



31 October 2023

Invasive Species Review
Natural Resources Commission
By email to: nrc@nrc.nsw.gov.au

Dear Commissioners,

NSW INVASIVE SPECIES MANAGEMENT REVIEW

The National Parks Association of NSW (NPA) appreciates the opportunity to comment on the Invasive Species Management Review

NPA's mission is to protect nature through community action. Our strengths include State-wide reach, deep local knowledge, evidence-based input to policy and planning, and over 65 years' commitment to advancing the NSW protected area network and its professional management. We also provide outstanding opportunities to experience and learn about nature through our unrivalled program of bushwalking, field surveys, bush regeneration and other outdoor activities.

NPA provides the follow details related to the review's stated questions:

1. To what extent are the NSW environment, industries and communities currently impacted by invasive species?

Invasive species have long been recognized as one of the most significant threats to biodiversity worldwide. New South Wales (NSW), a state with diverse terrestrial, aquatic, and marine ecosystems, is no exception. Across these environments, invasive species have brought substantial ecological, economic, and social consequences. NSW faces challenges from a range of invasive species. These include plants like the African Olive, Chilean Needle Grass, and animals like the European Rabbit and Red Fox (OEH, 2016). These species, without natural predators and in a favourable environment, can proliferate and have detrimental impacts on local ecosystems.

Australia - the only true 'island' continent apart from Antarctica – has a long history of deliberate and accidental introductions of invasive species. Some of the most infamous and environmentally harmful invasive species occur in NSW, including cane toads, prickly pear, foxes, cats and yellow crazy ants.

The term 'invasive' is applied inconsistently, often being used interchangeably with the terms 'exotic' and 'harmful'. More generally, a species is considered 'invasive' when a specific species or population is deemed to be 'out of place'.

The list of Key Threatening Processes under the *Biodiversity Conservation Act* provides insight into the significance of invasive species. Key threatening processes include 16 animals, 4 disease, and 7 weeds. More than 70% of threatened species and endangered ecological communities in NSW are threatened by invasive species. In defining invasive species it is important to note that:

- Some species are listed because they may 'trigger' profound ecological change. For example, bumblebees are listed as they will facilitate the spread of stich broom
- A 'species' does not have to be a plant or animal, with several bacteria and fungi listed.



I. Terrestrial Environment:

In the terrestrial landscapes of NSW, invasive species have dramatically altered ecosystem dynamics, directly impacting on flora and fauna and altering habitats. One such species is the European rabbit (*Oryctolagus cuniculus*). Introduced in the 19th century, rabbits quickly proliferated due to a lack of natural predators and their rapid reproduction rates (Dawson & Chapuis, 2006). They caused significant soil erosion, reduced native vegetation, spread weeds and outcompeted native species for resources. This leads to habitat loss for native species like the greater bilby (*Macrotis lagotis*) and the bandicoot (*Isodon obesulus*) (Cooke, B. D., 2012).

The control of rabbits has involved deliberately importing species specific pathogens such as myxomatosis and calicivirus.

Another threat comes from the blackberry (*Rubus fruticosus*). Although it provides food for many species, it forms dense, impenetrable thickets that prevent access for native animals and outcompete native plant species (Csurhes & Edwards, 1998).

Invasive plant species, such as the Lantana (*Lantana camara*), smother native vegetation, leading to reduced biodiversity and altered habitat structure. This has knock-on effects for the animals that rely on these habitats (Gentle, M., & Duggin, J. A., 1997).

2. Aquatic Environment:

NSW's freshwater systems, including the iconic Murray-Darling Basin, face threats from several invasive species. The common carp (*Cyprinus carpio*), for example, has a profound impact on water quality by increasing turbidity, uprooting vegetation, and altering natural habitats. This not only affects aquatic plants and animals but also has broader implications for water storage and human consumption. The introduction of the common carp has led to the decline of native fish populations. Carp muddies the water and uproot vegetation, degrading habitats and reducing water quality (Koehn, 2004).

The 2020-21 EPA State of the Environment report found that carp dominated freshwater fish communities, making up more than 80% of the biomass in some rivers in the Murray-Darling Basin.

Mosquito Fish (*Gambusia holbrooki*) were introduced into Australia in the 1920s to assist in the management of diseases spread by mosquitos. It is now widespread in NSW and is an aggressive and voracious predator of native fauna, particularly threatened frogs.

Similarly, the redfin perch (*Perca fluviatilis*) preys on native species, outcompetes them for food, and carries a disease fatal to other fishes, leading to diminished biodiversity in infested waters (Lintermans, 2004). The Snowy 2.0 project will enable Redfin to spread into new habitats along the Murrumbidgee River.

The invasive water hyacinth (*Eichhornia crassipes*) forms dense mats on water surfaces, obstructing light penetration and oxygen exchange. This leads to the death of submerged native plants and depletes oxygen levels, affecting fish and other aquatic life (Villamagna, A. M., & Murphy, B. R., 2010).

Native species can be invasive when introduced into bioregions beyond their natural distribution. The freshwater crayfish (*Cherax destructor*) has spread beyond its natural range of the Murray Darling Basin and invasive populations are now found throughout many Australian freshwater systems. *Cherax destructor* is a key threat to several species of crayfish in the genus *Euastacus*, including the critically endangered *Euastacus dharawalus* (McCormack, 2016), owing to its aggressive tendencies and life history traits.

3. Marine Environment:

The marine ecosystems of NSW face significant threats from invasive species. There are several vectors for the arrival of marine invasives, including on the hulls and in bilge waters from international shipping, discarded aquarium plants and animals (eg *Caulerpa taxifolia*) and changing distributions in response to climate change.

One of the most concerning marine invasives is the European green crab (*Carcinus maenas*). This crab not only competes with native species for food but also preys on them. Moreover, it affects commercially important species, thereby influencing local economies (Geller, Carlton, & Larson, 2010).

Another marine invader is the Japanese seaweed (*Undaria pinnatifida*). Found in the waters of NSW, this seaweed grows rapidly, dominating space and overshadowing native kelp forests. This results in reduced biodiversity and alters ecosystem structures, which can further have cascading effects on species that depend on these habitats (Valentine & Johnson, 2003).

The crown-of-thorns starfish (*Acanthaster planci*) is a native species but has had outbreak populations in recent years, leading to the significant destruction of coral reefs. While not technically invasive, their uncontrolled proliferation acts in a similar manner (De'ath, G., Fabricius, K. E., Sweatman, H., & Puotinen, M., 2012). Coral reefs in NSW impacted by the crown-of-thorns starfish include the Solitary Islands Marine Reserve, and Lord Howe Island. Significant and occasional outbreaks have also occurred in Sydney Harbour and surrounding waters.

The invasive Pacific oyster (*Crassostrea gigas*) competes with native Sydney rock oysters for space and resources. Their rapid colonization impacts the food web dynamics, leading to reduced biodiversity (Ogburn, D. M., White, I., & McPhee, D. P., 2007).

4. Economic and Social Consequences:

The legacy of deliberate and accidental introductions of invasive alien species to Australia has had a hefty economic toll yet quantifying the magnitude of the costs associated with direct loss and damage, as well as for management interventions, remains elusive (Bradshaw et al 2021). This is because of issues associated with.

- reliability of cost estimates
- the variety of approaches used to collect and store distribution.
- The variety of protocols, geographic scale, and temporal frequency that have been applied, and.
- The complexity of assessing intangible social and cultural costs and benefits

Bradshaw (2021) shows three-quarters of the expenditure in NSW used on pest management is diverse or unspecified. Yet our estimates are that the costs associated with invasive species control and management can be significant (Pimentel, Zuniga, & Morrison, 2005, Bradshaw 2021). For example, the likely impact of Red Imported Fire Ant in Australia, if not eradicated, is between \$8.5 and \$45 billion. It will impact cropping, organic farming, forestry, cattle, equine, poultry, and aquaculture (Wylie 2016)

The implications of these invasions are not limited to ecological and agricultural impacts. People with the greatest direct dependence on nature, including those involved in gender- and ages specific activities, such as fishing or weeding, may be disproportionately affected by invasive species. In NSW, nature-based tourism and recreation is vital to the state's economy. Invasive species degrade landscapes, reduce agricultural productivity, and decrease fish stocks, leading to economic downturns. Changes in the environment can also impact Indigenous communities whose cultures, identities, and livelihoods are intricately linked with the land and its resources (Muller, 2008).

Each year untold numbers of land managers, government staff and volunteers work individually and collectively to manage invasive plant species through Bushcare and Landcare. Yet metrics of impact often focus on ecological and economic outcomes, with little consideration of the social processes and outcomes. Even when social metrics have been developed, they often focus on measuring the number of hours spent on surveillance and management activities or the number of participants who attended

trainings and working bees. Such narrow metrics fail to account for the diverse social benefits that underpin such community-based weed species management programs, such as establishment of social networks, connection to Country, or collective skills development.

2. To what extent do you think existing programs in NSW are effectively managing invasive species?

Invasive species management programs in NSW generally involve a combination of strategies and actions aimed at preventing the introduction of new invasive species, controlling the spread of existing invasive species, and mitigating their impacts on ecosystems, agriculture, and human health. These programs involve multiple stakeholders, including government agencies, landowners, community groups, and scientists.

Their effectiveness can vary widely, depending on:

1. **Species-specific characteristics:** The biology, behaviour, and reproductive capacity of the invasive species in question. Some species are more challenging to control than others. It also is dependent on the 'value' we hold for the species being impacted. For example, fox predation became a high-profile public issue in Sydney when they began preying on the little penguin colony in Manly. The response to this new fox threat was a multifaceted and resource intensive approach, deploying a range of technologies to remove the small number of foxes threatening the penguin colony.
2. **Funding and resources:** Adequate funding and resources are essential for effective invasive species management. This includes funding for research, monitoring, control measures, and public education.
3. **Monitoring and research:** Ongoing monitoring and research are crucial for assessing the effectiveness of control programs. This allows for adjustments and improvements in strategies based on real-time data.
4. **Coordination and collaboration:** Effective invasive species management often requires collaboration among various stakeholders, including government agencies, landowners, and community groups. Coordination and cooperation can enhance the overall impact of control efforts. For example, several NGOs in NSW, including NPA's Southern Sydney Branch, are undertaking Environmental DNA monitoring in Port Hacking south of Botany Bay to identify cryptic species and monitor marine and estuarine weed occurrence (IUCN 2023). Increased funding for using such modern technologies to monitor introduced species is recommended.
5. **Public engagement and education:** Public awareness and engagement are important for reporting invasive species sightings, complying with control measures, and preventing the spread of invasive species.
6. **Regulatory frameworks:** Effective control programs often rely on regulations and policies that support the management of invasive species. In NSW this involves restrictions on the importation and sale of certain species, quarantine measures, and enforcement mechanisms.
7. **Adaptive management:** The ability to adapt strategies based on changing circumstances and new information is key to the success of invasive species management programs.

The NSW government, in collaboration with local communities, has initiated several programs targeting invasive species.

1. **Biosecurity Act 2015:** This legislative framework recognises the shared responsibility of the government, industry, and the public in managing biosecurity risks. It mandates measures to prevent, eliminate, or minimise biosecurity risks (NSW Government, 2015).

2. **Saving our Species program:** This program primarily targets the conservation of threatened species, but indirectly deals with invasive species by aiming to enhance habitats and reduce threats, including invasive competitors (OEH, 2018).
3. **Local Land Services (LLS):** LLS boards play an essential role in managing biosecurity risks, including invasive species, at the regional level. They offer services, support, and advice to farmers and landholders (LLS, 2019).
4. **Community-based programs:** Several local community initiatives, often in partnership with the government, work towards eradicating or controlling invasive species. Examples include the 'Bushcare' groups and 'Landcare' networks.

Several factors can be considered when evaluating the effectiveness of control programs:

1. **Species-specific outcomes:** Certain programs have achieved considerable success for specific species. For instance, the management of the rabbit through the introduction of biocontrol agents like the Rabbit Haemorrhagic Disease Virus has reduced their populations significantly (Cox, et al., 2013).
2. **Adaptive Management:** The ability to adapt strategies based on ongoing research and monitoring is crucial. Programs that incorporate adaptive management, like those under the Biosecurity Act, tend to be more effective (NSW Government, 2015).
3. **Community engagement:** Programs that actively involve the community, such as the Bushcare and Landcare initiatives, have shown better results due to increased localised efforts and surveillance (Moore & Runge, 2012).

However, there are challenges:

1. **Continuous introductions:** Despite best efforts, new invasive species or strains continue to establish in NSW, suggesting the need for better border controls and early detection mechanisms.
2. **Ecological complexities:** In some cases, the removal of an invasive species might lead to the surge of another, leading to unforeseen consequences.
3. **Limited resources:** Allocating adequate resources for a wide array of invasive species remains a challenge.
4. NSW must appreciate invasive species **ignore state boundaries**. This means NSW cannot go it alone or rely solely on the *NSW Biosecurity Act 2015*. Policies relevant to biological invasions can often be fragmented between States and across sectors (for example the management and eradication of red ants). Effective strategic responses include co-operative arrangements to: enhance coordination and collaboration across international and regional mechanisms; develop and adopt effective and achievable national strategies; share efforts and commitment and understanding of the roles of all actors; improve policy coherence between states; co-operative resourcing innovation, research and technology; and common frameworks for information systems, infrastructures and data sharing.

3. What, if any, are the key barriers to effective management of invasive species?

Effective management of invasive species in NSW faces multiple barriers, including:

1. **Lack of Awareness:** Many community members and stakeholders might not be fully aware of the threats posed by invasive species, their identification, or methods to control them.
2. **Limited Resources:** Managing invasive species requires significant resources, including funds, personnel, and equipment. Often, agencies and organisations lack the necessary resources to comprehensively address the problem.
3. **Vast Geographical Area:** The large and diverse landscapes of NSW, from coastal zones to western arid landscapes, present challenges in monitoring and controlling invasive species.

4. **Insufficient Research:** There are gaps in knowledge about the biology, ecology, and impact of certain invasive species. Without this knowledge, control measures can be less effective.
5. **Delayed Response:** Rapid response to new invasions is crucial, but there can be delays in detection, reporting, and subsequent action, allowing species to become established.
6. **Border Control Challenges:** NSW has multiple entry points, both from international locations and other states within Australia, making it difficult to prevent the introduction of new invasive species.
7. **Public Resistance:** Resistance from the public or stakeholders towards control measures, especially if they impact recreational activities, have perceived negative environmental impacts, or affect economic interests. Deliberate undertreatment of pests such as deer to enable ongoing recreational shooting is an example of misplaced approaches to effective, long-term controls. The *Kosciuszko Wild Horse Heritage Act* is a prime example of populist politics trumping science.
8. **Climate Change:** Changing climate conditions can favour certain invasive species, making them more difficult to control. Some invasive species might expand their range due to these changes. For example, Chytridiomycosis has already contributed to the decline or extinction of at least 43 amphibian species in Australia and further losses are likely as the geographical range of the fungi changes to overlap with other susceptible frog species.
Climate change may also cause events that create temporal opportunities for invasion and temporal opportunities for management. For example, after major bushfire events, there is a short window which provides a great opportunity to treat emerging weed seedlings and regrowth before they have a chance to smother the ground preventing indigenous plant growth, and before they mature to seeding and reproduce on mass.
9. **Complex Ecosystem Interactions:** In some cases, removal, or control of one invasive species might unintentionally benefit another invasive species.
10. **Regulatory and Jurisdictional Challenges:** Overlapping responsibilities between different government agencies or jurisdictions can lead to coordination challenges.
11. **Economic Interests:** Some invasive species have commercial value, leading to conflicts of interest in their management.
12. **Social and Cultural Values:** Some species, even if invasive, might be valued by certain communities for cultural, aesthetic, or other reasons, leading to opposition to their control. Examples include horses in the Alpine environment, how we manage the feral/domestic cat dilemma, and the value we hold for various 'Game' animals. Differences in perception, including conflicting interests and values, of the importance and urgency of the threat of invasive alien species can influence our approach
13. **Difficulty in Eradication:** Once invasive species are established, they can be incredibly hard to eradicate entirely. Control might require continuous and long-term efforts.
14. **Resilience and Adaptability of Invasive Species:** Many invasive species are highly adaptable and can develop resistance to control measures, such as chemical herbicides or pesticides.

4. How has invasive species management changed since the introduction of the NSW Biosecurity Act 2015 legislation and associated programs and plans?

The *Biosecurity Act 2015* represents a significant improvement in the management of invasive species. Previously, invasive species management was scattered across various pieces of legislation, leading to inconsistency and inefficiency. The *Biosecurity Act* is designed to provide a more unified, risk-based, and responsive approach, characterised by:

1. **Shared Responsibility:** One of the foundational principles is the idea that biosecurity is a shared responsibility between governments, industries, and the community.
2. **General Biosecurity Duty:** Instead of just relying on lists of prohibited or controlled species, the Act introduced a General Biosecurity Duty. This means that any person dealing with biosecurity matter or a carrier of biosecurity matter has a duty to ensure that, as far as is

reasonably practicable, the biosecurity risk associated with that matter or carrier is prevented, eliminated or minimised.

3. **Risk-Based Approach:** The Act adopts a more proactive and risk-based approach. It's designed to prioritize resources and responses based on the potential impacts of invasive species rather than just their presence.
4. **Biosecurity Zones:** The Act empowers authorities to establish 'biosecurity zones' where specific measures can be imposed to prevent, eliminate, or manage biosecurity risks.
5. **Alignment with National Frameworks:** The Act aligns NSW with national biosecurity strategies and frameworks, ensuring consistency and cooperation between states and territories.
6. **State Priority Weeds:** The Act and associated NSW Weeds Action Program, weeds are categorized based on the risk they pose. State Priority Weeds are those that pose the greatest threat and require coordinated efforts for management.
7. **Rapid Response:** The Act facilitates quicker response to new and emerging biosecurity threats. There are provisions that allow for emergency powers to be exercised in the event of a biosecurity threat.
8. **Integrated Approach:** The Act promotes a more holistic approach, acknowledging that pests and diseases don't respect property boundaries. Hence, landscape-scale coordinated efforts, rather than isolated actions, are emphasized.
9. **Enhanced Powers:** The Act provides authorities with enhanced powers to manage biosecurity risks. This includes powers of entry, inspection, and the ability to issue biosecurity directions or undertakings.
10. **Flexible Management Tools:** The Act provides a range of tools to manage biosecurity risks, including biosecurity plans, programs, and emergency measures.
11. **Biosecurity Advisory Committees:** These committees were established to ensure stakeholder engagement in the development of strategies, plans, and programs related to invasive species and other biosecurity threats.
12. **Public Education and Engagement:** Since the introduction of the Act, there's been an increased emphasis on public education and engagement to ensure community understanding and compliance.
13. **Introduction of Associated Plans and Strategies:** Following the Act, various plans and strategies were developed, such as the NSW Invasive Species Plan. These documents provide a roadmap for coordinated efforts and detailed strategies for managing specific invasive species or biosecurity threats.
14. **Increased Funding:** The significance of the Act's introduction was followed by increased investment in biosecurity measures, including funding for research, on-ground actions, and public engagement campaigns.
15. **NSW Biosecurity Strategy 2013-2021:** While it predates the Act, this strategy provided a foundation for the principles embedded in the NSW Biosecurity Act 2015. The strategy emphasizes prevention, preparedness, responsiveness, and recovery – which aligns well with the proactive approach advocated by the Act.

5. What are the future risks posed by invasive species to the NSW environment, industries, and communities?

See response to question 1 above for future risks to be an extension of current risks and threats.

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

NPA recommends that the NSW Government:

1. **Enhance Research and Surveillance.** Investing in research to better understand invasive species' behaviour and ecology is crucial. Regular surveillance and data collection can help identify emerging threats and adapt control strategies accordingly.
2. **Expand the Priority Species List.** Periodically reviewing and expanding the list of priority species is essential to address evolving threats effectively. A more comprehensive list can guide resource allocation to high-risk invasive species.
3. **Integrated Pest Management (IPM)** Implementing IPM strategies can reduce reliance on chemical control methods and minimize environmental impacts. IPM combines various techniques, including biological control and habitat modification, to manage invasive species.
4. **Collaborative Efforts.** Strengthening collaboration between government agencies, researchers, landholders, and local communities can improve coordination and communication. This can lead to more efficient and effective invasive species control programs.
5. **Community Involvement and Education.** Engaging local communities and raising awareness about the importance of invasive species control can foster a sense of shared responsibility. Education programs can help individuals and communities understand the impact of invasive species on their environment and livelihoods.
6. **Adaptive Management.** Incorporating adaptive management principles into control programs allows for flexibility and adjustment based on feedback and changing circumstances. This approach enables a more responsive and effective control strategy.
7. **Utilizing emerging technologies.** Technologies are evolving which provide more effective management of invasive species. For example, the hawkweed (*Pilosella aurantiaca* and *P. officinarum*) eradication program, where RGB and multispectral sensors are proving very effective for identifying flowering stands of the weeds. Likewise, mobile apps like PlantSnap and PictureThis apply artificial intelligence to analysing a plant photo and providing species identification. WeedScan is being developed by the Centre for Invasive Species Solutions, CSIRO and the NSW Department of Primary Industries (DPI). ABARES is running a project in collaboration with jurisdictions, CSIRO and other partners, to address fundamental data gaps and challenges regarding invasive species to provide a better understanding of weed distributions nationally. Similarly, the InvaCost database was recently developed to provide the most comprehensive and standardised compilation of invasion costs globally.

Case Study: Successful Invasive Species Control Initiative

Biological Control of Prickly Pear Cactus The introduction of the *Cactoblastis* moth (*Cactoblastis cactorum*) in the early 20th century effectively controlled the invasive prickly pear cactus (*Opuntia* spp.) in Australia. This biological control method has since become a model for successful invasive species management.

Case Study: Lessons from International Programs

Looking globally, regions like New Zealand have achieved commendable success in managing invasive species. The 'Predator Free 2050' vision in New Zealand, aiming to eliminate invasive predators, offers lessons in terms of integrated approaches, community engagement, and utilising technology (Russell, et al., 2015). Adopting some of these best practices might enhance the effectiveness of NSW's programs.

Recent advice from the NSW NPWS

NPA has been advised by the NPWS that aerial shooting across NSW national parks has more than doubled the average for the decade to 2020, and aerial baiting has increased fivefold. In 2022-23, NPWS delivered:

- 1,490 hours of aerial shooting

- 30,367 kilometres of aerial baiting.

The action has contributed to the removal of over 40,000 feral animals during the year across all forms of control by NPWS.

NSW Feral Pig Coordinator

NPA notes that the NSW Government has announced the appointment of a feral pig coordinator. The LLS based position has a budget of \$13M with the aim of culling 87,000 pigs over the next 8 months.

NPA Recommendations

1. The current model of independently funded government agencies, undertaking or coordinating landscape wide control operations with partners is an appropriate on-ground delivery model for NSW
2. The *Biosecurity Act 2015* is functioning as planned
3. A new funding model is required for the development and timely implementation of new control technologies
4. A statewide monitoring and evaluation program is required to map out the expansion of current and new invasive species, and measure the effectiveness of control measures.

I can be contacted at [REDACTED] or on [REDACTED]

Yours sincerely,

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National Parks Association of NSW
protecting nature through community action

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