecurity Committee oversees the national biosecurity system with support from component subcommittees.[24]

[23] Department of Agriculture, Fisheries and Forestry (2022) *National Biosecurity Strategy*
[24] Department of Agriculture, Fisheries and Forestry (2023) *National Biosecurity Committee*

There are three national biosecurity emergency response agreements, overseen by the National Biosecurity Committee, which provide for governments and industries to cost-share eradication programs for significant incursions into Australia. These are the:

- Emergency Animal Disease Response Agreement (EADRA)[25]
- Emergency Plant Pest Response Deed (EPPRD)[26]
- National Environmental Biosecurity Response Agreement (NEBRA).[27]

The decision to eradicate requires that the pest or disease would cause nationally significant impacts and is technically feasible to eradicate, and that the long-term benefits of doing so would substantially outweigh the cost of eradication (i.e. is cost-beneficial).

The Environment and Invasives Committee[28] reports to the National Biosecurity Committee and is the national intergovernmental committee with responsibility for weeds, vertebrate pests and environmental invertebrates, both terrestrial and non-marine aquatic.

NSW is generally assessed as progressive in its invasive species management system, with well-embedded elements of best practice aligned with the national system. Indeed, the statutory review of the *Biosecurity Act 2015* found that NSW legislation is contemporary and has been drawn on as a model by other jurisdictions.[29] However, as in this Review, it notes the system has not fully matured and issues must be addressed to realise its potential (see **Chapters 5** to **10**).

2.2 NSW legislative and policy settings

The *Biosecurity Act 2015* commenced on 1 July 2017 with the primary object to:

> '*...provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers, or potential carriers.*'[30]

Other key objects include to:

- *'Promote biosecurity as a shared responsibility between government, industry and communities*
- *Provide a framework for the timely and effective management of biosecurity risks*
- *Provide a framework for risk-based decision-making in relation to biosecurity*
- *Give effect to intergovernmental biosecurity agreements to which the State is a party*

25 Animal Health Australia (2023) *Emergency Animal Disease Response Agreement*
26 Plant Health Australia (2024) *Emergency Plant Pest Response Deed*
27 Department of Agriculture, Fisheries and Forestry (2021) *National Environmental Biosecurity Response Agreement*
28 On 14 February 2018, the cross-jurisdictional National Biosecurity Committee established the Environment and Invasives Committee. The Environment and Invasives Committee replaced the Invasive Plants and Animals Committee, whose responsibilities have now been taken on by the new Environment and Invasives Committee.
29 Department of Regional NSW (2023) *Statutory Review of the Biosecurity Act 2015*
30 *Biosecurity Act 2015*, Part 1(3). The components of biosecurity matter include; (i) pests, diseases, contaminants and other biosecurity matter that are economically significant for primary production industries; (ii) threats to terrestrial and aquatic environments arising from pests, diseases, contaminants and other biosecurity matter; (iii) public health and safety risks arising from contaminants, non-indigenous animals, bees, weeds and other biosecurity matter known to contribute to human health problems; (iv) pests, diseases, contaminants and other biosecurity matter that may have an adverse effect on community activities and infrastructure.

- *Provide the means by which biosecurity requirements in other jurisdictions can be met, so as to maintain market access for industry'*.[31]

The *Biosecurity Act 2015* was introduced to improve biosecurity risk management through a proportionate risk-based approach, introduce the concept of shared responsibility, reduce red tape and simplify existing policies and procedures.[32] A central pillar of this approach is the 'general biosecurity duty', which states that:

> *'Any person who deals with biosecurity matter or a carrier and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter, carrier or dealing has a biosecurity duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised.'*[33]

The general biosecurity duty supports the principle of shared responsibility and means everyone must do what is reasonable to prevent, eliminate or minimise biosecurity risks.[34]

The *Biosecurity Act 2015* is supported by subordinate legislation[35] and includes nine key tools for biosecurity risk management (**Figure 2**).

The NSW system is guided by the *NSW Biosecurity and Food Safety Strategy 2022-2030*, which articulates the NSW Government's responsibilities for biosecurity within the national framework.[36] The system includes component regulation, education and compliance programs and a wide range of partnership agreements and plans. **Figure 3** shows the intended governance and key documents in the NSW invasive species management system, noting that the actual operation of these components and relationships varies in practice (see **Chapter 5**).

The *NSW Invasive Species Plan* aligns with the strategy and adopts four goals and associated strategies to help guide investment and resource allocation for invasive species prevention and management activities in NSW.[37] The strategies are designed to help prevent new incursions, eliminate or contain existing populations and effectively manage already widespread invasive species. Its scope includes weeds, vertebrate pests and invertebrate pests in terrestrial, freshwater and marine environments. Regional strategic weed management and pest animal management plans align with the *NSW Invasive Species Plan,* as well as other relevant local invasive species management plans as shown above.

31 *Biosecurity Act 2015*, Part 1(3).
32 The *Biosecurity Act 2015* replaced 11 whole Acts and parts of another three Acts of biosecurity-related legislation.
33 *Biosecurity Act 2015*, Part 3(22).
34 Department of Primary Industries (2016) *What does the General Biosecurity Duty Mean?*
35 This includes the *Biosecurity Regulation 2017*, *Biosecurity (National Livestock Identification System) Regulation 2017* and *Biosecurity Order (Permitted Activities) 2019*
36 Department of Regional NSW (2022) *NSW Biosecurity and Food Safety Strategy 2022-2030*
37 Department of Primary Industries (2023) *NSW Invasive Species Plan 2023-2028*

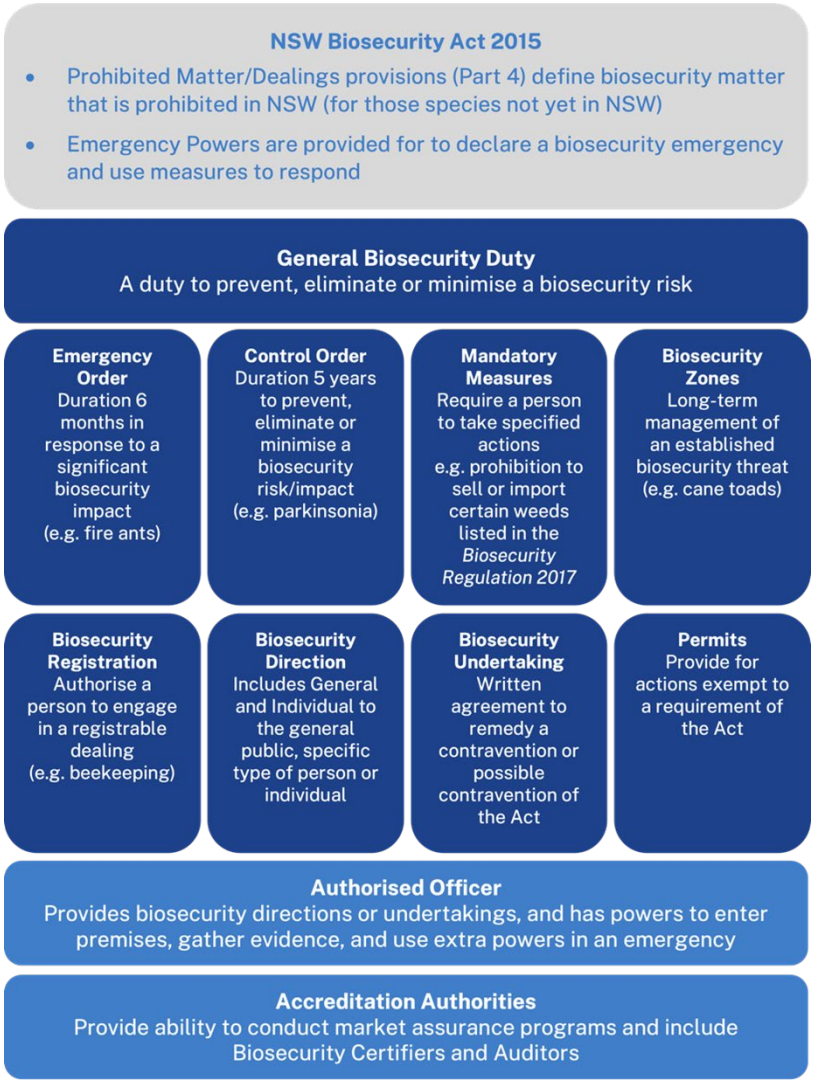

Figure 2: Overview of the *Biosecurity Act 2015* and key tools

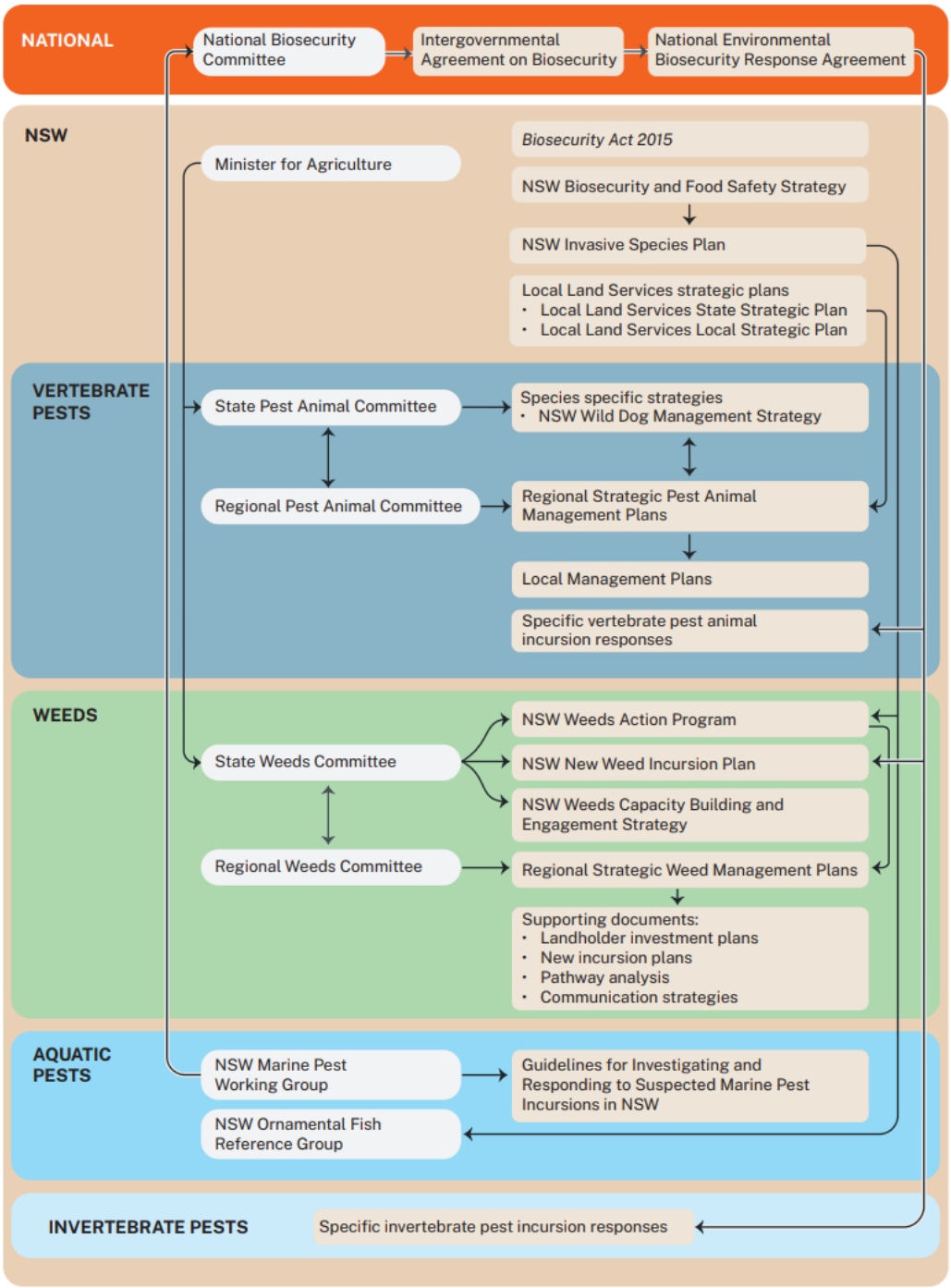

Figure 3: NSW invasive species management system governance and guiding documents[38]

[38] Figure adapted from Department of Primary Industries (2023) *NSW Invasive Species Plan 2023-2028*. Note: this figure excludes aquatics due to the limited scope of this Review.

2.2.1 Audit of regional and state invasive species management in NSW

Planning implements such as the *NSW Invasive Species Plan* and regional plans are only valuable if they are implemented. Considering this, the Terms of Reference also required the Commission to undertake an audit of the implementation of current state and regional invasive species management plans. The following audits have been completed by the Commission:

- **Audit of the implementation of the key deliverables of the *NSW Invasive Species Plan 2018-2021* by the responsible agencies**[39] – Agriculture and Biosecurity was the lead responsible agency under this audit. Other agencies with responsibilities under the Plan included LLS and DCCEEW. The audit was undertaken as a limited assurance audit and conducted in line with relevant Australian assurance standards.

  The state audit found that almost all 42 key deliverables under the plan had either been successfully implemented (noting some significant delays) or progressed to some extent. Achievements included supporting the implementation of the *Biosecurity Act 2015* and regulation, the expansion of the NSW Weeds Biological Control Taskforce and DCCEEW meeting or exceeding its control targets on national parks. However, on balance, the Commission considered that Agriculture and Biosecurity, as the author of the plan as well as the lead agency responsible for most of the deliverables, had not implemented in full its responsibilities for state invasive species management.

  The audit identified opportunities to improve invasive species management in NSW and made recommendations to Agriculture and Biosecurity and other responsible agencies, including key deliverables that should be high priority. These concerned the lack of formal processes or governance to support pest animal incursions, fragmented biosecurity information systems, and limited monitoring, evaluation and reporting for key deliverables.

- **Audit of the implementation of three regional strategic weed management plans and three regional strategic pest animal management plans**[40] – LLS was the auditee. Testing focussed on the year 2022-23 and the regions of the Central West, Hunter and Northern Tablelands for pest animal management, and the North Coast, North West and Riverina for weed management. The audit was undertaken as a limited assurance audit and conducted in line with relevant Australian assurance standards.

  The regional audit found that LLS had delivered many aspects of its pest animal and weed management functions efficiently and effectively, including diverse stakeholder participation, a cross-tenure focus, a well-established weed risk assessment process and mitigation of impacts to biodiversity, landscape health and primary industries. However, the Commission found that overall, LLS had not implemented in full its responsibilities for regional pest animal and weed management. The Commission's recommendations to LLS focussed on key issues, including limited compliance and enforcement activities, a lack of regional surveillance and inspection processes for pest animals, and limited outcome-focussed monitoring, evaluation, reporting and improvement.

A full list of findings and recommendations is provided in the state and regional invasive species management audit reports, with discussion of the audit findings also included throughout this report as relevant, particularly as part of the evaluation of the current system in **Chapters 5** to **10**.

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39 Natural Resources Commission (2024) *Audit of state invasive species management in NSW - Independent assurance report*.

40 Natural Resources Commission (2024) *Audit of regional invasive species management in NSW - Independent assurance report*.

2.3 Roles and responsibilities

Under the *Biosecurity Act 2015*, the lead agency for invasive species in NSW is Agriculture and Biosecurity within DPIRD. Machinery of Government changes occurred during the period of this Review during which the Department of Regional NSW became DPIRD. The Department of Primary Industries within the Department of Regional NSW was split into Agriculture and Biosecurity and Fisheries and Forestry divisions within DPIRD. This saw the invasive species management functions of the Department of Primary Industries move to the new Agriculture and Biosecurity division on 1 July 2024. The Review refers to Agriculture and Biosecurity throughout the analysis and reporting.

The key responsibilities of Agriculture and Biosecurity include taking direct actions, such as invasive species emergency responses, and leading the response to invasive species risks, particularly through collaboration with stakeholders across government, industry, and the wider community. Agriculture and Biosecurity's key partners in delivering its biosecurity responsibilities are LLS and local governments.

Like Agriculture and Biosecurity, LLS sits within DPIRD. Each of the 11 LLS regions is responsible for developing and implementing strategies to manage pest animals and weeds within their region.[41] They are also responsible for providing operational assistance to Agriculture and Biosecurity in responding to new reports of pest animals or weeds in their regions and staffing local emergency control centres when an emergency response is triggered. LLS is also a public land manager, responsible for managing approximately 530,000 hectares of travelling stock reserves, a large component of which comprises invasive species management.

Local government has a specific role in weed management being designated LCAs for weed management under the *Biosecurity Act 2015*.[42] The primary functions of LCAs under the Act are to:

- prevent, eliminate, minimise and manage biosecurity risks posed or likely to be posed by weeds
- develop, implement, coordinate and review weed control programs
- inspect land in connection with its weed control functions
- keep records about the exercise of the LCAs' functions under the Act and report these to the Secretary.

Local governments also have responsibilities for managing invasive species on land they own, occupy or manage.

There are also several related responsibilities for NSW invasive species management that fit under distinct legislation. DCCEEW has responsibilities to mitigate the impacts of invasive species on biodiversity under the *Biodiversity Conservation Act 2016*.[43] Of the 39 key threatening processes listed under the Act, 22 of them are invasive species and more than 70 percent of threatened species in NSW are impacted by invasive species.[44]

41 Machinery of Government changes have also seen LLS transition from the Department of Regional NSW to DPIRD during the period of the review. This change came into effect on 1 July 2024.
42 The council of a Local Government Area is the LCA for land within that area unless the weed control functions for that area have been conferred on a county council or joint organisation, who then become the LCA (see *Biosecurity Act 2015*, Section 70).
43 *Biodiversity Conservation Act 2016*
44 NSW Environment Protection Authority (2021) *NSW State of the Environment 2021*

The *Biodiversity Conservation Act 2016* also requires the establishment of a 'Biodiversity Conservation Program' to maximise the long-term security of threatened species, and to minimise the impacts of key threatening processes.[45] This program is the Saving our Species program, which identifies and implements actions to protect threatened species and communities at priority sites across NSW. Over 70 percent of priority sites involve invasive species management as a primary action.[46] Invasive species management will be a key component of the 'nature positive' approach of the NSW plan for nature.[47]

NPWS sits within DCCEEW and also has responsibilities for invasive species management under the *National Parks and Wildlife Act 1974*.[48] NPWS manages an estate that covers over seven million hectares (more than 9 percent of NSW).[49] Under the Act, it must undertake invasive species management to conserve biodiversity on the NPWS estate, as well as ensuring that invasive species management programs are coordinated across different tenures relevant to the social and economic context of each NPWS estate park or reserve.

The actual delivery of this system of roles and responsibilities is a key focus of the Review, and is evaluated generally in terms of its efficiency, effectiveness and impact in **Chapters 5** to **10**.

45 *Biodiversity Conservation Act 2016*
46 DCCEEW (2024) *Saving our Species Conservation Strategies*
47 The Cabinet Office (2024) *NSW plan for nature; NSW Government response to the reviews of the Biodiversity Conservation Act 2016 and the native vegetation provisions of the Local Land Services Act 2013*
48 *National Parks and Wildlife Act 1974*
49 NPWS (2024) *About NSW National Parks and Wildlife Service*

3 What is the extent and impact of invasive species?

Invasive species are widespread across NSW. While individual species have differing levels of extent and impact, the cumulative effects are complex and substantial. Invasive species are one the of the greatest threats to biodiversity and agricultural production and can also have significant social (including health) impacts.

These impacts have a range of tangible effects on the people and environment of NSW. To allow assessment and comparison of different types of impacts, these effects are often translated into a financial cost to the NSW economy. These costs have two main components:

- management expenditure – the financial outlay of controlling the invasive species
- residual losses – the financial cost associated with the impacts of not controlling invasive species.

While many of the real-world impacts of invasive species are understood, they can be difficult to evaluate quantitatively in terms of their financial cost. For example, determining the financial cost of impacts to agriculture is relatively straightforward, but attributing an equivalent financial cost to environmental and social impacts is more complex and remains severely underestimated.

Key Findings

- More than 340 weed and 40 pest animal species cause extensive impacts to the NSW economy, environment, and communities.
- Considered separately, widespread pest animals, such as feral cats and foxes, have a far greater extent and impact than any single weed species, and their impacts are more prominent. However, the overall number of weed species is larger than pest animal species and their combined impacts and associated costs are also much greater.
- Invasive species are everywhere and not all their impacts can be effectively managed. Therefore, invasive species management must use a prioritised approach based on the feasibility of reducing the risk of impacts. The prioritisation approach used is heavily dependent on where the invasive species are on the invasion curve (how established they are).
- The financial cost of invasive species in NSW has been estimated to be at least $1.9 billion, but this is likely to underestimate the public expenditure on management and cost of environmental impacts. Significant improvements in the collection, collation and analysis of expenditure data and cost of impacts (particularly non-market) will be required to produce more reliable estimates.

3.1 The overall extent of invasive species in NSW

Pest animals and weeds, collectively known as invasive species, are animal and plant species that have been introduced to NSW either accidentally or deliberately, and their establishment and spread have the potential for adverse economic, environmental and social impacts.[50]

Although there were some early accidental introductions, the first major introduction of invasive species in Australia was with the First Fleet landing in Sydney Harbour on 26 January 1788.[51] This included domestic animals such as pigs (*Sus scrofa*), goats (*Capra hircus*) and cats (*Felis catus*), which subsequently escaped and became feral, as well as wild animals that escaped the ships, such as black rats (*Rattus rattus*), brown rats (*Rattus norvegicus*) and house mice (*Mus musculus*).

Over the following 230 years, subsequent invasive species have either escaped domestic use (for example, ornamental plants) or have been wild species that have been transported (for example, parthenium, *Parthenium hysterophorus*). In addition, some wild species have also been deliberately introduced for purposes such as attempted biological control (for example, cane toads, *Rhinella marina*), landscape remediation (for example, bitou bush, *Chrysanthemoides monilifera* subsp. *rotundata*) and hunting (for example, foxes, *Vulpus vulpus*).

Since 1788, more than 1,750 introduced species of plant have established populations in NSW, with over 340 of these plant species recognised as weeds that have negative environmental, economic and social impacts.[52] Over the same period, more than 64 introduced species of animal have established populations in NSW, with 40 of these being recognised as pest animals having negative environmental, economic and social impacts.[53]

Invasive species occur across all of NSW, although there is a trend of more species being present on the coast and fewer in the west (see **Figure 4** and **Figure 5**).[54] However, this does not necessarily mean invasive species impacts are greater in the coastal areas. For example, invasive species can have more impacts in lower-productivity landscapes such as the arid areas of western NSW. Further, a single high-density invasive species in one location may have greater impacts than multiple invasive species occurring with the same combined overall density in another location.

Invasive species are everywhere and not all their impacts can be managed. A prioritised management approach is needed based on available funding and the feasibility of reducing the risks of impacts. Prioritisation will also be heavily dependent on where the invasive species are on the invasion curve, which indicates how established a species is (see **Figure 6**).[55] The following **Sections 3.1.1**, **3.1.2** and **3.1.3** each detail the extent and best practice management of species across the key parts of the invasion curve.

50 Department of Primary Industries (2023) *NSW Invasive Species Plan 2023-2028*
51 *Ibid*.
52 Downey, P.O., Scanlon, T.J. and Hosking, J.R. (2010) *'Prioritising weed species based on their threat and ability to impact on biodiversity: A case study from New South Wales'*, *Plant Protection Quarterly*, 25, pp. 111–26.
53 Invasive Animals Cooperative Research Centre (2008) *Risk assessment models for establishment of exotic vertebrates in Australia and New Zealand*; NSW Environment Protection Authority (2021) *NSW State of the Environment; Invasive Species*
54 Department of Planning, Industry and Environment (2021) *Assessing invasive alien species pressures on biodiversity in New South Wales, Biodiversity Indicator Program Implementation Report*; DCCEEW (2024) *NSW biodiversity outlook report 2024; Status and trends of biodiversity and ecological integrity*
55 Department of Primary Industries (2023) *NSW Invasive Species Plan 2023-2028*

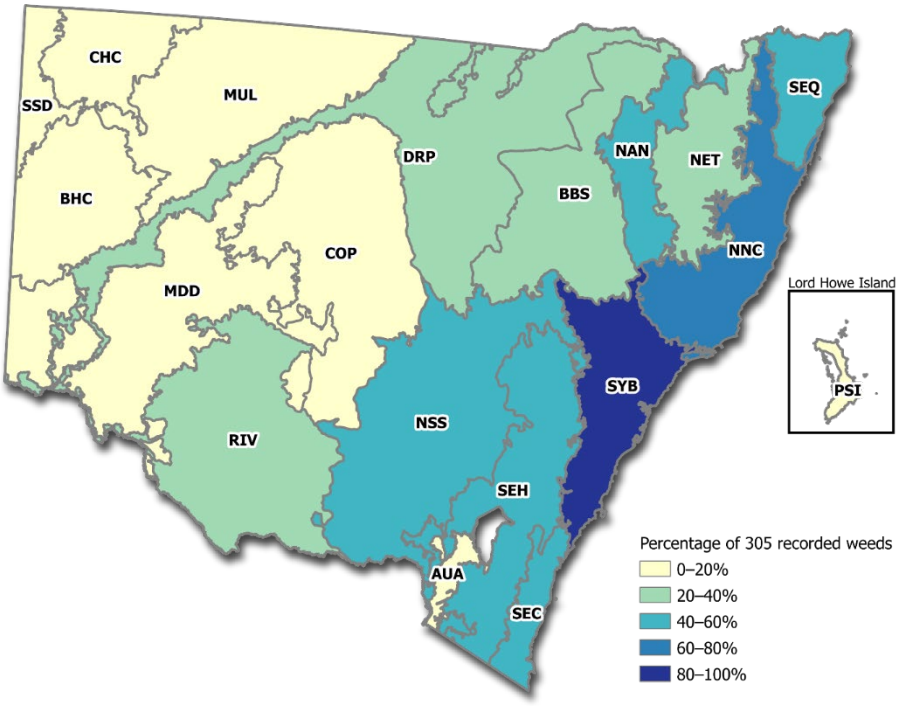

Figure 4: Percentage of weeds recorded within NSW bioregions from 1980 to 2017[56]

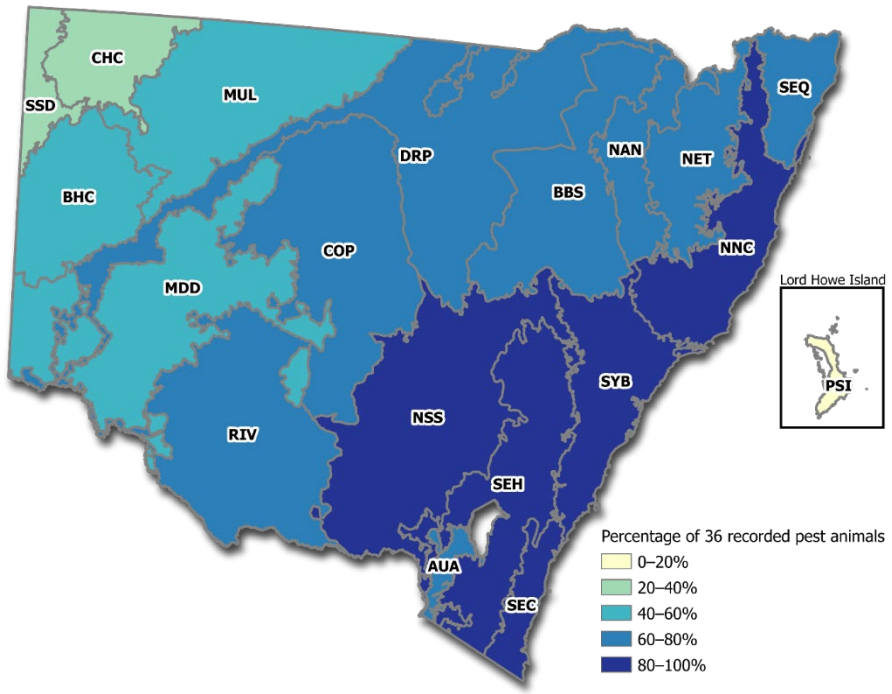

Figure 5: Percentage of pest animals recorded within NSW bioregions from 1980 to 2017[57]

[56] Percentage of 305 weeds recorded across NSW. Adapted from Department of Planning, Industry and Environment (2021) *Assessing invasive alien species pressures on biodiversity in New South Wales, Biodiversity Indicator Program Implementation Report*. Source: DCCEEW (2024) *NSW biodiversity outlook report 2024; Status and trends of biodiversity and ecological integrity*

[57] Percentage of 36 pest animals recorded across NSW. Adapted from *Ibid.*

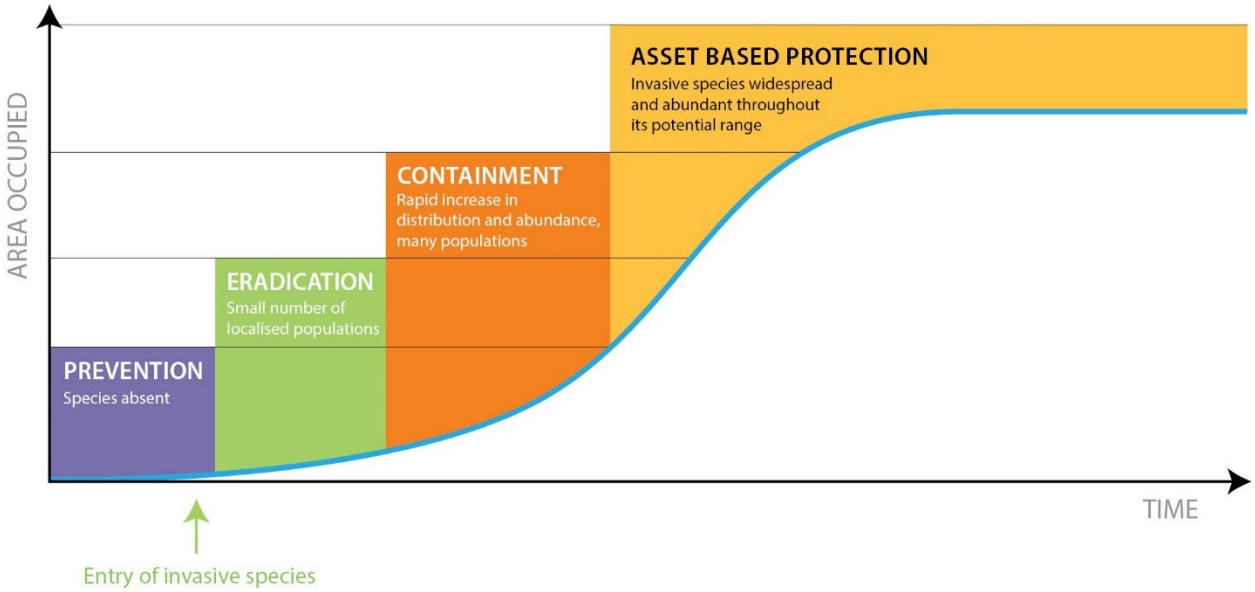

Figure 6: Generalised invasion curve[58]

3.1.1 Widespread species and asset-based protection

The cumulative impacts of invasive species are complex and interactive. Considered individually, widespread pest animals, such as feral cats and foxes, have a far greater extent and impact than individual weed species. However, the overall number of weed species is much greater than pest animal species and their combined impact is broader.[59] This is reflected in the cost estimates discussed in **Section 3.3**.

The extent of many widespread invasive species is relatively stable. These species have either reached the limits of their geographic range or are constrained by other factors. Their distribution and abundance fluctuate according to climatic seasonality and management programs, but they remain comparatively constant over longer-time periods.

Table 3 shows the most widespread weeds and pest animals in NSW, which are also depicted in the maps shown in **Figure 7** and **Figure 8.**

58 Department of Primary Industries (2018) *NSW Invasive Species Plan 2018-2021*, p. 11, curve sourced from Biosecurity Victoria.
59 NSW Environment Protection Authority (2021) *NSW State of the Environment; Invasive Species*

Table 3: The most widespread weeds and pest animals in NSW[60]

Name	Spatial extent (%)
Weeds	
Paterson's curse (*Echium plantagineum*)	9
Sweet briar (*Rosa rubiginosa*)	5
Saffron thistle (*Carthamus lanatus*)	5
Lantana (*Lantana camara*)	5
Horehound (*Marrubium vulgare*)	5
Prickly pear (*Opuntia* spp.)	5
Blackberry (*Rubus fruticosus* aggregate)	4
African boxthorn (*Lycium ferocissimum*)	4
Fireweed (*Senecio madagascariensis*)	4
Pest animals	
Red fox (*Vulpus vulpus*)	99
Feral cat (*Felis catus*)	98
Rabbit (*Oryctolagus cuniculus*)	82
Feral pig (*Sus scrofa*)	70
Feral goat (*Capra aegagrus hircus*)	47
Wild dog (*Canis familiaris*)	46

60 Adapted from: Department of Planning, Industry and Environment (2021) *Assessing invasive alien species pressures on biodiversity in New South Wales, Biodiversity Indicator Program Implementation Report*

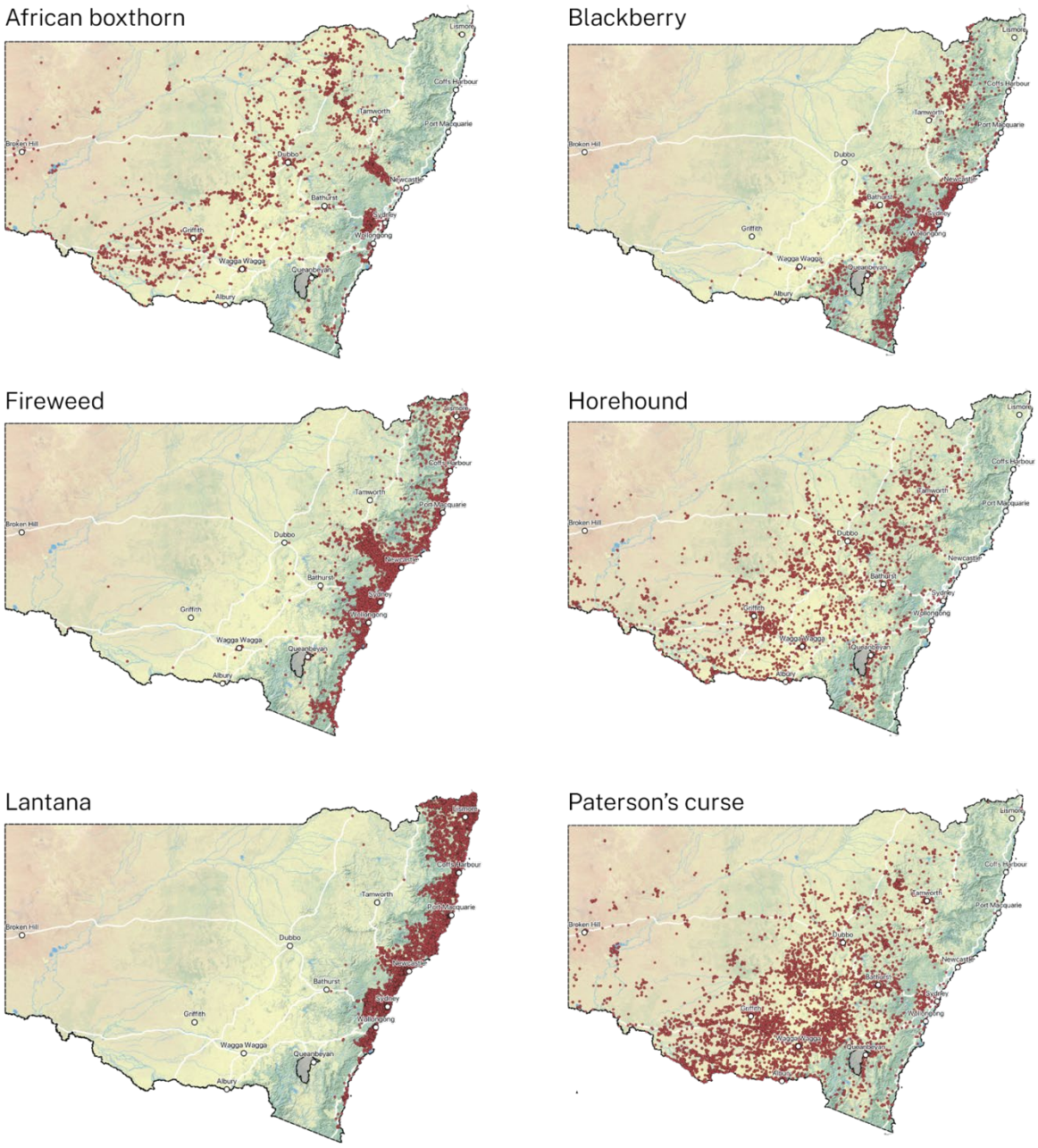

Figure 7: The most widespread weeds in NSW[61]

[61] Data sourced from the *Atlas of Living Australia*

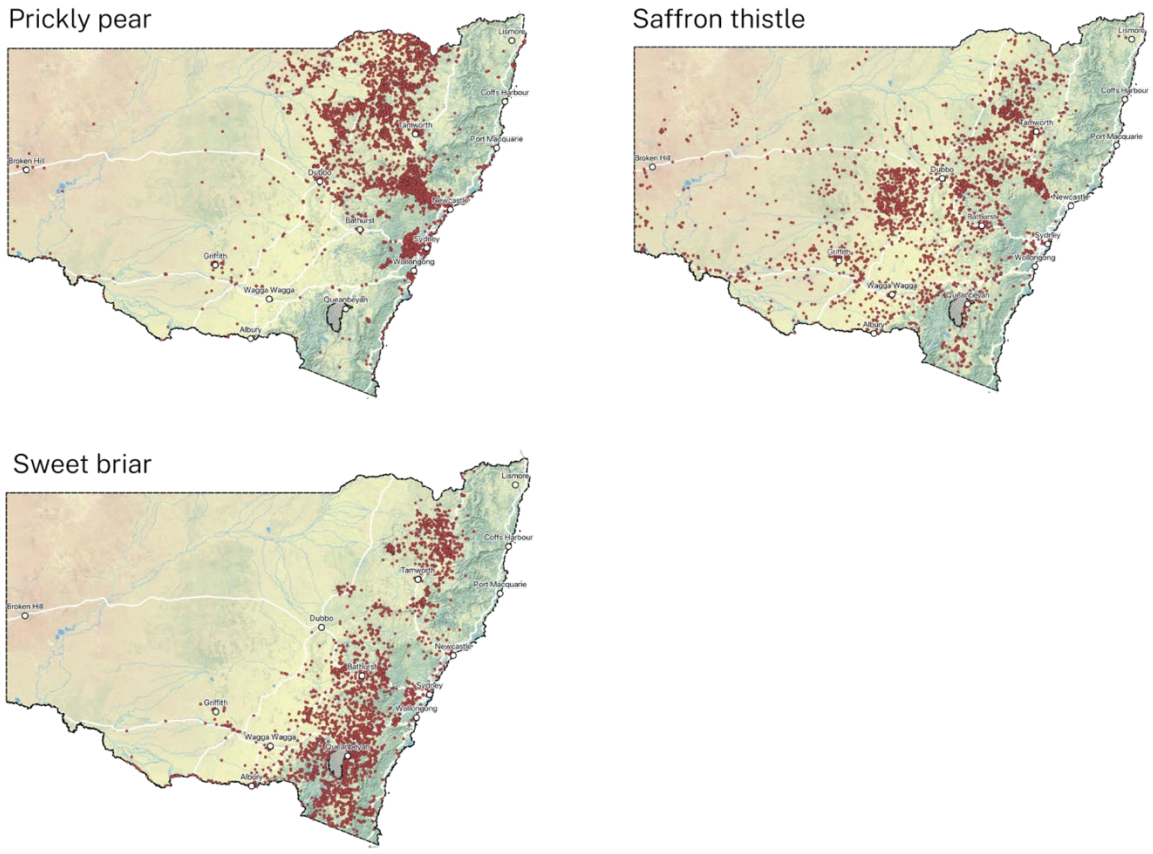

Figure 7 cont.: The most widespread weeds in NSW[62]

[62] Data sourced from the *Atlas of Living Australia*

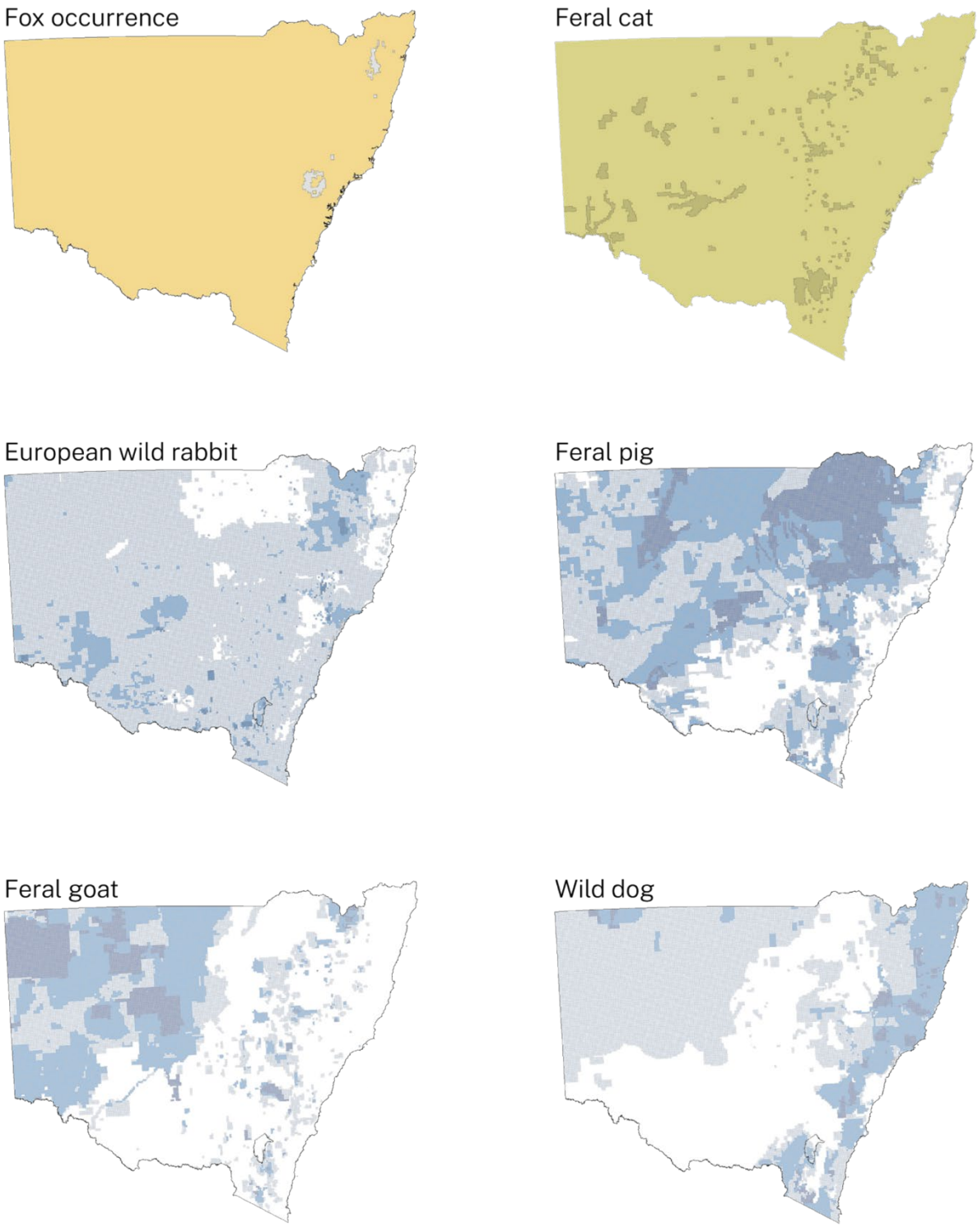

Figure 8: The most widespread pest animals in NSW[63]

63 Maps sourced from Agriculture and Biosecurity's *Distribution maps for vertebrate pests*

Asset-based protection to manage the impacts of widespread species

Widespread invasive species have the greatest overall impact but return on investment in their management is generally lower (based on the reduction in risks versus the resources required to undertake management).

In this context, management actions must focus on the protection of high value assets (environmental, agricultural, community or cultural) to maximise risk reduction.[64] This involves identifying and prioritising sites for control based on the:

- value and condition of high-priority assets at the location
- level of impact by invasive species
- feasibility of control
- likelihood that control will lead to an improvement in condition.[65]

This assessment requires a holistic approach that considers:

- the cumulative effects of all invasive species at the sites
- whether the same techniques can be used to target multiple species at once
- the consequences of undertaking control.

Both the invasive species and high-value assets need to be monitored to ensure the level of control results in the desired protection of the assets.

Widespread invasive species and any associated management programs are identified in the regional strategic weed and pest animal management plans and addressed in the *Biosecurity Act 2015* through the general biosecurity duty (see detailed discussion in **Section 8.2**).

The development of biological control agents can improve management return on investment for widespread species. Biological control involves the deliberate introduction of one or more natural enemies (biocontrol agents) sourced from the invasive species' native range.[66] Biological control can be extremely effective in reducing the density of widespread species across the range of their distribution, as has been the case for European rabbits (*Oryctolagus cuniculus*),[67] prickly pear, horehound and Paterson's curse.[68] However, developing biological control agents is neither quick or easy, and often agents cannot be found to meet the criteria of effective and safe deployment.[69]

64 Department of Primary Industries (2023) *NSW Invasive Species Plan 2023-2028*
65 Department of Primary Industries and Office of Environment and Heritage (2011) *Biodiversity priorities for widespread weeds; Statewide framework*
66 Centre for Invasive Species Solutions (2023) *National Weed Biocontrol Pipeline Strategy; A Roadmap to guide Australia's future weed biocontrol research, development, and extension*
67 CSIRO (n.d.) *Biological Control of Rabbits*
68 Department of Primary Industries (2024) *NSW WeedWise*
69 The process of developing biological controls involves searching for suitable candidate biocontrol agents, rigorous risk assessment to ensure there are no risks to native and other valuable non-target species, extensive testing to ensure both effectiveness on the target invasive species and no adverse impacts on non-targets, and then mass release and distribution of the agent (Centre for Invasive Species Solutions (2023) *National Weed Biocontrol Pipeline Strategy; A Roadmap to guide Australia's future weed biocontrol research, development, and extension*)

3.1.2 Limited distribution species and containment-based management

Although many invasive species are long established and widespread, others are more recent arrivals or have had their distribution otherwise restricted. For these species, there is still potential for them to significantly increase in extent and impact in the future. Examples include bitou bush, alligator weed (*Alternanthera philoxeroides*), water hyacinth (*Eichhornia crassipes*), Hudson pear (*Cylindropuntia pallida*), sticky nightshade (*Solanum sisymbriifolium),* cane toads, deer (*Cervidae spp.*), horses (*Equus caballus*), donkeys (*Equus asinus*) and camels (*Camelus dromedarius*). These are shown in **Figure 9** and **Figure 10**.

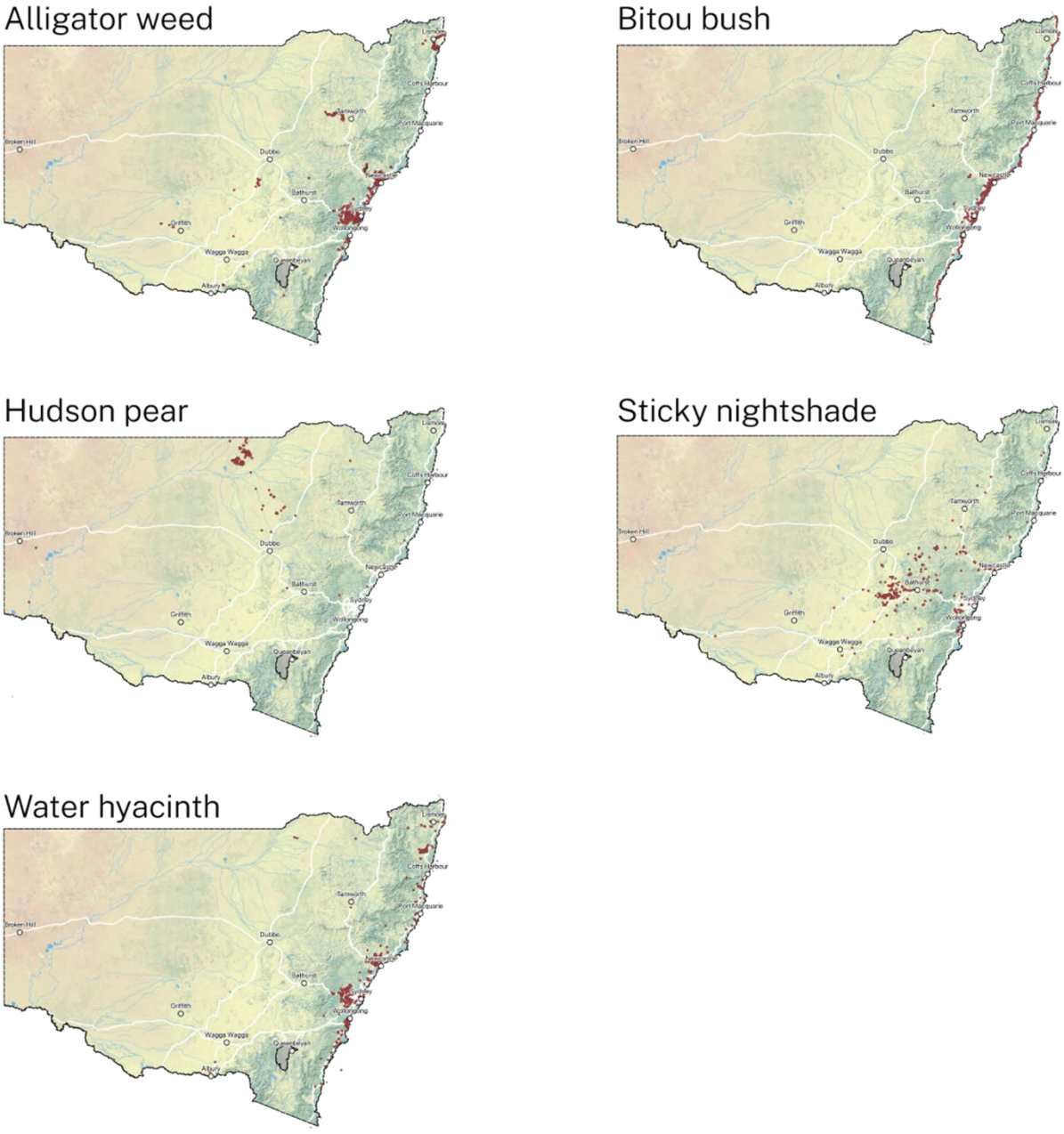

Figure 9: Limited distribution weeds in NSW[70]

[70] Maps sourced from Agriculture and Biosecurity (2024) *Biosecurity Information System (Weeds)*

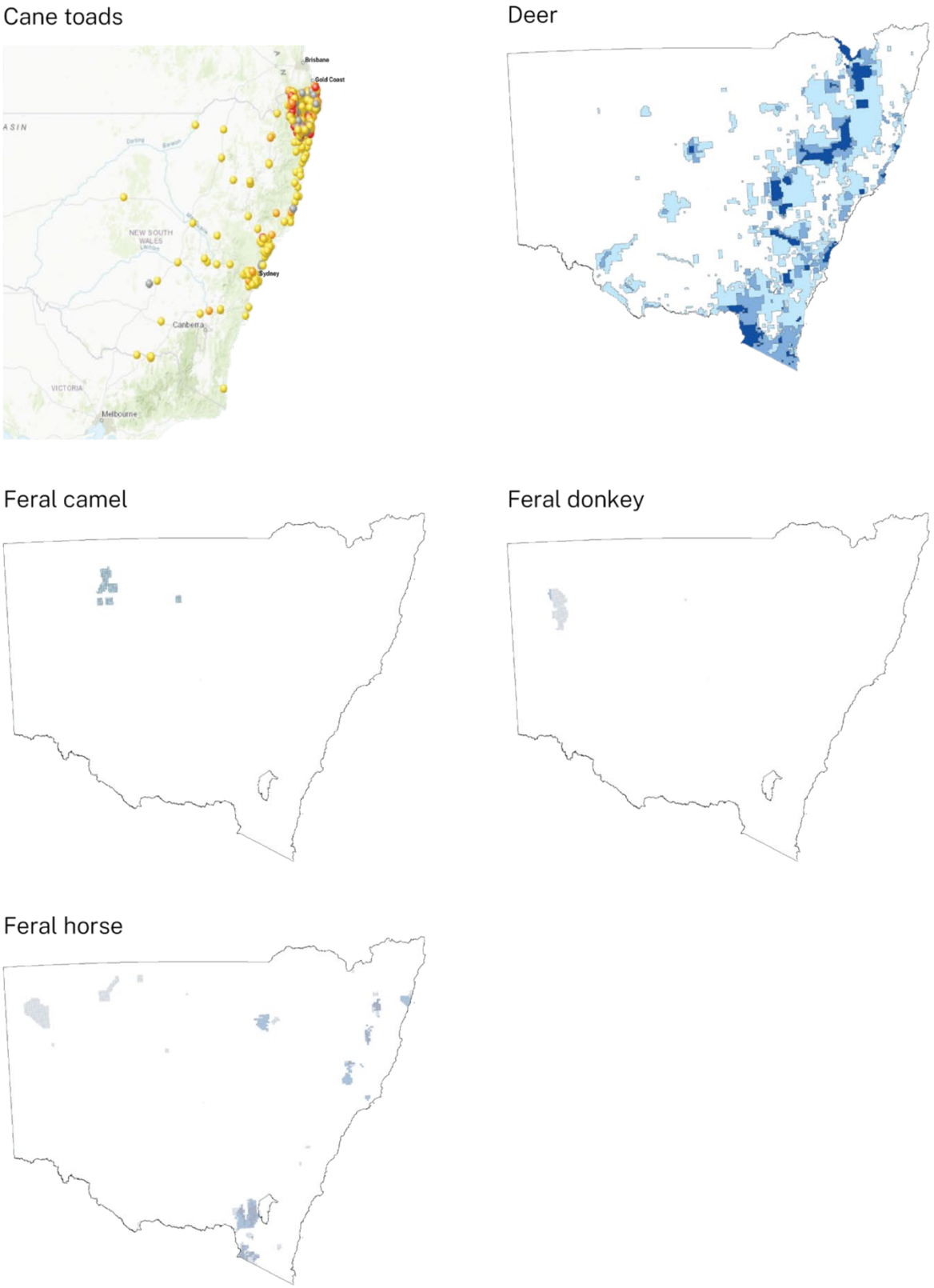

Figure 10: Limited distribution pest animals in NSW[71]

[71] Maps sourced from Agriculture and Biosecurity *Distribution maps for vertebrate pests*

The containment-based approach to managing limited distribution species

The management of limited distribution species requires a containment approach. This involves identifying core areas and non-core areas defined by containment lines or zones. Core areas are where the invasive species is widespread and long-established, with a relatively continuous distribution.[72]

Within core areas, management is focused on asset protection and biological control, as outlined above.[73] In non-core areas, management focusses on responding to all reports and removing all infestations to the point of eradication within the containment zone or lines. Where this can be achieved, the size of the core areas may be reduced by moving the containment zone or line to continue the eradication of the new outlying infestations and slowly reduce the size of the core areas.[74] This approach combines the benefits of maximising the reduction in risk of impacts through asset protection within core areas, and minimising the likelihood of any impacts outside the core areas by completely removing them. **Figure 11** below show examples of the core areas and containment lines or zones for bitou bush, cane toads, alligator weed and water hyacinth.

Note that some containment programs are identified as biosecurity zones under the *Biosecurity Act 2015* (for example, bitou bush, alligator weed, water hyacinth, and cane toads), while others are identified in regional strategic weed and pest animal management plans and addressed in the Act through the general biosecurity duty (see **Chapter 8** for further discussion of these approaches).

72 Department of Primary Industries (2007) *Alligator weed control manual; Eradication and suppression of alligator weed (Alternanthera philoxeroides) in Australia*

73 Department of Primary Industries and Office of Environment and Heritage (2011) *Biodiversity priorities for widespread weeds; Statewide framework*

74 Department of Primary Industries (2007) *Alligator weed control manual; Eradication and suppression of alligator weed (Alternanthera philoxeroides) in Australia*

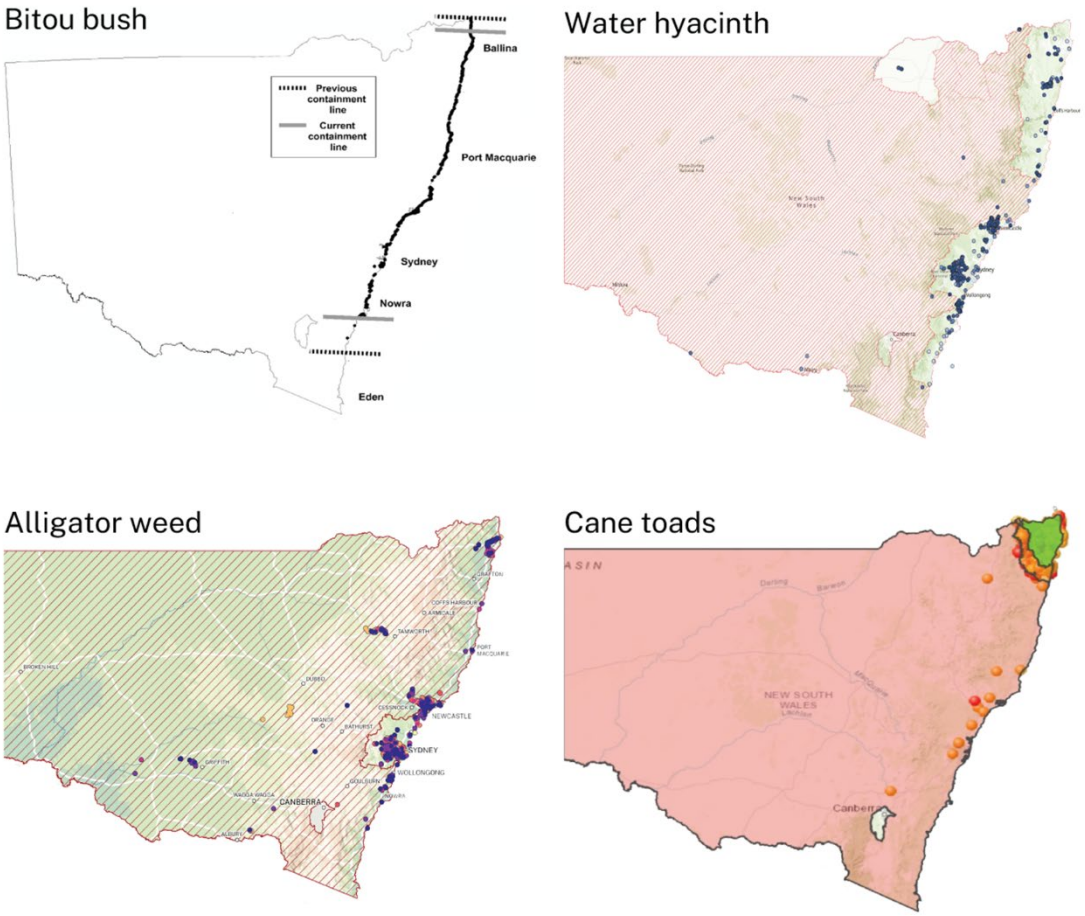

Figure 11: Core areas and containment lines and zones for invasive species in NSW[75]

3.1.3 Isolated infestations and eradication

Although most invasive species in NSW are too well-established to consider eradication, it is the most effective management response where possible, particularly where a new incursion or confirmed establishment has a defined and limited distribution. The definition of eradication is the complete and permanent removal of an invasive species, including all individuals and propagules, from a defined area that has little or no likelihood of re-invasion.[76]

Priority species with potential for eradication in NSW include black knapweed (*Centaurea nigra*), orange hawkweed (*Pilosella aurantiaca*), mouse-ear hawkweed (*Hieracium pilosella*), parthenium, parkinsonia (*Parkinsonia aculeata*), tropical soda apple (*Solanum viarum*), red imported fire ants (*Solenopsis invicta*) and red-eared slider turtles (*Trachemys scripta elegans*). These are highlighted in **Figure 12** and **Figure 13**.

75 Maps sourced from Agriculture and Biosecurity
76 Department of Primary Industries (2023) *NSW Invasive Species Plan 2023-2028*

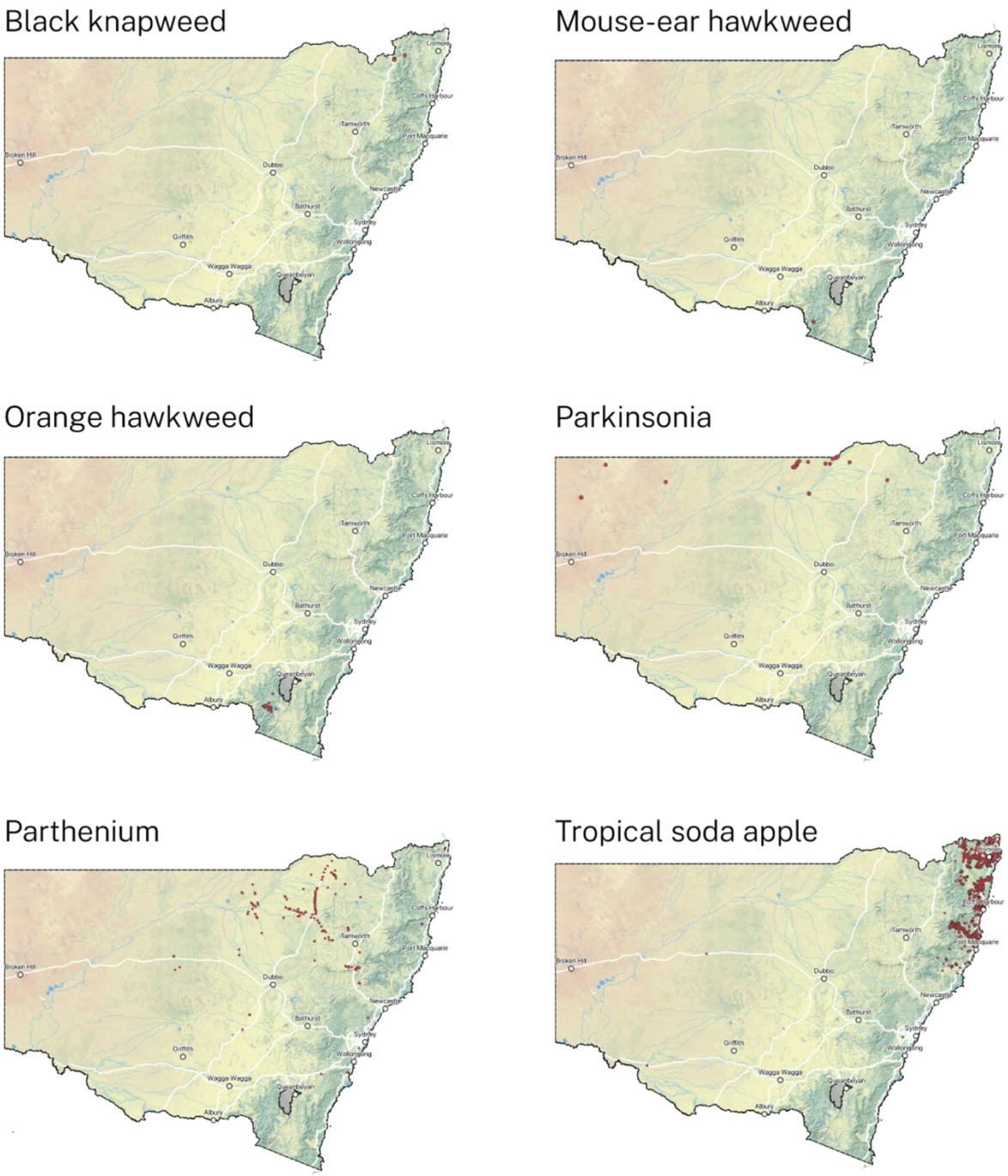

Figure 12: Priority weed species with potential for eradication in NSW[77]

[77] Maps sourced from Agriculture and Biosecurity (2024) *Biosecurity Information System (Weeds)*

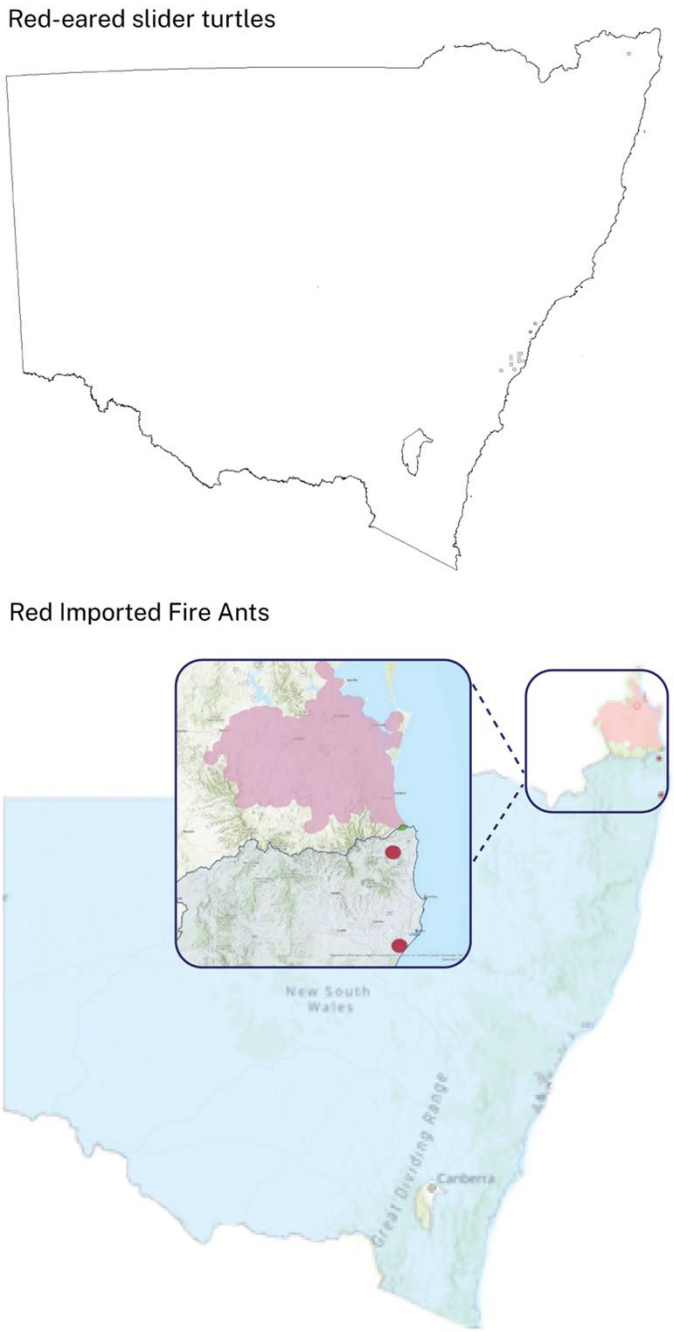

Figure 13: Priority pest animal species with potential for eradication in NSW [78]

Eradication as the goal of isolated species management

Eradication is the management goal for isolated species as, once achieved, resources can be reallocated elsewhere. However, eradication can be extremely costly in the short term and must be properly assessed. It is only achievable if:

- programs are adequately funded and resourced
- lines of authority are clear with commitment from all stakeholders
- the biology of the target species and adequate control procedures are known

[78] Maps sourced from Agriculture and Biosecurity *Distribution maps for vertebrate pests, Map of red imported fire ant infestations*

- reinvasion is prevented
- the target is detectable at relatively low densities.[79]

If any of these criteria cannot be met, then the program needs to transition to a containment program as a more cost-effective approach to management.

Incursions into NSW may have been previously listed as prohibited matter under the *Biosecurity Act 2015*. The species that have triggered an eradication response as prohibited matter include black knapweed, mouse-ear hawkweed, parthenium and red imported fire ants. Additional legislative tools may be used to contribute to eradication efforts, with examples to date including:

- the NSW *Biosecurity (Fire Ant) Emergency Order (No 7) 2024*, which was issued to prevent the movement of materials potentially carrying red imported fire ants into and within NSW[80]
- the *Biosecurity Order (Permitted Activities) 2019*, which requires vehicles, equipment and grain harvesting machinery from Queensland to be appropriately cleaned and inspected prior to entering NSW to prevent the introduction of additional parthenium material[81]
- control orders for parkinsonia and tropical soda apple.

Of course, if a potentially invasive species is identified outside of NSW, prevention is the goal where possible.[82] If species are successfully prevented from entering and establishing in NSW, the potential impacts of the species on the environment, industry and communities can be avoided altogether. Prevention activities also have the advantage of potentially applying to numerous species. For example, good vehicle hygiene and washdown procedures to prevent weed seed spread or teaching the public to look out for and report unusual species can apply to a wide variety of potential novel invasive species.[83] However, as soon as a species is detected in sufficient numbers to potentially establish itself (rather than being an isolated incident), this should trigger processes to assess the risk of a species and whether an eradication program is feasible, or another management approach is required.[84]

79 Myers, J.H., Simberloff, D., Kuris, A.M. and Carey, J.R. (2000) 'Eradication revisited: dealing with exotic species', *Trends in Ecology and Evolution*, 15(8), pp. 316-320.
80 *Biosecurity (Fire Ant) Emergency Order (No 7) 2024*
81 Department of Primary Industries (n.d.) *Parthenium – our greatest threat*
82 Department of Primary Industries (2023) *NSW Invasive Species Plan 2023-2028*, p. 22.
83 Department of Planning, Industry and Environment (2020) *Hygiene guidelines; Protocols to protect biodiversity areas in NSW from* Phytophthora cinnamon, *myrtle rust, amphibian chytrid fungus and invasive plants*
84 Department of Primary Industries (n.d.) *NSW Weed Risk Management system – Background Information*

3.2 The extensive impacts of invasive species

3.2.1 Environmental impacts

Invasive species are implicated in the decline and extinction of many native species.[85] After land clearing, invasive species pose the greatest threat to threatened biodiversity in NSW (**Figure 14**) and are the primary threat where the impact of land clearing has been mitigated, such as in the national parks estate, other protected areas, and areas under private conservation agreements.[86]

Over 70 percent of threatened species and communities in NSW are believed to be impacted by invasive species.[87] This is correlated with the priority sites protecting threatened species and communities under the Saving our Species program, 70 percent of which designate invasive species management as a primary action.[88] Unsurprisingly, 22 of the 39 key threatening processes listed under the *Biodiversity Conservation Act 2016* are invasive species. Each of these invasive species impacts numerous threatened species and communities (**Figure 15**), but there is also a cumulative effect of being impacted by multiple invasive species at one time, and management needs to be considered wholistically in this context.

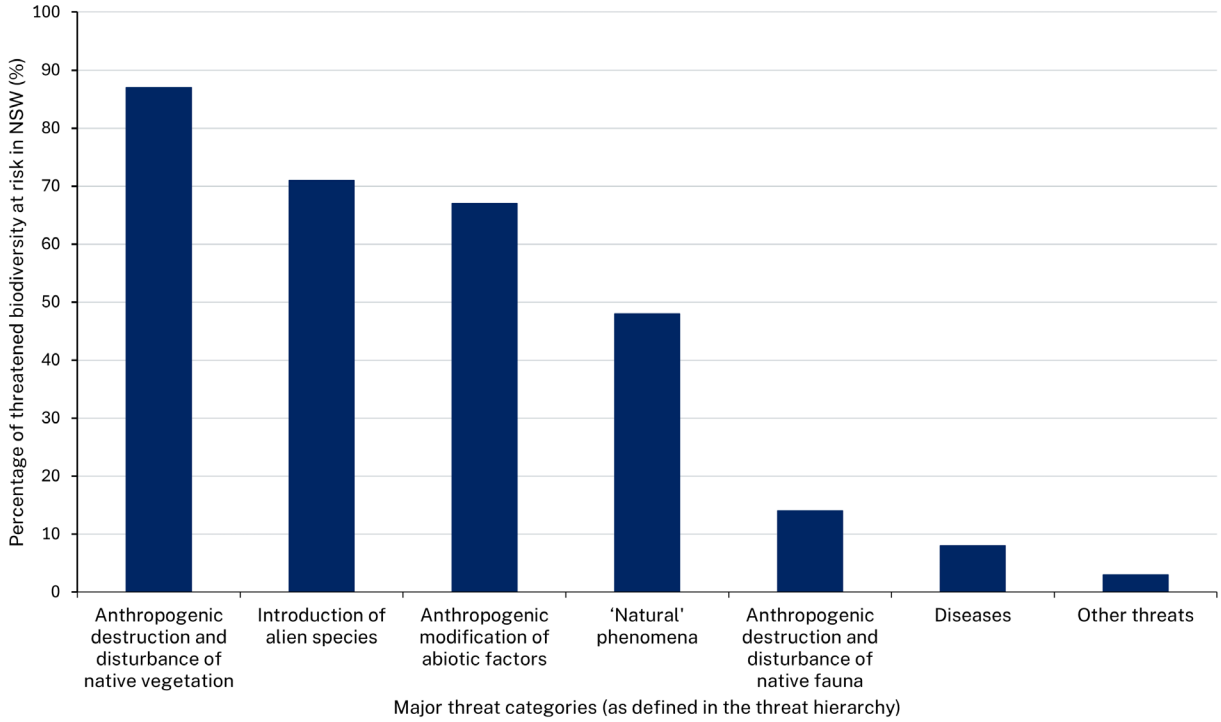

Figure 14: Percentage of threatened biodiversity at risk in NSW[89]

85 NSW Environment Protection Authority (2021) *NSW State of the Environment; Invasive Species*
86 Invasive Animals Cooperative Research Centre (2007) *The threat posed by pest animals to biodiversity in New South Wales*
87 *Ibid.*
88 DCCEEW (2024) *Saving our Species Conservation Strategies*
89 Invasive Animals Cooperative Research Centre (2007) *The threat posed by pest animals to biodiversity in New South Wales*

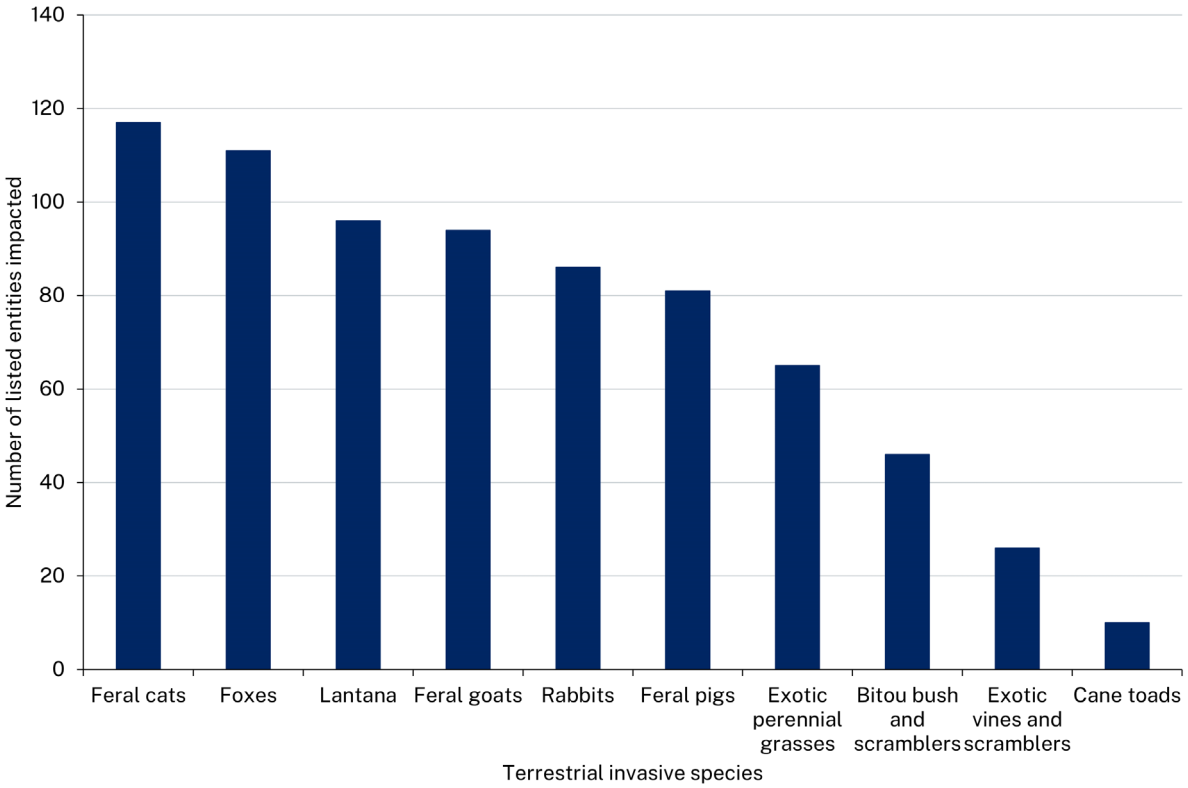

Figure 15: Number of threatened species and communities impacted by invasive species key threatening processes[90]

There are several direct ways in which invasive species have devastating impacts on natural ecosystems, including by:

- killing native species through predation of animals, herbivory of plants and shading out, smothering and releasing chemicals into the soil to kill other plants
- competing with similar native species, reducing the available resources for their survival, including food, water, and shelter
- changing landscape features, including physical destruction such as digging or wallowing, affecting soil chemistry through faeces and urine, decomposition of leaf litter and secretion of chemicals, and structural microclimate changes affecting light and moisture availability.[91]

These direct effects have flow-on impacts to biodiversity, affecting:

- native species richness and abundance
- risk of native species extinction
- genetic composition of native populations
- native animal behaviour and trophic networks.[92]

90 *Ibid.*

91 NSW Environment Protection Authority (2021) *NSW State of the Environment; Invasive Species*

92 Pyšek, P., Hulme, P.E., Simberloff, D., Bacher, S., Blackburn, T.M., Carlton, J.T., Dawson, W., Essl, F., Foxcroft, L.C., Genovesi, P., Jeschke, J.M., Kühn, I., Liebhold, A.M., Mandrak, N.E., Meyerson, L.A., Pauchard, A., Pergl Roy, J., Seebens, H., Kleunen, M., Vilà, M., Wingfield, M.J. and Richardson, D.M. (2020) 'Scientists' warning on invasive alien species', *Biological reviews of the Cambridge Philosophical Society*, 95(6), pp. 1511-34.

As well as impacting biodiversity, invasive species can also have broader landscape impacts, such as affecting the hydrology and water quality of wetlands.[93]

3.2.2 Social impacts

Invasive species have a range of social impacts, including impacts to human health. Some are directly related to environmental or agricultural impacts, such as a reduction in the quality of natural experiences like bushwalking and ecotourism, or psychological distress from the economic impacts of decreases in agricultural production.[94]

Some social impacts take the form of direct aggression, for example:

- wild dogs have been known to attack humans when their instinctive fear of humans is overcome by the provision of food[95]
- infestations of fire ants that sting humans and, in some cases, cause allergic reactions, restricting the use of backyards, parks, playgrounds, beaches and sports fields[96]
- larger herbivores such as feral pigs, horses and deer can also become aggressive towards humans, especially larger males of each species during the mating season.[97]

Habituation and greater interactions with humans also result in increases in vehicle collisions (road and rail), with significant consequences, including death, destruction of vehicles and infrastructure and transport delays. For example, over 212 deer have been struck by trains in the northern Illawarra region since 2010/11, resulting in millions of dollars of damage. There were also 107 motor vehicle accidents involving deer in the Wollongong and Lake Illawarra area between 2005 and 2017, of which 90 were rated as serious and one resulted in fatality.[98]

Other health impacts of invasive species include allergies and disease. Weed species such as ragweed (*Ambrosia artemisiifolia*), Paterson's curse, parthenium and ribwort plantain (*Plantago lanceolata*) can cause severe hay fever and other allergy symptoms.[99] Pest animals can also be vectors of pathogens that impact human health. For example, researchers estimate that more than 8,500 Australians are hospitalised and about 550 die every year from causes linked to cat-dependent diseases.[100] While this is predominantly from interactions with domestic cats, feral cats can act as an important reservoir for these pathogens, especially a subset of stray cats that live in proximity to humans. Both pest animals and weeds can also have negative impacts on drinking water quality when left unmanaged in water catchment areas.[101]

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93 Whalley, R.D.B., Price, J.N., Macdonald, M.J. and Berney, P.J. (2011) 'Drivers of change in the social-ecological systems of the Gwydir Wetlands and Macquarie Marshes in northern New South Wales, Australia', *The Rangeland Journal*, 33, pp. 109-119; NSW Environment Protection Authority (2021) *NSW State of the Environment; Invasive Species*

94 Fitzgerald G. and Wilkinson R. (2009) *Assessing the social impact of invasive animals in Australia*, Invasive Animals Cooperative Research Centre

95 Biosecurity Queensland (2016) *Wild dog facts; Why control wild dogs?*

96 Department of Primary Industries (2023) *How do fire ants affect us?*

97 Queensland Government (2021) *Safety and feral animal; Feral Pigs;* Sweeney, K. (2022) *"*'Deer are not good pets'; Coroner calls for register after man killed*'*, *The Age*, August 24.

98 Invasive Species Council (2018) *Feral deer putting NSW drivers at risk*

99 Dearnaley, J. (2022) 'Sneezing with hay fever? Native plants aren't usually the culprit', *The Conversation*, 13 September.

100 Legge, S., Taggert, P., Dickman, C.R., Read, J. and Woinarski, J.C.Z. (2020) 'Cat-dependent diseases cost Australia AU$6 billion per year through impacts on human health and livestock production', *Wildlife Research*, 47, pp. 731-746.

101 WaterNSW and Office of Environment and Heritage (2015) *Special Areas Strategic Plan of Management 2015*

Invasive species also create social impacts from damage to infrastructure such as buildings, fences and waterpoints. Indeed, the costs of infrastructure damage can be much more significant than grazing or crop impacts on some properties.[102]

Damage to both European and Aboriginal cultural heritage from invasive species is a critical and ongoing impact. Impacts on Aboriginal cultural heritage include physical aspects, such as damage to rock engravings and grinding stones,[103] but also extend to Aboriginal cultural connections to Country such as:

- degrading culturally significant landscapes (such as buffel grass (*Cenchrus ciliaris*))
- impacting totem species, which Aboriginal peoples connect with spiritually, and through cultural responsibilities[104] (for example, the cane toad, which has caused the local extinction of culturally significant native reptile and mammal species in northern Australia).[105]

3.2.3 Agricultural impacts

Invasive species impacts on agriculture are similar to those on biodiversity. Weeds out-compete crops and pasture species, resulting in lower economic returns and the need for expensive and ongoing control measures.[106] Pest animals harass, kill and eat livestock, consume crops and pasture, and are responsible for disease transmission.[107] While these impacts of pest animals can seem more damaging for primary producers to experience,[108] the overall impacts of weeds are much greater, as borne out in the cost analysis detailed in **Section 3.3**.

The ABARES Pest Animal and Weed Management Survey customised report for NSW[109] reveals that foxes, rabbits and feral pigs are among the most commonly reported species causing pest animal problems on farms in NSW,[110] reflecting their widespread distribution (as outlined in **Section 3.1.1**). Rats and mice were the other species most commonly reported by land managers as causing pest problems. Although they are not as broadly widespread as the other species, their distribution is largely commensurate with human habitation.[111]

The survey also asked land managers about problems with Weeds of National Significance on their property. The results again emphasise that the weeds with broader distribution have the greatest cumulative impact (see **Figure 16**). Further interrogation of the ABARES database[112] reveals that these patterns are also consistent at a regional level, with more broadly distributed species having the greatest agricultural impact.

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102 Australian Government Bureau of Rural Sciences (2006) *Australia's Pest Animals: New approaches to old problems*
103 NSW Environment Protection Authority (2021) *NSW State of the Environment; Invasive Species*
104 Seebens, H., Niamir, A., Essl, F. *et al.* (2024) 'Biological invasions on Indigenous peoples' lands', *Nature Sustainability*, 7, pp. 737-746.
105 Letnic, M., Webb, J.K. and Shine, R. (2008) 'Invasive cane toads (*Bufo marinus*) cause mass mortality of freshwater crocodiles (*Crocodylus johnstoni*) in tropical Australia', *Biological Conservation*, 141(7), pp. 1773-1782.
106 Department of Primary Industries (2023) *NSW Invasive Species Plan 2023-2028*
107 Environment and Heritage (2023) *Pest Animals*
108 Fitzgerald G. and Wilkinson R. (2009) *Assessing the social impact of invasive animals in Australia*, Invasive Animals Cooperative Research Centre
109 Stenekes, N., Ticehurst, J. and Arthur, T. (2024) *Pest Animal and Weed Management Survey 2016/2019/2022*, NSW land manager survey custom results, report prepared by ABARES for the Commission.
110 *Ibid.*
111 Van Dyck, S. and Strahan, R. (2008) *The Mammals of Australia.*
112 ABARES (2024) *Pest animal and weed management survey dashboard*

Proportion (%) of NSW land managers reporting weeds as a problem	
Blackberries	28
Fireweed	20
African boxthorn	20
Serrated tussock	12
Lantana	11
Silverleaf nightshade	11

Figure 16: Proportion of NSW land managers reporting problems with Weeds of National Significance 2022[113]

3.3 The total costs of invasive species in NSW

Quantifying the costs of invasive species is required for informed decision-making and effective management. This information gives decision-makers valuable insights into the magnitude of the problem, and helps them prioritise management efforts, allocate resources efficiently, and evaluate the effectiveness of management interventions. A clear understanding of the current and projected impacts of invasive species informs the development of a strategy to manage these risks.

The various environmental, social and agricultural impacts may be estimated in terms of their financial cost. The total financial cost of invasive species management may be represented as a function of the management expenditure and the residual losses incurred from the unmitigated impacts of invasive species to the environment, agriculture and the community (**Figure 17**). As more money is spent on management, there may be less financial cost in terms of actual impacts. Conversely less investment in management would increase the cost of impacts.

[113] Note: the category 'Brooms' includes scotch, montpellier, and flaxleaf species, while all willow species are accounted for except weeping willows, pussy willow, and sterile pussy willow. See: Stenekes, N., Ticehurst, J. and Arthur, T. (2024) *Pest Animal and Weed Management Survey 2016/2019/2022*, NSW land manager survey custom results, report prepared by ABARES for the Commission.

Figure 17: Components of invasive species costs

Two recent independent studies using different methodologies both estimated the annual total financial cost of invasive species in NSW at approximately **$1.35 billion**:

- The *Cost of established pest animals and weeds to Australian agricultural producers* report[114] produced by ABARES drew on data from landholder responses to the ABARES 2019 Pest Animal and Weed Management Survey to update the previous estimates developed for the Commission's reviews of statewide weed[115] and pest animal management.[116] They provided a total estimate of invasive species costs to private landholders of **$1.35 billion for the 2020/21 financial year** in NSW.
- The *Invasive Species Cost Assessment for New South Wales* report[117] developed by the Centre of Excellence for Biosecurity Risk Analysis (CEBRA), the Centre for Environmental and Economic Research (CEER), University of Melbourne, and the Commission, used the global InvaCost database as a starting point and added records from a systematic rapid review of available literature focused on NSW. The final dataset after exclusions included 374 individual cost estimates from 50 records, which were primarily technical reports and peer-reviewed research articles. The total invasive species costs for NSW were subsequently estimated at **$1.34 and $1.38 billion for 2020 and 2021** respectively, which was broadly consistent with the average annualised costs during the 2010s (i.e. $1.32 billion per year). InvaCost provides a database of cost data that can be updated for future analyses and a robust foundation for future assessments of costs.

Both studies found almost the same breakdown in costs between weeds and pest animals, with weeds making up a higher proportion of the total cost. For the ABARES report,[118] 82.6 percent of the costs were attributed to weeds and the remaining 17.4 percent to pest animals. For the CEBRA report,[119] 82.9 percent of costs were attributed to weeds and 16.7 percent to pest animals (combining terrestrial vertebrate and invertebrates), with 0.2 percent for aquatic pests and 0.2 percent unspecified (see **Figure 18**). As identified earlier, although widespread pest animals, such as feral cats and foxes, have a far greater

114 Hafi, A., Arthur, T., Medina, M., Warnakula, C., Addai, D., and Stenekes, N. (2023) *Cost of established pest animals and weeds to Australian agricultural producers, report prepared by ABARES*
115 Kalisch Gordon, C. (2014) *The economic cost of weeds in NSW Final Draft*, report by Grain Growers Limited prepared for the Commission.
116 eSYS Development Pty Ltd (2016) *Cost of Pest Animals in New South Wales and Australia 2013-14*, report prepared for the Commission; eSYS Development Pty Ltd (2018) *Annual Costs of Weeds in Australia*, published by the Centre for Invasive Species Solutions.
117 Hanea, A., Moran, N., Wang, L., Li, C., Baumgartner, J., Palma, E., Camac, J., Bell, J. and Kompas, T. (2024) *Invasive Species Cost Assessment for New South Wales*, report prepared by CEBRA for the Commission.
118 ABARES (2023) *Cost of established pest animals and weeds to Australian agricultural producers*
119 Hanea, A., Moran, N., Wang, L., Li, C., Baumgartner, J., Palma, E., Camac, J., Bell, J. and Kompas, T. (2024) *Invasive Species Cost Assessment for New South Wales*, report prepared by CEBRA for the Commission.

extent and impact than individual weed species, the overall number of weed species is much greater and their combined impact and associated financial cost is broader than the impact and costs of pest animals.

Terrestrial plants	82.9%	$25,497m
Terrestrial vertebrates	15.5%	$4,775m
Terrestrial invertebrates	1.2%	$373m
Aquatic pests	0.2%	$66m
Unspecified	0.2%	$53m

Figure 18: CEBRA report InvaCost Datatbase total costs ($ millions) NSW by taxonomic groups 1970-2022

The CEBRA analysis also recorded a **highly conservative estimate of the cumulative impact of invasive species in NSW between 1970 and 2022 at $30.8 billion (excluding public expenditure)**. Average annual costs have high variation between years likely linked to the incomplete reporting of costs as well as reporting biases. CEBRA point out that this estimate only includes reliable costs that have actually been incurred and incurred only during the periods that were reported.

The Commission notes that the costs in the CEBRA studies were primarily based on primary production costs. The ABARES study[120] was specifically looking at management expenditure and residual losses of agricultural private land managers. The CEBRA report[121] estimates were just over 92 percent based on agricultural costs, just over 7 percent on health, public and social welfare, and only 0.2 percent on environment and 0.2 percent on research (as shown in **Figure 19**). Therefore, although the results of the two methods were similar, these are both likely to be underestimates of the true total cost of invasive species in NSW.

120 Hafi, A., Arthur, T., Medina, M., Warnakula, C., Addai, D., and Stenekes, N. (2023) *Cost of established pest animals and weeds to Australian agricultural producers, report prepared by ABARES*

121 Hanea, A., Moran, N., Wang, L., Li, C., Baumgartner, J., Palma, E., Camac, J., Bell, J. and Kompas, T. (2024) *Invasive Species Cost Assessment for New South Wales*, report prepared by CEBRA for the Commission.

Industry/Agriculture	92.2%	$28,353m
Health, Public & Social Welfare	7.4%	$2,289m
Environment	0.2%	$67m
Research	0.2%	$53m
Mixed/Other	0%	$0.6m

Figure 19: CEBRA report InvaCost Database costs ($ millions) by sector 1952-2022[122]

As part of this Review, the Commission also identified estimates of the annual cost of invasive species based on environmental impacts and NSW public spending:

- a CEBRA study of the value of ecosystem services estimated **the current annual damage cost for NSW environmental assets to be $320 million** (further detail on this study is provided in **Section 3.3.1**)
- a rapid analysis of the NSW Government's annual public expenditure on invasive species management by the Commission estimates the **2022-23 public expenditure in invasive species management in NSW was $200 million** (further detail on this study is provided in **Section 3.3.2**).

These estimates are not directly comparable to the ABARES and CEBRA figures, given they were produced using different methodologies and time periods. However, they illustrate that the ABARES and CEBRA estimates are likely significantly under-representative.

For illustrative purposes only, adding the estimates for environmental costs ($320 million) and public expenditure ($200 million) to the ABARES and CEBRA estimates ($1.35 billion) provides an indicative **total of $1.87 billion in costs**.

The actual costs are certainly higher, given the limitations in quantifying the costs of invasive species (further outlined in **Section 3.3.3**). As noted above, significant improvements in the collection, collation and analysis of data will be required in the future to produce more reliable estimates.

122 Agricultural and industry losses are attributed to production losses and control costs. Research costs are research and innovation expenditure by industry representative bodies. Health and public welfare costs include medical costs, as well as costs to community-based assets (for example, indigenous communities, infrastructure, road crashes). Environmental costs include estimates of the monetary value of damage to environmental assets/services, and the value of community volunteer work on environmental programs. See: Hanea, A., Moran, N., Wang, L., Li, C., Baumgartner, J., Palma, E., Camac, J., Bell, J. and Kompas, T. (2024) *Invasive Species Cost Assessment for New South Wales*, report prepared by CEBRA for the Commission.

3.3.1 Costs of environmental impacts

Recent research[123] into the value of ecosystem services and their vulnerability to invasive species gives an estimate of associated costs for Australia. This national study was commissioned by the Australian Government in 2020 to estimate the value of the Australian biosecurity system.[124] As part of this analysis, CEBRA used value transfer methodology[125] to determine the monetary value of goods and services vulnerable to incursions by invasive species.[126]

The national research study made estimates at the scale of Australia's 56 natural resource management regions. It also generated spatially explicit estimates of the current value of 16 different ecosystem services.[127] Even after omitting human health and social capital, CEBRA estimated the annual values of those services in Australia at over $250 billion. Almost 60 percent were non-market values, primarily environmental. Based on this study, CEBRA estimated the **current annual damage cost for NSW environmental assets to be $320 million**.[128] CEBRA noted this figure is likely to be an underestimation.[129]

Methods for valuing invasive species impacts on non-market ecosystem goods and services are available and their implementation is feasible.[130] Recent advancements in this area include the NSW Government's *Natural Capital Statement of Intent*[131] and valuations required to implement the nature-positive strategies recommended by the Australian Government.[132] These valuation approaches will have flow-on benefits in improving assessment and allocation of invasive species management resources.

However, institutional capacity building is likely to be required before these methods can be widely applied at low cost.[133] The development of institutional capacity must include the consistent application of economic principles and a commitment to the valuation of the impact of invasive species on non-market values, particularly biodiversity (see **Section 6.1**).

123 Stoeckl, N., Dodd, A. and Kompas, T. (2023) 'The monetary value of 16 services protected by the Australian National Biosecurity System: Spatially explicit estimates and vulnerability to incursions', *Ecosystem Services*, 60, pp. 1-38.

124 Dodd, A., Stoeckl, N., Baumgartner, J., and Kompas T. (2020) *Key Result Summary: Valuing Australia's Biosecurity System*. Report prepared by CEBRA

125 Value transfer refers to applying quantitative estimates of ecosystem service values from existing studies to another context. See: IPBES (2019) *Policy Support Tool: Value Transfer Method*.

126 Stoeckl, N., Dodd, A. and Kompas, T. (2023) 'The monetary value of 16 services protected by the Australian National Biosecurity System: Spatially explicit estimates and vulnerability to incursions', *Ecosystem Services*, 60, pp. 1-38.

127 *Ibid*.

128 The Commission requested that CEBRA postulate an estimated impact value. CEBRA formed a postulate by estimating the damage cost for the environment from results associated with the Value Model reported for NSW in the Australian valuation study.

129 This underestimation of the value of invasive species' impact on the environment values is cumulative. Estimating the extent of this cumulative underestimation is beyond the scope of this analysis. It is unlikely that the rate of impact increase on environmental and social values aligns with that observed for production impacts. However, it is important to note that the valuation of this impact is considerable and may exceed that observed for production values.

130 Greiner, R., Kancans, R., and Nelson, R. (2023) *Methods for non-market valuation of alien invasive species.* Report prepared by ABARES.

131 NSW Government (2022) *NSW Natural Capital Statement of Intent: Recognising the value of nature*

132 DCCEEW (2022) *Nature Positive Plan: better for the environment, better for business*. This has also been recommended by the Independent Review of the *Biodiversity Conservation Act 2016* (State of NSW and Department of Planning and Environment (2023) *Independent Review of the Biodiversity Conservation Act 2016*.

133 ABARES (2023) *Methods for non-market valuation of alien invasive species.*

3.3.2 NSW public spending on invasive species management

The NSW Government plays two key roles in invasive species management:

- providing leadership and coordination with all relevant land managers across the region
- funding the management activities of public land managers.

The Commission has undertaken a rapid research and analysis of the NSW Government's annual public expenditure on invasive species management that **estimates the 2022-23 public expenditure in invasive species management in NSW was $200 million**. This amount is higher compared to previous annual estimates of NSW Government expenditure of approximately $107 million (from 2014-2016), but also includes additional public expenditure sources not considered previously.[134] The Commission notes that the analysis:

- relies on publicly available data supplemented with data requests to NSW Government agencies where required
- focuses on final expenditure rather than resource allocation to minimise the inherent risks of double counting across agencies/programs
- includes some Australian Government expenditure within NSW
- only includes local government expenditure as its contribution to the WAP
- only includes management expenditure on national parks, state forests and Crown reserves, and does not include the expenditure of other public authorities (for example, Transport for NSW's management of roadsides)
- does not reflect the considerable variability in public expenditure on invasive species management each year based on competing demands and climatic and political seasonality. This means that extrapolations should be avoided.

A breakdown of this analysis found that recurrent expenditure on invasive species management across the four public land categories totalled $59 million and varied considerably across the categories (see **Figure 20**). This reflects differing management objectives, priorities and legislative requirements. For example, NPWS has requirements under the *National Parks and Wildlife Act 1974*[135] and undertake invasive species management to conserve biodiversity, as well as ensuring that invasive species management programs are coordinated across different tenures relevant to the social and economic context of each park or reserve. This is in addition to the requirements of the *Biosecurity Act 2015* and the *Biodiversity Conservation Act 2016* that other public land managers are bound by.

134 The Commission undertook reviews of NSW weed and animal management in 2014 and 2016, respectively. In both reviews an estimation of the NSW Government expenditure was included. For the weed review, the Commission engaged Dr Cheryl Kalisch Gordon, Senior Economist at GrainGrowers, to prepare the report *The Economic Cost of Weeds in NSW (2014)*. The report estimated the 2011-12 annual NSW Government expenditure on weeds at $64.5 million. For the 2016 pest animal review, the Commission engaged the Centre for Invasive Species Solutions to prepare the report *Cost of Pest Animals in NSW and Australia, 2013-14*. The public expenditure values of these previous weed and pest animal reviews have been combined and converted to a 2022-23 cost estimate of $107 million (to account for inflation). Both the previous reviews acknowledged the limitations of their estimates and indicated that the public expenditure was likely to be higher.

135 *National Parks and Wildlife Act 1974*

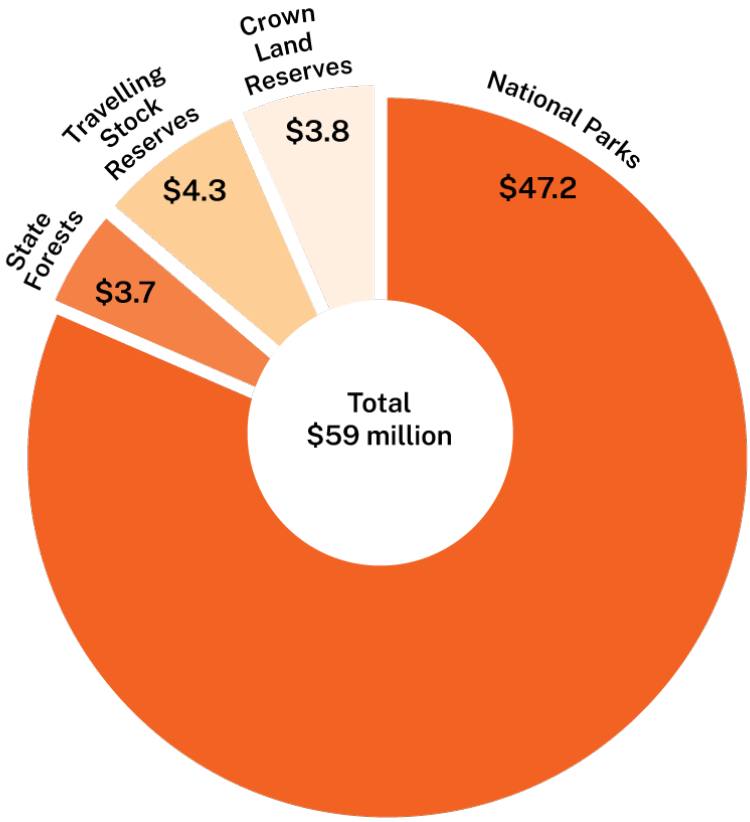

Figure 20: Estimated recurrent expenditure ($ millions) by public land categories 2022-23

The analysis also identifies important issues for the NSW invasive species management system:

- Public investment in invasive species management is delivered through complex arrangements with a broad variety of interacting funding sources and recipients. This means that generating a clear picture of total public investment, its effectiveness, and attribution to specific agencies and programs, is extremely difficult.
- The types of funding mechanisms employed are often inconsistent with the invasive species management issue being addressed. For example, the use of short-term funding to resource long-term management programs.
- The processes for allocating resources and measuring the return on investment are complex and often inconsistent with best practice.
- There are no consistent standards for NSW Government funding,[136] recording or monitoring and reporting that enable the clear identification of invasive species management costs.[137]
- There is no requirement for the NSW Government to publicly disclose its expenditure on invasive species management.

These underlying systemic issues are further detailed in **Chapters 5** to **10** of this report.

136 This includes no clear definition or consistent application of different funding mechanisms, such as program grants and recurrent funding (some grants had longer timeframes than programs).

137 Invasive species management is an activity that contributes to higher goals such as biodiversity conservation, timber production and infrastructure protection, rather than an outcome in its own right.

State and local governments play a crucial role in funding and coordinating efforts to manage the impacts of invasive species, given the public goods nature of ecosystem services and the inability of markets to efficiently allocate resources. There are many competing demands on government budgets and there will never be sufficient resources to satisfy varied expectations. As such, the success of biosecurity systems relies on sustained levels of well-targeted government investment over time, underpinned by strong funding principles, methods and processes.[138]

3.3.3 Challenges in quantifying the costs of invasive species

Quantifying the costs of invasive species is required for informed decision-making and effective management. This information gives decision-makers valuable insights into the magnitude of the problem, and helps them prioritise management efforts, allocate resources efficiently, and evaluate the effectiveness of management interventions. A clear understanding of the current and projected impacts of invasive species informs the development of a strategy to manage these risks.

However, quantifying the costs of invasive species presents several challenges. The complexity of ecological systems, variability of species interactions, and limitations of reliable data and estimation methodologies make it hard to accurately determine the financial cost of the residual impacts from invasive species, which affects the accuracy of the total cost. The Commission notes that assessing the cost of management expenditure is similar across different fields and would be relatively straightforward if good financial records of labour and equipment used for invasive species management were consistently maintained.

One of the drivers of inaccuracies in cost estimates is the tendency for quantification studies to report more easily observable and measurable costs. As cost estimates based on monetary values (for example, management expenditure, production losses and control costs) are relatively easily to quantify, there may be biases towards reporting and counting those types of impacts. Existing cost assessment methodologies often focus on economic costs on primary industries. Available data continues to expose a considerable bias towards agricultural and industrial costs.

The impacts of invasive species on non-market values such as biodiversity, ecosystems, human health, cultural values and community wellbeing can be much more difficult to estimate in monetary terms and are rarely reported. As such, these impacts are often underreported, leading to a gross underestimation of their reported costs.

A primary challenge in estimating the residual losses or the unmitigated impacts of invasive species is the inherent complexity of natural, agricultural, and urban ecosystems. These ecosystems comprise intricate networks of species interactions. Changes caused by invasive species can have cascading effects across multiple levels. Identifying and quantifying these effects is challenging because they often manifest over long time scales and may not be immediately apparent.[139]

Limited data availability and quality also pose significant barriers. Comprehensive data on invasive species distributions, population dynamics, and ecological interactions are often lacking. Further, existing data may be incomplete, inconsistent, or biased. This hinders accurate assessments of invasive species impacts.

138 Audit Office of NSW (2019) *NSW Auditor-General's Report to Parliament - Biosecurity risk management*
139 Tobin, P.C. (2018) *Managing invasive species*

4 Future risks of invasive species

In addition to the existing risks described in **Chapter 3**, several factors have the potential to drive increased costs and risks from invasive species into the future, which will require careful consideration. These include:

- increasing urbanisation from population growth, which creates more areas with favourable conditions for invasive species (**Section 4.1.1**)
- agricultural intensification, which can make landscapes more vulnerable to invasive species incursions (**Section 4.1.2**)
- increases in trade, which creates more opportunities for incursions (**Section 4.1.3**)
- increasing and more severe natural disasters, which can create pathways for the movement of invasive species beyond normal weather conditions (**Section 4.1.4**)
- climate change, which may compound the impacts from invasive species (**Section 4.1.5**).

Despite improvements in approaches to invasive species management, costs have continued to increase over the past 50 years. This trend is expected to continue (**Section 4.2**), particularly if new incursions are not effectively managed (**Section 4.2.1**).

Key Findings

- Reported costs in NSW have escalated from approximately $25.5 million annually in the 1970s to $1.4 billion in the 2020s — and are likely to continue to increase.
- Factors that may affect future risks of invasive species include urbanisation, intensification of agriculture, increases in trade, climate change and natural disasters. These all have the potential to increase the severity of impacts and speed of potential spread of some invasive species.
- The failure to effectively manage new incursions could result in an estimated worst case annual total cost of $29.7 billion by 2030. This worst-case estimate includes market and non-market impacts across all sectors, including agriculture, environment, health, social amenity and infrastructure.
- If the national red imported fire ant eradication program were to cease, the estimated management expenditure required ranges from $20.8 to $77.7 billion over the next 30 years.

4.1 Factors that affect the future risks of invasive species

4.1.1 Increasing urbanisation will create more favourable environments for invasive species

The total NSW population is expected to increase from 8.2 million in 2022 to between 9 and 9.7 million people by 2032,[140] driven by migration and the balance between births and deaths.[141] Projected increases in the NSW population will require more urban land areas and increasingly dense urban settlements.[142]

An increase in urban land area and density could lead to an increase in the establishment of new species and favour the expansion of established invasive species. Urban landscapes have high rates of both intentional and unintentional invasive species introductions. Invasive species also take advantage of the increased resources available in urban areas and there are generally fewer predators and less competition. Milder urban climates and the presence of artificial structures also help the establishment and spread of some invasive species.[143]

Expanding urbanisation also creates fringes on the edge of cities that are recognised areas of increased biosecurity risk. These urban fringes are often under the stewardship of land managers who are either inexperienced or less engaged with invasive species management programs.[144]

4.1.2 Agricultural intensification can make landscapes more vulnerable

NSW agricultural production is projected to increase to ensure food security in Australia and satisfy increasing global demand.[145] This demand for increased food production coincides with increased competition from urban land uses and the projected impacts of climate change, which combined may affect how much food and fibre NSW can produce, and where it can be produced.[146] ABARES estimates that changes in seasonal conditions over the period 2001-2020 reduced annual average farm profits relative to 1950-2000 by 23 percent, or around $29,200 per farm.[147]

Adaptation to climate change may result in the intensification of production systems in some areas, the expansion of agriculture into new areas and retreat from others,[148] changes that make landscapes more vulnerable to damage from new and established invasive species.[149]

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140 Australian Bureau of Statistics (2023) *Population projections (based on assumptions of fertility, mortality and migration) for Australia, states and territories and capital cities*
141 NSW Government (2022) *Projections*
142 NSW Environment Protection Authority (2021) *NSW State of the Environment 2021*
143 Carlon, E. and Dominomi, D. (2023) *Reviewing the role of urbanisation in facilitating the introduction and establishment of Invasive Animal Species*
144 Bureau of Rural Sciences (2007) *Biosecurity and small landholders in peri -urban Australia*
145 Linehan, V., Thorpe, S., Andrews, N., Kim, Y. and Beaini, F. (2012) *Food demand to 2050: Opportunities for Australian agriculture*
146 AdaptNSW (n.d.) *Impacts of climate change on our agriculture*
147 Parliament of Australia (2023) *Inquiry into food security in Australia Australian Food Story: Feeding the Nation and Beyond*
148 *Ibid.*
149 CSIRO (2020) *Australia's Biosecurity Future: Unlocking the next decade of resilience (2020–2030)*

4.1.3 Increases in trade create more opportunities for incursions

Greater volumes and rates of trade, travel and freight are creating new opportunities for pests and diseases to enter and spread across Australia. In the last 50 years, global trade has grown tenfold, with shifting patterns of trade across regions.[150] In addition, freight and passenger numbers are predicted to increase, with estimates that by 2030:

- international and domestic passenger movements through Australia's capital cities will likely double compared to 2016,[151] with the majority of international passengers entering the country through NSW
- the volume of freight flown in and out of Australia is projected to increase by 120 percent based on 2014 levels,[152] with most of the movement though Sydney's Kingsford Smith Airport[153]
- interstate road freight is predicted to increase by 1.7 percent each year.[154]

Invasive species are known to trace these shipping, road and air traffic networks,[155] and their numbers are strongly linked to the volume of commodity imports in a region. The growth of ecommerce also presents greater risks for the introduction of invasive species, mostly through illegal flora and fauna trade. Recent research recorded a diversity of non-domesticated pets traded online in Australia over a 14-week period (excluding mammals). It detected 1,192 species, including 667 non-native species (totalling 56 percent).[156] Most trade listings were in Sydney and the highest volume of trade occurred in NSW.[157]

Among those non-native species detected in Australia were several classified in NSW as 'prohibited dealings' (i.e. non-indigenous animals that cannot be kept, moved or dealt with in NSW under any circumstances).[158] These included yellow-collared macaws (*Primolius auricollis*) with 27 listings; rose-crowned parakeets (*Pyrrhura rhodocephal)* with 24 listings; African collared doves (*Streptopelia roseogrisea)* with 22 listings; helmeted guineafowl *(Numida meleagris)* with 11 listings; and brown-throated parakeets (*Aratinga pertinax)* with three listings. It is highly likely that not all dealings were detected.[159]

The COVID-19 pandemic has accelerated trends towards online shopping and trade, providing greater opportunities for plants and animals to be purchased from overseas.[160] The most recent *Biosecurity Attitudinal Research Report* showed that 26 percent of survey respondents purchased plants (including seeds) online from overseas at least occasionally.[161] Online sales within NSW can also facilitate the spread of high-risk weeds. Between July 2021 and September 2023 there were 11 instances reported to Agriculture

150 IPBES (2023) *Summary for Policymakers of the Thematic Assessment Report on Invasive Alien Species and their Control of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.*
151 Pre-COVID-19 estimate based on Bureau of Infrastructure, Transport and Regional Economics data, analysis and projections. See: Bureau of Infrastructure, Transport and Regional Economics (2016) *Trends: Transport and Australia's development to 2040 and beyond*
152 Bureau of Infrastructure, Transport and Regional Economics (2016) *Trends: Transport and Australia's development to 2040 and beyond*
153 Transport for NSW (2023) *Kingsford Smith Airport*
154 Department of Agriculture, Fisheries and Forestry (2022) *National Biosecurity Strategy*, p. 21.
155 Transport for NSW (2023) *Kingsford Smith Airport*
156 Toomes, A., Moncayo, S., Stringham, O., Lassaline, C., Wood, L., Millington, M., Drake, C., Jense, C., Allen, A., Hill, K.l., García-Díaz, P., Mitchell, L. and Cassey, P. (2023) 'A snapshot of online wildlife trade: Australian e-commerce trade of native and non-native pets', *Biological Conservation*, 282, 110040.
157 *Ibid*.
158 Department of Primary Industries (2016) *Biosecurity Act 2016, Supplementary Information Paper: Non-Indigenous animals*
159 *Ibid*.
160 Department of Agriculture, Fisheries and Forestry (2022) *National Biosecurity Strategy*, p. 22.
161 Department of Regional NSW (2022) *Biosecurity Attitudinal Research Report*, p. 26.

and Biosecurity of the prohibited matter weed frogbit (*Limnobium laevigatum*) being sold on Facebook Marketplace or eBay in NSW.

Nationally, there is a trend of increasing cumulative burden from invasive species incursions, which are compounded by variable influxes in new incursions (see **Figure 21**).

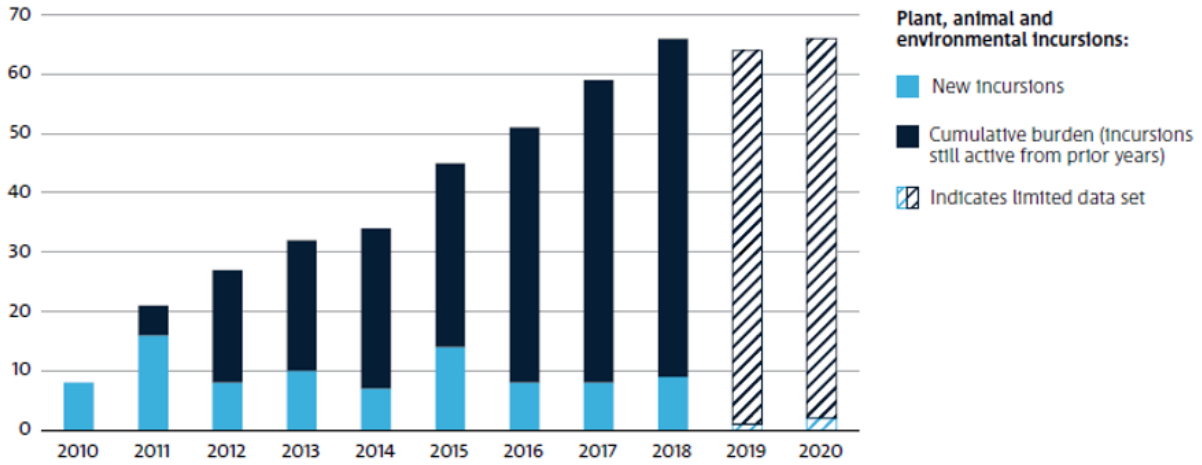

Figure 21: Indicative biosecurity incursions and cumulative burden in Australia[162]

Biosecurity measures at international borders are already struggling to keep pace with the growing volume, diversity, and origin of global trade.[163] Trends in trade and travel have resulted in an increase in the number of invasive species interceptions on the Australian border. For example, between 2012 and 2017, the annual number of interceptions of biosecurity risk materials rose by almost 50 percent.[164] Projected growth in international trade, together with the movement of people, will lead to further pressure on border inspection regimes and could overwhelm current biosecurity capability.[165]

A recent audit of the Australian Government's capacity to respond to non-compliance with biosecurity requirements found that the current arrangements were largely insufficient.[166] It concluded that there was no framework to assess risk across the entire biosecurity system and that undetected non-compliance was increasing. In response, the Australian Government introduced new reforms, including a new funding model to strengthen Australia's biosecurity system.[167] The funding model increased the passenger movement charge and introduced a new Biosecurity Protection Levy payable by primary producers.[168]

NSW bears much of the impacts from invasive species due to its role as a major transport and trade hub. The NSW Government has cost-sharing arrangements in place with other Australian jurisdictions and industries designed to share the cost of eradicating new incursions that bypass border control.[169] These national cost-sharing arrangements include specific requirements that must be met to trigger them. However, there are still circumstances where high risk incursions are not covered by these agreements, leaving the

162 CSIRO (2020) *Australia's Biosecurity Future Unlocking the next decade of resilience (2020–2030)*
163 IPBES (2023) *Summary for Policymakers of the Thematic Assessment Report on Invasive Alien Species and their Control of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*
164 CSIRO (2020) *Australia's Biosecurity Future Unlocking the next decade of resilience (2020–2030)*
165 *Ibid.*
166 Australian National Audit Office (2021) *Responding to Non-Compliance with Biosecurity Requirements*
167 Australian Government (2024) *Biosecurity Protection Levy*
168 *Ibid.*
169 Emergency Plant Pest Response Deed (EPPRD); National Environmental Biosecurity Response Agreement (NEBRA); Emergency Animal Disease Response Agreement (EADRA).

local jurisdiction to carry the full cost of the eradication effort, such as in the case of mouse-ear hawkweed.

The establishment of national eradication programs are also no guarantee of success, as evidenced by the recent varroa mite (*Varroa destructor*) incursion. After careful consideration, the decision was made by the National Management Group to transition to a management approach, once the criteria for eradication were identified as no longer feasible (see **Section 3.1.3** for eradication criteria).[170]

4.1.4 Natural disasters create new pathways for invasive species

Extreme weather events can give rise to natural disasters, which may influence the way that invasive species establish and spread. Natural disasters declared in NSW in recent years include bushfires, severe weather, storms, floods and tornadoes.[171] In 2022-23, seven bushfires and five events of severe weather and flooding were declared as natural disasters, covering large portions of the state.[172]

Natural disasters can create pathways for the movement of invasive species beyond normal weather conditions, for example:

- floodwaters and extreme winds can carry weed seeds and propagules further and faster than they would otherwise spread,[173] creating new populations from which weeds can spread further
- highly destructive events such as bushfires and floods can create opportunities for invasive species such as ants to be transported on debris that is removed or new building materials and fodder that are brought into an area to support recovery efforts.[174]

Natural disasters are also significant disturbance events that can facilitate and promote the establishment of invasive species and exacerbate their impacts, for example:

- weed species readily invade bare areas of ground denuded of vegetation by drought, fire and floods, as these conditions reduce competition for light, nutrients, moisture and space and allows for quick weed establishment following these events[175]
- red foxes and feral cats can use burnt landscapes to their advantage immediately post-fire, as the open vegetation of recently burnt areas leaves some prey species more vulnerable to predation.[176]

Events such as flooding can pose a safety hazard and prevent access for invasive species control, disrupting management efforts. Natural disasters also require significant work by property owners, land managers and government agencies to rebuild, clean up and support communities to recover, which can divert resources away from invasive species management programs, many of which require continuity to be effective.

170 Australian Government (2024) *Outbreak Current responses Varroa mite (Varroa destructor)*
171 NSW Reconstruction Authority (2024) *Natural disaster declarations*
172 NSW Reconstruction Authority (2024) *Natural disaster declarations from financial year 2022-23*
173 Business Queensland (2019) *Preventing the spread of invasive plants after a natural disaster*
174 Business Queensland (2019) *Preventing the spread of invasive ants after a natural disaster*
175 Department of Primary Industries (2007) *Weed strategies following drought, fire and flood.*
176 Geary, W., Doherty, T., Nimmo, D., Tullocj, A. and Richie, E. (2020) 'Predator responses to fire: A global systematic review and meta-analysis' *Journal of Animal Ecology*, 89(4), pp. 995-997.

4.1.5 Climate change will compound many impacts posed by invasive species

According to the latest State of the Climate report,[177] NSW is expected to continue experiencing elevated temperatures and increases in the frequency and intensity of both heatwaves and fire. Rainfall is becoming more variable, snow cover is expected to decrease, and extreme meteorological events are likely to intensify.[178]

NSW and Australian Regional Climate Modelling (NARCliM) is the NSW Government's climate change projection dataset that is one of the NSW Common Planning Assumptions.[179] Some examples of the predicted climate change trends that are relevant to the management of invasive species in NSW are described below. The Commission notes that, for the management of invasive species, land managers may use more locally specific predictions of climate change from NARCliM to help them understand risks and manage to mitigate some impacts.[180]

Climate change is predicted to lead to the formation of novel ecological conditions that expand colonisation opportunities for new species[181] and promote shifts in the composition of plant and animal communities.[182] Habitat suitability and therefore likely extent of invasive species will change, but these effects are variable across NSW, with both increases and decreases in habitat suitability for many species, including increases in the invasion potential for high-risk species.[183]

Climate change will augment and compound many impacts posed by invasive species.[184] For example, natural disasters and extreme weather events will increase in frequency and intensity under climate change.[185] This will likely exacerbate the issues discussed in the previous section, whereby natural disasters can promote the establishment and rate of spread of invasive species.

Environmental and agricultural systems are facing various challenges, one of which is invasive species. Climate change is an additional challenge that will also compound pressure on these systems over time:

- More frequent and more extreme weather events and natural disasters such as bushfires and floods,[186] which can damage ecosystems and farms through fire and washing away of topsoil.[187]
- More droughts, changing rainfall patterns, rising temperatures and increased evaporation are leading to reduced water availability, which can cause a shortage in

177 CSIRO (2022) *State of the Climate 2022*
178 *Ibid.*
179 NSW Treasury (2023) *NSW Common Planning Assumptions*
180 AdaptNSW (2024) *Interactive climate change projections map*
181 Hoffmann, A.A., Rymer, P.D., Byrne, M., Ruthrof, K.X., Whinam, J., McGeoch, M., Bergstrom, D.M., Guerin, G.R., Sparrow, B., Joseph, L., Hill, S.J., Andrew, N.R., Camac, J., Bell, N., Riegler, M., Gardner, J.L and Williams, S. (2019) 'Impacts of recent climate change on terrestrial flora and fauna: Some emerging Australian examples', *Austral Ecology*, 44, pp. 3–27.
182 Indeed, the climate suitability for many Weeds of National Significance in Australia may decrease under climate change. See: O'Donnell, J., Gallagher, R.V., Wilson, P.D., Downey, P.O., Hughes, L. and Leishman, M.R. (2012) 'Invasion hotspots for non-native plants in Australia under current and future climates', *Global Change Biology*, 18, pp. 617–629.
183 Duursma, D.E., Gallagher, R.V., Roger, E., Hughes, L., Downey, P.O. *et al*. (2013) 'Next-Generation Invaders? Hotspots for Naturalised Sleeper Weeds in Australia under Future Climates', *PLoS ONE*, 8(12).
184 Australian Government (2008) *Biological Advisory Committee Climate Change and Invasive Species - A review of Interactions*
185 AdaptNSW (2024) *Climate change impacts on our weather and oceans*
186 *Ibid.*
187 AdaptNSW (2024) *Climate change impacts on our agriculture*; AdaptNSW (2024) *Climate change impacts on our biodiversity*

water resources for native and cultivated plants and animals.[188] Drought and rising temperatures can also make some typically wetter ecosystems such as rainforests more susceptible to bushfires, which was seen in NSW in the 2019-20 bushfires' impacts on many rainforest species.[189]

- Increases in the frequency and intensity of heatwaves have already been observed in NSW[190] and can cause stress to animals and plants, particularly those suited to alpine and cooler environments.[191] Increasing temperatures can also alter animal behaviour and reproduction, such as for some native fish species, which use seasonal temperatures as cues to begin migration and spawning.[192]
- Sea level rise will reduce the area of land available for some ecosystems and industries.[193]

The NSW Biodiversity Indicator Program has been developed to monitor NSW's biodiversity and ecological integrity over time.[194] The indicator of ecosystem resilience under climate change is the 'percentage of spatial resilience remaining', meaning the proportion of the landscape that still has suitable connectivity to allow species to migrate as a result of climate change pressure.[195] In 2013, the assessed spatial resilience remaining in NSW was 11 percent, as a result of a 41 percent reduction from habitat loss and fragmentation and a 48 percent reduction due to future climate change if not mitigated.[196] This indicator has not been updated for 2024.

Reduced resilience from the climate change pressures described above, combined with a low proportion of habitat connectedness and a lack of adaptability for key species, will see an increase in both the relative impacts of current invasive species and vulnerability to invasion from new invasive species.[197] In this context, management to reduce the pressures of invasive species on natural and agricultural ecosystems may become more important to allow these systems to survive the increasing challenges of climate change.

4.2 The cost of managing invasive species has continued to grow

The CEBRA analysis supporting this Review estimates the recorded cumulative impact of invasive species in NSW between 1970 and 2022 at $30.8 billion.[198] From 1970 onwards there has been a generally increasing trend in the total reported invasive species costs for NSW (see **Figure 22**).[199] Reported costs in NSW have escalated from an estimated $25.5 million annually in the 1970s to $1.3 billion in the 2020s.[200]

188 AdaptNSW (2024) *Climate change impacts on our agriculture*
189 AdaptNSW (2024) *Climate change impacts on our rainforests*
190 AdaptNSW (2024) *Impacts of climate change*
191 AdaptNSW (2024) *Climate change impacts on our agriculture*; AdaptNSW (2024) *Climate change impacts on our alpine areas*
192 DPIRD (n.d.) *Climate change*
193 AdaptNSW (2024) *Climate change impacts on sea level rise*
194 DCCEEW (2024) *NSW biodiversity outlook report 2024*; Indicators have been developed to provide data on the expected survival of biodiversity, state of biodiversity, ecosystem quality, ecosystem management and ecosystem integrity.
195 DCCEEW (2024) *NSW biodiversity outlook report 2024*, p. 29.
196 *Ibid*.
197 CSIRO (2012) *Implications for policymakers: climate change, biodiversity conservation and the National Reserve System*
198 Hanea, A., Moran, N., Wang, L., Li, C., Baumgartner, J., Palma, E., Camac, J., Bell, J. and Kompas, T. (2024) *Invasive Species Cost Assessment for New South Wales*, report prepared by CEBRA for the Commission.
199 *Ibid.*
200 Note: these figures were based on yearly estimates that were transformed according to yearly conversion rates and inflation to 2023 Australian Dollar values.

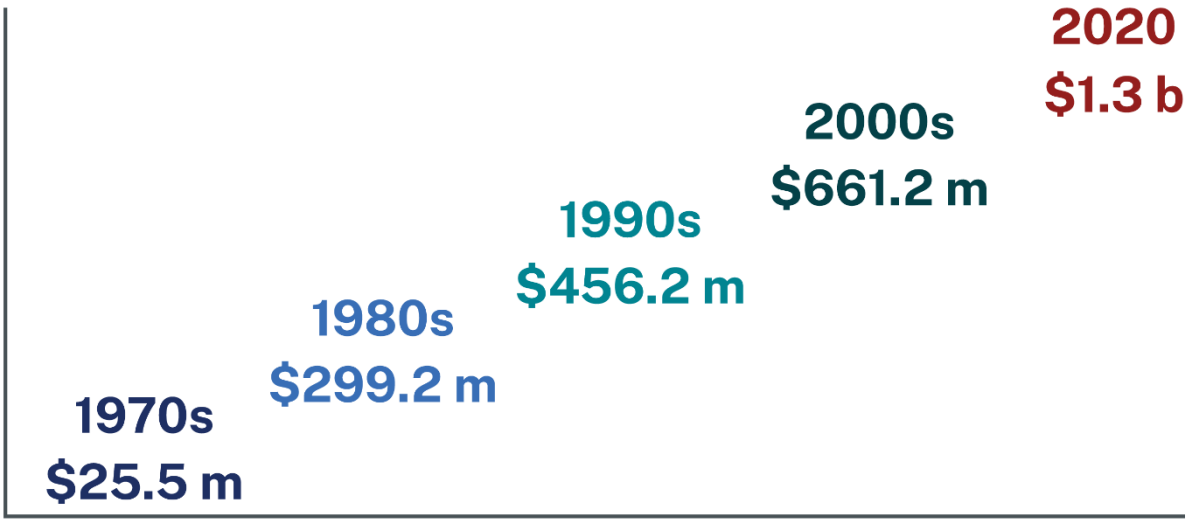

Figure 22: Estimated annual reported invasive species costs NSW, 1970-2023[201]

These rising costs have been influenced by an increase in reporting and inflation but are predominantly indicative of a rapid growth in the actual costs of invasive species in NSW from 1970 to 2023.[202]

The total cost of $1.9 billion for NSW reported in this Review may seem comparable to the $1.8 billion reported after the previous Commission pest animal and weed reviews.[203] However, this does not mean that costs have remain unchanged over the decade. Indeed, the ABARES report identifies that, for both pest animals and weeds, management expenditure is now higher and residual losses lower in comparison to the previous studies. This means that more money is being spent on management currently, which has in turn resulted in lower impacts from invasive species.[204]

4.2.1 Future costs will be compounded if new incursions are not managed

The importance of undertaking invasive species management is highlighted effectively by modelling the likely costs of priority high-risk invasive species if they were to establish in Australia and not be subject to management.

As part of research for the Australian Government, CEBRA developed a spatially explicit, bio-economic model (the Value Model).[205] The model simulates the arrival and spread of 40 functional groups of species not yet present, but of high risk of entering Australia,

201 Note: this image portrays the annual total costs for each year based on the modelled trend in invasive species costs from 1970 to 2023 generated by robust linear and quadratic regression. It is important to note that these average annual impacts of invasive species vary considerably due to seasonal and other factors. The figures have also been transformed according to yearly conversion rates and inflation to 2023 Australian Dollar values. Figure adapted from Hanea, A., Moran, N., Wang, L., Li, C., Baumgartner, J., Palma, E., Camac, J., Bell, J. and Kompas, T. (2024) *Invasive Species Cost Assessment for New South Wales*, report prepared by CEBRA for the Commission.

202 *Ibid*.

203 Natural Resources Commission (2014) *Weeds – Time to get serious: Review of weed management in NSW*; Natural Resources Commission (2016) *Shared Problem, Shared Solutions: State-wide review of pest animal management*

204 ABARES (2023) *Cost of established pest animals and weeds to Australian agricultural producers*

205 CEBRA (2020) *Key Result Summary: Valuing Australia's Biosecurity System*

acknowledging key limitations (described below).[206] The model estimates the impact of these incursions over time using the best available data on invasive species arrival and establishment rates[207] and describes the impacts (distribution and value) on 16 different vulnerable asset groups.[208]

CEBRA has adapted the Value Model for this Review to enable the estimation of the impact of potential invasive species incursions in NSW. This analysis focused on 24 functional groups of invasive species likely to establish and spread within NSW in the next seven years (through to 2030-31).[209] Importantly, the Value Model indicates that many functional groups will not establish in that period.[210]

The Value Model has limitations. For example, it assumes that there will be no post-border management of the incursion. Therefore, management costs are not included. It also assumes that individual species operate in isolation and that there are no additional costs or, conversely, savings generated, by the interaction of the different incursions occurring at the same time.[211] Extrapolating from the current impacts (as measured by the available cost data) to the future should be done with caution, given the data limitations discussed above and the various factors that may influence these costs in the future. The Commission expects massive uncertainty to surround future cost values and assume that this uncertainty is generated by the unknown, missing or under-representative data.[212]

The Value Model estimates that, in a worst-case scenario, the annual total cost without any management for these species in the year 2030 could amount to $29.7 billion.

Another example regarding the importance of managing new incursions is red imported fire ants. If the national eradication program were to cease, the estimated cost of controlling these insects over the next 30 years ranges from $20.8 billion to $77.7 billion.[213] This cost would be borne predominantly by NSW and Queensland. This high-risk example is highlighted in the Case Study featured below.

206 The value model has limitations. For example, it assumes that there will be no post-border management of the incursion. Therefore, management costs are not included. The model also assumes that individual species operate in isolation and that there are no additional costs or, conversely, savings generated by the interaction of the different incursions occurring at the same time.

207 The model also incorporates hazard-specific national arrival/establishment rates, post-establishment spread rates (local and long-distance), and impacts (percentage yield reduction) on each affected asset group.

208 The 16 vulnerable asset groups include: agriculture, domestic animals, recreation, tourism, recreational horses, infrastructure, carbon sequestration, erosion, biodiversity, water, existence, flood mitigation, forestry, toxin mediation, indigenous, subsistence. See: Hanea, A., Moran, N., Wang, L., Li, C., Baumgartner, J., Palma, E., Camac, J., Bell, J. and Kompas, T. (2024) *Invasive Species Cost Assessment for New South Wales*, report prepared by CEBRA for the Commission.

209 Importantly, the model indicates that many functional groups will have no impact.

210 *Ibid*.

211 *Ibid*.

212 *Ibid*.

213 *Ibid*.

CASE STUDY: The escalating risks and impacts of red imported fire ants

Red imported fire ants (fire ants) are one of the most notorious invasive pests in the world. They were first detected in Southeast Queensland in 2001 and a national eradication program has been underway for more than 20 years.

An outbreak of fire ants in Port Botany in NSW was discovered in 2014 and successfully eradicated in 2016. However, in 2023-24, fire ants were found in Wardell and South Murwillumbah in Northern NSW.[214] Agriculture and Biosecurity, the National Fire Ant Eradication Program, and local governments worked together to conduct treatment and surveillance of these incursions.

Fire ants, if established in NSW, will have a devastating impact on the state's economy, environment, and population. **Figure 23** shows the habitat suitability for fire ants across the country, with most suitable areas highlighted in darker colours. This habitat suitability is likely to increase with projected climatic changes.[215]

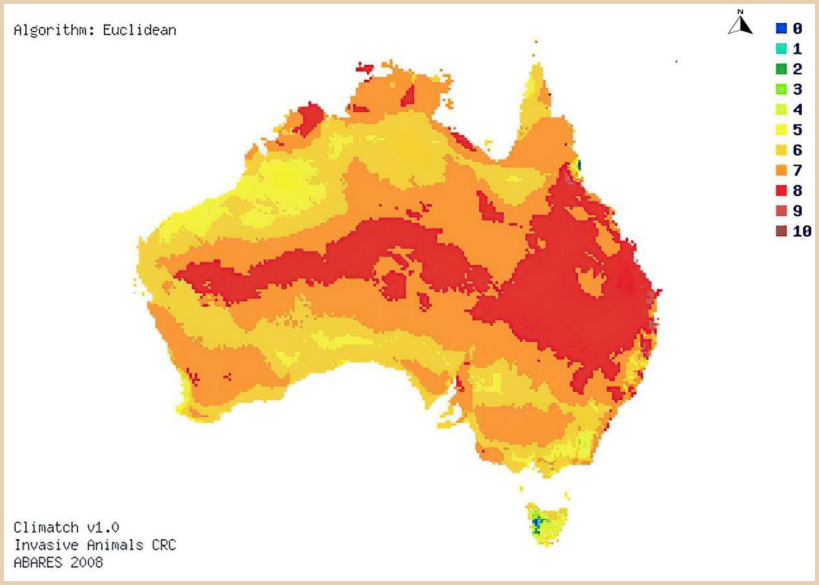

Figure 23: Map of climatic suitability of red imported fire ants in Australia[216]

Adverse impacts are likely in most sectors of the economy, including plant and animal industries and infrastructure.[217] Fire ants will also have significant health and lifestyle impacts.[218] Fire ant stings cause burning pain and the ants release hormones when they sting to recruit more ants to attack as a group.[219] Approximately a third of the human population in fire ant-infested areas in some areas of the world is stung each year.[220] Between 0.5 and two percent of people who are stung experience a systemic allergic reaction that can result in death.[221]

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214 Australian Government (2024) *Red imported fire ant (Solenopsis invicta)*

215 Li, D., Li, Z., Wang, X., Wang, L., Khoso, A.G. and Liu, D. (2023) 'Climate change and international trade can exacerbate the invasion risk of the red imported fire ant Solenopsis invicta around the globe', *Entomologia Generalis*, 43(2).

216 Janssen, S. (2017) *Ten Year Eradication Plan, National Red Imported Fire Ant Eradication Program, Southeast Queensland, 2017–2018 to 2026–2027*, Queensland Department of Agriculture and Fisheries.

217 Sectors in the NSW economy that are likely to be impacted include cropping, organic growers, forestry, apiculture, nursery and landscaping, the cattle industry, the equine industry, the poultry industry, aquaculture, the pet industry, development and construction, the mining industry, infrastructure, schools, public amenities, sport, and tourism. See: Wyle, F.R. and Janssen-May, S. (2016) 'Red Imported Fire Ant in Australia: What if we lose the war?' *Ecological Restoration and Management,* 18(1), pp. 32-34.

218 *Ibid*.

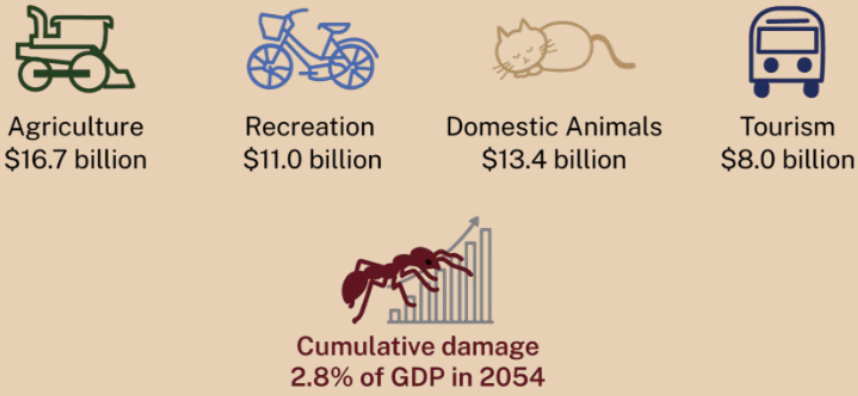
219 *Ibid*.

220 Lopez, D.J., Winkel, K.D., Wanandy, T., van Nunen, S., Perrett, K.P. and Lowe, A.J. (2024) 'The Human Health Impacts of the Red Imported Fire Ant in the Western Pacific Region Context: A Narrative Review', *Tropical Medicine and Infectious Disease*, 9(4), p. 69.

221 *Ibid*.

The ecological impacts of established fire ant populations will be substantial. Potentially, the impacts from fire ants will exceed the combined effects of all currently established invasive species.[222] Fire ants are likely to cause population declines in 45 percent of birds, 38 percent of mammals, 69 percent of reptiles, and 95 percent of amphibians.[223] Fire ant infestations can also disrupt ecosystem function. For example, fire ants compete with native ants, which as well being an important food source for many native animals, disperse the seeds of over 1000 Australian plants.[224]

CEBRA estimated that the potential cost due to the impact of fire ants could be more than $60 billion over 30 years, from 2023 to 2053, (or roughly $2.2 billion per year).[225] The highest cost impacts in the next 30 years by asset categories include:[226]



These costs would be predominately borne by the Queensland and NSW governments, industries and communities, and can escalate rapidly with increasing numbers of uncontrolled outbreaks. [227]

Overall, CEBRA projects that the cumulative and combined damage to agriculture, recreation, and tourism will exceed 1.5 percent of Australia's GDP, and that the largely unreported 'silent cost' to the environment will be 1.3 percent of GDP.[228] Jointly, this amounts to a cumulative damage of 2.8 percent of GDP measured in 2054. This is approximately half of the reported impact cost of the COVID-19 pandemic to Australia in 2020-2021.[229]

222 Magee, B., Oi, D., Parkes, J., Adamson, D., Hyne, N., Langford, D., Holtkamp, R. and Lawson, S. (2016) *Report of the Independent Review Panel: Independent Review Panel of the National Red Imported Fire Ant Eradication Program*.

223 Lach, L. and Barker, G. (2013) *Assessing the Effectiveness of Tramp ant Projects to Reduce Impacts on Biodiversity*, prepared by The University of Western Australia and G.M. Barker and Research Associates for the Australian Government Department of Sustainability, Environment, Water, Population and Communities.

224 DCCEEW (2024) *The reduction in the biodiversity of Australian native fauna and flora due to the red imported fire ant* Solenopsis invicta *(fire ant)*, key threatening process determination under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

225 Hanea, A., Moran, N., Wang, L., Li, C., Baumgartner, J., Palma, E., Camac, J., Bell, J. and Kompas, T. (2024) *Invasive Species Cost Assessment for New South Wales*, report prepared by CEBRA for the Commission.

226 *Ibid*.

227 Note: the Australian Government's contribution to the management of incursions under NEBRA is contingent on the assessment that the invasive species can be eradicated. See: *Ibid*.

228 *Ibid*.

229 *Ibid*.

5 Prioritising strategic planning for risk reduction

Key Findings

- While LLS and Agriculture and Biosecurity have been effective in delivering specific programs and on-ground projects for weed and pest animal management, there has been little improvement in the implementation of shared responsibilities for planning and resourcing introduced under the *Biosecurity Act 2015*.
- The *NSW Invasive Species Plan* only provides high-level guidance, not an actionable plan to tackle invasive species based on clear priorities and responsibilities.
- Regional plans do not consistently prioritise high risk pathways or identify and map responses to target sites. Planning processes do not adequately consider key risks and assets outside primary production, and are implemented inconsistently across pest animals and weeds, as well as different types of species.
- Regional strategic weed management plans use a risk-based approach to identify new and emerging weeds but more work is needed around widespread weeds listed for asset protection, as well as vertebrate and invertebrate pest animals.
- Complex NSW Government structures create the potential for confusion, overlaps and gaps in roles. Siloed management without consistent leadership from Agriculture and Biosecurity means the operation and understanding of responsibilities varies significantly between organisations, weed and pest animal functions, and new/emerging and widespread species.
- Without clear authority or lines of communication, the State Weeds Committee and State Pest Animal Committee did not ensure a consistent, coordinated and strategic approach to invasive species management across the state.
- State-level leadership and coordination by Agriculture and Biosecurity has worked for surveillance and incursion management of state priority weeds because of the contractual requirements of the WAP. Statewide policies, processes and response plans developed by Agriculture and Biosecurity are implemented at a regional level by LLS and LCAs, leading to a consistent and documented approach to surveillance and incursion management. However, there is no equivalent program for vertebrate and invertebrate pest animal management.

Key recommendations (see detailed recommendations in Executive Summary)

Recommendation 1 – DPIRD develop a NSW Invasive Species Planning Framework that consistently prioritises and resources risk reduction to manage current and future invasive species risks

Recommendation 2 – DPIRD redesign the *NSW Invasive Species Plan* to focus on strategic risk reduction through defined roles, responsibilities, investment priorities and actions

Recommendation 4 – DCCEEW develop relevant contributions for inclusion in the state and regional plans to ensure biodiversity and Aboriginal cultural values are prioritised

Recommendation 6 – The NSW Independent Biosecurity Commissioner review and make recommendations on state and regional committee functioning and membership to improve leadership, strategic decision making and accountability.

5.1 The concept of 'shared responsibility'

State, regional and local scales of planning are critical to effective risk-based landscape scale invasive species management. This is highlighted in previous reviews[230] and emphasised by key stakeholders involved in this Review. The concept of shared responsibility for both planning and resourcing through strong partnerships is embedded in biosecurity legislation and central to effective invasive species management activities.[231]

Shared responsibilities in invasive species management have gradually been defined and strengthened over time following a range of system-wide reviews, with one review noting that shared responsibility is most effective when '*stakeholders are aware of each other's roles and responsibilities*' and are '*working collaboratively toward achieving agreed outcomes*'.[232]

Both national and NSW guidance materials also refer to the concept of shared responsibility as an important approach between multiple stakeholders to address the scale and diversity of invasive species risks and impacts – rather than something individuals do separately on their own property:[233]

> *'A shared responsibility approach is the strengthening of coordination and collaboration between stakeholders in sharing resources, information, and risk, to develop a biosecurity system that can withstand exotic pest and disease threats.'*[234]

This concept is also more practically illustrated by one stakeholder interviewed for this Review:

> *'One important element of [invasive species management] is building greater understanding and increased acceptance of the importance of managing the whole landscape, regardless of ownership of the land. The gains lost when an adjoining landowner or manager fails to participate in effective management of invasive species is particularly demoralising for … other community members who invest effort in eradication of these species.'* [235]

The concept of shared responsibility is also well aligned with Aboriginal approaches to caring for Country:

> *'It is about everyone, both Indigenous and non-Indigenous, recognising they have an obligation to look after Country, and a key part of healthy Country is managing invasive species collectively.'*[236]

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230 Natural Resources Commission (2014) *Weeds – Time to get serious: Review of weed management in NSW;* Natural Resources Commission (2016) *Shared Problem, Shared Solutions: State-wide review of pest animal management*

231 Rawluk, A., Beilin, R. and Lavau, S. (2021) 'Enacting shared responsibility in biosecurity governance: insights from adaptive governance', *Ecology and Society*, 26(2), p. 18.

232 Craik, W., Palmer, D. and Sheldrake, R. (2017) *Priorities for Australia's biosecurity system; An independent review of the capacity of the national biosecurity system and its underpinning intergovernmental agreement,* pp. 12

233 Department of Primary Industries (2022) *NSW Biosecurity and Food Safety Strategy 2022-2030*

234 Bryant, M., Higgins, V., Hernández-Jover, M. and Warman, R. (2023) 'Transforming the Australian agricultural biosecurity framework: The role of institutional logics', *Australian Journal of Public Administration*, 82(4), pp. 405-595.

235 Submission: Individual, received 30 October 2023.

236 Aboriginal Stakeholder Forum (2023) 'Improving Aboriginal involvement in NSW Invasive Species Management', held on Dharug Country, 28 November.

5.2 Redesigning the *NSW Invasive Species Plan*

The NSW Government's overarching approach to planning invasive species management is captured in the *NSW Biosecurity and Food Safety Strategy 2022-2030* (see **Section 2.2**).[237] The *NSW Invasive Species Plan* then identifies how Agriculture and Biosecurity's objectives will be met within a framework of NSW invasive species management,[238] which includes the structure for regional-scale planning and implementation processes.[239]

The audit component of this Review highlights parts of the *NSW Invasive Species Plan* that have been implemented in accordance with the plan's requirements and identifies key areas for further improvement.[240] The audits demonstrate that further work is required by agencies to fully implement the existing state invasive species management plan (see **Section 2.2.1**).

The *NSW Invasive Species Plan* is more of a general guideline on issues that stakeholders should consider when undertaking invasive species management. It does not provide an actionable plan to tackle these issues based on clear priorities and responsibilities.

As identified above, the *NSW Invasive Species Plan* establishes the framework of regional committees developing regional plans, and the principles that should guide the development of these plans. However, the previous *NSW Invasive Species Plan 2018-2021* further specified that the regional plans should identify priority invasive species and management areas. Two other key elements have been removed from the latest version of *NSW Invasive Species Plan*: key deliverables, and case studies illustrating best practice management. The removal of these elements limits the ability of NSW Government to monitor its achievements and to conduct evaluation of invasive species management outcomes:

> *'The NSW Invasive Species Plan 2023–2028 also does not specify any outcomes relevant to invasive species or performance measures. In these respects, it is a considerable deterioration from the previous plan (2015–2022), which did specify some meaningful and measurable indicators – no new invasive species become established, reduced distribution and/or abundance of priority emerging species, success of eradication programs, success of control programs for selected widespread invasive species'.*[241]

The *NSW Invasive Species Plan* is also missing important statewide information regarding policy frameworks and details around state priority weeds and priority pest animals.[242] This information is instead included in regional planning documentation regional strategic weed management plans and regional strategic pest animal management plans, where it is

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237 Department of Primary Industries (2022) *NSW Biosecurity and Food Safety Strategy 2022-2030*

238 Department of Primary Industries (2023) *NSW Invasive Species Plan 2023-2028*

239 Other statewide documents that are derived from the *NSW Invasive Species Plan* include the WAP (Department of Primary Industries (2019) NSW Weeds Action Program Guidelines 2020-2025, and Department of Primary Industries (2022) *Wild Dog Management Strategy*)

240 Note: The audit did not seek to provide an evaluation of the quality of the plans themselves, unless aspects of planning or review of plans were allocated to agencies within the plans. See: Natural Resources Commission (2024) *Audit of state invasive species management in NSW – Independent assurance report;* Natural Resources Commission (2024) *Audit of regional invasive species management in NSW – Independent assurance report.*

241 Submission: Invasive Species Council, received 5 December 2023.

242 Weeds that pose a high risk to the entire state of NSW and are regulated under the *Biosecurity Act 2015* and *Biosecurity Regulation 2017* through the listing of either prohibited matter, control orders, biosecurity zones or mandatory measures. There are 16 priority pest animals identified across the 11 plans. Common to all 11 plans are seven pest animals; wild dog, fox, feral pig, rabbit, feral goat, feral cat, and deer. Two pest animals are identified in seven of the 11 plans (carp and horses) and seven species are identified in three or fewer plans (starlings, Indian mynas, camels, donkeys, cane toads, tilapia and redfin perch).

repetitive and distracts from more regionally focussed content. This content should be moved from the regional plans and incorporated into the redesigned *NSW Invasive Species Plan*.

This would allow the *NSW Invasive Species Plan* to be more actionable by including specific commitments for state-level programs, such as eradication programs for species like mouse-ear hawkweed or high-level containment programs for species like cane toads. For other species, the general approach would be described in the *NSW Invasive Species Plan*, but the actions would be devolved to the relevant regional plans. Moving this content to the *NSW Invasive Species Plan* also allows the regional plans to focus on regional delivery, through the identification of specific agreed actions to be undertaken.

The Commission recommends that DPIRD lead the delivery of the statewide strategic planning and resourcing framework through redesign of the *NSW Invasive Species Plan* to focus on strategic risk reduction through defined roles, responsibilities, investment priorities and actions, to:

- be outcomes driven, rather than activity driven, with associated targets – this needs to include Aboriginal values and outcomes, and biodiversity outcomes
- identify priority risk pathways (incursions and spread) and include requirements to develop component strategies to mitigate these risks to achieve agreed outcomes
- embed a partnership model with system-wide involvement across scales and management components
- align requirements for invasive species management under both the *Biosecurity Act 2015* and the *Biodiversity Conservation Act 2016,* and in line with the nature positive approach under the NSW plan for nature[243]
- identify emergency response planning, training and resourcing protocols for incursions of priority new or high-risk established species, including:
  - leadership from DPIRD to deliver coordinated emergency responses and plans following the state protocols
  - provisions for drawing on a broader pool of agencies, staff and authorised officers
- establish coordinated state response plans led by DPIRD for priority invasive species with specific objectives and targets for inspection, containment and eradication (where possible) and asset protection (where appropriate). This would include:
  - invasive species identified through control orders or biosecurity zones (for example, cane toads, tropical soda apple)
  - widespread species with escalating risk profiles (for example, feral pig, deer)
- detail specific commitments for state-level programs for compliance and enforcement, prevention and surveillance, eradication and containment, communication, research, MERI, and training
- include a plan for resourcing intense reduction of pest animals and weeds from high conservation value regions
- detail specific commitments for regional coordination and local delivery.
- include guidance for more active and targeted use of the existing legislative and regulatory toolkit (for example, general biosecurity directions, authorised officers)

[243] The Cabinet Office (2024) *NSW plan for nature; NSW Government response to the reviews of the Biodiversity Conservation Act 2016 and the native vegetation provisions of the Local Land Services Act 2013*

- be adapted as a 'living plan' and monitored and reported on through the knowledge strategy (see **Recommendation 12**).

To support this, the Commission recommends that LLS redesign regional-scale plans for invasive species management as cross-tenure partnership agreements to deliver risk reduction through management, surveillance, compliance and emergency responses. LLS need to:

- align with, and further detail, the *NSW Invasive Species Plan* at regional scales including priority risk pathways, statewide programs and targets
- be co-designed with partner organisations and regional committees in each region as 'living' agreements – this needs to include organisation wide commitment as well as endorsed support at local levels (for example, LCAs) and agreement to collaborate in delivery
- identify how Aboriginal people will be engaged in the implementation of the plan
- describe how funding will be allocated at the regional scale by partners to achieve risk reduction and asset protection across environmental, economic, social and cultural interests – this needs to consider existing and planned funding commitments and allocating funding at scales and times when programs are most likely to achieve the desired outcomes
- identify and map regional priority pathways and programs across both weeds and vertebrate and invertebrate pest animals for:
  - surveillance and incursion responses – inspections and other surveillance and compliance activities based on risk, with detailed response plans for how new incursions will be managed
  - new and emerging species – management priorities for containment and eradication of priority new and emerging species already present in the region
  - widespread species – management priorities for widespread species based on identified high-value assets.

5.3 Ensuring consistent, risk-based regional planning

The audit component of this Review highlights parts of the regional invasive species management plans that have been implemented in accordance with the plans' requirements and identifies key areas for further improvement.[244] The audits demonstrate that further work is required by agencies to fully implement the existing regional invasive species management plans (see **Section 2.2.1**).

The two key planning tools for regional-scale implementation are the regional strategic weed management plans and regional strategic pest animal management plans:

- **Regional strategic weed management plans** were developed by LLS Regional Weeds Coordinators, who are funded from the WAP to coordinate WAP activities undertaken by LCAs. These plans were developed in consultation with regional weed committees, that predominantly include LCA representatives. Although the purpose of the plans is to inform landholders and stakeholders what they should consider to meet their

[244] Note: The audit did not seek to provide an evaluation of the quality of the plans themselves, unless aspects of planning or review of plans were allocated to agencies within the plans. See: Natural Resources Commission (2024) *Audit of state invasive species management in NSW – Independent assurance report;* Natural Resources Commission (2024) *Audit of regional invasive species management in NSW – Independent assurance report.*

obligations under the *Biosecurity Act 2015*, they are primarily focused on state priority weeds, forming the basis for the inspections and incursion management activities undertaken by LCAs under the WAP. Some widespread species are included as regional priority weeds, but the focus of the plans and their implementation is on state priority weeds and as such they reflect the statewide plans and other guidance documents for state priority weeds prepared by Agriculture and Biosecurity.

- **Regional strategic pest animal management plans** were developed by LLS Team Leaders Invasive Species and their biosecurity officers with varying levels of consultation with stakeholders (five of the eleven regional pest animal committees are no longer functional, see **Section 7.3**). The regional strategic pest animal management plans are focused on describing activities land managers can undertake to manage widespread vertebrate pest species, and the role LLS will take in coordinating and implementing those activities. The plans do not identify high-risk pathways or related surveillance and inspection regimes for priority vertebrate and invertebrate species, and there has been less oversight from Agriculture and Biosecurity in their development and implementation. The plans all include a page on 'Incursion Management and Alert Species', which relies largely on public reporting.

The *NSW Invasive Species Plan*[245] identifies that these plans should be:

- tenure-neutral
- effective
- risk-based
- inclusive of all major stakeholders in the landscape.

Both the regional plans for weeds and pest animals are developed by LLS to provide broad information to enable land managers and potential risk creators to effectively meet their obligations under the *Biosecurity Act 2015*.[246] However, they purposefully do not include prescriptive measures on how to discharge their biosecurity duties.

The key issues identified around regional planning were that planning processes do not strategically prioritise high risk pathways and do not identify and map responses to target sites. Planning processes also do not adequately consider key risks and assets outside primary production. These issues are discussed in the following subsections.

Across these issues, the Review found that the regional planning structure and processes coordinated by LLS are implemented inconsistently across pest animals and weeds, as well as for different types of species:

> *'[We're] frustrated with the inconsistencies between plans and lack of formal assessment of outcomes and the business-as-usual approach. There is a lack of will to formally assess the outcomes of state and regional plans'.*[247]

> *'[The] pest plan is more about [LLS] communicating the priorities and the [pest] plan is a defence of why we make choices to manage certain species. We don't expect the councils to follow the [pest] plan [like for weeds]. It's more a useful tool to help landholders understand their role and responsibilities'.*[248]

245 Department of Primary Industries (2023) *NSW Invasive Species Plan 2023-2028*
246 These plans are nested under the LLS local strategic plans and the LLS State Strategic Plan and reflect respective content from the WAP and the *NSW Wild Dog Management Strategy*, as well as the *NSW Invasive Species Plan*.
247 Interview: State Pest Animal Committee Chair, 12 October 2023.
248 Interview: LLS regional staff, 11 October 2023.

5.3.1 Prioritising high-risk pathways in planning processes

Current NSW planning processes are limited in the consistent and strategic prioritisation of invasive species in terms of high-risk pathways and related surveillance and incursion management responses — this occurs variably between weeds and pest animals, and between regions. For weed species, each LLS region is required under the WAP to develop a systematic approach to inspections, specifically addressing high-risk pathways and sites for new weed incursions, and corresponding rapid response procedures.[249] For pest animal species, there is no equivalent risk-based prioritisation approach for either vertebrates or invertebrates. For widespread species of both pest animals and weeds, asset protection is listed as the goal for their management, but it is expected that individual land managers identify the assets at risk (environmental, agricultural or community) and determine the potential reduction in risk that could be achieved by their management.[250]

The importance of prioritising management according to risk was highlighted in the Review by many stakeholders.

> *'[We need to be] defining management goals not only in relation to reduction in invasive species population numbers or deaths, but also to include reference to reduction of broader negative impacts associated with invasive species, for example, outcomes assessed could include the response of native wildlife or impact on agricultural assets'.*[251]

> '*We need work to be done across agencies looking at those high-risk entry pathways, like the sale of plants, pets and aquarium fish. We know the risks of new invasive species being spread through those pathways are increasing.'*[252]

> *'Each bushfire management committee does the bushfire risk management plans, based on risk assessment and assets. Out of that you draw focus areas and then work out the treatment. A similar process would be useful. That helps us target any resources available at a landscape scale. One area of success in bushfire plans is having the regional and local level, so a couple of people statewide that facilitate the process regionally across the state consistently, otherwise the local level is too inconsistent. [Including] subject matter experts for coordinators to refer back to so they can focus on coordination and consistency'.*[253]

5.3.2 Addressing risks outside of primary production

In the regional plans, initial identification of priority species is often driven by primary production considerations, with ancillary consideration of environmental and community concerns. This is consistent with the findings of the NSW Audit Office in 2019, which found that NSW biosecurity activities focus on risks to the economy but did not directly address emerging risks to the environment and community amenity.[254] Aboriginal values and interests have also been inadequately addressed across both state and regional plans:

249 Department of Primary Industries (2020) *NSW Weeds Action Program Guidelines 2020-2025*
250 Graham, S., Height, K. and Smart, J. (2023) *Assessment of landscape-scale cross-tenure collective action on the management of widespread invasive species*, the University of Wollongong, report prepared for the Commission.
251 Submission: The NSW Young Lawyers Animal Law Sub-Committee, received 9 November 2023.
252 Interview: Invasive Species Council, 7 December 2023.
253 Interview: FCNSW, 8 December 2023.
254 Audit Office of NSW (2019) *NSW Auditor-General's Report to Parliament - Biosecurity risk management*

> *'I wrote all this material for the regional weeds plan, but they didn't take it on. The Plan is formulaic. It shouldn't be optional, we need to tell our [Aboriginal] story and it needs to be integrated into the whole plan'.*[255]
>
> *'Because regional strategic plans are LLS documents focused on agriculture, incorporating more on conservation threats and assets would be good … Impacts on Aboriginal cultural heritage, threatened species areas, would be good to recognise in the regional plans'.*[256]
>
> *'We're looking at conservation and a lot of those plans are looking at agricultural species of priority, that becomes tricky to balance those different priorities'.*[257]
>
> *'[The regional plans are] largely focused on protecting agricultural assets so environmental assets get very little or no specific attention such as for the Saving Our Species program'.*[258]

This was supported by the findings of the Commission's audit of regional invasive species management. The regional audit found that in the regions examined, there were not consistent and formal processes to identify regional assets of different kinds, their vulnerability to invasive species, and prioritise management programs to mitigate risks to assets.[259] LLS was typically able to identify regional agricultural and environmental values and projects and programs to mitigate risks to specific assets within these value classes. Although many programs were originally set up to mitigate impacts to primary production, these programs may also have environmental benefit.[260] Risks from invasive species to other values such as Aboriginal cultural heritage, public safety, waterways and water infrastructure, tourism and public amenity were not clearly or consistently considered and used to inform management priorities for asset-based protection.[261]

5.3.3 Identifying, mapping and prioritising target sites

Collaborative cross-tenure programs to target priorities are not consistently described or mapped. This includes a lack of management activities for widespread species based on identified and mapped high value assets (environmental, agricultural, social, cultural)[262] and management activities for both containment and eradication of priority new and emerging species:

> *'The plans need to be more prescriptive, they need to identify weeds in certain places and what actions are needed there … mapping out the priorities and expectations and requirements would be a beneficial step forward'.*[263]
>
> *'The missing piece is mapping extent and risk and cost, then not targeting our investment and resourcing. The spatial connection between whatever asset it is, agricultural or environmental, and then the impact and extent … is critical'.*[264]

255 Aboriginal Stakeholder Forum (2023) 'Improving Aboriginal involvement in NSW Invasive Species Management', held on Dharug Country, 28 November.
256 Interview: NPWS staff, 9 November 2023.
257 Interview: BCT, 4 December 2023.
258 Interview: FCNSW, 8 December 2023.
259 Natural Resources Commission (2024) *Audit of regional invasive species management in NSW – Independent assurance report,* pp. 27-31.
260 *Ibid,* p. 28.
261 *Ibid,* pp. 27-31.
262 Graham, S., Height, K. and Smart, J. (2023) *Assessment of landscape-scale cross-tenure collective action on the management of widespread invasive species*, the University of Wollongong, report prepared for the Commission.
263 Interview: Local Government NSW, 20 November 2023.
264 Interview: Saving our Species regional staff, 25 October 2023.

'Mapping would be good to elevate why we're doing things in certain areas. This kind of thing needs to be workshopped and have strong guidance from the state level to make it work'.[265]

The Case Study below outlines how the recommendations of this Review could be implemented by clearly mapping containment areas and activities to address the risks of Hudson pear.

CASE STUDY: Applying review recommendations to Hudson pear

Hudson pear is an invasive cactus species originating in Mexico and southern USA. It is a large-spined, branched cactus growing to 1.5 metres tall and 3 metres wide, which spreads easily and rapidly, degrading agricultural and environmental land values by displacing plants and seriously injuring animals and people.[266]

There are several types of infestation in NSW currently. The core infestation of Hudson pear in NSW is in the North West LLS region, around Lightning Ridge, Grawin and Glengarry, with scattered outlying infestations in other parts of the region, as well in Central West, Western and Northern Tablelands LLS regions (**Figure 24**).[267]

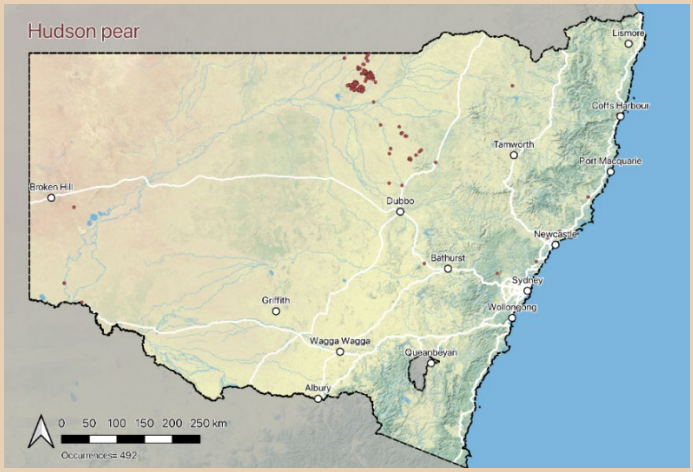

Figure 24: Hudson pear infestations in NSW[268]

Given the different degrees of infestation, regionally appropriate management responses are required. Implementing the recommendations of this review would see state-wide coordination supported by regionally specific plans and management tools. The core infestation of Hudson pear would be clearly mapped, including mapped actions to continue delivery of best practice biological control and herbicide application as appropriate. Other known infestations would also be mapped, including mapped actions to contribute to their localised eradication. Priority areas for inspection of potential other sites by LCA staff across these regions would be identified and mapped. All mapped actions would be included in the relevant regional weed plans and updated as necessary in the new, dynamic versions of these plans.

A range of stakeholders, including Castlereagh Macquarie County Council, Northern Slopes Landcare, Agriculture and Biosecurity, and local landholder groups, are becoming skilled at on-ground delivery of Hudson pear management and have done good work to try to address the issue, including developing best practice delivery of herbicides and biocontrol agents for Hudson pear control.[269] These stakeholders would benefit from state-wide coordination that would ensure that resources are consistently and efficiently used.

265 Interview: NPWS staff, 9 November 2023.
266 DPIRD (2024) *Hudson Pear (Cylindropuntia pallida)*
267 *Ibid.*
268 Map sourced from Agriculture and Biosecurity (2024) *Biosecurity Information System (Weeds)*
269 Northern Slopes Landcare (2020) *Releasing the Hounds on Hudson pear Final Report*

Under the previous *NSW Invasive Species Plan 2018-2021*, the development of regional invasive species plans was to include identification of priority invasive species and priority management areas.[270] The Commission's audit of state invasive species management showed that, although priority species were identified, priority management areas were typically not identified, although there was variation between the regional plans.[271]

Regional invasive species plans identify broad management strategies to be applied for different species (for example, asset-based protection) and may identify values to be broadly protected (for example, agriculture) without any priority locations or management areas identified.[272] This reduces the opportunity for management to be prioritised and undertaken in specific locations where it will have the greatest benefit and for land managers to understand and participate in these efforts.

The approach to identify, map and prioritise sites for invasive species management based on asset protection has previously been successfully applied to critical priority biodiversity assets such as threatened species. This was first undertaken in NSW in 2001 by NPWS under the *Threat Abatement Plan for Predation by the red fox (Vulpes vulpes)*.[273] Under the plan, 81 sites were identified, mapped and prioritised based on the severity of impacts by foxes on threatened species. The same approach was applied by NPWS in 2006 under the *Threat Abatement Plan for Invasion of native plant communities by Chrysanthemoides monilifera (bitou bush and boneseed)*.[274] This plan identified, mapped and prioritised 349 sites based on the impacts of bitou bush and boneseed on threatened species.

With over 340 species of weeds recognised to have impacts on biodiversity in NSW, it would be impractical to develop a threat abatement plan for all of them. Many weeds co-exist at sites, impact the same species and are subject to the same control techniques. Therefore, in 2011 a joint Agriculture and Biosecurity and NPWS project identified 2,631 priority sites across NSW for the protection of biodiversity from widespread weeds.[275] The Biodiversity Priorities for Widespread Weeds process prioritised and ranked all 2,631 sites based on distribution and impact of the weed species, conservation significance of the site, feasibility of effective control and likelihood that effective control would lead to an increase in the biodiversity values at the location.[276]

The sites identified under the fox and bitou threat abatement plans and Biodiversity Priorities for Widespread Weeds process were incorporated into the Saving our Species program in 2013. The Saving our Species program has mapped and identified priority actions to protect the most important sites for species and ecological communities listed under the *Threatened Species Conservation Act 1995*. Over 70 percent of Saving our Species sites have invasive species management as one of the priority actions for protecting threatened species at that site. In 2022-23 this equated to 1,316 invasive species management actions (control and/or monitoring) being planned, with 90 percent of those actions being implemented.[277] The Independent Review of the *Biodiversity Conservation Act 2016* found that the Saving our Species program was effective at protecting threatened

270 Department of Primary Industries (2018) *NSW Invasive Species Plan 2018-2021*, p. 16.
271 Natural Resources Commission (2024) *Audit of state invasive species management in NSW – Independent assurance report,* pp. 14-16.
272 *Ibid,* pp. 14-16.
273 NPWS (2001) *Threat Abatement Plan for Predation by the Red Fox (Vulpes vulpes)*
274 Department of Environment and Conservation (2006) *NSW Threat Abatement Plan – Invasions of native plant communities by* Chysanthemoides monilifera *(bitou bush and boneseed)*
275 Department of Primary Industries (n.d.) *Biodiversity priorities for widespread weeds - Statewide framework*
276 Whiffen, L.K., Turner, P. and Johnson, S. (2011) *Managing widespread weeds for biodiversity conservation using an asset-based site-led approach*, proceedings of the 16th Biennial NSW Weeds Conference.
277 Environment and Heritage (2024) *Saving our Species program*

species at those priority sites, but considered the approach needed to be enhanced with a more broadscale approach across ecosystems, to effectively protect biodiversity.[278]

Based on these processes, NPWS has also mapped and identified priority actions for 279 sites with Assets of Intergenerational Significance since 2022, all of which are currently threatened species. For each asset, NPWS has a statutory obligation to prepare and implement a concise conservation action plan, which includes management activities to address and mitigate the risks, including invasive species control.[279] NPWS has also developed a list of 2,241 invasive species management programs. Each program identifies the target pest animals or weeds, the aim of control, the values to be protected, the location and priority of the program. A total of 1,141 of these programs have been given a critical priority.[280]

The Commission recommends that the biodiversity priorities for widespread weeds process be re-applied for widespread weeds in the current context, as well pest animals. The process could also include a broader range of landscape values, including how management of invasive species will contribute to maintaining healthy Country, and clarify requirements for compliance, both in terms of priority areas for enforcement and corresponding management actions. By adding these elements to the planning process, it will clearly identify where resources can best be used according to risk reduction, both for monitoring and surveillance, and on-ground management.

5.4 Reducing complexity and siloes in NSW Government structures

Recent reviews have recommended that stakeholders are '*aware of each other's roles and responsibilities*' and '*working collaboratively toward achieving agreed outcomes*'. However, this is challenging within the inherently siloed structures and processes of NSW Government.[281] Building shared responsibility requires better coordination both within NSW Government agencies and through collaborative management arrangements.

Under the current system, the organisational lead roles and responsibilities for invasive species management are generally that (see also **Section 2.3**):

- **Agriculture and Biosecurity** is the lead agency for invasive species policy, training and research in NSW, and is responsible for surveillance and incursion management for new pest animal and weed species
- **LLS** is the is lead agency for regional implementation of invasive species management. [282]

While these responsibilities are defined in theory, in practice the actual operation and understanding of responsibilities varies significantly between organisations, weed and pest animal functions, and new/emerging and widespread species.

278 Department of Planning and Environment (2023) *Independent Review of the Biodiversity Conservation Act 2016*
279 Environment and Heritage (2024) *Assets of Intergenerational Significance conservation action plan consultation*
280 Environment and Heritage (n.d.) *Regional Pest Management Strategies*
281 Craik, W., Palmer, D. and Sheldrake, R. (2017) *Priorities for Australia's biosecurity system; An independent review of the capacity of the national biosecurity system and its underpinning intergovernmental agreement* pp. 12
282 Department of Primary Industries (2023) *NSW Invasive Species Plan 2023-2028*; Memorandum of Understanding between the NSW Department of Primary Industries and Local Land Services (2019)

Figure 25 illustrates the way roles, responsibilities and relationships are typically implemented in the current system, as described by interviewees. This highlights the complexities in the system that create the potential for confusion, as well as overlaps and gaps in roles. The Commission notes that there is also significant variation in these relationships, particularly between regions. For example, the Commission's audit of regional invasive species management observed that regional pest animal committees are no longer functional in five of the 11 LLS regions.[283]

Research and stakeholder feedback for this Review confirmed many systemic issues caused by piecemeal coordination of roles and responsibilities, including impacts on the delivery of coherent and effective invasive species management. Most critically, issues relate to inconsistent leadership and guidance from Agriculture and Biosecurity, which relies largely on informal relationships, as well as disconnected responsibilities for weeds and pest animals and separated functions for widespread and new/emerging species. These issues are further detailed in the subsections below.

The appointment of an Independent Biosecurity Commissioner has been a valuable undertaking of the NSW Government to provide oversight of invasive species management, promote coordination and accountability and provide impartial expert advice. This has been further supported through additional coordination roles for specific species (for example, the LLS feral pig coordinator in October 2023).[284]

While the impacts of these new roles are still emerging, the Commission has included integrated recommendations in this Review for clearer coordination of roles and responsibilities throughout state, regional and local scales to improve invasive species management outcomes.

The current structure also results in highly variable engagement in invasive species management varies across other public land managers (including NPWS, FCNSW, Crown Lands and Transport for NSW), which is reflected in the vastly different levels of spending on invasive management (detailed further in **Section 6.2**). Current governance structures also limit engagement and leveraging of resources from other non-land management agencies that play a role in invasive species management (discussed further in **Section 6.3**).

283 Natural Resources Commission (2024) *Audit of regional invasive species management in NSW - Independent assurance report,* p. 12.

284 LLS (2023) *New $13 Million Control Program has Feral Pigs in its Crosshairs* [press release], 18 October.

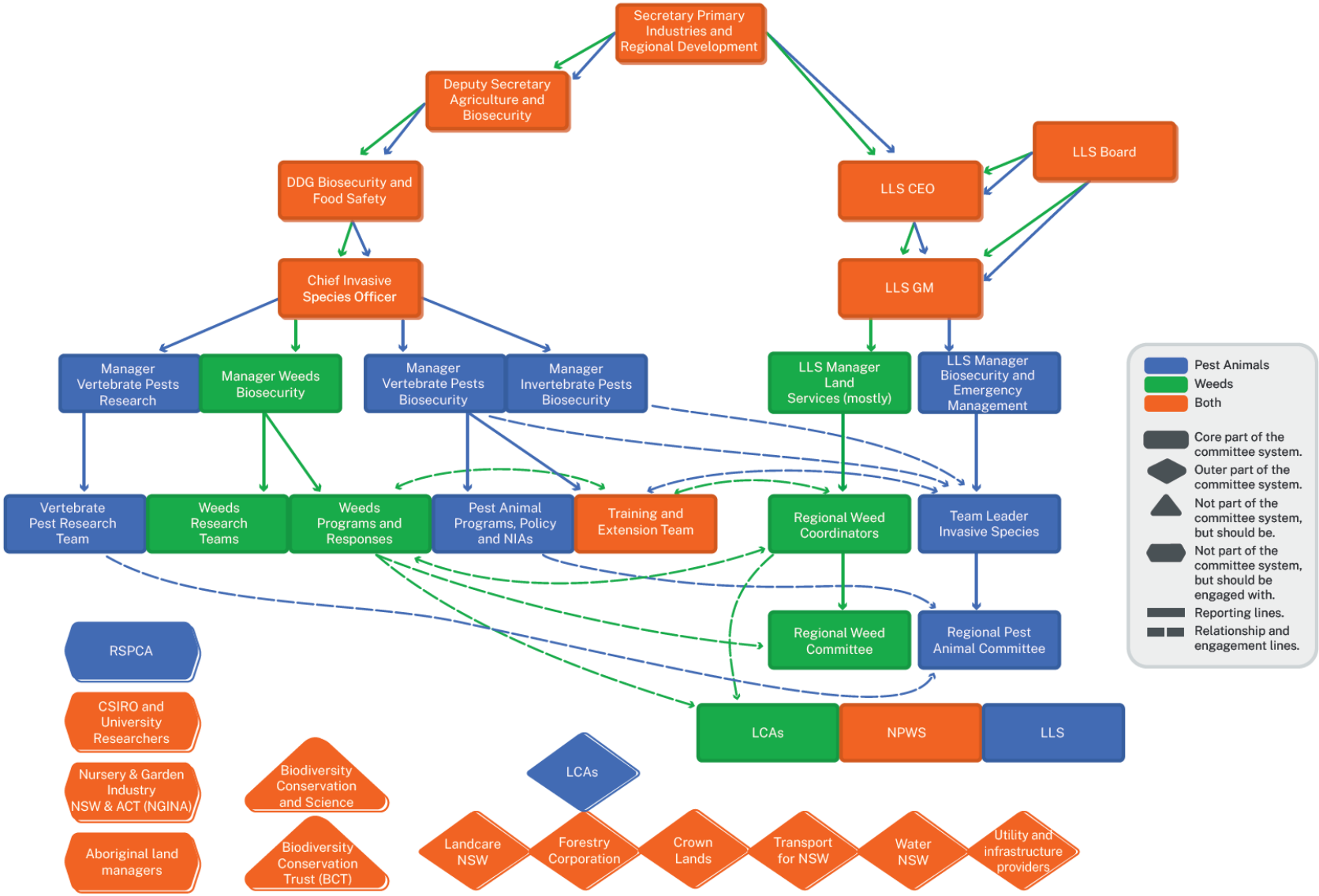

Figure 25: NSW invasive species management system - roles, responsibilities and relationships

5.4.1 Strengthening Agriculture and Biosecurity leadership and guidance

The NSW Audit Office's 2019 performance audit found that Agriculture and Biosecurity's reliance on informal arrangements with partner agencies increased the likelihood that resources will not be available where and when needed.[285] The statutory review of the *Biosecurity Act 2015* also identified that Agriculture and Biosecurity needed to establish and maintain better partnerships with relevant state agencies.[286]

This Review confirmed that many of these issues are ongoing and create gaps in responsibility in key parts of the system. While Agriculture and Biosecurity is responsible for statewide policies, research and training, and programs and responses to new incursions,[287] LLS has responsibility for regional implementation of invasive species management. A key role of LLS is to provide for regional voices in decision-making. In an ideal system, the implementation of statewide policies at a regional level would allow for enough flexibility to reflect unique local circumstances. Regular communication and executive oversight are required to maintain an appropriate level of balance between state support and guidance (currently perceived to be lacking) and regional autonomy. Such devolution of decision making is valuable but also contains risks from a state perspective.

Agriculture and Biosecurity relies on inherently variable interactions with LLS across regions, functions and teams. Despite the Memorandum of Understanding (MOU) between Agriculture and Biosecurity and LLS, Agriculture and Biosecurity has been unable to consistently rely upon LLS to undertake activities. While there are many examples of good collaboration, there remains significant opportunities for this relationship to break down, which impacts on the delivery of the system:

> *'[We] don't want state control that loses regional individuality but there's a lot of things at state level [Agriculture and Biosecurity and LLS] that would save resources and [reduce] inconsistency, so it makes sense to roll up certain things … tried to get consistent measures for reporting as well for each region to report on grants funding for WAP … [Agriculture and Biosecurity] would get better reporting data and then statewide consistency'*.[288]
>
> *'I think the process where [Agriculture and Biosecurity] used to run the planning was good, with an assessment and prioritisation of programs and risk. Not sure that LLS took on that advice in their activities. LLS were brought in to have a more important role but they've drifted away from that approach in my view'*.[289]
>
> '*Part of the issue is the interaction between [Agriculture and Biosecurity] and LLS isn't as close to what we'd hoped it would be'*.[290]

285 Audit Office of NSW (2019) *NSW Auditor-General's Report to Parliament - Biosecurity risk management*
286 Department of Regional NSW (2023) *Statutory Review of the Biosecurity Act 2015*
287 There are four divisions within Agriculture and Biosecurity with functional responsibilities for invasive species: Weeds Biosecurity, Vertebrate Pest Biosecurity, Vertebrate Pest Research and Invertebrate Biosecurity.
288 Interview: LLS regional staff, 11 October 2023.
289 Interview: State Pest Animal Committee, 12 October 2023.
290 Interview: Anonymous, 24 October 2023.

5.4.2 Aligning weed and pest animal responsibilities

At a statewide level, Agriculture and Biosecurity has four invasive species sections:

- Invertebrate Pest Biosecurity
- Vertebrate Pest Biosecurity
- Vertebrate Pest Research
- Weeds Biosecurity, which covers research, and program and response functions.

The Weeds Biosecurity section interacts with LLS and LCAs daily, both through guidance on the delivery of the WAP and the implementation of LCA statutory responsibilities. Interactions between each of the Agriculture and Biosecurity pest animal sections and LLS are more sporadic and informal, and LCAs do not currently play a defined and consistent statewide role in pest animal management.

At a regional level, each of the 11 LLS regions has weed and pest animal responsibilities, but these are implemented through separate organisational arrangements. For pest animals, there is a Team Leader Invasive Species and a team of biosecurity officers in each region who report to the Manager Biosecurity and Emergency Services. Their role is to provide advice and support to LLS rate payers regarding pest animal management.[291] These positions are not involved in weed management. For weed management, each LLS region has a Regional Weeds Coordinator. However, these positions report separately through the Manager Land Services, or other management streams within LLS.[292]

This structure inherently limits opportunities for cohesiveness across invasive species management as well as the effectiveness and reach of coordinator roles, which are currently focused primarily on implementation of the WAP by LCAs (see further discussion in **Chapter 7**). The coordinators identified that their role is seen as relatively new in LLS, and with LLS not having a specific legislated role in weed management, they receive limited support from within LLS, leaving them feeling isolated.[293]

5.4.3 Integrating widespread and new/emerging species

In response to the recommendations of the Commission's 2014 statewide review of weed management,[294] local government's role through LCAs (see **Section 2.3**) has been narrowed to focus on surveillance and incursion management for new and emerging weed species. This is driven by the WAP, a contract-based program that Agriculture and Biosecurity uses to fund LCAs to undertake inspections, extension and incursion management for state priority weeds (i.e. it specifically excludes programs for widespread weeds).[295]

This has seen LCAs shift away from managing widespread weeds.[296] The expectation was that responsibility for coordinating widespread weeds would be fulfilled by LLS, and while this is

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291 This includes providing advice and training to landholders in pest animal management techniques, supplying baits and vertebrate pesticides, coordinating group control programs, and undertaking priority pest animal programs, such as aerial baiting and aerial shooting programs, as well as localised baiting, trapping and ground shooting programs (Interview: State invasive species leads (Agriculture and Biosecurity, LLS, NPWS), 15 September 2023; Interview: LLS regional Staff, 11 October 2023).

292 *Ibid*.

293 Interview: LLS regional staff, 11 October 2023.

294 Natural Resources Commission (2014) *Weeds – Time to get serious; Review of weed management in NSW, Final report and recommendations*

295 State priority weeds are those listed under the *Biosecurity Act 2015* and *Biosecurity Regulation 2017* as either prohibited matter, within control orders or within biosecurity zones.

296 Graham, S., Height, K. and Smart, J. (2023) *Assessment of landscape-scale cross-tenure collective action on the management of widespread invasive species*, the University of Wollongong, report prepared for the Commission.

reflected in the MOU between Agriculture and Biosecurity and LLS, this responsibility has generally not been realised:

> '*Originally when LLS got involved, they were going to deal with widespread weeds and we were focused on higher priority weeds … Don't think they have the staff to do that really and fulfil that function'*.[297]

In most LLS regions, regional coordinator roles are characterised by short-term contracts with a high turnover, which tends to limit their focus to the immediate delivery of the WAP. However, in the three LLS regions where regional coordinators have been employed fulltime for more than four years, they have started to develop some more collaborative cross-tenure programs for widespread weeds.

In contrast, for pest animals LLS are responsible for both new/emerging and widespread species at the regional scale. However, unlike for weeds, there are no formal surveillance and incursion response programs. Instead, there is a reliance on members of the public to report any unusual animals to Agriculture and Biosecurity. Responses to incursions are guided by an Agriculture and Biosecurity procedure, but there are no formal networks established in each region, as there are for weeds, and each response is rebuilt from scratch based on personal relationships and the willingness of organisations in the region (such as LLS, LCAs and NPWS) to be involved.[298]

5.5 Shared responsibility and collaboration through state committees

Key stakeholders interviewed for this Review highlighted some of the gaps in collaboration between government and other partners, as well as how critical collaboration is to a 'shared responsibility' approach:[299]

> '*The 'general biosecurity duty' introduced in the NSW Biosecurity Act 2015 is intended to encourage greater collaboration between government, industry and the community. However, the extent to which this actually occurs is very variable. Greater understanding across all sectors, of the factors that foster the required collaboration, is critical to increased success in eradicating and managing invasive species'*.[300]

> '*Improved coordination and cooperation between government, [non-government organisations], and the community are essential, extending beyond funding to include knowledge exchange, strategic alignment, and persistent effort'*.[301]

> *'[We need] greater collaboration within government, and with other spheres, to maximise efficiencies. Greater collaboration across land managers and with the community*.'[302]

To date, the system relied on the state committees to provide the foundations of collaborative cross-tenure partnerships, which would then be reflected in the regional committees. Indeed, the State Weeds Committee and State Pest Animal Committee were appointed by the Minister for Agriculture in 2016 and 2017, respectively, to ensure a consistent, coordinated, and strategic approach to invasive species management across NSW.[303] The Terms of

297 Interview: NSW Weeds Officer Association, 21 November 2023.
298 Interview: State invasive species leads (Agriculture and Biosecurity, LLS, NPWS), 15 September 2023; Interview: LLS regional staff, 11 October 2023.
299 See also: Rawluk, A., Beilin, R. and Lavau, S. (2021) 'Enacting shared responsibility in biosecurity governance: insights from adaptive governance', *Ecology and Society,* 26(2), p. 18.
300 Submission: Individual, received 30 October 2023.
301 Submission: Landcare NSW, received 3 November 2023.
302 Submission: Local Government NSW, received 31 October 2023.
303 Department of Primary Industries (2023) *NSW Invasive Species Plan 2023-2028*

Reference are broadly consistent for these two groups, and comprise the following functions:[304]

- Ensuring that regional weeds committees and regional pest animal committees have a consistent approach and operate on a tenure-neutral basis inclusive of all major stakeholders in the region.
- Overseeing the development and implementation of tenure-neutral regional strategic weed management plans and regional strategic pest animal management plans to ensure they are effective, risk-based and inclusive of all major stakeholders.
- Providing advice on and overseeing the implementation of key policy, strategy and regulatory documents relating to weed and pest animal management.
- Improving monitoring, evaluation and effectiveness of weed and pest animal management.
- Considering options for responding to high-risk incursions of new weed and pest animal species.

Common membership of both committees includes Agriculture and Biosecurity, LLS, NPWS, Local Government NSW, the Nature Conservation Council and NSW Farmers. The State Weeds Committee additionally includes Crown Lands, the NSW Weeds Officer Association, and the Nursery and Garden Industry NSW & ACT. The State Pest Animal Committee additionally includes RSPCA NSW and Landcare NSW.

This Review found that both committees have lacked consistent engagement of key stakeholder members, clear and consistent definitions of their shared responsibilities, delivery of implementation function,[305] and strong oversight requirements. The Commission also found that:

- utilities and infrastructure organisations are not fully engaged in the committee processes
- there is limited understanding of invasive species management by staff within organisations on the edge of or outside the system
- regional committees are focused on issues that are not relevant to many land management organisations or committee members
- a lack of enforcement of the legislation reduces organisational drive for invasive species management by organisations not well engaged in the system.[306]

The actual functioning of the committees has been problematic and variable. The State Weeds Committee held its inaugural meeting on 1 June 2016, with 22 meetings held to date. The last meeting was held on 7 July 2023, with a subsequent workshop on 7 August 2023, and out of session papers circulated for approval on 30 October 2023. The State Weeds Committee was dedicated to discussing statewide weed issues, including member updates, but lacked clear communication protocols to influence regional weed committees and the regional delivery of weed management.

304 Department of Primary Industries (2023) *NSW Invasive Species Plan 2023-2028*

305 Meetings of both committees generally include member updates, presentations on major programs, and updates on and endorsement of major plans, policies or regulatory changes (for example, the *NSW Invasive Species Plan*, priority weed incursion response plans, codes of practice and standard operating procedures for the humane destruction of pest animals).

306 Graham, S., Height, K. and Smart, J. (2023) *Assessment of landscape-scale cross-tenure collective action on the management of widespread invasive species*, the University of Wollongong, report prepared for the Commission.

The State Pest Animal Committee held its inaugural meeting on 29 August 2017, with 14 meetings held to date. The State Pest Animal Committee has been inoperative, not meeting since 22 November 2022.[307] The State Pest Animal Committee mainly focused on member reports, national coordination initiatives, research updates and the allocation of the Special Purpose Pest Animal Management Rate. As for the State Weeds Committee, there was no process to communicate with or influence regional pest animal committees and regional delivery of pest animal management.

In June 2024, the Deputy Director General of the Department of Primary Industries – Biosecurity and Food Safety wrote to the members of the State Weeds Committee and State Pest Animal Committee to inform them that the committees had been discontinued and that consideration of any future committees would be informed by both this Review and the advice of the Independent Biosecurity Commissioner.

Stakeholders interviewed for this Review considered that the State Weeds Committee and State Pest Animal Committee lacked influence and clear purpose despite having a Terms of Reference. They also considered there was inadequate regional-scale interaction with key stakeholders and a lack of communication protocols between the state and regional committees, leading to confusion and frustration:

> *'The statewide pest committee seemed to have little ability to influence government.'*[308]

> *'The statewide weeds committee was like secret business. We only heard from them when funding rounds were on. There was no real process of providing input or agenda items into the committee, no minutes available. Our regional committee puts up questions to the state committee and we hear nothing back. There's no standard way for that communication to happen between regions and state. There are many instances of inconsistencies in the way the committee communicates and responds to requests or issues … they said they have to put everything before the Minister before going out but we don't hear anything on that process and why. We need clarification of what the committee is for. We need to know what they will and won't deal with.'* [309]

> *'You don't get any feedback … We used to get the notes, omitting confidential items, but now even they come out in dribs and drabs. We've given up taking issues up to the committee … we don't get papers until 6 months after the meeting. I know it's meant to advise the Minister but that doesn't make for timely responses to our actions … I think it's lost its way in the last couple of years. People are questioning its purpose now.'*[310]

There was also limited oversight and alignment between the state and regional levels. Despite the Terms of Reference, LLS do not consider the State Weeds Committee and State Pest Animal Committee as having a role in overseeing the regional committees, and LLS are more likely to consult with the LLS Statewide Advisory Groups on statewide matters.[311] One of the key functions of the State Pest Animal Committee was to assess, rank and allocate funding to applications put forward by member agencies for the state component of the Special Purpose Pest Management Rate. However, LLS took over responsibility for allocating the state component of the Rate in 2022 and it is now allocated to LLS regions along with the regional component.

307 Interview: State Pest Animal Committee, 12 October 2023.
308 Interview: Invasive Species Council, 7 December 2023.
309 Interview: LLS regional staff, 11 October 2023.
310 Interview: NSW Weeds Officer Association, 21 November 2023.
311 Interview: State invasive species leads (Agriculture and Biosecurity, LLS and NPWS), 15 September 2023; Interview: LLS regional staff, 11 October 2023.

The State Weeds Committee was advised by LLS of the development of the updated regional strategic weed management plans but was not involved in the development process or approval of the updated plans:[312]

> *'[LLS] have our own GMs, Board, [Agriculture and Biosecurity], we don't need another layer of oversight. What value are they adding? They seem to just get technical experts to review the list and then the committee rubber stamp it, so they don't seem to actually do any work.'*[313]
>
> *'We have a (LLS) statewide advisory group that functions really well which is the team leaders in LLS and we resolve a lot of issues in that forum so may not need the other committee.'* [314]

Although the committees were not considered successful, most stakeholders felt strongly that this type of collaborative function is critical for enabling collaborative and coordinated programs and could be effective if:

- committee membership was truly representative of the whole invasive species management system
- two-way communication between the state and regional committees was properly established
- the state committees were able to review and guide the activities of the regional committees.

Under this scenario, the state committees could provide the critical oversight and guidance to ensure coordinated and effective invasive species management across the state, as envisioned when these committees were first proposed:

> *'If it's run to do what it's supposed to do then, absolutely, the committee has value.'*[315]
>
> *'Those committee positions need to be properly supported … they are valuable.'*[316]
>
> '*There is a need for clear roles and responsibilities at state and local levels, calls for transparency in decision-making, and advocating for state-level coordination to ensure decisions serve the broader state interests rather than being perceived as region-centric.'*[317]

The Independent Biosecurity Commissioner has been tasked by the NSW Government to review the governance arrangements of the state and regional committee system, which should feed into this process.[318] This review should consider examples of best-practice cross-tenure committees currently operating in NSW. For instance, the NSW bushfire management committees have the following core attributes:

- **A clear statutory purpose** – namely, holistic protection of the community, based on a tenure-neutral, cooperative and coordinated approach that draws on community and interagency involvement.
- **Active membership** – drawn from statutorily mandated invitees.
- **A clear governance charter** – clearly stating roles and responsibilities.

312 Interview: State invasive species leads (Agriculture and Biosecurity, LLS and NPWS), 15 September 2023.
313 Interview: LLS regional staff, 11 October 2023.
314 Interview: LLS regional staff, 11 October 2023.
315 Interview: Landcare NSW, 13 October 2023.
316 Interview: Invasive Species Council, 7 December 2023.
317 Interview: NPWS, 29 November 2023.
318 Minister for Agriculture (2023) *NSW Government delivers on Biosecurity Commissioner election commitment with passing of bill* [press release], 30 November.

- **Authority and agreement** – a policy that all members of the committee have the authority to commit their organisation to agreed actions (the '*Bushfire Management Committee Policy*').[319]

At a minimum, the Commission advises that the Independent Biosecurity Commissioner reviews and makes recommendations on state and regional committee functioning and membership to improve leadership, strategic decision making and accountability, including:

- an overarching NSW Invasive Species Management Committee with decision-making powers
- oversight and influence from senior executives of key agencies (for example, DPIRD, DCCEEW, the Department of Planning, Housing and Infrastructure, Transport for NSW) on the state committee who have authority to make decisions on behalf of their agencies, with an appropriate Chair (for example, the Independent Biosecurity Commissioner) and secretariat (for example, DPIRD)
- participation of key stakeholder groups outside of government (for example, NSW Farmers, Landcare NSW, RSPCA NSW, Nature Conservation Council, Invasive Species Council, NSW Aboriginal Land Council)
- well-defined core functions to ensure consistent, coordinated, strategic planning and resourcing of invasive species management across the state
- support from interagency technical specialist working groups where required
- associated regional-level committees, coordinated by LLS, that align with state committee roles and functions
- clear escalation pathways for when consensus cannot be met, and accountability lines for when agency partners cannot meet their commitments
- transparency and reporting requirements, including transparent minute taking and annual reporting
- independent oversight by the Independent Biosecurity Commissioner.

319 Rural Fire Service (2024) *Bush Fire Coordinating Committee*

6 Identifying resourcing requirements and maximising value for money

Key Findings

- Increasing threats from invasive species coupled with limited government funding means that the NSW Government must ensure public resources are targeted to actions that most effectively reduce risk and maximise the rate of return on investment or 'value for money'. However, this has not been the case. Driven by a lack of a statewide risk-based approach or resourcing strategy, funding is often instead allocated based on existing program maintenance, public visibility of invasive species or pressure from interest groups.
- Without specific regional planning and coordination, engagement and resource allocation across NSW Government organisations varies significantly. Across NSW public land managers, expenditure per hectare on invasive species management ranges from $1.79 by FCNSW up to $8.64 by LLS on travelling stock reserves.
- Non-land management government agencies such as the NSW Environmental Trust, BCT and BCS fund various invasive species management programs and have the potential to contribute more to collaborative approaches, but currently are not effectively engaged with Agriculture and Biosecurity, LLS and LCAs.
- NSW investment focusses on the short-term management of species and incidents rather than the development of biosecurity management system capacity as a whole.

Key recommendations (see detailed recommendations in Executive Summary)

Recommendation 7 – DPIRD propose a NSW Invasive Species Investment Program to NSW Treasury

Recommendation 1 – DPIRD develop a NSW Invasive Species Planning Framework that consistently prioritises and resources risk reduction to manage current and future invasive species risks

Recommendation 2 – DPIRD redesign the *NSW Invasive Species Plan* to focus on strategic risk reduction through defined roles, responsibilities, investment priorities and actions

6.1 Targeting resources to areas of highest risk

The Commission's analysis estimates that the NSW Government spends at least $200 million annually on invasive species management (see **Section 3.3.2**).[320]

Invasive species management in NSW does not occur as one or more discrete programs, rather as a complex system of funding sources, land managers and researchers, with managers often receive funding from multiple sources. Although there are some funding sources specifically for invasive species, such as the WAP and Special Purpose Pest Management Rate, most funding sources are focused on protecting either environmental or agricultural values. Broadly, funding and resourcing for invasive species management comes from the following organisations:

- **Public land managers:** NPWS, FCNSW, Crown lands, Transport for NSW and LLS for travelling stock reserves (discussed in detail in **Section 6.2**).
- **Agriculture and Biosecurity:** Agriculture and Biosecurity fund statewide invasive species management programs. The key statewide program funded by Agriculture and

320 Hanea, A., Moran, N., Wang, L., Li, C., Baumgartner, J., Palma, E., Camac, J., Bell, J. and Kompas, T. (2024) *Invasive Species Cost Assessment for New South Wales*, report prepared by CEBRA for the Commission.

Biosecurity is the WAP, which comprises a state-wide and a regional sub-program, as well as co-investment from LCAs, to the value of $35 million in 2022-23. In 2022-23, the statewide sub-program was $1.75 million and included overall program coordination, mass rearing and release of biocontrol agents, development and delivery of training and extension materials, and incursion response activities for state priority weeds such as parthenium, tropical soda apple and orange hawkweed and mouse-ear hawkweed. In 2022-23, the regional sub-program funded by Agriculture and Biosecurity was $11.05 million, which was allocated to LLS to fund each of the regional weed coordinators, and to LCAs to undertake monitoring, surveillance and incursion management for state priority weeds and extension and community engagement activities. Submissions for funding are assessed based on how their proposed activities align with these functions, and the level of cash or in-kind co-funding proposed by the LCAs, aligned with their statutory functions in weed management under the *Biosecurity Act 2015*. In 2022-23, co-funded activities totalled $22.2 million.

There is no equivalent program for pest animals. Agriculture and Biosecurity deliver vertebrate pest animal management training, the 2022-23 cost of which was $111,000. Agriculture and Biosecurity also leads, funds and implements emergency incursion management for new priority invasive species; in 2022-23 this amounted to $152,000 for vertebrate pest animals, $324,000 for invertebrate pest animals and $435,000 for weeds.

- **LLS:** The focus for LLS implementation is supporting rate payers (private land holders) to control widespread vertebrate pest animals on their land, with predominantly a primary production focus. This includes providing advice and training in pest animal management techniques, supplying baits and vertebrate pesticides, coordinating group control programs, and undertaking priority pest animal programs, such as aerial baiting and aerial shooting programs, as well as localised baiting, trapping and ground shooting programs.[321]

  LLS coordinates significant collaborative cross-tenure programs, where the focus is the protection of primary production on rate payers' lands. Funding predominantly comes from rates paid by rate payers and the Special Purpose Pest Management Rate.[322] The Rate is collected to support statewide plague locust control as a priority, with the remainder apportioned to LLS to control pest animals as per the priorities in the regional strategic pest animal management plans. In 2022-23, the amount of the Rate apportioned for this purpose was $6.183 million.[323] In 2022-23, LLS received an additional $22.8 million for feral pig control.[324] The total for LLS pest animal management programs in 2022-23 was $48.6 million. As well as hosting the regional weed coordinators funded by the WAP, LLS also provides weed management advice related to crop and pasture management to landholders through its agronomists.

- **Local governments:** Local governments have a statutory requirement under the *Biosecurity Act 2015* as LCAs to manage the biosecurity risk posed by weeds. This function is largely fulfilled through their involvement in the WAP but may also include other activities related to the management of widespread weeds, which is outside the scope of the WAP, but still within their statutory responsibilities. Local councils have obligations to manage invasive species on land they own, occupy or manage, including Crown lands and road reserves as identified above. Local councils are also involved in pest animal and weed management as a response to their service function of environmental protection under the *Local Government Act 1993*.

321 Interview: LLS regional staff, 11 October 2023.
322 *Ibid*.
323 Information provided by LLS, 11 July 2024.
324 Over the past three years, LLS has received additional funding specifically for feral pig control.

- **Other environmental agencies and organisations:** A range of invasive species programs are funded by other government agencies and organisations, including DCCEEW's Saving our Species Program, the BCT, the NSW Environmental Trust and Landcare NSW (discussed in detail in **Section 6.3**).

Although the total public investment in invasive species management is considerable, there is a widespread view among stakeholders that it is not commensurate with the risks posed. This is a growing concern in the context of cumulative and increasing cost impacts across all parts of the system:

> *'If government are going to support eradication and containment and put it into legislation, we need funding systems to support them. Funding is getting less, and they still want outcomes.'*[325]

> *'[It is a] chronically underfunded and ad hoc biosecurity system, bits are working well where funded, but the heart of this is there's a lot of things we can do but we need to increase resources. The level of resources, both in terms of agency capability, research focus, surveillance, information, community awareness and education, is chronically below the level of risk and impact of invasive species. That makes it hard to say there are simple fixes because most of the agencies might know what's needed but they don't have the resources.'*[326]

The costs of managing invasive species has risen significantly over the past 50 years (**Section 4.2**), coinciding with growing competition for limited government resources.[327] While the review of the *Biosecurity Act 2015* noted the need for longer-term and sustainable resourcing of the NSW invasive species management system,[328] inevitable funding constraints within government will require efficient allocation of public resources targeted to actions that most effectively reduce risk and maximise the rate of return on investment or 'value for money'. A principle of IGAB is that *'investment prioritises the allocation of resources to the areas of greatest return, in terms of risk mitigation and return on investment*'.[329]

Resources from multiple sources are often combined by land managers and researchers into single or multiple programs, with intersecting objectives as invasive species can have wide-ranging environmental, agricultural and social impacts. This combined approach can lead to efficiencies and positive benefits across a wider spectrum of impacts. For example, invasive species management undertaken to protect agriculture can have significant benefits for biodiversity (for example, aerial baiting to protect sheep from wild dogs is also extremely effective at removing foxes from the landscape and protecting native wildlife).

However, this Review found that, overall, resources are not always allocated to the area of greatest risk reduction and rate of return. Even where risk assessments are used to allocate resources, they generally focus on threats and not on the activities used to manage them, their outcomes or value.[330]

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325 Interview: State invasive species leads for Agriculture and Biosecurity, LLS and NPWS, 15 September 2023.
326 Interview: Invasive Species Council, 7 December 2023.
327 The Australian Government's 2023 intergenerational report predicts slower economic growth in the coming decades. This slower growth will place pressure on the tax base at a time of rising costs, creating a long-term fiscal challenge. See: Australian Government (2023) *Intergenerational Report 2023 Australia's future to 2063*
328 Department of Regional NSW (2023) *Statutory Review of the Biosecurity Act 2015*
329 Australian Government (2019) *Intergovernmental Agreement on Biosecurity*
330 Current use of risk prioritisation frameworks or rankings are limited in their effectiveness because they; provide little information on the 'value for money' of proposed projects; do not assess the extent of risk reduction achieved from investing in a project; do not inform the decision on whether one project should be funded over another; do not give information on the total amount of expenditure needed to reduce risk to the agreed acceptable level. (See: Kompas T, Chu L, Van Ha P and Spring D (2019) 'Budgeting and portfolio

Stakeholders indicated that invasive species management is often undertaken because the funding is available for those activities, rather than because they are the highest priorities or generate the greatest return on investment. Stakeholders suggest that other factors may influence resource allocation, including the maintenance of existing programs, the visibility of the invasive species and perceived impacts, and pressure from interest groups:

> *'Public accountability for expenditure on invasive pests and weeds in 2023 is arguably at the lowest level that it has ever been. There is no visibility around what is being spent where and no system for monitoring and evaluating the effectiveness of that spend.'*[331]

Inefficiencies in the strategic allocation of limited funds are driven by the lack of an overarching resourcing strategy given the *NSW Invasive Species Plan* does not adequately guide the allocation of resources to identified management priorities. This is further complicated by an array of funding sources, mechanisms and service providers, which fragment the available public resources into smaller programs and projects.

Without specific regional planning and coordination, resource allocation across NSW Government organisations largely occurs in silos. This allows different land managers to contribute vastly different amounts to the shared responsibility of invasive species management, an issue that is particularly evident across public land managers (discussed in **Section 6.2**). A lack of strategic coordination also means that funding from other environmental agencies and organisations may not be effectively targeting priority risks.

These issues impact on effectiveness and return on investment as many invasive species have impacts across conservation, social and production assets and often share the same incursion risk pathways. In this context, investments focused on broader system functions, and not just individual species, can generate improved outcomes and returns on investment. For example, post-border surveillance programs can provide a cost-effective management tool if program design can balance the required surveillance expenditure and the expected benefit of early detection and response. Advances in technology are rapidly reducing surveillance costs and facilitating the involvement of the general community. Further efficiencies can also be generated through multi-species and general surveillance programs.

In addition, the lack of formal strategic planning and resourcing '*increases the risk that resources may not be available where and when needed*' and limits the ability to '*analyse and report cost, resource and activity data*' across partner agencies.[332]

Overall, the complexity and fragmentation of NSW funding arrangements, and the absence of an overarching strategy, make it difficult to generate a clear understanding of planned outcomes, the amount and effectiveness of public investment, or its sufficiency:

> *'[The Government] needs to embed the long-term nature of the response required into policy and budget planning.'*[333]

allocation for biosecurity measures', *Australian Journal of Agricultural and Resource Economics*, 63, pp. 412–438).

331 Submission: Timber NSW, received 3 November 2023.

332 Audit Office of NSW (2019) *NSW Auditor-General's Report to Parliament - Biosecurity risk management*

333 Interview: State invasive species leads for Agriculture and Biosecurity, LLS and NPWS, 15 September 2023.

Reviews have previously recommended a consistent approach to biosecurity investment prioritisation across the system.[334] However, significant improvements in data and capability are required to enable this to occur in NSW (see **Chapter 10**):[335]

> '*Invasive species management programs for many species are ineffective and not properly evidence based. There is limited research on the effectiveness of management programs, and little is done to monitor the impact of invasive species management on native ecosystems.*'[336]

Efficient funding arrangements are a key attribute of invasive species management system effectiveness. Key design criteria for an effective and efficient invasive species resource allocation process include:[337]

- the total state budget available for invasive species management is applied
- resource allocation is informed by a consistent and rigorous approach to risk and likelihood and consequence analysis
- expenditure on invasive species management is routinely monitored to assess rates of return on activities and inform future resource allocation
- decision-makers make use of available knowledge, tools, and models to support budget allocation decisions
- a model for optimally allocating resources across different invasive species risks is adopted
- there are clearly defined accountability arrangements for budget allocation and strategy development
- resource allocation informed by a clearly articulated statewide strategy for invasive species management that enshrines shared responsibility for decision-making and action
- a statewide invasive species strategy accompanied by an independent performance monitoring and evaluation framework.

With the projected increases in risk, and limitations in available resources, the NSW Government must ensure that public resources invested are allocated in a manner that maximises the efficiency of the system and delivers the highest return on investment. The Commission recommends DPIRD:

- develop a whole-of-government biosecurity planning and resourcing framework that prioritises risk reduction to manage current and future risks. Such a framework could be for biosecurity as a whole or focus initially on invasive species to:
  - clarify the purpose, partnerships and interrelationships of the *NSW Invasive Species Plan* and regional plans and programs and commit agencies to working and investing together
  - specify planning commitments and accountabilities for the *NSW Invasive Species Plan* and regional plans (see **Recommendations 6** and **8**)

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334 See: Craik, W., Palmer, D. and Sheldrake, R. (2017) *Priorities for Australia's biosecurity system, An independent review of the capacity of the national biosecurity system and its underpinning Intergovernmental Agreement*

335 As noted in **Section 5**, development of a consistent risk reduction and return framework would require significant improvements in: the information available to guide decision-making, monetary valuations of the impact of invasive species on non-market ecosystem services (particularly biodiversity), and information and evaluation of the rates of return of management interventions (for example, control, research, compliance, surveillance).

336 Submission: Individual, received 9 October 2023.

337 CEBRA (2020) *Evaluating the health of Australia's biosecurity system*

- develop capability to better assess risk reduction and rate of return on investment (including market and non-market values), drawing on external expert partners where required across:
  - pathways of new incursions and established species' spread
  - key landscape assets and values (economic, social, environmental)
  - core components (for example, prevention, surveillance, eradication/emergency response, containment, management, research, MERI, education and training)
- invest in suitable data collection systems and standards to support delivery of the strategic planning and resourcing framework (see **Chapter 10**)
- propose a NSW Invasive Species Investment Program to NSW Treasury built on the existing WAP that includes:
  - five-year funding program allocated in 5-year terms
  - additional funding for aligned vertebrate and invertebrate pest animal functions, to be undertaken by LCAs and coordinated by LLS
  - contractual arrangements for regional coordination and local delivery requirements as in current WAP
  - dedicated funding for long-term regional invasive species coordination roles
  - review of existing and planned expenditure against the framework to understand and communicate rate of return and value for money investment
  - review and identification of potential integration of additional funds (for example, the Good Neighbour Program)
  - review and identification of opportunities for integrating cost-recovery tools.

This will need to be informed by a review of existing and planned expenditure against the framework to better understand and communicate rate of return and value for money investment, including of public land managers' highly variable expenditure. This review will need to consider how risk creators and beneficiaries contribute to the cost of risk management to align with the principles of the biosecurity system,[338] including identifying opportunities for integrating cost-recovery tools.

The effectiveness of this reform will be contingent on:

- the establishment of accountability arrangements that provide a sound framework for leadership (see **Section 5.5**)
- a clear and coherent *NSW Invasive Species Plan* (see **Section 5.1**)
- a strong and responsive knowledge strategy to ensure appropriate data collection to inform the strategic planning and resourcing process (see **Chapter 10**).

338 Department of Prime Minister and Cabinet (2019) *Intergovernmental Agreement on Biosecurity*

6.2 Public land managers spend very different amounts on management

There are a range of public land management agencies that undertake invasive species management activities, but they are not consistently aware of, or engaged in, the system.

NPWS manages a large area of public land covering over seven million hectares or more than nine percent of the state.[339] In this role, it conducts invasive species management programs to protect natural and heritage values. At a statewide level, it is represented on the statewide committees and has been active in coordinated cross-agency initiatives, including conducting joint training with Agriculture and Biosecurity and LLS to both NPWS and LLS staff regarding aerial shooting and vertebrate pesticides. However, at a regional level, NPWS delivers its invasive species programs largely independently to LLS.[340] Although it often aligns with the regional management work conducted by LLS, including the regional committees, this varies by region and it is not consistently engaged as a planning and program partner to deliver coordinated, cross-tenure programs (see **Section 6.1** for more details).

Other relevant land managers, including FCNSW, Crown Lands, and Transport for NSW, as well as utility and infrastructure providers, have limited or inconsistent involvement in the system at both state and regional levels.[341] Invasive species management is not viewed as a priority by senior managers in these agencies, and resources are commonly spent on invasive species management to address 'squeaky wheels' rather than to address regionally strategic priorities (see **Section 6.1**).

Agency stakeholders engaged in this Review indicated there is a gap in the public land management system when it comes to invasive species management. Improvements in statewide coordination, as well as regional engagement and coordination of collaborative cross-tenure programs, would help to engage agency executives and drive prioritisation of resources within these agencies:[342]

> *'[Crown Lands] would like to see better coordination through all the agencies of pest and weed management, piecemeal efforts don't do anything to address root causes of the problem… [this would lead to] more coordination and shared vision across public land managers.'*[343]

> '*Some land managers without environmental or agricultural focus have little understanding of their [invasive species] responsibilities, such as Transport NSW or Crown Lands.'*[344]

The different levels of engagement of public land managers is reflected in vastly different levels of expenditure by the different managers on invasive species management. **Table 4** shows the annual expenditure by public land managers on invasive species management on their respective lands. Expenditure per hectare ranges from $1.79 per hectare by FCNSW up to $8.64 per hectare by LLS on travelling stock reserves. The Commission acknowledges the limitations of comparisons on a cost per hectare basis, as different agencies manage different landscapes, have different management objectives and funding sources, and account for their

339 NPWS (2024) *About NSW National Parks and Wildlife Service*
340 Interview: NPWS regional staff, 23 November 2023.
341 Graham, S., Height, K. and Smart, J. (2023) *Assessment of landscape-scale cross-tenure collective action on the management of widespread invasive species*, the University of Wollongong, report prepared for the Commission; Interview: FCNSW, 8 December 2023; Interview: Crown Lands, 23 November 2023; Interview: Transport for NSW, 5 December 2023.
342 Interview: FCNSW, 8 December 2023; Interview: Crown Lands, 23 November 2023; Interview: Transport for NSW, 5 December 2023.
343 Interview: Crown Lands, 23 November 2023.
344 Interview: Invasive Species Council, 7 December 2023.

expenditure using different reporting mechanisms. More detail on the expenditure for each agency is provided in the following subsections, along with information on other programs.

Table 4: Comparison of expenditure by public land managers on invasive species management

Agency	Expenditure in 2022-23
NPWS	**Total**: $47.18 million [includes $26.8 million staff] **Area managed**: 7 million hectares **Expenditure per hectare**: $6.74
FCNSW (state forest and Crown-timber land)	**Total**: $3.86 million **Area managed**: 2.1 million hectares **Expenditure per hectare**: $1.79
Crown Lands (Crown reserves managed directly)	**Total**: $3.8 million **Area managed**: 1 million hectares **Expenditure per hectare**: $3.80
Transport for NSW	N/A – no data available
LLS (travelling stock reserves)	**Total**: $4.32 million **Area managed**: 0.5 million hectares **Expenditure per hectare**: $8.64

6.2.1 National Parks and Wildlife Service

NPWS has the largest and most comprehensive invasive species management program amongst the public land managers. In addition to the *Biosecurity Act 2015* and the *Biodiversity Conservation Act 2016*, it also has obligations under the *National Parks and Wildlife Act 1974* to undertake invasive species management to conserve biodiversity and ensure that invasive species management programs are coordinated across different tenures relevant to the social and economic context of each park or reserve.

The priorities for NPWS invasive species management are identified in the Regional Pest Management Strategies, which define every NPWS invasive species operational program according to the target pest animals or weeds, the aim of control (eradication, protection or asset protection), the actions to be taken, the assets to be protected (for asset protection programs), and the priority of the program.[345] Programs identified as critical for the conservation of threatened species have been informed by the Biodiversity Priorities for Widespread Weeds, Saving our Species and Asset of Intergenerational Significance (see **Section 5.2.3**). Two major programs for aerial shooting and arial baiting are planned and coordinated at a statewide level. All other invasive species program are planned and coordinated at a regional level. Invasive species control actions are documented in annual service delivery plans, which are updated quarterly and linked to outputs and budget expenditure.[346]

In 2022-23, operating expenses for NPWS invasive species management totalled $20.3 million as per **Table 5**, and labour expenses were estimated at $26.8 million. It is worth noting that this funding includes contributions from Saving our Species, the NSW Environmental Trust and the WAP, which are discussed below. NPWS sets its own priorities

345 NPWS (2024) *Regional Pest Management Strategies*
346 Submission: NPWS, received 18 March 2024.

for invasive species management but based on the principles of the NSW Invasives Species Plan, and subsequently its programs do align with the regional plans developed by LLS.

Table 5: NPWS invasive species management operating (non-employee) expenditure 2022-23

	NSW Government funding	Australian Government funding	Other sources	Total
Pest animal	$ 10,518,398	$ 1,440,351	$ 55,904	$ 12,014,652
Weed	$ 5,221,469	$ 1,892,409	$ 1 253 638	$ 8,367,516
Total	$15,739,867	$3,332,760	$1,309,542	$20,382,168

6.2.2 Forestry Corporation of NSW

FCNSW is the land manager for forestry areas under the *Forestry Act 2012*, which includes state forests and other Crown-timber land. Its responsibilities as land manager include invasive species management and adherence to the principles of ecologically sustainable development, including conservation of biological diversity and ecological integrity. As well as the requirements of the *Biosecurity Act 2015* and the *Biodiversity Conservation Act 2016,* the *Forestry Act 2012* requires the managers of forestry areas to conserve fauna and preserve flora within flora reserves. Further, they have obligations under Integrated Forestry Operations Approvals to protect biodiversity in mapped exclusion zones, and obligations under the *Plantation and Reafforestation 1999* to protect unique and special wildlife values (includes endangered species, endangered ecological communities, or extinct species listed under the *Biodiversity Conservation Act 2016* and the *Fisheries Management Act 1994*).

FCNSW runs different invasive species management programs in its softwood plantation division compared to the hardwood forest division. Invasive species management undertaken for the softwood plantation division is primarily focussed on protecting the economic return from plantation establishment. For the hardwood forest division, the majority of funding is for wild dog control as part of collaborative cross-tenure programs to protect livestock on neighbouring properties, with the remainder spent on reactive weed management in response to direction from LCAs (see **Table 6**).

Table 6: FCNSW invasive species expenditure

	Hardwood Forest Division	Softwood Plantation Division	Total
Pest animal	$ 809,565	$ 313,003	$ 1,122,568
Weed	$ 437,137	$ 2,305,168	$ 2,742,305
Total	$ 1,246,702	$ 2,618,171	$ 3,864,873

In addition, FCNSW contributes funding towards two plant pest surveillance programs on state forests:

- *Forest biosecurity surveillance:* This focusses on points-of-entry for early detection of invading exotic pests and pathogens. Monitoring of traps and sentinel trees as well as stakeholder engagement of local councils etc. The program has been operating since 2014 and is part of national forest biosecurity surveillance strategy[347] funded by Plant

[347] Department of Agriculture and Water Resources (2018) *National Forest Biosecurity Surveillance Strategy*

Health Australia through subscription income from the Commonwealth government, state and territory governments and plant-based industries totalling $120,000 annually.

- *Forest health surveillance and invasive species management:* This involves an annual surveillance of the plantation estate mapping and monitoring pest spread and impact, pest and disease management advice and monitoring, training, and engagement in biosecurity. The program has been operating since 1996. It is funded $350,000 annually by FCNSW.

However, these surveillance programs are not used to inform FCNSW's invasive species management programs.[348] The FCNSW invasive species management programs are funded from a combination of community service obligation grant funding and income from harvesting. The level of community service obligation grant funding that FCNSW receives is insufficient for them to fulfil their legislative duties as a public land manager of 2 million hectares of forest, including significant areas of high conservation value land.

There are no FCNSW staff dedicated to invasive species management, rather it is a small component of the total workload of 15 staff across the state. As a result, FCNSW has limited understanding of its broader regional requirements for invasive species management, as well as limited knowledge and capacity to successfully apply for additional external funding. FCNSW staff acknowledged they would benefit from stronger cross-tenure coordination and identification of specific mapped regional invasive species priorities.

6.2.3 Crown Lands

The *Crown Land Management Act 2016* requires environmental, social, cultural heritage and economic considerations to be taken into account in decision-making about Crown land. The principles of the *Crown Land Management Act 2016* include that:

- environmental protection principles be observed in relation to the management and administration of Crown land
- the natural resources of Crown land (including water, soil, flora, fauna and scenic quality) be conserved wherever possible
- where appropriate, Crown land should be used and managed in such a way that both the land and its resources are sustained in perpetuity.

All these principles are relevant to invasive species management. Over one million hectares of Crown reserves are either managed directly by the Department of Industry Planning, Housing, and Infrastructure – Crown Lands, or indirectly by Crown land managers, including community boards, trusts, local government, and others.

The primary funding source for invasive species management on Crown lands is the Crown Reserve Improvement Fund. The Fund is a self-sustaining program supported by income generated from loan repayments and interest, leases, and licences on Crown land, as well as levies from the operation of coastal Crown caravan parks. The Fund covers all improvements to Crown Reserves. This may include invasive species management but also activities such as repairs to buildings and sporting facilities. It operates as an annual grant system and is available to all managers of Crown lands. This means that department staff are competing in the grant application process with other Crown land managers, such as local government, and community trusts and boards. This creates significant problems in terms of a lack of continuity of funding, with managers unsure if funding will be available again the following year. Managers are required to wait until they are granted funds to start work each year,

348 Interview: FCNSW, 8 December 2023.

which often doesn't align with optimum seasonal conditions for particular invasive species control.

In 2022-23, $16.5 million of the Crown Reserve Improvement Fund was allocated to the Crown Lands team for directly managed Crown lands, including $2.8 million for invasive species management. The regional strategic weed management plans and regional strategic pest animal management plans are held in high regard in the prioritisation of Fund applications, but the lack of prioritisation and specificity in the regional plans means almost any invasive species application is equally justified. In 2022-23, an additional $1 million was expended from the Crown Lands operational budget on invasive species management, for a total of $3.8 million across the financial year. However, allocation of funding for invasive species management is driven by neighbour complaints, rather than a strategic collaborative approach considering regional priorities. Crown Lands staff would welcome stronger cross-tenure coordination and identification of specific mapped regional invasive species priorities, believing it would allow for their contributions to have greater value, and justify more consistent dedicated funding from year to year.[349]

6.2.4 Transport for NSW

Transport for NSW is bound by the requirements of the *Biosecurity Act 2015* and the *Biodiversity Conservation Act 2016*. It has a biodiversity policy, which states that Transport for NSW strives to protect and enhance biodiversity. However, while it references control measures such as weed control, the document focusses on biodiversity offsets and mitigating direct habitat loss, rather than invasive species management.[350]

While the total amount of land managed is much smaller than the NPWS, state forests and Crown lands estates, the Transport for NSW estate is still extensive across the entirety of NSW, including the rail corridor (fence to fence either side of the railway lines), and the road reserve either side of the freeways. All other road reserves are the responsibilities of local councils, although Transport for NSW manages some other road reserves through formal paid agreement with local councils. This situation can lead to confusion as to who is responsible for particular roads, with some instances where local councils submitted compliance notices to Transport for NSW for roads that the local council itself was responsible for.

The differences between the two systems are also reflected in their approach to decision making and implementation of invasive species management, although for both the focus is more on weeds than pest animals. For freeways and other roads under its management, Transport for NSW works directly with LCAs to identify priorities for weed control and contract the LCAs to undertake the work on its behalf. For the rail network, Transport for NSW staff develop prioritisation plans based on a combination of the regional plans and other relevant parameters such as landscape sensitivity, proximity to threatened species and communities, and cost and feasibility of control, and then engage contractors to undertake the work as per the prioritisation plan.

Transport for NSW invasive species management is funded internally from three main sources:

- corrective funding, which is related to safety issues
- amenity, which is when scheduled maintenance has not kept up with public expectation
- scheduled maintenance.

349 Interview: Crown Lands, 23 November 2023.
350 Transport for NSW (2022) *Biodiversity Policy*

Similar to the Crown Reserve Improvement Fund, these funding sources cover a wide range of maintenance activities. As for state forests and Crown lands, stronger cross-tenure coordination and identification of specific mapped regional invasive species priorities would benefit its capacity to secure funding and ensure the highest priorities for invasive species management are met on the lands it is responsible for managing.[351]

6.3 Leveraging funding from other agencies to address strategic risks

There are several other non-land management government agencies that fund invasive species management to mitigate impacts on environmental assets but are not effectively engaged with Agriculture and Biosecurity, LLS and LCAs. This includes the NSW Environmental Trust, BCT and the BCS Group of DCCEEW. While not a government body, Landcare NSW have been applying LLS strategic priorities to guide their actions and investment and could be integrated further into the overall system. These stakeholders indicated they would welcome more engagement and suggested they could make valuable contributions to invasive species outcomes with a more collaborative approach:

> '*[BCS staff] don't know how to influence priorities, identifying things we want addressed. It's not clear who, what they do, avenues for funding and support and how to access those. We don't know who to talk to.*'[352]

> '*It would be useful to have those core roles to go to … interaction and networking opportunity would be really useful … we are always looking to improve outcomes and coordinate response across landholder efforts.*'[353]

The following subsections detail each agencies' programs and opportunities to better integrate them into the broader invasive species management system.

6.3.1 DCCEEW: Saving our Species Program

The BCS Group of DCCEEW oversees the Saving our Species program, which strategically identifies and implements the most important actions needed to ensure the survival of threatened species and ecological communities in NSW.[354] In 2022-23, Saving our Species implemented projects to reduce threats and monitor outcomes for more than 350 threatened species and ecological communities; over 70 percent of these projects included invasive species management as a major component.[355] This equated to 1316 Saving our Species invasive species management actions being planned, of which 90 percent (1193) were implemented over the course of the financial year. Out of a total annual budget of approximately $15 million, the amount allocated to invasive species management or monitoring actions in 2022-23 was $3.8 million.

Despite this level of investment in invasives species management, BCS staff are not involved in the regional committees and regional plans, although they indicated they would welcome more involvement. The regional plans do reference Saving our Species, but only as a program to be considered regarding asset protection activities. BCS staff identified that greater interactions with regional coordinators and committees, and stronger cross-tenure coordination and identification of specific mapped regional invasive species priorities that

351 Interview: Transport for NSW, 5 December 2023.
352 Interview: BCS regional staff, 25 October 2023.
353 Interview: BCT, 4 December 2023.
354 Environment and Heritage (n.d.) *Saving our Species program*
355 DCCEEW (2024) *Saving our Species Conservation Strategies*

included Saving our Species sites would benefit both the Saving our Species program and invasive species management more broadly.[356]

6.3.2 Biodiversity Conservation Trust

BCT develops and funds Biodiversity Conservation Agreements on private lands across NSW.[357] BCT invested $70 million in 2022-23 to protect 226,240 hectares of private land and 199 threatened species via agreements with 420 private landholders.[358] Both its 'in perpetuity conservation agreements' and 'wildlife refuge agreements' involve funding private land holders to undertake biodiversity conservation activities on their property, including invasive species management.[359]

Despite this level of investment in invasives species management, BCT staff are not involved in the regional committees and regional plans, although they indicated they would welcome more involvement. Staff reference the LLS regional plans to private land managers as guiding documents for invasive species management but are concerned that the plans do not focusses as strongly on environmental impacts as they do on agricultural impacts and lack the level of detail and specificity that would help private land managers prioritise their invasive species efforts. BCT staff identified that greater interactions with regional coordinators and committees, and stronger cross-tenure coordination and identification of specific mapped regional invasive species priorities that included biodiversity assets would benefit both their program and invasive species management as a whole.[360]

6.3.3 NSW Environmental Trust

The NSW Environmental Trust invests in invasive species management for the protection of the environment through both its Major Projects Program and Contestable Grant Program (**Table 7**).[361]

Projects funded under this Major Projects Program are not contestable and are designed to tackle large-scale and/or complex issues. The Trust identifies and designs these projects through consultation with key stakeholders. The Trust also provides funding through a range of contestable grant programs and administers both long-standing annual programs and one-off, issue-specific programs.

NSW Environmental Trust staff identified that a clearly prioritised prospectus for invasive species research would help target grants to where they are needed most, as well as stronger cross-tenure coordination and identification of specific mapped regional invasive species priorities, including biodiversity assets.

356 Interview: BCS regional staff, 25 October 2023.
357 BCT (n.d.) *What we do*
358 BCT (2023) *NSW Biodiversity Conservation Trust Annual Report Financial Year 2022-2023*
359 Interview: BCT, 4 December 2023.
360 *Ibid*.
361 Environment and Heritage (n.d.) *About the NSW Environmental Trust*

Table 7: NSW Environmental Trust funded programs and projects

Program and project	Description
Major Projects Program	
Hawkweed eradication project	$7.2 million over eight years. This investment is matched by a $5.2 million contributions from other agencies including $3.7 million from NPWS.
Weed biocontrol program	$ 2million over four years. This investment allocated to CSIRO to develop new biocontrol agents for use against specific environmental weeds in New South Wales contributes to the National Weed Biocontrol Pipeline Strategy. [362]
Cross-tenure feral deer project	$9.2million over eight years. This investment is complimented by a further $7.4 million from other sources over the same period.
NPWS feral predator free area program (aka rewilding initiative)	In 2020 the NSW Environmental Trust invested $20.3 million over 10 years from 2021-31. Establishing four new feral predator-free areas paves the way to return wildlife lost from national parks due to feral cats and foxes This commitment is matched by an in-kind contribution by NPWS to establish and manage the predator free areas. NPWS estimates this expenditure at $25 million expenditure over 20 years.
Beyond Fencing Project	The NSW Environmental Trust allocated UNSW a grant of $516,223 for 10 years 2020-30. This project is conducted in Sturt National Park in partnership with the NPWS. This project aims to use an innovative two-pronged approach through improving control of feral predators and increasing prey awareness to these predators to enable these species to live beyond fences and co-exist with feral predators.
Keeping Cats Safe at Home	The NSW Environmental Trust allocated RSPCA a grant of $2,547,393 for 4 years 2020-24. This project will develop and implement a behaviour change strategy in 11 local government areas to reduce domestic cat predation on wildlife by encouraging responsible cat ownership, especially increased containment of owned pet cats.
Developing Strategies for Effective Feral Cat Management	The NSW Environmental Trust allocated University of New England a grant of $14,683,125, over six years. To address the widespread, recognised need for feral cat control by developing effective, integrated management strategies for feral cats in NSW environments.
Contestable Grants Program	
Saving our Species Partnership Grants Program	$10 million over 10 years to Savings our Species Partnerships. The program includes pest plant and animal management as well as revegetation projects. The contribution of projects to invasive species management varies. Some such as *Turtles Forever: Securing the NSW population of Bell's Turtle* focusses on egg predation by invasive species. Others focus on data collection and make no contribution. A review of project summaries[363] suggest

362 Centre for Invasive Species Solutions (2023) *National Weed Biocontrol Pipeline Strategy; A Roadmap to guide Australia's future weed biocontrol research, development, and extension*

363 Environment and Heritage (n.d.) *Saving our Species partnership grants awarded and project summaries*

Program and project	Description
	approximately 50 percent of the funds are expended on invasive species management totalling approximately $500,000 annually.[364]
Saving our Species Contestable Grants Program	Aligned with the NSW Saving our Species program the NSW Environmental Trust allocated $8.2 million running over 7.5 years until 2025. Project activities include education training and revegetation as well as invasive species management. A review of project summaries[365] suggest that approximately 50 percent of the funds are expended on invasive species management totalling $1 million annually.
Bush Connect Program	The NSW Environmental Trust allocated $8 million running over 10 years. This program delivers on-ground and community capacity-building activities within the Great Eastern Ranges corridor. A review of project summaries[366] suggest that approximately 50 percent of the funds are expended on invasive species management, so it is estimated the approximate expenditure on invasive species management is $400,000 annually.
Restoration and Rehabilitation Grant Program	Restoration and Rehabilitation Grant Program Projects extend from two to four years. Eligible activities include bush regeneration and other pest plant and animal management practices. However, eligible activities also include community development, signage, fire, etc so it is difficult to ascertain the proportion of the $4 million annually that is spent on invasive species management. A review of a sample of successful projects[367] suggests that 50 percent of the funds are expended on invasive species management, so it is estimated that approximately $2 million annually is spent.

6.3.4 Landcare NSW

Landcare NSW plays an important role, acting as the conduit between local Landcare communities and the main players in NSW invasive species management. Its involvement in some of the regional committees has been of benefit in accessing this broader network, as it is also directly engaged with the Saving our Species program, BCT and the NSW Environmental Trust.

Landcare NSW identified that while the LLS regional plans are used extensively in applying for funds, because of their general nature they are used as a justification rather than guiding prioritising and guiding the work that needs to be done. It is also concerned that the plans are more focussed on the agricultural impacts of invasive species, rather than biodiversity issues. Landcare NSW considers it could play a more prominent role in invasive species management if given the opportunity. Landcare NSW also considers that stronger cross-tenure coordination and identification of specific mapped regional invasive species priorities that include biodiversity assets would benefit its programs and invasive species management as a whole.[368]

364 NSW Environmental Trust (2023) *NSW Environmental Trust Annual Report 2022-23*
365 Environment and Heritage (n.d.) *Saving our Species partnership grants awarded and project summaries*
366 Environment and Heritage (n.d.) *Bush Connect grants awarded and project summaries*
367 Environment and Heritage (n.d.) *Environmental Restoration and Rehabilitation 2022-23 grants awarded and project summaries*
368 Interview: Landcare NSW, 13 October 2023.

6.4 Aligning funding periods to best practice management

Invasive species require long-term management programs. However, although there are a small number of secure, long-term recurrent funding streams, funding is more often insecure, short-term funding projects and grants targeting specific species.[369] This Review found the focus of NSW investment is on the short-term management of species and incidents rather than the development of biosecurity management system capacity as a whole.[370]

While short-term, species-specific investments play a key role in the system, their overuse generates inefficiencies and reactive, intermittent management programs rather than systematic improvements. In addition, the short time frames of many invasive species funding programs are also inconsistent with the shared responsibility approach required for cross-tenure, landscape-scale management of invasive species, particularly collective community-based actions:[371]

> '*Short term funding (anything less than 5 years) works against effective management … The fundamental problem with this [short-term] model is that it fails to consider the complex human social dynamics and the long-term issues surrounding such social dynamics in rural and regional communities. Effective invasive species management programs require long-term coordinated group control over local or regional landscapes involving many landowners, stakeholders, or community groups.*'[372]

In addition to the duration of funding programs, the timing of funding does not always align with need and impact. Stakeholders noted critical issues with a lack of funding certainty, and a misalignment between the timing of funding announcements, the actual provision of this funding and the accurate timing of management interventions. For example, weed spraying is more effective in certain seasons,[373] and pest animals such as rabbits and feral pigs are best targeted during dry periods when population sizes are low and their distribution is limited (see featured Case Study below).[374]

Stakeholders highlighted that certainty of funding is required to support the maintenance of core services while allowing capacity to scale up these services to take advantage of seasonal opportunities as they arise:

> *'Funding is opportunistic. We were continually frustrated by pest animal programs as you couldn't have long-term impact. It would be nice to be able to fund rabbit control programs when there's not many around.'*[375]

369 Note: Grants play an important role and recent NSW Government reforms to improve their administration should improve their effectiveness. See: NSW Cabinet Office (2024) *Grants Administration Guide*

370 Hanea, A., Moran, N., Wang, L., Li, C., Baumgartner, J., Palma, E., Camac, J., Bell, J. and Kompas, T. (2024) *Invasive Species Cost Assessment for New South Wales*, report prepared by CEBRA for the Commission.

371 Graham, S., Metcalf, A.L., Gill, N., Niemiec, R., Moreno, C., Bach, T., Ikutegbe, V., Hallstrom, L., Ma, Z. and Lubeck, A. (2019) 'Opportunities for better use of collective action theory in research and governance for invasive species management', *Conservation Biology*, 33(2), pp. 275-287.

372 Submission: Individual, received 30 October 2023.

373 Department of Planning and Environment (2022) *Aerial Spraying Guidelines*.

374 Department of Primary Industries (2022) *New South Wales Code of Practice and Standard Operating Procedures for the Effective and Humane Management of Feral Pigs.*

375 Interview: Independent Chair, State Pest Animal Committee, 12 October 2023.

CASE STUDY: NSW investment in the feral pig management program

The Commission's audit of regional invasive species management examined the large-scale *Foot and Mouth Disease Prevention and Preparedness Program* delivered by LLS in 2022-23.[376] This was a $22.8 million program, which included significant aerial control of feral pigs and other cloven-hoofed pest animals, supported by ground control activities.[377] The aim of the program was to achieve an 80 percent reduction in feral pig numbers within a target area in each LLS region.

While LLS publicly reported the total number of cloven-hoofed pests culled, kilograms of bait issued to landholders, and number of participants, it did not publicly report on whether the population density reduction objectives were achieved.[378] Evidence provided under the audit of regional invasive species management indicated variable results in different regions; with an 80 percent reduction in feral pigs achieved in the Hunter, whereas a 44 percent reduction in feral pigs was achieved in the Northern Tablelands.[379]

Between October 2023 and June 2024, the NSW Government invested a further $13 million in a feral pig management program, which was delivered by LLS. This program was developed in response to widespread growth in the number of feral pigs across NSW due to above average and sustained rainfall over this period.

Although communicated widely as a success,[380] the program has been identified by many stakeholders in this Review as a recent and largescale example of ineffective NSW Government resource allocation. These stakeholders noted that this one-off injection of funding, among other examples, was characterised by delivery constraints, a limited evidence base, insufficient cross-tenure planning, and a lack of monitoring, evaluation, and reporting.

> *'We have money thrown at us, like for feral pigs, and foot and mouth. This type of funding is poorly structured and badly designed generally, with a lot of money, time frames too short, no planning time or structure, no focus on long-term benefits. Just a dump of money for 12 months and the planning stage takes up most of that. Then trying to deliver that is difficult among other responsibilities for everyday work'.*[381]

Critically, the outcomes of this intervention are questionable. For example, the investment and roll-out occurred during the sustained wet period that saw feral pig numbers increase across NSW. Indeed, land managers in 10 of 11 LLS regions[382] reported an increase in feral pig issues on their properties (2016-2022).[383]

It is generally recommended that feral pig control be undertaken in dryer periods when the populations are smaller and the impact of control greater (in that it also prevents population increases in subsequent wet periods).[384] Indeed, in Northwest NSW, landowners are reporting that the number of feral pigs remain above average despite the control program, and NSW Farmers has requested additional public investment of over $100 million to address the issue.[385]

> *'Funding for pigs for example, there's money being chucked at it, [but the] timeframes do not allow for long term management outcomes. This is problematic and contradictory to aims of the [Biosecurity] Act. At a state level, that's where that advice needs to happen on where to get best bang for buck because not sure it's getting through to policy and decision makers. There is a focus on number of pigs killed not the best impact'.*[386]

The program also highlights a key gap in prioritisation of risk reduction whereby a $13 million investment in feral pig control is almost equivalent to the $16 million NSW contributes annually to the National Fire Ant Eradication Program, despite the estimated cost impacts of red imported fire ants being far greater (see **Section 4.2.1**).

The sporadic timing of funding arrangements also undermines efficiencies in the system. For example, the WAP, despite being a five-year program, has funding allocated annually by NSW Treasury, with the amount varying from year to year. Agriculture and Biosecurity cannot begin the allocation process to LLS regional coordinators until the amount is confirmed each year. It can then take several months for the regional coordinators to complete contracts with LCAs, with funding not being received by LCAs until as late as March, nine months into the financial year.[387] In 2023-24, regional allocations to LCAs were changed to comply with the *NSW Grant Administration Guide*. While this will improve the allocation in future years, this late change meant that WAP funding was not provided to LCAs until the final two months of the financial year.

The timing of funding also affects planning of work throughout the year as LCAs are uncertain of their funding situation, and employment stability with staff only offered short-term employment leading to a high level of staff turnover. Weed County Councils are specialised organisations empowered by their general-purpose member councils. There are advantages to this approach,[388] but they are particularly impacted in terms of financial security, as a significant proportion of their total funding comes from the WAP.

Short-term and fragmented funding limits the retention and development of skilled staff. The *NSW Biosecurity and Food Safety Strategy 2022-2030* comprises a core objective to expand and invest in a capable and response-ready workforce.[389] This is further reinforced in the *NSW Invasive Species Plan,* which includes an aim '*to maintain an adequate network of biosecurity professionals across the state*'.[390] However, feedback from agency stakeholders indicates that the chronic patterns of short-term and fragmented funding limits the long-term and strategic development and retention of a skilled workforce. This is particularly problematic in emergency responses where surge workforce capacity is required in the system, an issue also documented by the NSW Audit Office in 2019:[391]

> '*What I would like to see is increased and ongoing funding for councils and programs that are long-term and have a strategy to solve the invasive species. This funding must be for the front-line staff to enable them to do their job.*'[392]

376 Natural Resources Commission (2024) *Audit of regional invasive species management in NSW - Independent assurance report,* pp. 12-13.
377 LLS (n.d.) *Foot-and-mouth disease prevention and preparedness program*
378 *Ibid.*
379 Natural Resources Commission (2024) *Audit of regional invasive species management in NSW - Independent assurance report,* pp. 12-13.
380 NSW Government (2024) *Leaving feral pigs with nowhere to hide*
381 Interview: LLS Team Leaders, 11 October 2023.
382 The only exception was South East LLS region, which had a small decline in the percentage of land managers reporting feral pig related issues.
383 Stenekes, N., Ticehurst, J. and Arthur, T. (2024) *Pest Animal and Weed Management Survey 2016/2019/2022*, NSW land manager survey custom results, report prepared by ABARES for the Commission.
384 Department of Primary Industries (2022) *New South Wales Code of Practice and Standard Operating Procedures for the Effective and Humane Management of Feral Pigs.*
385 Webster L, Paras J and Reading K (2024) 'Feral pig population booms in NSW, sparking more calls for more funding to control pests', *ABC News Online*, 23 April.
386 Interview: National Pest Animal Coordinators, 24 November 2023.
387 Interview: Weeds County Councils, 26 October 2023; Interview: NSW Weeds Officer Association, 21 November 2023.
388 County Councils are specialised organisations empowered by their general-purpose member councils. They are advantaged by both increased strategic scope and economies of scale in the local delivery context. The internal Council boundaries do not exist under the model, meaning allocation of resources can be species led, rather than jurisdiction led. This is a significant advantage when delivering regional invasive species programs.
389 Department of Primary Industries (2022) *NSW Biosecurity and Food Safety Strategy 2022-2030*
390 Department of Primary Industries (2023) *Invasive Species Plan 2023-2028*
391 Audit Office of NSW (2019) *Biosecurity Risk Management*
392 Submission: Individual submission, received 31 October 2023.

'[The system] needs to invest in new frontline jobs in invasive species management to secure additional capacity of 180 FTE, comprising: 110 new pest and weed officers (10 in each Local Land Services region); 50 new local government weed control positions; 20 new [Agriculture and Biosecurity] biosecurity officer.'[393]

'*Whilst under the current system NSW will always play catch up. It is not possible to be in front of the game. Lack of funding and frontline staff for programs which are long-term and strategic, rather than ad-hoc and politically driven.'*[394]

'*Not just funding but capacity to deliver that funding. All of a sudden, we get money for something, but we don't have the staff to deliver the program.'*[395]

393 Submission: Invasive Species Council, received 5 December 2023.
394 Submission: Individual, received 31 October 2023.
395 Interview: NPWS regional staff, 9 November 2023.

7 Supporting regional coordination and local delivery

Key Findings

- Regional coordinators are a critical component of the system and key to delivering consistent and coordinated risk reduction through partnerships between government, industry and community. However, the pest animal roles are inconsistently defined and have not been filled in all regions, and the weed roles are hindered by limited and short-term funding, lack of consistent institutional support, gaps in local delivery partner responsibilities, and inadequate engagement of key stakeholders.
- Regional committees represent a lost opportunity to effectively prioritise and coordinate collaborative cross-tenure management. Committee engagement and attendance has diminished over time, as the collective needs of key stakeholders have not been prioritised.
- As land managers, traditional owners and knowledge holders, Aboriginal communities are a valuable component of the invasive species management system but have not been effectively engaged to date.
- There are formal arrangements for surveillance and incursion responses implemented by Agriculture and Biosecurity, LLS and LCAs for weeds, but not for pest animals.
- Incursion responses are primarily implemented by Agriculture and Biosecurity, LLS and LCA staff, taking them away from everyday duties. Staff from other agencies (such as the NPWS, Environment Protection Authority and DCCEEW) have assisted in responses but this has not been supported by formal agreements. The general public can also play an important role in identifying incursions, but more can be done to build public understanding and capacity in this area.

Key Recommendations (see detailed recommendations in Executive Summary)

Recommendation 3 – DPIRD redesign regional-scale plans for invasive species management as cross-tenure partnership agreements to deliver risk reduction through management, surveillance, compliance and emergency responses

Recommendation 4 – DCCEEW develop relevant contributions for inclusion in the state and regional plans to ensure biodiversity and Aboriginal cultural values are prioritised

Recommendation 5 – DCCEEW support Aboriginal staff engaged in activities related to invasive species management, both to connect with each other, and with Aboriginal communities

Recommendation 6 – The NSW Independent Biosecurity Commissioner review and make recommendations on state and regional committee functioning and membership to improve leadership, strategic decision making and accountability

Recommendation 8 – DPIRD resource regional coordinators to deliver regional planning and collaborative programs

7.1 Increasing support for regional coordinators

As detailed in **Chapter 5 and Chapter 6**, there is a critical need for a well-led statewide planning and resourcing framework that set outs the processes to identify high priority, cross-tenure risk reduction programs. These then need to be coordinated for delivery across both pest animals and weeds, regions, and with key stakeholders and local delivery partners. A regional coordination function forms the critical 'linchpin' to deliver this approach, as noted by stakeholders:

> '*Plans needs to be an agreement, not a directive, between all the land managers, that's prioritised and contextualised and driven by a regional coordinator, with clear accountability and funding.*'[396]
>
> '*Plans without a coordinator are plans that are likely to fail.*'[397]
>
> '*If we rely on an understanding that effective management should be tenure-neutral, then coordination should be essential and the state should be resourcing that. It should be an absolute priority. This needs to include the on-ground coordination of activities and coordination across agencies, and also on education and engagement with non-government sectors.*'[398]

Regional coordinators (as well as regional committees) are the primary engagement tool for developing collaborative and cross-tenure invasive species management programs but the potential for their development has not been fully realised.

Public land managers engaged in this Review advised that, while their activities were generally aligned to invasive management outcomes, they consider the limited and fragmented regional coordination functions as a lost opportunity to effectively prioritise management activities in collaborative ways across tenures.[399]

For weed management, the WAP requires each LLS region to employ a regional coordinator and provides $100,000 per region to fund at least 50 percent of this role.[400] The remaining funding for the coordinator roles is derived in different ways by each LLS region. Some LLS regions provide the remaining funding for a fulltime regional weed coordinator. However, in other regions, the weed coordinators undertake a combination of their weed coordination functions and other duties for LLS.[401]

With the annual allocation cycle of the WAP, most regional weed coordinators are employed on short term contracts with 6-12 month terms.[402] This has resulted in a high turnover of staff.[403] Only one region, Central West, has had the same regional weed coordinator since 2018.[404] All other LLS regions have had multiple regional weed coordinators during this time.[405] The effectiveness of these positions is highly dependent on developing strong relationships with stakeholders, but this process needs to begin again every time the regional weed coordinators change:

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396 Interview: Landcare NSW, 13 October 2023.
397 Interview: Invasive Species Council, 7 December 2023.
398 Interview: Invasive Species Council, 7 December 2023.
399 Interview: NPWS regional staff, 9 November 2023; Interview: FCNSW, 8 December 2023; Interview: Crown Lands, 23 November 2023; Interview: Transport for NSW, 5 December 2023.
400 Department of Primary Industries (2019) *NSW Weeds Action Program Guidelines 2020-2025*
401 Interview: LLS regional staff, 11 October 2023; Interview: NSW Weeds Officer Association, 21 November 2023.
402 Interview: LLS regional staff, 11 October 2023.
403 *Ibid*.
404 Department of Primary Industries (2023) *Department of Primary Industries Weeds Biosecurity Presentation for NRC 2023*, internal document prepared for the Commission.
405 *Ibid*.

> *'[They're on] short term contracts, so people taking advantage of other longer-term roles is an issue.'*[406]
>
> *'[There's] huge turnover and vacancies in the role…Coordinators are extremely stressed out working for LLS…they're required to take on additional other non-related roles…the system worked better when [Agriculture and Biosecurity] engaged directly with Local Councils with no LLS involvement.'*[407]
>
> '*With weeds we've got LCAs so it makes sense for a coordinator role whereas pest animals…it's all land managers, which is impossible. If [regional pest animal committees] could be strengthened, then it would more fully justify a coordinator role*.'[408]

Equivalent regional coordinator roles have not been established for vertebrate and invertebrate pest animals. While some LLS regions have a 'pest animal coordinator', these roles are not involved in strategic planning through involvement on regional committees or the implementation of regional plans. Instead, they focus on coordinating internal LLS vertebrate pest animal activities.

Within LLS regions, the pest animal and weed coordination functions sit within separate business units. The pest animal coordination function is the responsibility of the Team Leader Invasive Species and their team of biosecurity officers. These positions are not involved in weed management and report to the Manager Biosecurity and Emergency Services in each region. The regional weed coordinators report separately through the Manager Land Services, or other management streams within LLS regions.

The legislative drivers and framework set out in the *NSW Invasive Species Plan* is the same for both pest animals and weeds, as are many of the stakeholders. Organisational separation of pest animal and weed coordination functions limits opportunities for support, alignment and synergy across the system. The regional weed coordinators identified that there is not a lot of support or understanding of their roles within LLS and new staff struggle without support, which is one of the contributing factors to the high turnover of staff in these roles.[409]

7.2 Coordinating local delivery partner responsibilities

Under the current invasive species management system, regional coordinators work with LCAs and LLS as the local delivery partners for functions described in the *NSW Invasive Species Plan* and regional plans.

The statutory responsibilities of LCAs (as local delivery partners) are to minimise the biosecurity risk of weeds by inspecting lands, implementing weed management programs, and recording and reporting data to Agriculture and Biosecurity. This is primarily achieved through the delivery of WAP activities, which focus on surveillance and incursion responses for state priority weeds, and education and extension to landholders regarding weed management. This program has positively evolved over the past 10 years since the previous review of statewide weed management by the Commission,[410] with LCAs demonstrating their increased value to the weed management system. There is currently not an equivalent program for vertebrate and invertebrate pest animals, although some LCAs have suggested it is worth exploring, provided appropriate additional funding is made available:

406 Interview: LLS regional staff, 11 October 2023.
407 Interview: Weeds County Councils, 26 October 2023.
408 Interview: LLS regional staff, 11 October 2023.
409 *Ibid*.
410 Natural Resources Commission (2014) *Weeds – Time to get serious: Review of weed management in NSW*

> *'[The Review should] explore LCAs taking on more of a pest animal management role as well [as weeds] as this would better justify our existing administrative investment if it had more diverse remit.*[411]
>
> '[*There's an] opportunity for pest animals, we're there doing the work anyway and it's a good thing from a landholder's perspectives…if we record pigs as well as weeds…We could do something in that area to support LLS, we can value-add to what they do'.*[412]

As local delivery partners, LLS regions are focused on supporting private landholder rate payers to control widespread pest animals on their land, with predominantly a primary production focus.[413]

These individual and fragmented roles across weed and pest animal functions create significant gaps and administrative inefficiencies in delivery of the statewide system.

7.3 Harnessing the potential of regional committees

The Regional Weed Committees and Regional Pest Animal Committees were established to facilitate collaboration between key regional stakeholders involved in invasive species management and develop regional plans identifying priorities for managing priority invasive species, similar to the Bush Fire Management Committee model.

The membership of the regional weed committees includes LCAs as well as major public and private land managers. However, the focus of regional weed committee meetings has been on coordinating WAP activities undertaken by LCAs, and participation and attendance at meetings by other regional weed committee members has decreased over time.[414] Public and private land managers consider the regional weed committees as a lost opportunity to effectively prioritise and coordinate weed management activities in collaborative ways across tenures.

The membership of the regional pest animal committees included LLS staff, major public and private land managers, and in some cases local government staff. However, only six of the eleven regional pest animal committees are still functioning, and the focus of the meetings are LLS pest animal management activities, undertaken for the protection of rate payers' land (private land managers). This includes collaborative cross-tenure programs such as wild dog and feral pig management, but the focus is still where these programs ultimately benefit ratepayers, rather than looking at how the pest management activities of all committee members could be better coordinated for the benefit of all. As for the regional weed committees, public and private land managers consider the regional pest animal committees as a lost opportunity to effectively prioritise and coordinate pest animal management activities in collaborative ways across tenures.

As per the statewide committees (discussed in **Section 5.5**), most stakeholders considered that, despite the regional committees failing to live up to their potential, they could play an

411 Interview: Weed Country Councils, 26 October 2023.
412 Interview: NSW Weeds Officer Association, 21 November 2023.
413 This includes providing advice and training in pest animal management techniques, supplying baits and vertebrate pesticides, coordinating group control programs, and undertaking priority pest animal programs, such as aerial baiting and aerial shooting programs, as well as localised baiting, trapping and ground shooting programs. LLS also provides support to rate payers for weed management with a primary production focus, through their agronomists. These functions are not applied to other land managers or for environmental programs (Interview: LLS regional staff, 11 October 2023).
414 Graham, S., Height, K. and Smart, J. (2023) *Assessment of landscape-scale cross-tenure collective action on the management of widespread invasive species*, the University of Wollongong, report prepared for the Commission.

important role in delivering collaborative and coordinated programs. To do this, they must have strong two-way relationship with the state committee, aligned roles and functions with the state committee, inter-agency technical support, clear escalation pathways and accountability and transparency and reporting requirements (see **Recommendation 6** in **Chapter 5**).

Committee membership needs to include key agency representatives as well as key stakeholder groups outside of government. There are other relevant stakeholders not directly relevant for inclusion on the regional committees, but could benefit from regular interaction, with regional coordinators acting as a conduit for information flow between the various relevant groups. This includes particular interest groups such as RPSCA NSW and the Nursery and Garden Industry NSW & ACT, industry research and development corporations, government and non-government researchers and Aboriginal communities.

Conservation agencies, such as BCS, BCT and Landcare NSW, are coordinating and funding initiatives to mitigate the impacts of invasive species on environmental values independently of Agriculture and Biosecurity, LLS and LCAs. They expressed interest and could see value in being involved in the regional committees as part of a more coordinated approach to invasive species management into the future.[415]

Given the critical roles of regional coordination and local delivery in achieving goals of risk reduction, the Commission recommends that DPIRD resource dedicated regional LLS coordinators to deliver regional planning and collaborative programs. These roles must:

- be resourced with dedicated funding from the NSW Invasive Species Investment Program (**Recommendation 7**) for fulltime, five-year roles for weed and pest animal functions in each LLS region
- be solely focused on invasive species coordination and report to the same Manager in each LLS region
- operate as the secretariat for respective cross-tenure regional committees
- lead and coordinate surveillance and inspection programs with LCAs as local delivery partners (for both weeds and vertebrate and invertebrate pest animals)
- support the extension activities of local delivery partners (LLS and LCAs)
- coordinate high priority collaborative programs for incursion response, containment, eradication and asset protection
- work with Landcare NSW and other relevant community groups to maximise the effectiveness of their contribution to priority regional projects
- facilitate engagement and collaboration with invasive species researchers
- engage Aboriginal communities and look for opportunities to improve Aboriginal involvement in invasive species management
- contribute to the delivery of statewide programs.

415 Interview: Landcare NSW, 13 October 2023; Interview: BCS regional staff, 25 October 2023; Interview: BCT staff, 4 December 2023.

7.4 Improving Aboriginal engagement

As land managers, traditional owners and knowledge holders, Aboriginal communities are a valuable component of the invasive species management system. However, feedback from stakeholders throughout the review was that engagement with Aboriginal communities has not been undertaken as effectively as it should be.

Recognising the importance of consulting with Aboriginal people to understand why engagement has not been more effective, the Commission held a forum on Dharug land in Richmond in November 2023 focussing on improving Aboriginal involvement in invasive species management. The forum was led by an Aboriginal Commission staff member, and involved Aboriginal participants from LLS, BCT, Landcare NSW, Murru Mittigar and the Invasive Species Council (with apologies from DCCEEW and Department of Planning, Housing and Infrastructure).

The forum identified specific barriers, enablers and opportunities for improving Aboriginal involvement in invasive species management.[416] The need to recognise Aboriginal peoples' continued, wholistic and active management of Country for tens of thousands of years was highlighted. For example, there are benefits to managing the impacts of pest animals and weeds by maintaining appropriate landscape structure through low intensity cultural burning. However, this is not widely recognised in invasive species management programs. Further, it was considered that some non-indigenous land managers do not respect NSW Aboriginal knowledge of land management or believe it has been diminished since the arrival of Europeans.

The forum also raised the pressure and challenges faced by Aboriginal government agency staff and Aboriginal land managers. Aboriginal government agency staff are a small cohort that can be overwhelmed with requests and responsibilities. Staff often are frustrated by the siloed approach of NSW Government agencies to managing Country, leading to disengagement. This is compounded by many Aboriginal land managers having multiple priorities, often without adequate support, and frustrations around projects not being maintained or completed. The need to increase both the intake and career progression opportunities for Aboriginal staff in relevant government agencies was also raised.

The forum was recognised as a catalyst to develop a professional Aboriginal peer network for support, awareness, knowledge and influence. Other opportunities identified to strengthen the contribution of Aboriginal stakeholders in invasive species management included:

- building obligation to Country into the invasive species system as a positive way to frame and involve people, both Aboriginal and non-Aboriginal
- accepting that Country and caring for Country is dynamic and that the goal is not to return the system to pre-1788 approaches, instead applying Aboriginal approaches and knowledge to the current invasive species management system
- conducting research to better understand and communicate the reasons and benefits of applying traditional Aboriginal approaches to land management
- making sure that senior decision makers in relevant NSW Government agencies are aware of and understand the importance and opportunity on engaging and involving Aboriginal people in invasive species management
- having Aboriginal representation at that senior level through an Aboriginal Land and Sea Commissioner or similar to continue to remind senior decision makers of the importance

[416] Key findings of the forum are available on the Commission's website.

of invasive species management to Aboriginal people as an obligation to appropriately manage healthy Country.

7.5 Ensuring consistent surveillance and incursion responses for weeds and pest animals

As described in **Chapter 4**, NSW is under rapidly increasing pressures from the potential arrival of new invasive species. Removing or reducing the risks of new invasive species before they become established is recognised as one of the most important and cost-effective elements of invasive species management.[417]

There are formal arrangements for surveillance and incursion responses for weeds, but not for pest animals. Agriculture and Biosecurity is the lead agency for managing new incursions of invasive species to NSW. Through the WAP, it has established a contractual requirement for all 11 LLS regions to have formally documented high-risk pathways and sites for new weed incursions, and rapid response procedures for new weed incursions.[418] These plans inform the regional approach to weed inspections undertaken by LCAs under the contractual arrangements of the WAP.

This strategic planning and resourcing ensures a consistent and coordinated approach across LLS regions and LCAs for inspections and incursion management. It is supported by inspection data entered in the Biosecurity Information System, which can be analysed and shared with stakeholders to deploy and adapt incursion management actions as required. This information has been used by Agriculture and Biosecurity to develop state strategic plans for the highest priority weed incursion management programs.

> '*[There is] good coordination and collaboration when new incursions are identified.*'[419]

> *'[The protocols and data standards] have made administrating the WAP easier, to do reports and get councils to put information in, which previously was collated manually, now we can just review what they input in the system.*'[420]

Unlike for weeds, there are no formal surveillance and incursion response plans for vertebrate and invertebrate pest animals. It was a requirement under the previous *NSW Invasive Species Plan 2018-2021* for regional committees to develop regional incursion prevention and response plans.[421] These have not been developed for pest animal management.[422] Instead, each of the regional strategic pest animal management plans have a generic 'incursion management and alert species' overview that relies on members of the public to contact Agriculture and Biosecurity if they notice any unusual animals.

417 Department of Primary Industries (2023) *NSW Invasive Species Plan 2023-2028*
418 Interview: Agriculture and Biosecurity Weeds Programs and Responses Team, 2 November 2023.
419 Interview: Local Government NSW, 20 November 2023.
420 Note: this statement was made prior to recent administrative changes to the WAP. Interview: Weeds County Councils, 26 October 2023.
421 Department of Primary Industries (2018) *NSW Invasive Species Plan 2018-2021*, p. 16.
422 Natural Resources Commission (2024) *Audit of state invasive species management - Independent assurance report*, pp. 23-24.

Responses to incursions are guided by an Agriculture and Biosecurity procedure, but there are no formal networks established in each region, and each response is built from scratch, often based on personal relationships and willingness of different land managers to be involved:[423]

> '*Sometimes it works really well but it's mostly due to personal relationships and that's not good enough.*'[424]

The Review found that this gap in the system could be filled by LCAs taking on additional responsibilities for surveillance and incursion management of vertebrate and invertebrate pest animals – noting this would require additional funding (as proposed in **Section 6.1**). LCAs could also record relevant information on pest animals while undertaking weed inspections, and provide basic extension materials to land managers, referring them to LLS for more extensive information where required. Such a role is meant to be complimentary to their existing role and intended to leverage their presence, not dilute their focus on weeds.

Invasive species incursions into NSW are also predicted to accelerate. Post-border surveillance programs can provide a cost-effective management tool if program design can balance the required surveillance expenditure and the expected benefit of early detection and effective response.[425] With advances in technology rapidly reducing surveillance costs and facilitating the involvement of the community, a multi-species general surveillance program across shared risk pathways could be feasible and generate significant benefits.[426]

7.6 Leveraging key players for surveillance and incursion responses

Under existing arrangements, incursion responses are primarily implemented by Agriculture and Biosecurity, LLS and LCA staff. However, this takes staff from these agencies away from everyday duties, which is an increasing resourcing risk given the projected increases in new and expanding incursions (see **Chapter 4**):

> '*The same staff are called on each time, [they're] investing a lot of time and energy, leading to fatigue. Long-term or multiple concurrent responses are going to lead to burnout and a lack of resources.*'[427]

There are national and state emergency arrangements and plans, such as NEBRA, which can ensure resourcing and involvement of agency staff, but these arrangements are often difficult to trigger in a timely manner.[428] When these arrangements are not enacted, other government agency staff, such as NPWS or EPA, occasionally get involved in incursion responses but in a limited and informal capacity, usually based on personal relationships between staff. Indeed, the NSW Audit Office review in 2019 recommended that Agriculture and Biosecurity implement formal agreements with partner agencies that it relies on to deliver effective biosecurity compliance activities and emergency responses.[429]

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423 Interview: State invasive species leads for Agriculture and Biosecurity, LLS and NPWS, 15 September 2023; Interview: LLS regional staff, 11 October 2023.
424 Interview: Invasive Species Council, 7 December 2023.
425 Kompas T, Chu L, McKirdy S, Thomas M and Van Der Merwe J (2023) 'Optimal post-border surveillance against invasive pests to protect a valuable nature reserve and island asset', *Ecological Economics*, 208, 107789.
426 Martinez B, Reaser JK, Dehgan A, Zamft B, Baisch D, McCormick C, Giordano AJ, Aiche R and Selbe S (2020) 'Technology innovation: advancing capacities for the early detection of and rapid response to invasive species', *Biological invasions*, 22(1), pp. 75-100; ABARES (2022) *Making General Surveillance Programs Work – Lessons learned from case studies*.
427 Interview: Local Government NSW, 20 November 2023.
428 KPMG (2017) *National Environmental Biosecurity Response Agreement Five Year Review Final Report*
429 Audit Office of NSW (2019) *NSW Auditor-General's Report to Parliament - Biosecurity risk management*

The Commission's audit of state invasive species management confirmed that formal agreements (such as an MOU) with partner agencies to clearly guide vertebrate pest animal incursion management have still not been developed.[430] In addition, an intragovernmental response group for vertebrate pest animal incursion management has not been established.[431] These were both requirements under the previous *NSW Invasive Species Plan 2018-2021* that have not been implemented, creating risk by the informal arrangements governing pest animal incursion management that resourcing will not be available in time to support a prompt incursion response. Relevant recommendations to address these issues have been made under the audit of state invasive species management.

In addition to NPWS and EPA, incursion responses could also include other staff within DCCEEW such as those involved in threatened species management, as well as other public land management agencies such as FCNSW, Crown Lands and Transport for NSW. These agencies indicated to this Review they would be open to an increased role in invasive species surveillance and incursion management, provided appropriate support for their role was provided. This support would need to include training in the common surveillance techniques used in incursion management and the formal authorised officer training under the *Biosecurity Act 2015*.[432] The training would also have expanded benefits in better preparing these staff to detect and respond to new incursions during their everyday land management activities.

Further, a more informed and motivated public is a powerful resource for recognising and reporting potential new invasive species incursions (see also **Chapter 9**).[433] For example, the current eradication programs for mouse-ear hawkweed in Kosciuszko National Park,[434] black knapweed near Tenterfield,[435] and the successful eradication of yellow crazy ants from the Lismore area were all initiated by reports from members of the public.[436]

The Commission tested whether Agriculture and Biosecurity has effectively provided education and training programs to raise awareness of incursion risk and reporting among front-line government staff, key stakeholder groups and the general community under the state audit of invasive species management. The audit found that, although Agriculture and Biosecurity has effectively trained front-line staff, further work is required to train the general community.[437] Although there were a variety of general awareness raising methods that have been used (for example, social media posts, webpages, posters and brochures), there was very little training on incursion risk that was made available to anyone beyond LLS, LCAs and NPWS.[438] Other public land managers (such as FCNSW and Crown Lands), government agency staff (such as BCS and BCT) and community groups (such as Landcare NSW) are interested in the training that Agriculture and Biosecurity runs for LCAs such as the course on identifying prohibited matter weeds.

Currently, the primary public reporting mechanism is the Agriculture and Biosecurity helpline (by phone), email or online form. There are also useful mobile phone and web applications such as Weedwise, iNaturalist, Atlas of Living Australia and FeralScan. These have recently been set up to send alerts to Agriculture and Biosecurity when used to identify potential new incursions of priority species. However, this process is still in its infancy. Improvements to

430 Natural Resources Commission (2024) *Audit of state invasive species management - Independent assurance report*, pp. 19-20.
431 *Ibid*, p. 20.
432 The authorised officer training would allow these staff to be deputised as authorised officers for the duration of their time in an emergency response.
433 ABARES (2022) *Making General Surveillance Programs Work - Lessons learned from case studies*
434 Department of Primary Industries (2023) *NSW Mouse-ear Hawkweed Strategic Plan*
435 Department of Primary Industries (2023) *NSW Black Knapweed Strategic Plan*
436 Department of Primary Industries (2019) *NSW says good riddance to crazy pest* [press release], 18 December.
437 Natural Resources Commission (2024) *Audit of state invasive species management - Independent assurance report*, pp. 40-42.
438 *Ibid*.

these systems, both in terms of usability for the general public and streamlining of reporting processes would lead to increased capacity of this valuable resource.

The most recent biosecurity attitudinal survey data highlighted a significant gap in the capacity or willingness of the general public to report new incursions, with over half (57 percent) of survey respondents in 2021 identifying that they never report any unusual or strange animal or plant sightings.[439] Building the understanding and capacity of the general public to report incursions, and improving the reporting tools and systems so that they are simple and easy to use is important to ensure that NSW can quickly identify new threats.

[439] Department of Regional NSW (2022) *Biosecurity Attitudinal Research Report*, p. 24.

8 Strengthening regulation, compliance and enforcement for a more reliable system

Key Findings

- Previous regulatory barriers to effective biosecurity management were largely removed by the introduction of the *Biosecurity Act 2015*. The Act brought weed and pest animal management under the same legislative and regulatory tools, and introduced a more flexible, outcomes-focused framework.
- Enforcement of compliance is relatively straightforward for species specifically identified under the legislation. However, compliance for species managed under the general biosecurity duty requires supporting detail in regional planning documents, which is currently inadequate.
- The regulatory approaches of Agriculture and Biosecurity, LLS and LCAs are siloed and differ significantly and there is a perception amongst stakeholders that regulatory processes do not apply equally to everyone, eroding the legitimacy of the system.
- Compliance and enforcement provisions in the *Biosecurity Act 2015* have not been well-defined or resourced as part of the policy or institutional arrangements of the NSW system and there is a lack of support, resourcing and tools to encourage enforcement cases.
- While some successful compliance activities have been implemented by LCAs, Agriculture and Biosecurity and LLS, a lack of consistency and public visibility opens the system up to inadvertent and deliberate non-compliance, and scepticism from land managers. Where possible, compliance provisions should be consistent, easy to understand and based on risk.
- Despite the risks that cats pose to conservation, production and human health, their status as a companion animal complicates their management and the *Companion Animals Act 1998* is ineffective at managing these biosecurity risks. In comparison to other Australian jurisdictions, NSW legislation is more permissive and allows almost unrestricted access of cats to the outdoors.

Key Recommendations (see detailed recommendations in Executive Summary)

Recommendation 9 – DPIRD strengthen a dedicated invasive species management compliance and enforcement function in NSW Government by establishing an MOU either with an existing regulator (e.g. the NSW Natural Resources Access Regulator) or resource a DPIRD division to provide specialised compliance and enforcement services

Recommendation 10 – the NSW Government remove regulatory barriers to improve biosecurity outcomes

8.1 The *Biosecurity Act 2015* removed many regulatory barriers

Previous regulatory barriers to effective biosecurity management were largely removed by the introduction of the *Biosecurity Act 2015*. The Act commenced on 1 July 2017, replacing (wholly or in part) 14 separate pieces of biosecurity-related legislation. The Act brought weed and pest animal management under the same legislative and regulatory tools, and introduced a more flexible, outcomes-focused framework.

NSW Government guidelines require a graduated and proportionate approach to regulation based on the level of risk associated with any alleged offence or behaviour.[440] Agriculture and Biosecurity's *Biosecurity and Food Safety Compliance and Enforcement Policy* reinforces this approach (see **Figure 26**).[441] The policy applies to the compliance and enforcement of various legislation that Agriculture and Biosecurity works under, including the *Biosecurity Act 2015*. The graduated enforcement tools include a range of actions from promoting voluntary compliance (education, advice and extension), to more formal processes of issuing directions, notices, orders and undertakings.[442]

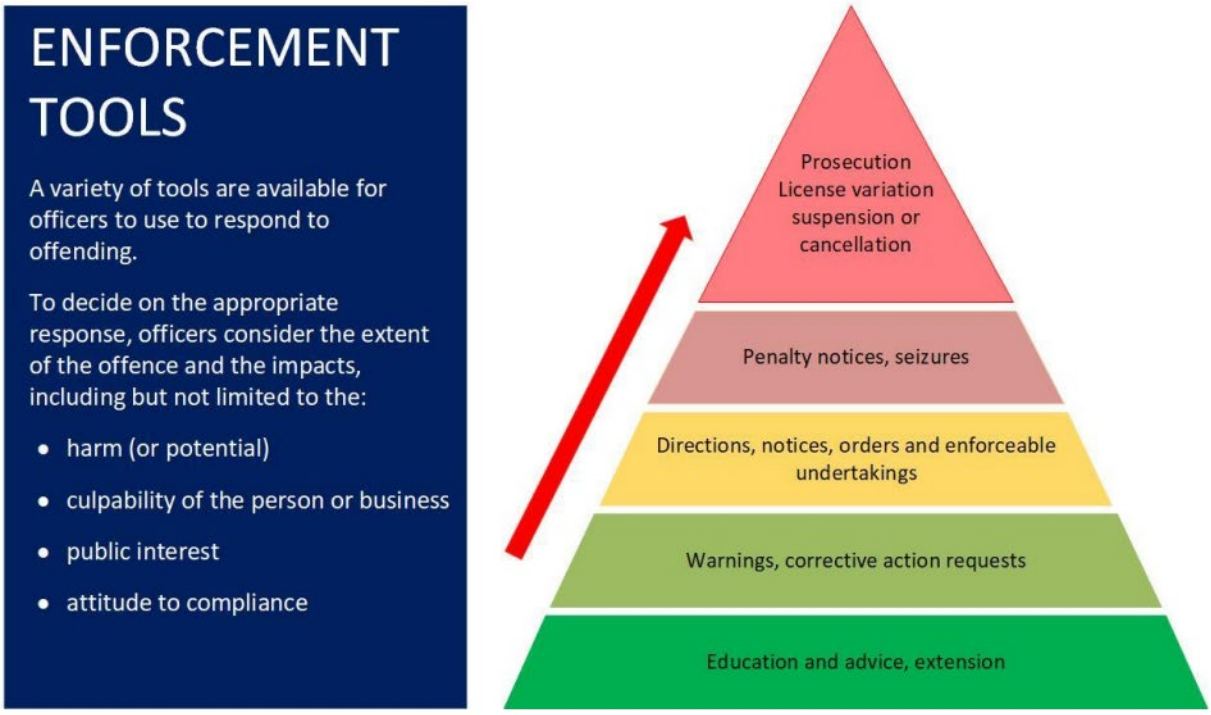

Figure 26: Graduated biosecurity enforcement tools based on assessment of risk[443]

440 NSW Treasury (2019) *NSW Government Guide to Better Regulation*
441 Department of Primary Industries (2021) *Biosecurity and Food Safety Compliance – Compliance and Enforcement Policy*
442 *Ibid*, p. 5.
443 *Ibid*, Figure 3, p. 5.

The 2023 statutory review of the *Biosecurity Act 2015* found that the policy objectives of the Act, and its supporting legislation, remain valid and that the terms of the Act remain appropriate for securing those objectives.[444] While the statutory review did not recommend any legislative amendments, it did make nine recommendations that '*build on outcomes, attitudes, awareness and understandings … to further mature the regulatory framework to ensure it remains fit for purpose*'.[445] The review also stated:

> *'Many internal, industry and community stakeholders expressed the view that it was not clear when a person had a duty to discharge and what actions were required to discharge the duty. Authorities and authorised officers tasked with ensuring the duty was discharged also expressed uncertainty as to when and how to undertake enforcement actions.'*[446]

Indeed, the review noted the need for improved support and guidance alongside the legislative tools under the Act.[447]

Subsequently in December 2023, the *Biosecurity Amendment (Independent Biosecurity Commissioner) Bill 2023* established the Independent Biosecurity Commissioner to provide oversight, clarify responsibilities and strengthen accountability of the biosecurity framework, in particular, through an appraisal of the enforcement approach.[448] This Review will be able to contribute to this work of the Independent Biosecurity Commissioner, highlighting several key barriers to effective compliance and enforcement below.

8.2 Improving the enforcement of the general biosecurity duty

The lack of enforcement of invasive species regulations was a key finding of the previous Commission reviews in 2014 and 2016. The subsequent reforms, including the introduction of the *Biosecurity Act 2015,* the establishment of LLS and collaborative regional planning, was intended to resolve the issue.[449] Indeed, the Commission considers that the intent and content of the Act and associated regulatory tools to promote integrated invasive species management are robust in their current form. However, this Review found that enforcement issues persist:

> '*There's a common view that the legislation has been provided with no support to enact and ensure compliance is supported and enforcement can be implemented where needed.'*[450]

> '*Since the new Biosecurity Act has been enacted, there is not a single example of a successful prosecution against a non-compliant land manager, despite there being overwhelming evidence of non-compliance. One of the key factors is a lack of regulatory support at the prosecution stage. Each Council is expected to develop its own systems, utilise its own legal resources, and gamble its own community funds on an Act which is nuanced and untested. Both LLS and [Agriculture and Biosecurity] refuse to provide any assistance, but at the same time generate large policy documents that attempt to guide local control authorities in the directions they should go. This 'support you in theory, but never in practice' model leads to the predictable outcomes of inaction.'*[451]

444 Department of Regional NSW (2023) *Statutory Review of the Biosecurity Act 2015*
445 Department of Regional NSW (2023) *Statutory Review of the Biosecurity Act 2015*
446 Department of Regional NSW (2023) *Statutory Review of the Biosecurity Act 2015*
447 Department of Regional NSW (2023) *Statutory Review of the Biosecurity Act 2015*
448 Legislative Assembly Hansard (2023) *Biosecurity Amendment (Independent Biosecurity Commissioner) Bill 2023 Second Reading Speech*, 23 November.
449 NSW Government (2016) *NSW government response: state-wide review of pest animal management*
450 Interview: NSW Farmers, 14 November 2023.
451 Submission: Hawkesbury River County Council, 4 October 2023.

The *Biosecurity Act 2015* introduced a system principally focused on supporting landholders to achieve voluntary compliance. This is based on well-evidenced models that assume the most effective starting point for compliance is education and engagement.[452] This includes making information available and directly engaging with land managers and risk creators in delivering this information to better understand and address their concerns. It was intended that this function would be delivered in the system through regional coordination and planning, and the associated local delivery partners (LLS and LCAs).

Such models also recognise that voluntary compliance cannot always be achieved and that incidents of non-compliance can impact invasive species management outcomes. For example, the effectiveness of landscape-scale management programs is significantly reduced if there are public or private land managers who are unwilling to undertake invasive species management actions on their land. These areas can become safe havens for invasive species, which can lead to rapid re-invasion after the implementation of management programs.

Although voluntary compliance supported by information provision is the primary objective, punitive sanctions for continued and informed non-compliance are critical. Without the genuine risk of enforcement, the effectiveness of efforts to encourage voluntary compliance can be eroded.[453] The importance of using the range of tools, including penalties on the more formal and legal end of the compliance spectrum was illustrated by key stakeholders:

> '*Because [the Biosecurity Act 2015] isn't specific, we're wanting for case law, but that won't come without the certainty. When a fine is issued [the] community will know, so [it would be] quite [a] powerful tool but you need all your ducks in order.*'[454]
>
> '*Compliance (and prosecution for non-compliance) must be improved and funds should be provided to encourage education, cooperation and collaboration.*'[455]
>
> '*There is a need for enhancements in compliance, audits, education, and the application of penalties.*'[456]

The two primary mechanisms in the *Biosecurity Act 2015* that can and have been employed to regulate invasive species risks are biosecurity directions and biosecurity undertakings.[457] These can be applied to both invasive species listed in the legislation under prohibited matter, control orders, biosecurity zones and mandatory measures, or other invasive species covered by the general biosecurity duty. The Act details the two types of directions that can be used to enforce compliance:

- an individual direction that can be issued to a person
- a general direction that can be issued to more than one person.[458]

While individual biosecurity directions can be issued by any authorised officer, a general biosecurity direction also requires spatial information at the property scale, public notification, and authorisation by:

- NSW Agriculture and Biosecurity Director level or higher

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452 Department of Primary Industries (2021) *Biosecurity and Food Safety Compliance and Enforcement Policy*
453 NSW Treasury (2019) *NSW Government Guide to Better Regulation*
454 Interview: Local Government NSW, 20 November 2023.
455 Submission: Individual, 15 October 2023.
456 Submission: Landcare NSW, 3 November 2023.
457 A biosecurity undertaking is a written undertaking by a person who may have contravened the *Biosecurity Act 2015*, specifying how they will remedy the contravention, and may be accepted by an authorised officer instead of giving the person a biosecurity direction.
458 Department of Industry (2017) *Procedure: Biosecurity – Biosecurity Directions*

- LLS General Manager level, and
- Local government (LCA) General Manager level.

Biosecurity directions need to be consistent with any relevant policy, plan and procedure for the management of a biosecurity risk. For species specifically identified under the legislation through prohibited matter, control orders, biosecurity zone or mandatory measures, this is relatively straightforward.

Enforcement is more difficult for species managed under the general biosecurity duty, the regulation of which was designed to be given effect through the regional planning process:

> *'Actions identified under these regional plans can be given effect under this Bill through the creation of biosecurity zones or control orders for higher priority actions, and through the general biosecurity duty for matters where the risk is considered less but the matter is still of interest at the regional level'.*[459]

There must be enough detail readily available in the regional plans or other documents to justify the biosecurity direction. This is the case for the regional strategic weed management plans, which list all 30 state priority weeds (those listed under prohibited matter, control orders, biosecurity zones and mandatory measures), as well as regional priority weeds dealt with under the general biosecurity duty. Regulation of all these species is through biosecurity directions. The vast majority of these are individual biosecurity directions, but some circumstances have warranted the limited use of general biosecurity directions.
However, for pest animals, cane toads are the only species listed under a Biosecurity Zone in the *Biosecurity Regulation 2017*. While there are prohibited dealings relating to camels, deer, feral pigs, rabbits and foxes, the management of these and other priority pest animals under the regional strategic pest animal management plans is through the general biosecurity duty. This is recognised in the procedure '*Biosecurity – Management of priority pest animals'* authorised by the Department of Primary Industries Director of Invasive Plants and Animals and endorsed by LLS, which identifies:

> *'The priority pest animals for each LLS region are determined by the regional pest animal committees (RPAC). RPACs assess the biosecurity risks of pest animals through a risk identification and assessment process and develop a list of priority pest animal species for management in each region. The list of priority pest species for an LLS region is published in the relevant Regional Strategic Pest Animal Management Plan (RSPAMP). The biosecurity risks and impacts posed or likely to be posed by priority pest animal species are generally regulated under Part 3 of the Biosecurity Act, using the general biosecurity duty.'*[460]

Similarly, the regional strategic weed management plans apply the NSW weed risk management system to develop a list of state and regional priority weed species. However, neither the regional strategic pest animal management plans nor regional strategic weed management plans include enough spatially explicit detail or actions to justify the enforcement of the general biosecurity duty through biosecurity directions.

Stakeholders are concerned that this level of detail is not adequate for many species, limiting the capacity of Agriculture and Biosecurity, LCAs and LLS to issue and/or prosecute biosecurity directions:

> *'We have strong concerns about the [general biosecurity duty] being unclear. There's a lot of work required to know what to do under that and there's a lack of legal clarity that hasn't been decided by the courts yet. Frustratingly, the departments haven't*

459 Legislative Assembly Hansard (2015) *NSW Biosecurity Bill 2015 Second Reading Speech*, 12 August.
460 NSW Government (2019) *Biosecurity - Management of priority pest animals*

been willing to test that clarity. I sometimes call [general biosecurity duty] 'choose your own adventure' legislation.'[461]

As part of **Recommendation 3**, the Commission considers that the redesign of the regional plans to include spatially explicit mapped priority areas will improve the ability of authorised officers to prioritise and maximise the effectiveness of compliance activities. However, the wording used in the plans should be considered by appropriate legal expertise to ensure they can be used as intended.

Stakeholders are also concerned that the *Biosecurity Act 2015*'s new tools and increased fines have been overshadowed by its complexity and that the Act and its supporting management tools are difficult for the general public and authorised officers to understand.[462] This includes reconciling general concepts like '*ought reasonably to know*' and '*reasonably practicable*' with the task of directing individuals to fulfil their general biosecurity duty.[463] Suggestions have been made by stakeholders that there is a need to more clearly define such terms and reduce individual discretion in their application.

8.3 Ensuring regulatory approaches are fair

Legitimacy is critical to effective regulation. Key to generating legitimacy is ensuring system participants accept regulatory processes as fair and applying equally to everyone, including that different responsible organisations apply regulatory approaches consistently. If you cannot hold everyone responsible, it is difficult to hold anyone responsible.

Building consistency between regulators is a key objective of the *Biosecurity and Food Safety Compliance and Enforcement Policy*, so that stakeholders '*receive similar, if not the same treatment from regulators involved in measuring compliance across animal welfare, biosecurity or food safety legislation'*.[464]

Despite this goal, there is a perception amongst stakeholders that some land managers are not subject to invasive species regulation in the same way as others. Supporting this, the Commission found that the regulatory approaches of Agriculture and Biosecurity, LLS and LCAs are siloed and differ significantly as a result. Although efficiency demands the allocation of responsibilities across different organisations, impacts on consistency need to be monitored.

LCAs are responsible under the *Biosecurity Act 2015* for compliance and enforcement of weed management activities, primarily undertaken under the WAP. LCA responsibilities include a significant component of engagement, education and extension, as well as a large number of inspections and individual biosecurity directions. Since the Act, LCA activities have resulted in:

- over 400,000 property inspections[465]
- over 10,000 individual biosecurity directions or undertakings to control weeds on a property (equivalent to 2.5 percent of inspections).[466]

461 Interview: Invasive Species Council, 7 December 2023.
462 Local Government NSW (2023) *Submission to the Statutory Review of the Biosecurity Act 2015*; Interview: Invasive Species Council, 7 December 2023.
463 Department of Primary Industries (n.d.) *General Biosecurity Duty*
464 Department of Primary Industries (2021) *Biosecurity and Food Safety Compliance and Enforcement Policy,* p. 1.
465 WAP data provided by Agriculture and Biosecurity, 1 November 2023.
466 WAP data provided by Agriculture and Biosecurity, 1 November 2023.

Further, it was found that, for LCA-driven compliance activities:

- most of the individual biosecurity directions and undertakings were complied with[467]
- 70 percent of inspections were on private land and 30 percent on public land (with equivalent levels of directions and undertakings across both land tenures)[468]
- approximately 30 percent of directions and undertakings were for state priority weeds (noting detections of state priority weeds often result in initiation of a control program, rather than a compliance action)[469]
- the remaining 70 percent of directions and undertakings were for regional priority weeds identified in the regional strategic weeds management plans[470]
- two general biosecurity directions were issued for weeds:
  - Upper Macquarie County Council, June 2020: to require public road authorities (landowners and managers) to have weed treatment plans in place[471]
  - Griffith City Council, November 2021: to exclude members of the public from a location infested with alligator weed[472]
- there were nine biosecurity directions that were not complied with and proceeded to successful prosecution in court.[473]

Despite the significant activity described above, there are inconsistencies between different LCAs in both their enforcement processes and the application of these processes. For example, the Commission's audit of regional invasive species management found that many LCAs in the three tested regions did not have a current compliance and enforcement policy in place for weed management, despite this being a requirement from Agriculture and Biosecurity.[474] Analysis under the audit of state invasive species management found that biosecurity directions and undertakings were inconsistently applied to large incursion sites for parthenium (applied in 10 out of 15 cases in 2022-23),[475] despite this being a requirement under the strategic plan for its management.[476] This illustrates the variation in LCAs and their willingness and ability to apply biosecurity tools, even where a management approach has been agreed based on the risk of the weed species.

Feedback from key stakeholders engaged in this Review noted the generally high levels of voluntary compliance in weed management. Despite this, stakeholders also noted the lack of legal prosecutions and felt that this was a gap created by limited legal support for LCAs to pursue these actions — from Local Government, LLS and Agriculture and Biosecurity. Key weed management staff engaged in this Review all noted that the enforcement side of weed compliance would benefit from a central team dedicated to supporting LCAs delivery of this function.[477]

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467 WAP data provided by Agriculture and Biosecurity, 18 March 2023.
468 WAP data provided by Agriculture and Biosecurity, 1 November 2023.
469 WAP data provided by Agriculture and Biosecurity, 18 March 2023.
470 WAP data provided by Agriculture and Biosecurity, 18 March 2023.
471 NSW Government (2020) *NSW Government Gazette 151 – Friday 10 July 2020*
472 NSW Government (2021) *NSW Government Gazette 644 – Friday 17 December 2021*
473 Pers Com. Central Tablelands Weeds Authority, 6 June 2024.
474 Natural Resources Commission (2024) *Audit of regional invasive species management in NSW - Independent assurance report*, pp. 24-25.
475 Natural Resources Commission (2024) *Audit of state invasive species management in NSW - Independent assurance report*, p. 25.
476 Department of Primary Industries (2024)*NSW Parthenium Weed Strategic Plan*, Strategy 4.6.
477 Interview: Agriculture and Biosecurity Weeds Programs and Responses Team, 2 November 2023; Interview: LLS regional staff, 11 October 2023; Interview: Weeds County Councils, 26 October 2023; Interview: NSW Weeds Officer Association, 21 November 2023.

There is also inconsistency in the enforcement of compliance between weeds and pest animals. Since the passage of the *Biosecurity Act 2015*, only two biosecurity directions have been issued for pest animal management:

- an individual biosecurity direction for cane toads issued by Agriculture and Biosecurity to a nursery in Sydney in August 2023 requiring the nursery to comply with a plan to prevent future infestations and respond to previously provided information on management of infestations from north-east NSW and Queensland[478]
- a general biosecurity direction for wild horses issued by North Coast LLS to all landholders within a defined Wild Horse Management Area in September 2023.[479] It required land managers to develop a written wild horse management program that either: allowed LLS to remove wild horses; demonstrated their actions to remove wild horses; or demonstrated their actions to domesticate and retain wild horses on their land.[480]

While there have been instances of LLS seeking legal advice on compliance and enforcement options,[481] LLS generally emphasised their critical role in delivering extension and education with landholders. This requires LLS to build trusting relationships with landholders and concerns that this could be compromised through legal enforcement activities. This creates an inherent tension. Some LLS staff felt that other specialist agencies may be better suited to such enforcement roles (for example, LCAs and the NSW Natural Resources Access Regulator).[482] However, LCAs have shown that, at least in the weeds space, it is possible to balance extension and enforcement activities within the compliance spectrum.

The Commission's audit of regional invasive species management found that in 2022-23 there were no inspection plans or regimes, no formal inspections were carried out and no enforcement tools were applied for pest animal management in the three LLS regions examined.[483] Without an effective enforcement function, LLS cannot fulfil its responsibilities as a regulator of the *Biosecurity Act 2015* and its ability to promote voluntary compliance is significantly curtailed.

The LLS *Compliance and Enforcement Policy* was published in 2015 to cover a range of its regulatory responsibilities set out in legislation related to native vegetation, animal biosecurity and welfare, and travelling stock reserves.[484] The policy was adopted in the same year the *Biosecurity Act 2015* was introduced and has not been amended. However, the LLS executive has stated it is committed to undertaking enforcement and is currently developing associated policy, guidelines and systems.

478 Interview: State invasive species leads for Agriculture and Biosecurity, LLS and NPWS, 15 September 2023.
479 The Wild Horse Management Area included Yuraygir National Park and surrounding state forests and private lands.
480 Interview: State invasive species leads for Agriculture and Biosecurity, LLS and NPWS, 15 September 2023.
481 Northern Tablelands LLS sought legal advice from the Department of Regional NSW Legal Team, with the intent to issue an individual biosecurity direction to make a landholder participate in an aerial baiting program. However, the legal advice advised that it would not be legal to impose the application of a restricted chemical product (1080) in an individual biosecurity direction. The enforcement process stalled at this point, but Northern Tablelands LLS worked with the landholder to voluntarily increase the level of ground-baiting and trapping on their property, which resolved the issue. Source: Interview: State invasive species leads for Agriculture and Biosecurity, LLS and NPWS, 15 September 2023.
482 Interview: State invasive species leads for Agriculture and Biosecurity, LLS and NPWS, 15 September 2023.
483 Natural Resources Commission (2024) *Audit of regional invasive species management in NSW - Independent assurance report*, p 25-27.
484 LLS (2015) *Local Land Services Compliance & Enforcement Policy*

In **Section 7.5**, the Commission recommended that LCAs could take on additional responsibilities for surveillance and incursion management of pest animals. This will require that their powers as authorised officers be extended to pest animals as well as weeds to be able to enter a property and request information regarding pest animals on that property. This role would not replace the LLS compliance function for pest animals but complement it by reaching a broader audience with basic extension materials, and directing them to LLS for more information. LCAs would also be able to pass information collected from these properties onto LLS for consideration of enforcement activities.

Local governments also have management responsibility for peri-urban areas where the practices of small landholders may give rise to exotic pests and diseases.[485] Despite the heightened biosecurity risk and specialised engagement requirements,[486] these areas generally fall below the LLS rate threshold and are therefore excluded from LLS compliance and engagement activities.[487]

8.4 Supporting regulatory organisations

The Commission appreciates the challenges of enforcing the compliance of invasive species regulations. Non-compliance is hard to detect, and enforcement encounters many practical challenges including limited funding, and community and political resistance.[488] Agriculture and Biosecurity's Biosecurity and Food Safety Compliance Branch has responsibility for ensuring that the *Biosecurity Act 2015* and *Biosecurity Regulation 2017* are applied effectively to protect the NSW economy, industry, the environment, and community from invasive species risks. This responsibility extends to overseeing the regulation of the Act by partner organisations, including LLS and LCAs.

Biosecurity regulation requires enforcement tools to be applied in some cases, which requires resourcing and specialist legal skills. The importance of funding and supporting legal processes for enforcement was raised by stakeholders:

> *'[Agriculture and Biosecurity] should coordinate a biosecurity regulatory centre that would at least allow the access to centralised legal services via a shared services model. This would greatly reduce overall costs and allow the development of minimum standards for legal representation. Insufficient cases could be knocked out before they enter the legal system, and learning could be shared amongst the industry. Councils would then have some confidence that a legal investment in court has a chance of success.'*[489]

Many stakeholders indicated that they required more support from the NSW Government to regulate biosecurity risks using the provisions of the *Biosecurity Act 2015*. Interviews with stakeholders indicated that successful prosecution of the Act could add the certainty of case law and encourage the use of regulatory tools. Others indicated that organisations did not have the skills and resources required. Effective regulation requires that the competency of regulatory organisations and their staff is periodically assessed, and deficiencies addressed.[490]

The Commission recommends that DPIRD should strengthen a dedicated invasive species management compliance and enforcement function in NSW Government by establishing an

485 Bureau of Rural Sciences (2008) *Biosecurity and small landholders in peri-urban Australia*
486 Charles Sturt University (2017) *Greater Sydney Peri urban Biosecurity Social Research Project*.
487 LLS does not collect rates from landholdings below 10 hectares and 20 hectares in some parts of the Murray and Riverina regions.
488 Martin, P. and Low Choy, D. (2016) *Recommendations for the reform of invasive species management institutions*.
489 Submission: Hawkesbury River County Council, 4 October 2023.
490 Local Government NSW (2023) *Submission to the Statutory Review of the Biosecurity Act 2015*.

MOU either with an existing regulator (for example, the NSW Natural Resources Access Regulator) or resource a DPIRD division to provide specialised compliance and enforcement services to support Agriculture and Biosecurity, LLS and LCA staff to deliver a standardised approach across the full spectrum of invasive species management compliance and enforcement actions, and support legal cases for prosecution against the *Biosecurity Act 2015*.

8.5 Ensuring consistent enforcement to increase compliance

While some successful compliance activities are being implemented by LLS and LCAs, a lack of consistency and public visibility opens the system up to inadvertent and deliberate non-compliance, and scepticism from land managers.

As previously discussed, NSW Government guidelines around efficient use of resources require Agriculture and Biosecurity's Biosecurity and Food Safety Compliance Branch to set regulatory priorities and determine what compliance and enforcement activities will be undertaken across this portfolio based on risk.

As such, Agriculture and Biosecurity publishes its regulatory priorities for biosecurity and food safety each year, identifying both enduring priorities (compliance, investigations, education, licensing and accreditation and emergency response) and strategic priorities for the financial year. For example, in 2023-24 the published strategic priorities included: compliance with egg testing requirements, National Livestock Identification System compliance particularly for sheep and goats, and compliance with emergency response/control orders for varroa mites and invasive ants.[491]

Agriculture and Biosecurity also publicly reports on its compliance and enforcement activity statistics from each financial year, and provides outcomes reports for some of its compliance programs.[492] However, annual reporting is not consistent between different programs and portfolios and is not transparent. Agriculture and Biosecurity reports activities such as audits and biosecurity directions as a bulk number across the whole Biosecurity and Food Safety group, which makes it unclear which aspects of biosecurity and food safety have been enforced and to what extent.[493]

Agriculture and Biosecurity also does not report on some compliance programs that it coordinates or activities that it has completed. For example, the Commission's audit of state invasive species management observed that the border biosecurity program for parthenium coordinated by Agriculture and Biosecurity in 2022-23 was not reported on,[494] and this program is not listed as one of its compliance programs on its compliance webpage.[495] This decreases the general awareness of the potential consequences of non-compliance, which could reduce people's willingness to comply with biosecurity orders.

In addition, compliance programs for weeds are not mentioned or reported on at all on Agriculture and Biosecurity's compliance webpage.[496] Biosecurity and Food Safety compliance actions reported online for 2022-23 included 288 biosecurity directions and undertakings,[497] whereas 1,951 biosecurity directions and undertakings were issued for weeds

491 Department of Primary Industries (n.d.) *Biosecurity & Food Safety Compliance Regulatory Priorities 2023-2024*
492 Department of Primary Industries (n.d.) *Compliance*
493 Department of Primary Industries (2024) *BFS Compliance Achievements 2022-23*
494 Natural Resources Commission (2024) *Audit of state invasive species management in NSW - Independent assurance report*, p. 24.
495 Department of Primary Industries (n.d.) *Compliance*
496 *Ibid*.
497 Department of Primary Industries (2024) *BFS Compliance Achievements 2022-23*

alone during 2022-23.[498] Although LCAs undertake much of the weed compliance work, Agriculture and Biosecurity has statewide oversight and gathers data on compliance and enforcement functions completed by LCAs under the *Biosecurity Act 2015*. These activities should be transparently reported so that the public understands the potential consequences of non-compliance and can have greater confidence in the invasive species compliance and enforcement work that is already occurring but not reported.

Transparent reporting and communication of any improvements is needed to build awareness of the risks of legal prosecution and increase the motivation of land managers to voluntarily comply.[499]

The Commission recommends that compliance and enforcement in the NSW invasive species management system is addressed as it is critical to reducing risk across the state. DPIRD should strengthen a dedicated invasive species management compliance and enforcement function in NSW Government by establishing an MOU either with an existing regulator (for example, the NSW Natural Resources Access Regulator) or resource a DPIRD division to provide specialised compliance and enforcement services to:

- support Agriculture and Biosecurity, LLS and LCA staff to deliver a standardised approach across the full spectrum of invasive species management compliance and enforcement actions
- assist authorised officers in developing materials for enforcement such as biosecurity directions
- develop the underlying investigation procedures and evidence collection protocols required to undertake enforcement and deliver associated training for regional and local staff
- implement a targeted engagement program with public land managers
- support legal cases for prosecution against the *Biosecurity Act 2015*
- support and test more active and targeted use of the existing legislative and regulatory toolkit (for example, biosecurity directions, control orders, and biosecurity zones), including advice to regional coordinators and local delivery partners
- provide transparent public reporting on investigations, directions, enforcement actions and prosecutions, including upcoming priority programs
- explore and identify options for a supporting compliance and enforcement 'toolkit' to implement with landholders (for example, property lees, loans, cost recovery).

The strengthened approach to compliance and enforcement would need to be integrated in the proposed NSW strategic planning and resourcing framework (see **Chapter 5**). This would require supporting statewide guidance in the *NSW Invasive Species Plan* and prioritisation and mapping of cross-tenure compliance and enforcement actions in the regional plans — these plans provide the critical detail needed to allow the general biosecurity duty to be enforced where it is needed most for risk reduction.

In addition, this approach would need to be reinforced through continued improvements in the critical work of LLS and LCAs in providing outreach and engagement with public and private land managers to better understand any underlying issues triggering or prolonging non-compliance.

498 Natural Resources Commission (2024) *Audit of state invasive species management in NSW - Independent assurance report*, p. 24.
499 Invasive Species Review Interview Analysis 2023, Natural Resources Commission.

8.6 Strengthening legislation for the management of roaming cats

> *'Currently, it is estimated that there are approximately half a million cats living as semi-owned, unowned or feral cats in NSW, largely due to inadequate cat management. The cat over population could be attributed to the gap in the Companion Animals Act 1988 that allows cats to roam.'*[500]

Cats present a significant biosecurity risk. Although feral cats receive much of the focus regarding the impact of cats on native wildlife, domestic cats also have a significant impact.[501] As domestic cats have access to a range of food sources, their per capita kill rate is estimated at between 14 to 25 percent that of feral cats.[502] However, as domestic cats live at much higher densities, the predation rate per square kilometre in residential areas can be as much as 28 to 52 times larger than predation rates by feral cats in natural environments.[503]

The proximity of cats to human populations also dramatically increases the biosecurity risks they pose. Cats act as vectors for various diseases and parasites posing a threat to wildlife, livestock and human populations.[504] There are several cat-dependent diseases in Australia that can be passed to humans, including, toxoplasmosis, sparganosis, toxocariasis and cat scratch disease. The health impacts of these diseases range from mild to severe and have been estimated to cost the Australian economy as much as $6 billion a year.[505] Feral cats, although exposed to diseases and parasites, have limited contact with humans and therefore the transmission risk is lessened.[506]

Cat transmitted diseases and parasites can also impact populations of native species.[507] Toxoplasmosis has contributed to the decline of native mammal and bird populations, such as urban populations of the Eastern Barred Bandicoot.[508]

It is important to note that these biosecurity risks are mostly associated with disowned or unsupervised cats. Responsibly-owned cats are more likely to be contained and have a lower burden of diseases and parasites.[509]

Despite the risks that cats pose to conservation, production and human health, their status as a companion animal complicates their management. In comparison to other Australian jurisdictions, NSW legislation is more permissive and allows almost unrestricted access of cats to the outdoors.[510]

The *Companion Animals Act 1998* is ineffective at managing the biosecurity risks posed by cats, including predation and disease transmission. For example, there are no provisions under the *Companion Animals Act 1988* requiring owners to prevent a cat from roaming beyond the

500 Blacktown City Council (2023) *Blacktown City Council submission to the inquiry into pounds in NSW*
501 Legge S *et al.* (2020) 'We need to worry about Bella and Charlie: the impacts of pet cats on Australian wildlife' *Wildlife Research*, 47, p 523–539.
502 *Ibid.*
503 *Ibid.*
504 Legge, S., Taggart, P., Dickman, C., Read, J. and Woinarski, J.C.Z. (2020) 'Cat-dependent diseases cost Australia AU$6 billion per year through impacts on human health and livestock production', *Wildlife Research*, 47, pp. 731–746.
505 *Ibid.*
506 *Ibid.*
507 Berger, L., Skerratt, L.F., Zhu, X.Q., Young, S. and Speare, R. (2009) 'Severe sparganosis in Australian tree frogs', *Journal of Wildlife Diseases*. 45, pp. 921–9.
508 Dickman, C.R. (1992) 'Impact of exotic generalist predators on the native fauna of Australia', *Wildlife Biology*, 2, pp. 185–95.
509 Mendoza Roldan, J.A. and Otranto, D. (2023) 'Zoonotic parasites associated with predation by dogs and cats', *Parasites & Vectors*, 16(1) p. 55.
510 Apart from food preparation and consumption areas and wildlife protection areas.

owner's property, unlike for dogs.[511] The Act states that cats are prohibited only from food preparation/consumption areas and wildlife protection areas.[512] The wildlife protection area prohibition is also conditional — a person can only seize a cat from a designated wildlife protection area 'for the cat's own protection'[513] and only an authorised officer may do so if the owner is present.[514] Even in a wildlife protection area, an authorised officer can only lawfully injure or destroy a cat if they find it attacking or harassing an animal (other than vermin) and if there is no other reasonably practicable way of protecting the animal.[515]

Under the *Companion Animals Act 1988* a cat is only deemed a nuisance if it persistently makes noises that disturb the peace or damages anything outside of the property on which it is ordinarily kept.[516] Only in these instances may a council issue an order to an owner. A person cannot seize a cat on their property and transfer the cat to a council pound. The Act requires that any action be reasonable and necessary to protect a person or animal (except vermin) from injury or death.[517] Importantly, although the *Companion Animals Act 1988* requires dog owners to pick up and dispose of their dog's faeces immediately,[518] the same does not apply to cat owners.

Enabling Local Government to more easily designate suburbs as 'cat-free' is an action within the Australian Government's Draft Threat Abatement Plan for Feral Cats (2023).[519] The draft plan seeks to harmonise state cat management legislation and the NSW Government should support this process.

A review of the *Companion Animals Act 1998* and regulation was an election commitment of the current NSW Government.[520] A parliamentary inquiry into pounds in NSW was established in June 2023.[521] A further parliamentary inquiry into the management of cat populations is scheduled for 2024.[522] The Commission recommends that the Act is amended to enable NSW Local Government to introduce cat containment and desexing policies.

511 NSW Government (2023) *NSW Government submission to the inquiry into pounds in NSW.*
512 *Ibid.*
513 *Companion Animals Act 1998*, Section 30 (3).
514 *Companion Animals Act 1998*, Section 30 (4).
515 *Companion Animals Act 1998*, Section 32 (4).
516 *Companion Animals Act 1998*, Section 20.
517 *Companion Animals Act 1998*, Section 32 (1).
518 *Companion Animals Act 1998*, Section 32 (4).
519 Australian Government (2023) *Threat abatement plan for predation by feral cats 2023 Consultation draft*
520 NSW Government (2023) *NSW Government submission to the inquiry into pounds in NSW*
521 Parliament of NSW (2023) *Pounds in NSW*
522 Parliament of NSW (2023) *Legislative Council Hansard – Animal Welfare Committee*

9 Communicating risks and impacts to expand reach of the system

Key Findings

- The public did not have an adequate awareness of the risks surrounding invasive species, the importance of invasive species management or the concept of shared responsibility.
- A lack of well-resourced public education is holding back public awareness of the risks and importance of biosecurity. Education efforts to date have only resulted in short-term increases in public awareness.
- Key gaps in awareness-raising and education campaigns include around high-risk pathways and peak risk creators and among stakeholders in urban and peri-urban areas. Several organisations who undertake invasive species management as part of everyday activities could also be better engaged, such as Landcare NSW, Aboriginal landowners and managers, bush regenerators, industry groups and universities.
- Key gaps in public awareness include around how to participate in invasive species management and what the benefits are, the links between invasive species and native species extinction and the acceptance of lethal methods of pest animal control. There is also no single reliable source of public information about invasive species and agricultural peer networks remain underused.
- The public can also be engaged to reduce the risks of invasive species by modifying their potentially high-risk activities. However, information needs to be more widely available about these activities and how to reduce their potential risk.

Key Recommendations (see detailed recommendations in Executive Summary)

Recommendation 11 – DPIRD deliver a risk-based awareness and education program to increase public understanding of the importance of invasive species management, shared responsibilities, and how to participate

9.1 Increasing public awareness of risks and management

The concept of shared responsibility embedded in biosecurity legislation and central to effective invasive species management activities is reliant on the engagement and involvement of all key players, including government, industry and community.[523] One of the core elements of effective shared responsibility is that 'stakeholders are aware of each other's roles and responsibilities'.[524]

The general public are a key stakeholder who are part of frontline defence as citizens, workers and community members whose activities, such as surveillance and reporting, maximise the ability to detect and respond to new invasive species or changing invasive species' pathways. A lack of public awareness and engagement around the risks and management of invasive species has long been identified in system reviews.

523 Rawluk, A., Beilin, R. and Lavau, S. (2021) 'Enacting shared responsibility in biosecurity governance: insights from adaptive governance', *Ecology and Society,* 26(2), p. 18.

524 Craik, W., Palmer, D. and Sheldrake, R. (2017) *Priorities for Australia's biosecurity system; An independent review of the capacity of the national biosecurity system and its underpinning intergovernmental agreement*

Stakeholder feedback received for this Review consistently noted that the general public did not have an adequate awareness of the risks surrounding invasive species, the importance of invasive species management or the concept of shared responsibility:

> '*[The] general public don't really care. [Agriculture and Biosecurity's communication] is great but we're already engaged [in the system]. If you spoke to your neighbour about the [general biosecurity duty] I'm sure you would get very blank looks. Biosecurity to most people would be Border Force Australia where it's about food being brought in … That's where we need to target communications if we want a mass understanding and awareness.*'[525]

> '*We work a lot on explaining different roles to the general community but could do with more guidance and clarification on what everyone's responsibility is … Communication could be done more clearly from a state level [by Agriculture and Biosecurity and LLS].*'[526]

This finding reflects those of previous system reviews.[527] For example, the review of the *Biosecurity Act 2015* highlighted a lack of education and awareness for the general community, land holders and control authorities:

> *'[There is] need for ongoing education to mature understandings, awareness, attitudes, and actions to further mature the implementation of biosecurity as a shared responsibility and discharging of the general biosecurity duty and other legislative requirements within the biosecurity management framework.'*[528]

In particular, it identified a need to better target education of the general community with how biosecurity is relevant to their lives (i.e. environmental and amenity values), rather than just impacts on primary production.[529]

Recent large scale surveys of attitudes to biosecurity in NSW have revealed moderate levels of awareness of what biosecurity is, with 59 percent of the public reporting that they 'understand biosecurity as a term' (representing an increase of 9 percent between 2017-2021).[530] Only 55 percent regarded biosecurity as 'important' (representing an increase of just 4 percent between 2017-2021).[531] Biosecurity is predominantly seen as the responsibility of the government, followed by relevant industry groups.[532]

The NSW Government has made some considerable awareness-raising efforts after the introduction of the *Biosecurity Act 2015* to build familiarity of the importance of biosecurity and its shared responsibilities. For example, the Agriculture and Biosecurity invasive species extension team has had a focus on developing tools and techniques for use by Agriculture and Biosecurity, LLS and LCA staff for engaging with local stakeholders using community based social marketing, with greater emphasis on what is protected (environment and agriculture).[533] Agriculture and Biosecurity has identified 'pulses' of increased interest in biosecurity issues after educational campaigns, such as increases in biosecurity helpline calls after campaigns on public reporting.[534] However, these increases are only temporary and do not signify a sustained increase in awareness and understanding of invasive species management.[535]

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525 Interview: Local Government NSW, 20 November 2023.
526 Interview: LLS regional staff, 11 October 2023.
527 Craik, W., Palmer, D. and Sheldrake, R. (2017) *Priorities for Australia's biosecurity system; An independent review of the capacity of the national biosecurity system and its underpinning intergovernmental agreement*
528 Department of Regional NSW (2023) *Statutory Review of the Biosecurity Act 2015*
529 *Ibid*.
530 Department of Regional NSW (2022) *Biosecurity Attitudinal Research Report*
531 *Ibid*.
532 Department of Regional NSW (2022) *State of Biosecurity Report 2018-2021*
533 Interview: Agriculture and Biosecurity Invasive Species Extension Team, 9 November 2023.
534 Interview: Agriculture and Biosecurity Weeds Programs and Response Team, 2 November 2023.
535 Interview: Agriculture and Biosecurity Invasive Species Extension Team, 9 November 2023.

While these efforts have been perceived as successful in parts of the system, they have not been consistent or well-resourced over time, and have suffered from a lack of coordinated leadership, as noted by one stakeholder below:

> *'We can't have 130 councils doing their own messaging because it will be mixed. It should be consistent. Eleven LLS areas as well that all do things differently, only one [Agriculture and Biosecurity] so makes sense to come from them.'*[536]

9.2 Addressing key gaps in awareness-raising and education campaigns

Recent research and stakeholder feedback for this Review indicate commonly identified gaps in awareness-raising and education campaigns that need to be better understood and targeted. The most critical areas for improving system performance are:

- **Targeting awareness along high-risk pathways and with peak risk creators:** The importance of high-risk pathways and potential risk creators has been recognised by Agriculture and Biosecurity in recent years. For example, one of the requirements under the WAP is that each LLS region identify all high-risk pathways for new weed invasions into the region as a way of targeting surveillance efforts.[537]

  However, these high-risk pathways are not well communicated more broadly to those people using or managing them — this impedes the effectiveness of both surveillance and management actions (see **Section 7.5**). It is critical that these efforts are supported with specific communication materials to target key audiences, including members of the public that may visit or travel through these high-risk pathways, and the managers of these high-risk pathways and/or potential risk creators themselves.

  'LLS was initially active, but communication has dwindled. I only know one [Agriculture and Biosecurity] staff member who remains active. My concern is the overall lack of regular support from the organisation if we require assistance during an emergency response.'[538]

- **Targeting awareness-raising in urban and peri-urban areas:** Attitudinal research and stakeholder feedback indicates that awareness and understanding of biosecurity issues is much higher among primary producers and their local rural and regional communities.[539] This may be due to the agricultural and production focus of Agriculture and Biosecurity and LLS as lead agencies, as suggested by stakeholders:

  'LLS do a good job of making their stakeholders aware but it's in those peri-urban areas and general public that there's not that level of education and understanding. That's where there's a gap.'[540]

  'Most land owners are aware but general households, education is not getting through there. LLS send out brochures to farmers but not to people in town. [There is] disparity in the current system in where information goes and therefore a concentration in knowledge.'[541]

- **Increasing engagement and awareness among all relevant land managers:** Awareness-raising and education campaigns regarding invasive species are primarily delivered by Agriculture and Biosecurity, LLS and LCAs with a focus on primary producers. However,

536 Interview: NSW Weeds Officer Association, 21 November 2023.
537 Interview: Agriculture and Biosecurity Weeds Programs and Responses Team, 2 November 2023; Department of Primary Industries (2022) *New South Wales Weeds Action Program Guidelines 2020-2025*
538 Interview: Nursery and Gardening Industry NSW & ACT, 23 November 2023.
539 Department of Regional NSW (2022) *Biosecurity Attitudinal Research Report 2022*; Essential Research (2022) *Invasive Species Council Research Report*.
540 Interview: National Pest Animal Coordinators, 24 November 2023.
541 Interview: Anonymous, 24 October 2023.

there are organisations who undertake invasive species management as part of everyday activities for protecting environmental, social or cultural assets that are not actively aware of, or included in, the system. This includes groups such as Landcare NSW, Aboriginal landowners and managers, bush regenerators, industry groups such as research and development corporations, and a range of university researchers. Key representatives of these groups included in this Review indicated they would welcome more understanding of, and engagement in, the NSW invasive species management system:

'[*The Cotton Research and Development Corporation] are not well engaged… We would love more engagement with them … having regional expertise is critical to understand risk, movement and also who to go to, to ask the questions.'*[542]

As well as benefitting from receiving this information, these groups can also contribute to its dissemination out amongst the broader community they interact with, beyond the current reach of Agriculture and Biosecurity, LLS and LCAs.

'*Landcare needs a more prominent role given the criticality of community to making this work on the ground.'*[543]

The Review also identified a series of other systemic communication gaps that could form the basis of valuable and targeted NSW awareness and educational campaigns as summarised below:

- **Providing practical messages for the public on how to participate in invasive species management and what the benefits are:** The performance of the system is highly reliant on the general public — from reporting new incursions, to undertaking management actions. Despite this, the general public remains largely unaware of what to look for, where to report something or why it is important:

  'Additional education is required to explain the Act concepts … to the wider community, along with clearer explanation of what is expected by members of the community.'[544]

- **Providing a central and consistent source of publicly available information:** Across both the agricultural and environmental portfolios, the general public find it difficult to access clear information about invasive species management, if they're not already engaged in the system:

  '[The Invasive Species Council] and other [external] organisations often provide services to members of the public to help them navigate the system, and its often people who have already tried to navigate what's out there.'[545]

  'We know because we're in the fold, but from an outside point of view it's not clear at all. There are gaps in the system, who's responsible? Council, LLS? Who enforces it, and does that happen? There's no one place to go to get that clear direction, it's murky.'[546]

- **Targeting peer networks for agricultural land managers:** The ABARES pest animal and weed management survey suggests that NSW land managers show a preference for 'peers and neighbours' (60 percent) as their primary information source, followed by the internet (45 percent), family and friends (37 percent), agribusiness (36 percent), state government (35 percent), while regional natural resource management groups (LLS in

542 Interview: Research Development Corporations (Cotton and Meat and Livestock), 21 November 2023.
543 Interview: Landcare NSW, 3 October 2023.
544 Submission: Local Government NSW, 31 October 2023.
545 Interview: Invasive Species Council, 7 December 2023.
546 Interview: Landcare NSW, 13 October 2023.

NSW) were at 20 percent.[547] The ABARES survey provides an ongoing way of monitoring and responding to communication preferences among this cohort.

- **Linking invasive species management to the extinction of native animals:** Agriculture and Biosecurity has made efforts to increase emphasis in guidance materials on what is protected (environment and agriculture), rather than what is controlled (invasive animals and weeds). In addition, other relevant land management agencies such as DCCEEW recognise the importance of invasive species management in terms of threats to biodiversity conservation (for example, the Saving our Species program).[548] However, both organisations defer to the other as the lead when it comes to the impacts of invasive species on native species.[549] Without strong leadership on this issue from either organisation, invasive species are not 'top of mind' for the general public when compared with other environmental issues.[550] Awareness would be improved with clear and strong connections between the impact of invasive species and the state of the environment, particularly impacts on native species.
- **Developing awareness of the effectiveness of critical management activities to improve social licence to use them:** The public generally demonstrates that they do not have a strong view of the acceptability of lethal management methods prior to engaging in the topic (88 percent of the Australian population indicated being a potential advocate if provided with the right information or circumstances).[551] However, key control techniques, including aerial shooting and the use of pesticides such as 1080 and glyphosate, have been the subject of significant opposition by special interest groups, which in some cases, hampers the effectiveness of management. Similarly, while recreational hunting by itself does not result in effective pest management, it needs to be recognised that ground shooting can contribute to integrated control programs when used in conjunction with other major control techniques like aerial shooting and baiting.[552] This requires clear and factual communication on effectiveness of management techniques and the associated positive environmental outcomes (for example, protecting native species) to counter misinformation and increase acceptance.

The Independent Biosecurity Commissioner has been tasked to improve communications of shared biosecurity obligations. This is an important step,[553] but will require further action. The Commission recommends DPIRD deliver a risk-based awareness and education program to increase public understanding of the importance of invasive species management, shared responsibilities, and how to participate. This must target:

- high-risk pathways and hotspots (for example, the NSW/Qld border, major ports) and potential risk creators (for example, importers, online traders, aquariums, horticulturalists, plant nurseries, developers)
- 'how' the public can deliver their responsibilities (for example, individually/collectively, methods of surveillance, community reporting apps and online/helpline reporting of high priority incursion species)
- socially-smart long and short-term campaigns (for example, quick response campaigns for emergency incursions in specific 'hot spots', well-designed and targeted social media, education on technologies, school-based campaigns)

547 Stenekes, N., Ticehurst, J. and Arthur, T. (2024) *Pest Animal and Weed Management Survey 2016/2019/2022*, NSW land manager survey custom results, report prepared by ABARES for the Commission.
548 Environment and Heritage (2024) *Saving our Species program*
549 Interview: Saving our Species program coordinators, 24 October 2023.
550 Essential Research (2022) *Invasive Species Council Research Report*.
551 *Ibid*.
552 Natural Resources Commission (2017) *Supplementary Pest Control Trial Final Evaluation*
553 Minister for Agriculture and Western NSW (2023) *NSW Government delivers on Biosecurity Commissioner election commitment with passing of bill* [press release], 30 November.

- Aboriginal connections to Country, and the importance of managing the land and water holistically for it to be healthy
- social and behaviour change research to tailor, monitor and prioritise this investment to align with the risk reduction and value for money framework
- delivery through a 'one-stop shop' NSW Government portal on invasive species management and supporting regional coordination and local delivery functions.

9.3 Engaging high-risk activities and creators

The public can also be more actively engaged to reduce the risks of invasive species by modifying their potentially high-risk activities. However, information needs to be more widely available about these activities and how to reduce their potential risk.

For example, the RSPCA NSW's 'Keeping Cats Safe at Home' project was funded by the NSW Environmental Trust in line with a recommendation in the Commission's statewide review of pest animal management in 2016.[554] While the program has been hailed as a success by participating local councils, they have also called for a supporting amendment of the *Companion Animals Act 1988* to enable the introduction of cat containment and desexing policies and associated education and enforcement initiatives in their local government areas (see further discussion in **Section 8.6**).[555]

The NSW Environmental Trust also funded the 'Gardening Responsibly' program in line with a recommendation in the Commission's statewide review of weed management in 2014.[556] 'Gardening Responsibly' is a certification scheme for ornamental plants, promoting low-risk plants to protect Australian biodiversity. Although a voluntary scheme, it brings together the weed risk assessment skills of professional weed management specialists, the capacity for participating nurseries to showcase their environmental certification and makes relevant information available to the general public.

> *'The benefits of the approach through 'Gardening Responsibly' is that it creates lists based on risk and people can choose their actions based on that risk. Promoting the fact that we need to make risk and knowledge of risk available to people who deal with plants.'*[557]

Similar issues have been identified for the aquarium industry, in terms of the potential introduction of invasive aquatic plants and animals, and the need to assess the risks and develop mechanisms to reduce them.[558]

DPIRD, working with bodies such as RSPCA NSW and the Nursery and Gardening Industry NSW & ACT, could ensure that programs such as the 'Keeping Cats Safe at Home' and 'Gardening Responsibly' are continued and expanded.[559] This work should include developing similar programs, such as for the aquarium industry, as potential high-risk pathways for invasive species are identified and prioritised.

554 NSW RSPCA (2024) *Keeping cats safe at home*; Natural Resources Commission (2016) *Shared Problem, Shared Solutions: State-wide review of pest animal management*
555 Submission: Local Government NSW, received 31 October 2023.
556 Gardening Responsibly (2021) *Gardening Responsibly*; Natural Resources Commission (2014) *Weeds – Time to get serious: Review of weed management in NSW*
557 Interview: State invasive species leads for Agriculture and Biosecurity, LLS and NPWS, 15 September 2023.
558 Submission: Invasive Species Council, received 5 December 2023.
559 RSPCA NSW (2024) *Keeping cats safe at home*; Gardening Responsibly (2021) *Gardening Responsibly*

Given the integrated nature of surveillance and incursion responses within the system, the Commission has proposed several recommendations across different scales and management components, including:

- cohesive delivery through regional coordination and local delivery partners
- state-level coordination of targeted high-risk programs and supporting education, training and public awareness raising actions.

These improvements are also contingent on the integration of surveillance and incursion response as a core component of the NSW strategic planning and resourcing framework for invasive species management (see **Chapter 5**).

10 Integrating knowledge and oversight to safeguard the system

Key Findings

- Integrating MERI in invasive species management is critical to ensure objectives are being achieved and to support continuous improvement. While there are provisions for MERI in the *NSW Invasive Species Plan* and associated regional plans, these are not being enacted in a consistent and rigorous way to support the NSW system.
- There is no overarching knowledge strategy identifying key research priorities to drive coordinated and resourced research, data and technology for NSW invasive species management. Monitoring and evaluation are instead driven by short-term funding and management programs, resulting in sporadic, fragmented and short-term programs.
- There is a disconnect between researchers and managers that limits the application of new approaches on-ground. Current links between researchers and land managers are through previous relationships and opportunistic engagement. While this works well for the parties involved, greater collaborative opportunities across the system are missed because researchers are unaware of key sites and activities that could be used to help answer priority research questions. Researchers also have limited involvement in statewide monitoring design and management.
- Effective linkages need to be developed and coordinated between research organisations and land managers to ensure efficient uptake of research and development as well as establishing effective feedback mechanisms.
- Recent advances in technologies such as gene editing techniques, remote sensing technology and artificial intelligence have the potential to address key challenges in invasive species management. These should be considered where their use is appropriate to address key priorities, with their implementation guided by researchers.
- Existing statewide MERI frameworks only provide high-level guidance and do not specify clear, consistent reporting requirements. As a result, each of the 11 regional committees for both weeds and pest animals has developed different approaches to MERI.
- There is inadequate focus on outcomes in MERI frameworks, leading to data collection on management activities and not their effectiveness.
- There is insufficient accountability and independent oversight built into the system to enable transparency and ongoing improvement.

Key Recommendations (see detailed recommendations in Executive Summary)

Recommendation 12 – DPIRD develop a NSW invasive species knowledge system that is smart and responsive

10.1 Aligning funding body and land manager research priorities

Both researchers and land managers identified that there are not enough resources to answer priority research questions. Agriculture and Biosecurity invasive species researchers are funded by a range of external providers, including NSW and Australian government agencies and trusts, industry research and development corporations, and national research funding bodies.[560] Although invasive species management is relevant to the focus of these funding sources, they are generally not aligned to the highest priorities for invasive species research.

While some researchers continue working on high priority issues, there are limited resources that can be diverted to these projects while still meeting the needs of the funding providers:

> *'I spent 30 years searching for money on research wherever it was available, but we were not going for funds based on impact and need.'*[561]

Two high priority research areas that remain largely unfunded include:

- unresolved questions to more effectively use aerial baiting across the full range of pest animal management scenarios: '*Bait rate research [has been going for] nearly a decade now and it's not resolved. We're not funding it and there's no continuity in staff in agencies with the corporate knowledge to keep that going. You need people able to do the work.'*[562]
- the development of new herbicides and techniques to respond to increasing herbicide resistance in NSW weeds: '*Herbicides and weed control for endemic species have no funding for research and it should be industry who are funding it but it's a major gap in terms of herbicide resistance and technical specialists for herbicides.'*[563]

  '[*There's been a] big loss in [Agriculture and Biosecurity] in herbicide field staff, so now it's left up to individual councils to do trials. Need that work done to have the confidence to enact those management actions.'*[564]

Agriculture and Biosecurity invasive species researchers are also competing with other researchers from universities and research organisations such as CSIRO for funds. These other researchers may be unaware of Agriculture and Biosecurity's priorities and following their own research agenda,[565] further diluting the available pool of funding for priority invasive species research questions:

> '*Coordination at state level would be worthwhile. Everyone is out there doing their thing and all reinventing the wheel which is a shame. It can be improved and there are good examples in the past and internationally.'*[566]

In response to a similar dilemma, Biosecurity Queensland led the development of a research prospectus that documented the agreed research priorities for a five-year time frame.[567] The prospectus was developed in conjunction with other relevant government agencies and key stakeholder bodies and is reviewed by this same group on an annual basis. Development of a similar invasive species research prospectus for NSW would:

560 Interview: Government Weed Researchers, 24 October 2023; Interview: Government Pest Animal Researchers, 3 November 2023.
561 Interview: State Pest Animal Committee Chair, 12 October 2023.
562 Interview: Government Pest Animal Researchers, 3 November 2023.
563 Interview: Anonymous, 15 September 2023.
564 Interview: NSW Weeds Officer Association, 21 November 2023.
565 Interview: Non-government agency weed researchers, 31 October 2023; Interview: Non-government agency pest animal researchers, 13 December 2023.
566 Interview: State invasive species leads for Agriculture and Biosecurity, LLS and NPWS, 15 September 2023.
567 Queensland Department of Agriculture and Fisheries (2020) *Research Prospectus, Invasive Plants and Animals Research, Research priorities and outlook for the period 2020-2025*

- increase transparency and accountability for addressing the highest priority research questions
- ensure dedicated government agency research funding is allocated to the highest priority programs
- provide a guide to other funding providers interested in invasive species research (for example, the Environmental Trust)
- provide a guide to other researchers interested in addressing the priorities of invasive species management and collaborating with government agency researchers.

10.2 Connecting researchers and land managers

Involvement by researchers in land management activities has the potential to improve management practices and monitoring techniques, as well as evaluating the effectiveness of programs. Applied research conducted in conjunction with operational programs provides real-world solutions and exposure to new technologies and techniques, which are more likely to be taken up by practitioners.[568] Researchers also bring partners together in collaborative programs and apply for funding, with flow-on benefits to land management practices.

Current involvement of researchers in on-ground management activities occurs through previous relationships and opportunistic engagement. While this works well for the parties involved, greater collaborative opportunities across the system are missed because researchers are unaware of key sites and activities that could be used to help answer priority research questions. With the development of a publicly available approved invasive species research prospectus as described in **Section 10.1** above, regional coordinators could play a key role in linking researchers to relevant invasive species management programs, and improving program outcomes:

> '*Trials can be really useful to do more efficient translation of research into practice … Landcare could have a role in that to synthesise research and translate that into practice and methodologies.*'[569]

One of the criticisms of monitoring programs raised by stakeholders is that they only occur where required in relation to funding agreements,[570] meaning monitoring is often short term and output-focused.[571] Involving researchers in the design and analysis of a statewide monitoring program would help to ensure that data collection is framed in the context of answering questions to improve management, and that the data collected is sufficient to do so. If the data is collected consistently and stored in a centralised database, researchers can also consider how else it can be analysed to contribute to improved invasive species management across the system:

> '*We don't have the systems…It's never given the priority it should be so it's an ongoing issue. First thing to consider is, what is my monitoring question? If the aim is to just 'monitor' then it is unclear from the start.*'[572]

> '*Invasive species management programs for many species are ineffective and not properly evidence-based. There is limited research on the effectiveness of management programs*

568 Interview: Non-government agency weed researchers, 31 October 2023; Interview: Non-government agency pest animal researchers, 13 December 2023.
569 Interview: Landcare NSW, 13 October 2023.
570 Interview: Government Pest Animal Researchers, 3 November 2023.
571 Interview: Government Weed Researchers, 24 October 2023.
572 *Ibid*.

and little is done to monitor the impact of invasive species management on native ecosystems'.[573]

10.3 Using new technologies to address priority risks

Recent advances in invasive species management technologies, such as remote sensing technology and artificial intelligence, have the potential to overcome challenges associated with detecting and monitoring invasive species. Their initial development requires the collection of large imagery datasets, best achieved through researchers and invasive species managers working together in the field. In developing an invasive species research prospectus (see **Section 10.1**), new technologies should be considered where their use is appropriate to address key research priorities. Researchers should then be engaged to test and implement new technologies.

One example of a new technologies with potential to address a key risk from invasive species are gene editing techniques, such as CRISPR-Cas9, which allow for precise modification of invasive species' genomes. Potentially, this could render them less harmful or even eradicate them altogether.[574] Genetic markers also enable the identification of individuals within a species, which can facilitate the tracing of invasion pathways and help with targeted control measures.[575] As well as refining the genetic techniques, which are still in the early stages of development, their safe deployment will require a thorough understanding of the distribution, impacts, behaviours and genetic profiles of invasive species populations, which would be assisted through collaboration between researchers and practitioners. This collaboration will also support the deployment of technologies to improve existing management techniques.

While these advances in technology could significantly benefit invasive species management, they come with some risks, which need to be acknowledged and well-communicated.[576] While recent CSIRO research has found that Australians were likely to be in favour of gene drive technology, this was dependent on having sufficient information on the risks and impacts.[577] As such, the use and impacts of invasive species technologies should be included in awareness and education programs targeted at the general public (see **Chapter 9**).

10.4 Designing MERI to be consistent and scalable

Agriculture and Biosecurity has existing statewide MERI framework documents for both weed and pest animal management.[578] However, these frameworks do not specify consistent statewide MERI requirements that are reported against. Rather, they provide guidance to LLS and respective regional committees and to Agriculture and Biosecurity and the state committees on what to broadly consider in the development of MERI.

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573 Submission: UNSW, received 9 October 2023.

574 McGaughran, A., Dhami, M.K., Parvizi, E., Vaughan, A.L., Gleeson, D.M., Hodgins, K.A., Rollins, L.A., Tepolt, C.K., Turner, K.G., Atsawawaranunt, K., Battlay, P., Congrains, C., Crottini, A., Dennis, T.P.W., Lange, C., Liu, X.P., Matheson, P., North, H.L., Popovic, I., Rius, M., Santure, A.W., Stuart, K.C., Tan, H.Z., Wang, C. and Wilson, J. (2023) 'Genomic Tools in Biological Invasions: Current State and Future Frontiers', *Genome Biology and Evolution*, 16(1).

575 *Ibid.*

576 Kirk, N., Kannemeyer, R., Greenaway, A., MacDonald, E. and Stronge, D. (2020) 'Understanding attitudes on new technologies to manage invasive species', *Pacific Conservation Biology*, 26, pp. 35-44.

577 CSIRO (2022) *Public perspective towards using gene drive for invasive species management in Australia*

578 Department of Primary Industries (2019) *A monitoring, evaluation, reporting and improvement (MERI) Framework for Regional Strategic Weed Management Plans*; Department of Primary Industries (2020) *Monitoring, Evaluation, Reporting and Improvement (MERI) framework for pest animal management in NSW, NSW Department of Primary Industries, 2020*

As a result, each of the 11 regional weed committees and 11 regional pest animal committees has developed different approaches to MERI.[579] The focus of MERI in weed management has been driven by the requirements of the WAP to enter data into BIS-Weeds, as per the BIS-Weeds Data Standard. This has resulted in general consistency in the weeds data entered into BIS-Weeds for some WAP activities (particularly property inspection data and associated compliance activities) and the corresponding statewide annual reporting by Agriculture and Biosecurity against these program targets. However, this does not occur across other elements of weed management.[580]

In the case of pest animals, the focus of MERI is on activities undertaken by LLS, with different regions having variable approaches in terms of what to measure and how. These different approaches within and across the system are neither complementary nor scalable, and lead to difficulties in compiling a statewide dataset:[581]

> '*Publication of a MERI plan is not monitoring. They keep throwing [the MERI Plan] at us but the monitoring of the regional pest animal and weed strategies are not being done consistently or reported. That raises trust issues on whether it's being implemented.'* [582]

The Commission's audit of regional invasive species management found that LLS regions had different structures and approaches to planning, target setting and annual reporting, which makes comparison of different regions and aggregation of data challenging.[583] In addition, LLS's monitoring and internal reporting of implementation for both pest animal and weed management typically did not align with the requirements of the regional strategic weed management plans or regional strategic pest animal management plans.[584]

In some regions additional monitoring and reporting was completed to allow regional committees and boards to understand the progress of implementation of these plans, and in other cases plan implementation was not transparent.[585] As a result, there were inconsistencies in MERI processes between LLS regions, and also inconsistencies within LLS regions between the overarching strategic plans, annual plans and annual reporting. This significantly constrains the usefulness of this information. Several recommendations have been made to LLS under the regional audit to improve the usefulness and consistency of regional MERI processes.

10.5 Designing MERI to be outcomes-focussed

The audit of regional invasive species management found that a variety of data was collected and reported by the six tested LLS regions in 2022-23. However, there was no evidence provided that clearly indicated that regions have implemented MERI processes to explicitly monitor the outcomes of invasive species management activities, in line with the intent of existing statewide MERI frameworks.[586]

Stakeholders identified that in many cases, invasive species monitoring and evaluation only occurs where it is required by a funding agreement. Monitoring is often short-term and

579 Interview: LLS regional staff, 11 October 2023; Minister for Agriculture and Western NSW (2023) *NSW Government delivers on Biosecurity Commissioner election commitment with passing of bill* [press release], 30 November.
580 Interview: Agriculture and Biosecurity Weeds Programs and Response team, 2 November 2024.
581 Interview: State invasive species leads for Agriculture and Biosecurity, LLS and NPWS, 15 September 2023.
582 Interview: Invasive Species Council, 7 December 2023.
583 Natural Resources Commission (2024) *Audit of regional invasive species management in NSW - Independent assurance report,* pp. 38-39.
584 *Ibid,* pp. 36-38.
585 *Ibid,* pp. 36-38.
586 *Ibid,* pp. 33-35.

outputs-focused, driven by short and fragmented funding. This is limiting the ability of the system to capture meaningful information on effectiveness of management to improve management actions over time:

> *'We need metrics and MER to be able to measure our success and trends towards state goals and that's just not happening.'*[587]

> *'Funding cycles [are] very short [and they don't] … support longer-term MERI, which is important. One year of funding and they want us to report on outcomes, it's just not possible.'*[588]

Strategic planning and resourcing for coordinated weed and pest animal management programs, as detailed in **Chapter 5**, would provide a suitable foundation for meaningful and consistent long-term MERI. This would need to be supported with outcomes-focused MERI and the appropriate research, data and technology systems (see **Sections 10.1**, **10.2** and **10.3**) to deliver the quality of MERI required to drive improvements in the system.

Best practice for the design and delivery of MERI should include the following principles:[589]

- **targeted and specific:** use evaluation questions to inform program design and focus monitoring to ensure that critical information for management and decision-making is collected
- **risk-based and value-driven:** determine priorities through an analysis of risks, opportunities and value for money; risks can be prioritised by ranking according to the potential reduction in risk, or by the cost-effectiveness of monitoring that mitigate multiple risks concurrently
- **credible and appropriate:** use robust metrics and thresholds that are based on best available evidence, and generate information using best practice monitoring approaches at relevant spatial scales and time periods
- **strategic and cost-effective:** seek to maximise the information generated given the available budget, and ensure the proposed activities are not overly onerous or costly for landholders
- **collaborative and transparent:** facilitate landholder engagement and report publicly on MER activities in findings to improve landholder confidence and encourage participation, considering the needs, rights and management objectives of landholders
- **adaptable:** ensure the program can evolve in response to new priority questions and risks and review frequently enough to drive better outcomes and improvement while also allowing landholders to keep pace with change.

587 Interview: Landcare NSW, 13 October 2023.
588 Interview: Government Weed Researchers, 24 October 2023.
589 Natural Resources Commission (2023) *Approved Private Native Forestry Monitoring, Evaluation and Reporting Framework November 2023*, Appendix 2.

10.6 Ensuring oversight and accountability to support adaptation and improvement

The NSW Audit Office provides general guidance on delivering regulation, including how lead NSW Government agencies should coordinate other agencies to meet their obligations.[590] This guidance includes specific provisions to:

- clarify the overall approach with respect to policy priorities, strategic risks and capabilities
- improve oversight, particularly with more meaningful reporting on performance and robust accountability mechanisms
- establish effective approaches to monitoring entities' compliance and performance
- improve the relevance and timeliness of support that promotes voluntary compliance and the achievement of objectives.

As illustrated across this Review, achieving these objectives can be challenging, particularly when responsibilities are devolved and where there are emerging risks, as is the case in invasive species management. However, doing so is important for good governance and to meet public expectations about accountability and transparency.

There are good examples of oversight and reporting in parts of the system such as the WAP. This program comprises key components highlighted by the NSW Audit Office including:

- expectations and requirements are clearly and contractually defined between the partner agencies
- there is a common data and reporting system accessible to all for mandatory communication and reporting (the Biosecurity Information System)
- there is regular and consistent support from the lead agency Agriculture and Biosecurity and regional coordinators to local delivery partners (LCAs).[591]

However, at the system-scale, accountability and transparency has been largely reliant on internal reviews and audits, and the statewide plan and committees' oversight of regional scale planning and delivery.

The Commission's audit of the implementation of the previous *NSW Invasive Species Plan 2018-2021* indicated that the state committees and responsible groups have not monitored implementation of this plan as was required.[592] The state and regional audits also found that where reviews of significant planning documents were required at the end of their period – for both regional strategic weed management plans and the *NSW Invasive Species Plan* – these had not been completed by LLS and Agriculture and Biosecurity.[593] This suggests that internal oversight designed to improve invasive species management has not been effective.

In addition, while there have been several audits and reviews undertaken by the Department of Regional NSW, these have largely focused on specific parts of the system (emergency management, compliance and weed management by LCAs) with little consideration of the interactions between these issues and without necessarily investigating the larger picture of invasive species management.

590 NSW Audit Office (2024) *Regulation Insights Report*
591 Department of Primary Industries (2019) *NSW Weeds Action Program Guidelines 2020-2025*
592 Natural Resources Commission (2024) *Audit of state invasive species management in NSW - Independent assurance report,* p. 44.
593 *Ibid*, p. 45; Natural Resources Commission (2024) *Audit of regional invasive species management in NSW - Independent assurance report,* p. 36.

Overall, incremental changes during the rollout of the current invasive species system have led to cumulative reductions in transparency and accountability across the entire system:

> '*The processes set up have not been operating, such as yearly reporting on the plans. We were not aware of it if it was. [The] mid-term review was not made available to us either. [The] end of plan review [was] not made available. So there are opportunities to improve.*'[594]

> '*[We have] no idea how good the oversight [of the system] is because there's a complete lack of transparency. We need independent evaluations of plans and outcomes if we're to have any confidence in how well they're being implemented.*'[595]

To better safeguard the NSW invasive species management system, the Commission recommends that DPIRD develop a NSW invasive species knowledge system that is smart and responsive, including:

- a dynamic research strategy developed by DPIRD in collaboration with universities, other research partners and end users, and reviewed annually by the NSW Invasive Species Committee, to:
  - identify priority research questions for investment over the next three years, focusing on incursions, risk pathways, monitoring, control methods, and future risk (for example, climate change)
  - detail requirements and standards for research, data and technology
  - improve accessibility, commercialisation and adoption of research outcomes.
- consistent and standardised data/research collection, mapping and reporting as part of a transparent and connected system to:
  - draw together existing data platforms where possible
  - provide appropriate access to information, including mapping, on current status of key invasive species, associated management actions and their outcomes
  - include financial planning and expenditure data.
- an outcomes-based MERI framework which links to the *NSW Invasive Species Plan* and regional plans, including provisions to:
  - assess and identify feasible MERI methods to achieve the outcomes
  - detail how MERI outcomes will inform decision-making and adaptation
  - include metrics to value changes in environmental, cultural and social impacts of invasive species, as well as economic costs
  - guide and train staff across NSW Government agencies and partners to embed consistent outcomes-focused MERI across the system
  - identify transparent reporting requirements on outcomes
  - provide accessible data and reporting (via the NSW invasive species portal)
  - ensure oversight by state leadership (for example, DPIRD, NSW Invasive Species Committees, Independent Biosecurity Commissioner).
- Independent evaluation requirements – the Commission conducts regular independent evaluations and audits of NSW invasive species management system outcomes (i.e. the *NSW Invasive Species Plan* and regional plans, tracking implementation of recommendations, evaluating performance of public land managers against the plans).

[594] Interview: Invasive Species Council, 7 December 2023.
[595] Interview: Invasive Species Council, 7 December 2023.

11 A roadmap for the future

The recommendations of this Review are intended to trigger a step change in the management of invasive species to deliver material improvements in how we protect our environment, agriculture and communities from the impacts of invasive species. To do this well will take time – we anticipate that it will take at least three years to properly implement these changes. This chapter introduces a staged roadmap to implement the recommendations over this period (**Section 11.1**).

This chapter also details considerations for sustainable funding mechanisms for invasive species management, which can provide a foundation to develop the NSW Invasive Species Investment Program (**Section 11.2**).

11.1 A staged approach

The review recommendations are interrelated, designed to build on and complement each other to build a better system. As such, appropriately sequencing the recommendations will maximise their effectiveness and allow time for their promise to be realised. The roadmap is split into six phases with each phase approximately six months in length, which are detailed in **Figure 27** and **Figure 28** and in the following subsections. Some tasks overflow into the following period, but this is in recognition of the time taken to finalise approvals – the bulk of the work will have been completed and facilitate the next phase in the sequence.

The sequencing of these phases is based on an approach where statewide objectives and principles are first clearly defined and documented. Supporting documentation is then developed for consistent application and articulation of how these objectives and principles will be approached within regional contexts, while allowing for the flexibility required for effective implementation at the local level. Importantly, this approach requires 'line of sight' with a clear accountability route between local delivery outcomes and the statewide objectives and principles.[596] The development and refinement of a comprehensive MERI framework is a critical component of this stage, to ensure that this accountability route remains transparent and functional. Reporting up and down the system needs to be not only consistent and relevant to improving the system, but also acted upon to better achieve the statewide objectives and principles.

Importantly, every step in this sequence will lead to improvements in the NSW invasives species system and will be implemented as soon as they are ready. This continual improvement will culminate in the full implementation of the new system in 2027/28.

[596] Evans, M., Dare, L., Tanton, R., Vidyattama, Y., and Seaborn, J. (2019) *Trust in Australian Regional Public Services: "Citizens not customers – keep it simple, say what you do and do what you say"*, University of Canberra.

Figure 27: Roadmap stages

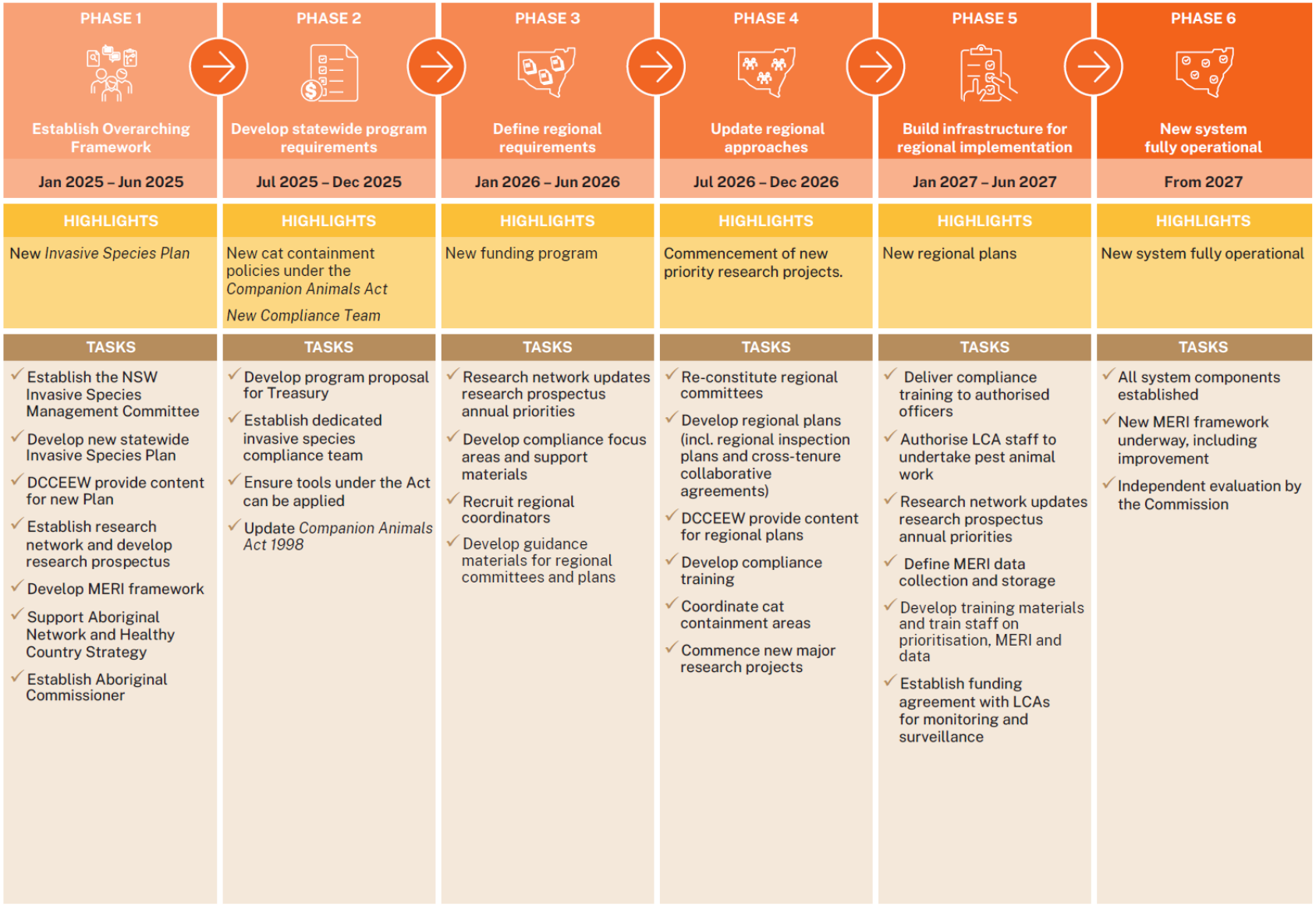

Figure 28: Detailed roadmap

11.1.1 Phase 1 – Establish overarching framework – January 2025 to June 2025

Phase 1 will establish a NSW Invasive Species Management Committee as the body to approve and commit to the NSW approach to invasive species management, comprising senior executives able to commit to decisions on behalf of their organisation (**Recommendation 6**).

During this time, Agriculture and Biosecurity will work with DCCEEW, LLS, LCAs, public land managers and other stakeholders to develop the new NSW Invasive Species Plan, which will include the elements identified in **Chapter 5.1** (**Recommendation 2**), transforming the document into an outcome-driven action plan. This will include contributions from DCCEEW to ensure biodiversity and Aboriginal cultural values are prioritised for protection from invasive species (**Recommendation 4**), the establishment of a research network by Agriculture and Biosecurity and the development of the first iteration of the annual research prospectus (**Recommendation 12**). It will also see the development of statewide requirements for the MERI framework (**Recommendation 12**) and communication materials for the launch of the new NSW Invasive Species Plan (**Recommendation 11**).

Phase 1 will also see the establishment of a network of Aboriginal staff involved in natural resource management and invasive species management, supporting the inclusion of invasive species management in the Health Country Strategy, and the establishment of an Aboriginal Land and Sea Country Commissioner (**Recommendation 5**).

11.1.2 Phase 2 – Develop statewide program requirements – July 2025 to December 2025

Once the new NSW Invasive Species Plan is finalised and approved by the NSW Invasive Species Management Committee, a comprehensive communication program will be launched to explain how the new system will work (**Recommendation 11**), Agriculture and Biosecurity will then work with DCCEEW, LLS, LCAs, public land managers and other stakeholders to develop the five-year NSW Invasive Species Investment Program proposal for submission to Treasury (**Recommendation 7**). This will look at existing resources and identify how additional resources would be used to maximise the efficient use of those existing resources, including additional Treasury funds, as well as the potential funding options identified in **Section 11.2**. The new program proposal will be approved by the NSW Invasive Species Management Committee before Agriculture and Biosecurity submits it to Treasury. Assuming the new program proposal is accepted by Treasury, the new program will start in July 2026.

During the development of the new program proposal, DPIRD will establish the team responsible for providing specialised invasive species compliance and enforcement services in support of Agriculture and Biosecurity, LLS and LCAs (**Recommendation 9**). Agriculture and Biosecurity will work with this new team to identify the steps required to strengthen the enforceability of the Biosecurity legislation throughout the subsequent rollout of the new system (**Recommendation 10**). The Compliance Team will also provide support to the Office of Local Government in its update of the *Companion Animals Act 1998* to enable councils to introduce cat containment policies in their local government area (**Recommendation 10**).

11.1.3 Phase 3 – Define regional requirements – January 2026 to June 2026

Phase 3 will see Agriculture and Biosecurity work with DCCEEW, LLS, LCAs, public land managers and other stakeholders to develop the basic requirements for regional implementation of the new system. This will result in the new Terms of Reference for the regional weed and pest animal committees (**Recommendation 6**) and the templates for the new regional plans (**Recommendation 3**) being approved by the NSW Invasive Species Management Committee, as well as an updated version of the annual priorities in the research prospectus submitted by the Research Network (**Recommendation 12**) and the Compliance Team will work with Agriculture and Biosecurity to develop a multi-year forward plan, including focus areas and support materials (**Recommendation 9**).

Recruitment for the regional coordinator positions in all 11 LLS regions will also be completed during this time (**Recommendation 8**). This will allow for their guaranteed employment from the beginning of phase 4 in July 2026 through to at least the end of the five-year period (June 2031) specified in the new program proposal.

11.1.4 Phase 4 – Update regional approaches – July 2026 to December 2026

During this phase, the initial funding from the new program proposal will come into effect. The first year of funding will cover the employment of the regional coordinators, as well as the costs associated with developing materials and setting up the new system. Subsequent years of funding will continue to fund the employment of the regional coordinators, as well as providing foundation funding for coordination of the activities identified under the NSW Invasive Species Plan.

Supported by Agriculture and Biosecurity, the regional coordinators will re-establish the regional committees under the new Terms of Reference (**Recommendation6**) and develop the new regional weed and pest animal plans (**Recommendation 3**), including content provided by DCCEEW addressing impacts on biodiversity and Aboriginal cultural values (**Recommendation 4**) and communication materials for the launch of the new regional plans (**Recommendation 11**). As part of their engagement with local councils and other stakeholders, regional pest animal coordinators will also contribute to the consistent rollout of cat containment policies in their region where relevant (**Recommendation 10**).

The new funding proposal will also see the commencement of new research projects identified as the highest priorities in the Research Prospectus (**Recommendation 12**).

11.1.5 Phase 5 – Build infrastructure for regional implementation – January 2027 to June 2027

With the content of the regional weed and pest animal plans finalised, this phase focuses on communicating how the regional plans will be implemented in phase 6 (**Recommendation 11**) and building the materials and tools required to see their effective implementation from July 2027.

Agriculture and Biosecurity will work with the Compliance Team to develop training based on the newly developed system, with the first round of training delivered in the second half of Phase 5, just prior to implementation of the new program (**Recommendation 9**). Related to the rollout of this training, the procedures required for LCA authorised officers to take on pest animal responsibilities will be completed (**Recommendation 10**).

Agriculture and Biosecurity will work with regional coordinators to define how MERI data will be collected and stored, in line with the framework established in the NSW Invasive Species Plan, and develop and deliver training on prioritisation, MERI requirements and

data collection and storage (**Recommendation 1** and **Recommendation 12**). Agriculture and Biosecurity will also finalise the funding agreements with LCAs for monitoring and surveillance activities over the following 4 years prior to the end of Phase 5 (**Recommendation 7**) and submit the updated annual priorities for the Research Prospectus identified by the Research Network to the NSW Invasive Species Management Committee for approval (**Recommendation 12**).

11.1.6 Phase 6 – New system fully operational – from July 2027 onwards

Although key management activities will begin from Phase 1, Phase 6 will see all elements of the system fully operational (**Recommendation 1**). This includes both on-ground management activities related to the state and regional plans, as well as the collection, reporting and analysis of the information identified in the MERI framework (**Recommendation 12**).

After the first full year of implementation of the new system, the Commission will evaluate how the recommendations of the Invasive Species Review have been implemented, and how the new system is performing, to contribute to the continual ongoing improvements that are a feature of this new system (**Recommendation 12**).

11.2 Sustainable funding mechanisms for invasive species management

As discussed in **Section 4.2**, the financial cost of invasive species management has grown significantly and will continue to grow under multiple new threats. This places increasing pressure on already stretched government resources. Funding for invasive species management was one of the most frequently raised concerns in public submissions received for this Review, with several additional issues identified during the Review. Key issues regarding funding raised in submissions and identified in the Review included:

- **insufficient funding** – particularly for staffing and operations, early detection and response, and in regions with lower ratepayer and industry funding bases
- **lack of strategic investment** – *ad-hoc* and politically driven funding driving short-term investment, lack of focus on return-on-investment and risk reduction
- **inappropriate funding** – including lack of security for multi-year funding, finance delivery not aligning to optimal control periods
- **administrative inefficiencies** – complex funding arrangements with multiple sources, differences in the management of funds, differences in funding models for weeds versus pest animals due to their separation between local government and LLS and lack of cost-sharing options for environmental invasive species.
- **lack of agreement on who should be funding management** – including landowner responsibilities versus government intervention
- **lack of transparency and accountability** – including lack of standards for government funding, no requirements to disclose public spending and inadequate MERI.

Several of the recommendations from this report will go some way to addressing these key issues. These include:

- adopting of advanced technologies
- harnessing latent capacity within the system, including better use of input from the general community and local government

- addressing administrative inefficiencies such as duplicative processes
- coordinating on-ground cross-tenure management at the regional level to maximise synergies between partner organisations/stakeholders.

While these opportunities will allow the NSW Government to 'do more with less' within current funding frameworks, it is clear that total funding for invasive species management must increase.

There is no 'one size fits all' funding model available for invasive species management. Mechanisms need to be fit for purpose, with their appropriateness dependent on the biosecurity risk being prevented or managed. As discussed in **Section 3.3**, current limitations in quantifying the costs of invasive species make informed decision-making around funding for effective management difficult. For example, the current focus on economic costs on primary industries creates a bias towards funding activities to mitigate impacts on agriculture and industry. Limited data availability and quality also pose significant barriers.

It is critical that the design of an NSW Invasive Species Investment Program (**Recommendation 7**) includes a comprehensive review of existing and planned expenditure and potential funds. This, in addition to information gathered from a more robust invasive species knowledge system for NSW (**Recommendation 12**), will help identify the best funding mechanisms for NSW.

While the Commission acknowledges this, given the concerns raised around funding by stakeholders, this section provides some insights and examples that could be considered in designing and implementing the Invasive Species Investment Program. This was based on a review of current and potential additional sustainable funding mechanisms in NSW, as well as consideration of other jurisdictions, in collaboration with John Virtue[597] and John Robertson.[598] **Table 8** outlines best practice principles for designing and selecting funding mechanisms. The list should be used to evaluate any potential new funding models and proposed changes to current funding mechanisms.[599]

Table 9 outlines potential funding mechanisms for key aspects of invasive species management that may be considered in designing the NSW Invasive Species Investment Program. These should be considered in addition to retaining and realising efficiencies in key existing funding mechanisms. Key mechanisms to retain including:

- NSW Government recurrent funding for core state-wide planning, co-ordination, reporting, policy oversight, surveillance, emergency response, compliance, research and management on government lands
- local government rates and LLS levies and recurrent funding for core staff, surveillance, emergency response and compliance
- cost-recovery mechanisms under the Act
- supplementary funding from state government through the WAP
- NSW Environmental Trust grants for management and research and development
- Ongoing project-based research collaborations with other states, universities, CSIRO and industry providers for competitive applications to sources of funding.

597 John Virtue is the former General Manager of Invasive Species with Primary Industries and Regions South Australia (PIRSA) and former member of the national Environment and Invasives Committee.
598 John Robertson is the former General Manager of Invasive Species with Biosecurity Queensland and former member of the national Environment and Invasives Committee.
599 Drawing on principles from other reviews and from guidelines (IPART 2014; Frontier Economics 2023; NSW Treasury 2016).

Table 8: Best practice principles for invasive species funding

Principle	Examples
Adequate	Sufficient, reliable, multi-year funding provided to enable long term suppression; logical combinations of fit for purpose funding mechanisms covering prevention through to established species management; sustained control and land restoration over multiple years for established pests; funding to ensure adequate enforcement under the *Biosecurity Act 2015*.
Strategic	Investments align with strategic priorities (captured in state and regional plans) focused on outcomes, risk reduction and return on investment; high risk pathways prioritised for intervention; funding for agreed research and development priorities.
Proactive	Focus on early detection and reporting; state-wide, multiagency rapid response capability across levels of government, industry and community organisations; enhance capacity and expertise for incursion response; consistent pro-active compliance across the state.
Efficient	Funding mechanisms are easy to understand and administer; new funding measures do not duplicate other existing mechanisms achieving similar purposes; competitive mechanisms are used to foster innovation, efficiencies, partnerships and leveraging of additional resources; funding models and supporting systems are integrated.
Tenure-neutral and collaborative	Co-owned and co-designed funding models, including government, industry and community; equivalent funding obligations for government and non-government land; co-ordinated, tenure-neutral control programs with resourcing partnerships between beneficiaries; agreed cost-sharing mechanisms for state-level eradications of invasive species not covered by NEBRA.
'Risk-creator' and 'beneficiary' driven	The key funders of a biosecurity activity are those who cause risks/impacts (risk creators) and/or who directly benefit from it (beneficiaries); funding incentivises risk-creators to improve practices and beneficiaries to capitalise on practices.
Accountable and transparent	Funding recipients are bound by formal agreements to deliver planned milestones and comply with guidelines and reporting requirements; people can see how funds are sourced and allocated, and the long-term outcomes being achieved; robust MERI enables informed adjustments of funding priorities and activities; landowners fulfilling their legal obligations.
For the public good	Taxpayer/ratepayer (via government recurrent investment) should be a significant funding contributor given broad risks from invasive species; government matches funding contributed by other stakeholders to programs that have a component of public benefit.
Equitable	Funding mechanisms are similarly applied across a jurisdiction, with a means to pool and allocate funds to regions for addressing biosecurity risks that could spread to cause state-level impacts.

Table 9: Potential funding mechanisms for key aspects of biosecurity management in NSW

Aspect of biosecurity management	Funding mechanisms to consider
Sustained on-ground control of established pests and weeds	▪ Treasury funding for regional coordinators to maximise the use of existing resources ▪ Establish a pooled fund through Treasury to leverage priority cross-tenure risk reduction activities. ▪ Establish competitive state program grant funding and/or procurement program for 3-5 year weed and pest control projects, open to government and non-government organisations, allocated according to their contribution to delivering on regional pest and weed plans. ▪ Engage with industry on potential options for greater cost recovery from risk creators.
Enhanced surveillance and early detection	▪ Mirror the WAP with an equivalent state-funded program for pest animals, and transition from one to five-year funding cycles for both programs. ▪ Create government-industry surveillance partnerships to improve intelligence systems and detection technology and skills (driven by initial government seed funding, and matched industry funding). ▪ Establish an intergovernmental cost-sharing agreement for national monitoring of online illegal trade in invasive species. The Digital surveillance for Illegal Wildlife Trade (DIWT) database[600] is transitioning from the University of Adelaide to the Centre for Invasive Species Solutions, but ongoing funding remains uncertain.
Preparation for rapid response to invasive species incursions	▪ Establish a state-funded grants and/or procurement program available to local government, industry bodies and community groups for biosecurity response training. ▪ Seek funding from state and federal grants programs aimed at raising the response capability of government and industry within a jurisdiction to meet national standards. ▪ Develop a formal NSW invasive species incursion response MoU between NSW funding parties (DPIRD, NPWS, LLS, local governments, affected industries), with pre-incident definition of cost-sharing proportions and limits thereof.
Pro-active compliance	▪ Increase state government recurrent funding and seek LCA and industry co-contributions (cash and in-kind) as appropriate to have an ongoing, sufficiently resourced stakeholder communications and engagement program for invasive species biosecurity. ▪ Increase state government recurrent funding for invasive species compliance to enable more investigators, training of and support for LLS staff, and security of funding for LCAs to be able to instigate legal proceedings. ▪ Establish a cost recovery fee structure for biosecurity compliance based on the level of risk the business or landowner poses.

600 Maher, J., Stringham, O.C., Moncayo, S., Wood, L., Lassaline, C.R., Virtue, J. and Cassey, P. (2023) 'Weed wide web: characterising illegal online trade of invasive plants in Australia', *NeoBiota*, 87:45–72

Robust information systems that chart success	▪ State-funded capital investment and associated staffing and ICT deployment into an improved, integrated invasive species information management system that enables the above outcomes. ▪ State-funded, interactive reporting on the status of invasive species prevention and management programs.
Research that delivers	▪ State-funded biosecurity research and development competitive grants and/or procurement program that while open to both government and non-government organisations, favour programs that involve collaboration between these different research sectors.