



**National
Feral Deer
Action Plan**



Photo of chital deer pushing under fence, by Luke Woodford provided by Centre for Invasive Species Solutions

National Feral Deer Action Plan

2022-27

DRAFT FOR CONSULTATION



Foreword

Feral deer are a growing threat to Australia's primary industries, natural environments and community values. Feral deer populations are increasing and spreading across Australia and are projected to cover much of the continent.

Current controls are inadequate to manage the impacts of deer populations – we need to adopt new tools and approaches to protect our primary production, the environment, cultural heritage and communities.

Australia's feral deer problem costs land managers and governments tens of millions of dollars every year. Land managers are paying more each year for measures to protect the land, through activities such as deer culling or exclusion fences. Transport departments are also increasing culling and fencing along highways and railways to reduce vehicle collisions with feral deer. Local governments are struggling to cull feral deer in urban and peri-urban areas, gardens and ovals.

Across Australia, people are starting to recognise the problem and are taking action to tackle what some have termed Australia's worst emerging vertebrate pest problem.

The Australian Government, and state and territory governments are investing more than \$40 million on feral deer research and management between 2018-2024. A key part of this response is a national coordinator and new research programs.

Communities are forming feral deer control groups, to network and share ideas and successes. Commonwealth and state and territory agencies, local government councils and not-for-profit and corporate organisations, are supporting these efforts in partnership to improve feral deer management.

This National Feral Deer Action Plan aims to build on this momentum and support coordinated effective deer management to reduce their impacts on Australia's agriculture, environment, cultural and social assets.

The plan was written in consultation with the National Feral Deer Working Group members, who gratefully acknowledge the work of all partners across Australia who helped build this plan.

The Traditional Owners of the land, sea and waters that we live and work on across Australia are acknowledged. We recognise their input into this Plan, continuing connection to their culture, and we pay our respects to their Elders past and present.

From the National Feral Deer Action Plan Working Group

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Executive summary

Australia's feral deer problem is increasing. In just 30 years, land managers in both rural and urban areas have seen feral deer go from being a novelty to being widespread in many parts of the country. Feral deer can be so damaging that many land managers believe they are emerging as 'Australia's next rabbit plague'. Feral deer impact our agricultural production, environmental and cultural assets, and pose risks to biosecurity and community safety.

States and territories have different policies for managing feral deer – most states treat feral deer as pests, while some treat them as wildlife or hunting resources (with some provisions for land managers to control them if they choose). These differences have added extra challenges to controlling feral deer across the country.

This plan addresses the need for a coordinated and strategic approach to managing Australia's feral deer problem, including priority areas for the protection of threatened species, ecological communities and nationally significant conservation assets.

The plan focuses on improving tools, strategies, capacity, awareness and efficiencies to reduce impacts of feral deer over landscape scales, to manageable levels, where local communities, regions or jurisdictions wish to do so, and to eradicate them where it is feasible.

It is not within the scope of this plan to set objectives for managing deer as a hunting resource (for trophies, meat or recreation). This is because the approaches to sustain or improve hunting experiences are different from the best practice approaches to reduce or minimise the impacts of feral deer.

Goals

The plan takes a multifaceted approach to reduce the impacts of feral deer, by focusing on three goals:

1. Stop the spread of large feral deer populations and reduce their impact.
2. Control (drive down densities as far as possible) or eradicate small, isolated populations before they spread.
3. Protect significant sites from impacts from feral deer (threatened species, ecological communities and places of national and international cultural or environmental significance).

The goals of this plan will be achieved by nine priority actions (Figure 1) and other actions in Table 1.

Expected outcomes

The goals and approach of this plan will guide consistent and effective control actions across Australia, to achieve six short-term outcomes by 2027:

- Land managers will be more aware of feral deer impacts, and can access more tools and options to control feral deer more quickly and effectively.
- Priority assets in the current large distributions of feral deer will be less impacted.
- The spread of feral deer beyond the containment buffer zone will stop.
- The spread of feral deer into peri-urban areas will stop or slow.
- Significant places of conservation or cultural value will be better protected from feral deer.
- Habitats recovering from bushfires will be better protected from feral deer.

Within 10 years (by 2032), three long-term outcomes will be achieved:

- Community groups will use best practice control methods to reduce impacts of feral deer.
- Large populations of feral deer will reduce in density around valued assets.
- Outlying populations of feral deer will be eradicated or contained, and new populations will be responded to rapidly.

There is an imperative to contain distributions to prevent feral deer becoming another widespread invasive pest like rabbits, pigs and foxes. The next five years will be important to establish actions and generate momentum for strategic, collaborative control in the future.



Photo of rusa deer, by Ashley Carlson provided by Centre for Invasive Species Solutions

This plan applies to areas where communities or agencies seek to reduce or remove feral deer impacts.

For the purpose of this plan, *feral deer control* promotes volunteer, paid or unpaid contract shooters, and commercial harvesters undertaking culling activities as part of integrated control programs, where the primary purpose is removing a target proportion of feral deer in a population to reduce impacts. This does not include recreational hunting (i.e. hunting feral deer for the primary purpose of recreation, where sourcing meat or trophies is the motivation). Although recreational hunting removes some deer, it is not enough on its own to stop the population growing and spreading.

Purpose

The plan has been developed to establish a national coordinated approach to actively suppress Australian feral deer populations to reduce their impact on Australia's agricultural productivity, environment, threatened species and ecological communities, nationally and internationally significant places of high conservation or cultural value, and social communities. The plan provides guidance and actions for:

- local, state and territory, and Australian governments
- corporate and non-government organisations
- public and private land managers and groups who are impacted by feral deer, or are likely to be impacted soon.
- people engaged in integrated control programs for the primary purpose of reducing feral deer populations (including volunteer and contract shooters, traditional owners and commercial harvesters).
- Indigenous groups seeking to protect areas of cultural values

Plan at a Glance

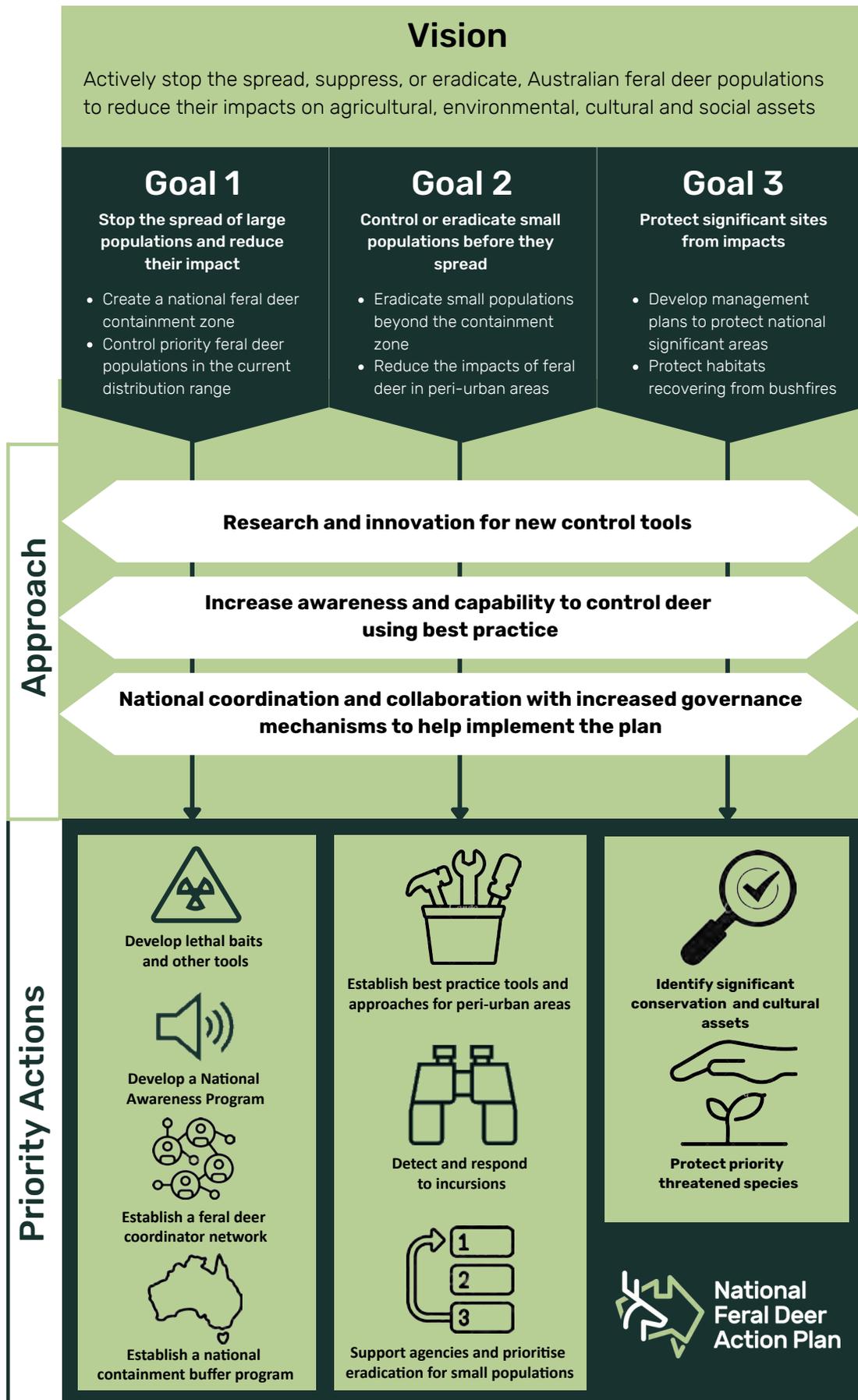
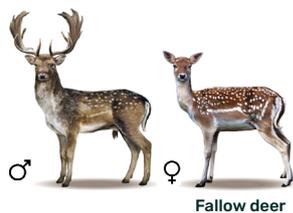
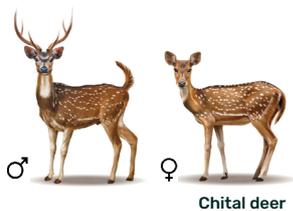


Figure 1. A summary of the Plan's vision, goals, approach and priority actions

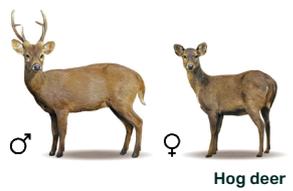
Introduction



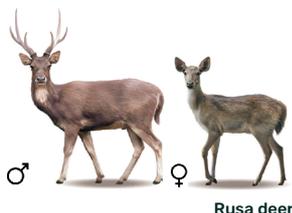
Fallow deer



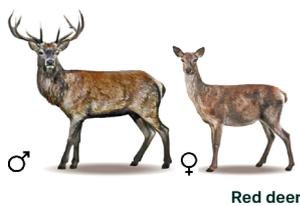
Chital deer



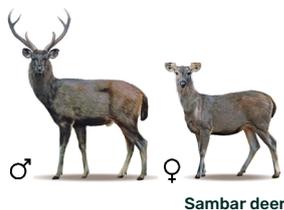
Hog deer



Rusa deer



Red deer



Sambar deer

Figure 2. The six feral deer species established in Australia are (top to bottom) fallow deer (*Dama dama*), chital deer (*Axis axis*) and hog deer (*Axis porcinus*), rusa deer (*Cervus timorensis*), red deer (*Cervus elaphus*) and sambar deer (*Cervus unicolor*). Images attributed to the Victorian Game Management Authority.

Across Australia, feral deer (known as *wild deer* in Victoria and Tasmania) have increased in numbers and spread across the landscape to a point where current control efforts are no longer effective.

Six species of feral deer occur in Australia: fallow, chital, hog, rusa, red and sambar, and their hybrids (Figure 2). These species have different habitats, behaviours, distributions and populations at different stages of their invasion trajectory. Despite these differences, species may overlap in their ranges, and all species impact primary production, the environment, biosecurity and road safety. Because of this, the same tools can be used to control all species. Local control plans reflect the many combinations of habitat and behavioural differences among species, as well as priority for control at local scales.

A growing problem

Deer were brought to Australia for hunting and farming in the 1800s. Over time – particularly after the venison industry (profitability) declined in the 1990s – farmed deer escaped, were released, or were relocated for recreational hunting. These animals soon established new populations. Because these populations were not effectively controlled when small, they quickly grew and spread across Australia.

Feral deer have almost doubled their range in the past 20 years. Today, they are found across almost one-quarter of New South Wales and Tasmania, and nearing half of Victoria. They are spreading out from every part of that range, increasing the impacts on primary production, biosecurity, the environment and community safety.

In 1980, there were an estimated 50,000 feral deer in Australia (Jesser 2005). By 2002, the estimate had grown to 200,000 (Moriarty 2004). In 2022, the population is likely to have reached 1–2 million in Australia (based on estimates in Victoria: Victorian Deer Control Strategy 2020; comparable spread in New South Wales: Department of Primary Industries 2020; and other states: Australian Senate 2021).

Current populations are too high to be controlled by recreational hunting or recent control efforts. For example, in Tasmania, farmer control and recreational hunting of feral deer have slowed population growth, but the growth is still around 11% per year. At this rate, the population doubles every 7 to 12 years (Department of Primary Industries, Parks, Water and Environment; Cunningham et al. 2021).

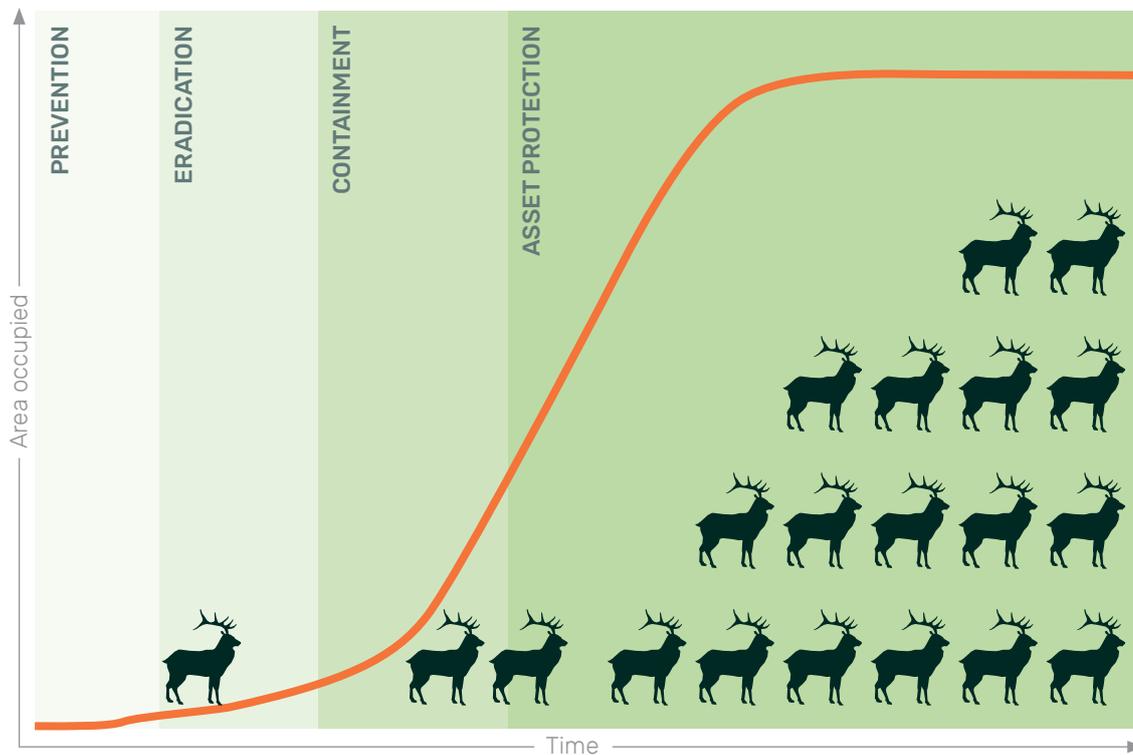


Figure 3. Invasion curve showing how feral deer populations grow, and when different control strategies (eradication, containment and asset protection) are most cost-effective for managing impacts. The benefit-cost ratio (return on investment in control) decreases as feral deer become more numerous and widespread. Modified from Fleming et al. (2017)

Feral deer populations in different regions of Australia are at different stages of the invasion curve (Figure 3), and many populations have not yet plateaued. Left uncontrolled in good conditions, feral deer populations can increase by 34–50% every year (Hone et al. 2010). This means that a small herd of 30 feral deer can grow to 500 in 10 years. Over the coming decades, climate and habitat suitability models predict that most of Australia could be inhabited by at least one species of feral deer unless more action is taken (Davis et al. 2016). Feral deer have spread in New Zealand in a similar way (Wilson et al. 2015).

Where populations are still spreading and growing, the most beneficial strategy is to eradicate or contain the spread of feral deer (Figure 3). Where feral deer are in established large numbers, resources may only be available to knock down feral deer numbers in and around sites with highly valued priority assets, and keep the deer suppressed with on-going control indefinitely.

Impacts of feral deer

The impacts of feral deer were not widely recognised in Australia until the early 2000's. They impact our agricultural production, environmental and cultural assets, and pose risks to biosecurity and community safety. This results in economic loss, and damage to important environments, properties, cultural heritage, infrastructure and people.

Economic impacts

Feral deer have major impacts on agriculture and primary production industries. They compete with livestock by eating pasture, crops and forestry saplings, and damage fences and infrastructure. They can also carry diseases and parasites that can be transmitted to livestock. They can therefore also hinder programs responding to disease outbreaks in exotic livestock.

Social and cultural impacts

Feral deer are spreading into peri-urban areas (the areas between rural and urban landscapes), impacting people's property and safety. They can cause vehicle collisions, and damage parks and gardens, and impact revegetation plantings. During deer mating seasons, males (stags/bucks) can be aggressive to people and domestic animals. They are also a potential reservoir for human disease (e.g. covid-19, Chandler et al. 2021). Feral deer on private property may also attract illegal poaching, resulting in trespassing, illegal use of firearms and damage to properties.

Feral deer also damage Traditional Owners' cultural sites through loss and fragmentation of valued living landscapes, scar and signal trees, and loss of culturally important trees such as Kurrajong (NESP Threatened Species Recovery Hub 2021, Ward-Jones et al. 2019).



Environmental impacts

Feral deer impact natural environments by eating, ring-barking, rubbing against and trampling native plants, and creating wallows. This habitat destruction can have flow on effects to other fauna that are sustained by healthy habitats. Feral deer also compete for food with native herbivores such as kangaroos and wallabies. As feral deer move to new areas, they spread weeds through seeds stuck to their fur and in their droppings, and they can spread diseases and parasites. They also damage waterways as their hoofs trample and erode riverbanks (Lindeman & Forsyth 2008, Côté et al. 2004, Davis et al. 2016). Feral deer can also cause serious damage to sensitive habitats recovering from bushfires, as they eat the new growth that sprouts after fire. This post-fire herbivory destroys shelter that ground dwelling native animals rely on and greatly inflates predation risks for small animals by cats and foxes.

Impacts to threatened species and ecological communities are particularly important to mitigate, because threatened species and communities have vastly reduced distributions and populations, making them vulnerable to threats. Impacts such as grazing, rubbing and tree destruction by feral deer on threatened plants may contribute to their decline and/or extinction.

Browsing by feral deer can lead to modification of the structure and floristics of vegetation communities as Australia has no large native mammalian browsers.

The environmental impacts of feral deer are officially recognised as a threatening process in New South Wales and Victoria (*New South Wales Biodiversity Conservation Act 2016*, *Victoria Flora and Fauna Guarantee Act 1988*). Nationally, feral deer are included in the key threatened process – novel biota and their impact on biodiversity, under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*.

The 2019 Senate Inquiry (tabled in 2021) into the impact of feral deer, pigs and goats in Australia, also recommended that a standalone Key Threatening Process listing for feral deer under the *Environment Protection and Biodiversity Conservation Act 1999* should be adopted, along with a Threat Abatement Plan to elevate the focus on controlling environmental impacts of feral deer. The inquiry also recommended that state and local legislative or regulatory frameworks should maximise the ability of landholders and park managers to control, eliminate or prevent feral deer on their land, including World Heritage Areas, National Parks, areas of national environmental significance and biodiversity hotspots.

Current feral deer control methods

Feral deer are controlled (reduce numbers and impacts to desired levels) in different ways across Australia (Figure 4), depending on state and territory policies, and the tools available to land managers.

Policies

In Queensland, New South Wales, South Australia, the Australian Capital Territory, Western Australia and the Northern Territory, feral deer are treated as pest animals under biosecurity policies and legislation. In these states and territories, land managers are responsible for controlling feral deer. Land managers can engage staff; families; volunteer, paid or unpaid contract shooters; or commercial harvesters. State and territory government agencies can also provide advice and support for control in priority areas, including private property. Recreational hunting (for meat, trophies or recreation) is permitted on private land, with land manager approval, but feral deer must not be actively harboured or sustained on properties for this purpose.

In New South Wales, some areas of public land are designated to allow recreational hunting opportunities for feral deer (for meat, trophies or recreation).

In Tasmanian and Victoria, feral deer have a game status, providing a framework to support and manage recreational hunting and harvest. Under this status, feral deer (except hog deer, for which culling can be done under permit) can be culled in national parks, or by land managers or their nominees on their property, when deer are causing damage to property or production. Landscape-scale management of feral deer can be hampered when neighbours have different, or conflicting management goals (game management or pest control).

A list of relevant legislation and government strategies for each state and territory is in Appendix 1



Figure 4. Policy status of feral deer in Australian states and territories

Control tools

Current control tools used for feral deer in Australia include aerial culling, ground culling, trapping and exclusion fences. Information about these tools and opportunities to improve their use is in Appendix 2.

The same control tools are used for all species of feral deer, although the way tools are applied can vary depending on the species and their behaviour. Tools must be developed and used in line with animal welfare standards. For example, ground and aerial culling should be performed by shooters who use appropriate equipment and humane techniques (Sharp and Saunders 2011), and shooters should meet program outcomes as quickly as possible to prevent the need to shoot larger numbers of feral deer in the future.

Existing tools are not being used intensively enough (to counter population growth), over large enough areas (to slow re-incursion), over all properties in an affected area (where feral deer can breed up), or over sufficient years of sustained pressure, to stop the spread of feral deer. New incursions are not being detected or eradicated until impacts are felt by land managers, and it is too late to eradicate them. These challenges can be tackled if tools are low-effort, accessible, cost-effective, enable feral deer to be readily detected (e.g. thermal technologies), and are humane.

This plan identifies opportunities to improve the use of existing control tools, and to develop new ones.

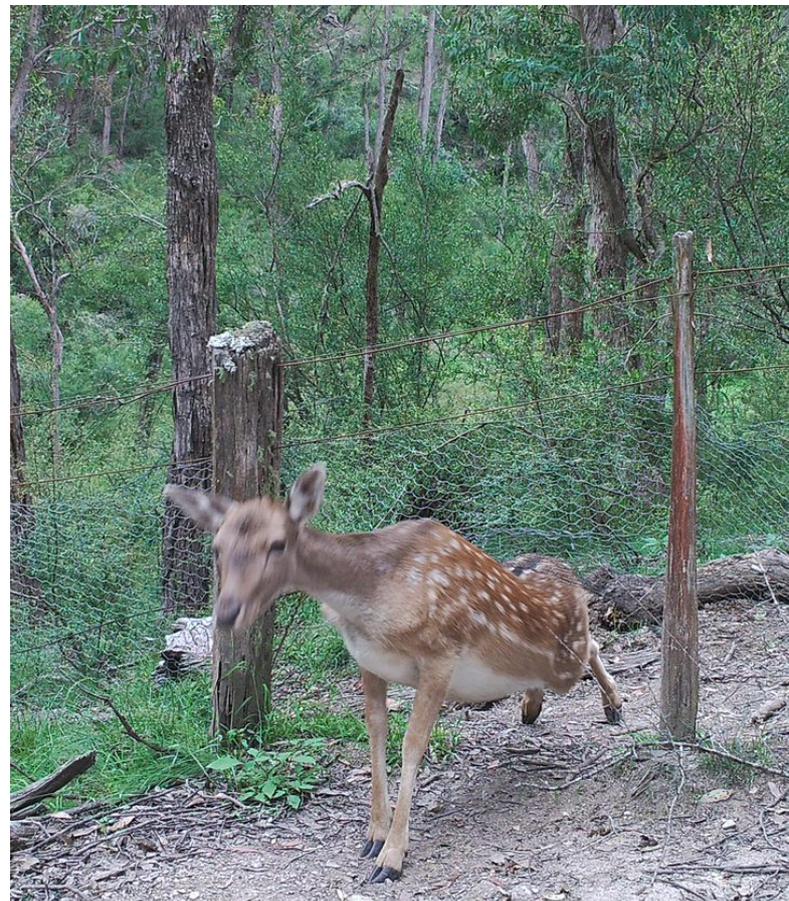


Photo of fallow deer pushing under a fence, by Peter Bradford provided by Centre for Invasive Species Solutions

Achieving the goals

This plan takes a coordinated, best-practice approach to managing feral deer, by focusing actions toward the 3 goals that target both large and small populations of feral deer across Australia (Figure 5). They align with the principles and priorities of the Australian Pest Animal Strategy 2017–27 (Appendix 3), and state and territory feral deer management strategies (Appendix 1).

GOAL 1: Stop the spread of large populations and reduce their impact

Large populations of feral deer generally have many thousands of deer spread across many adjoining properties. These populations are the most damaging, difficult to manage. A combination of containment and control is needed to reduce the impacts of large populations. The largest populations are found along the eastern seaboard. Further inland, and in other states and territories, populations are smaller and more isolated, but can still be tens of thousands in number (in Tasmania, south eastern South Australia and central Queensland) (Zone 1; dark green area in Figure 5).

Create a national feral deer containment buffer zone

Preventing feral deer from establishing in new areas is the most feasible approach to managing the spread of feral deer, especially as current control tools are often expensive for large populations. A priority action under this plan is to create a national feral deer containment buffer zone (Zone 2; orange area in Figure 5). This aims to stop the establishment of more large populations along the eastern states, as well as to stop the South Australian and Tasmanian populations from spreading west. The containment buffer zone will combine prevention and response efforts, particularly to new incursions, and buffer the maintenance of the mostly deer-free areas (zone 3: light green area in Figure 5). The zone will set a baseline to review spread of feral deer every 5 years.



Photo of red deer, by Liam Ford provided by Centre for Invasive Species Solutions

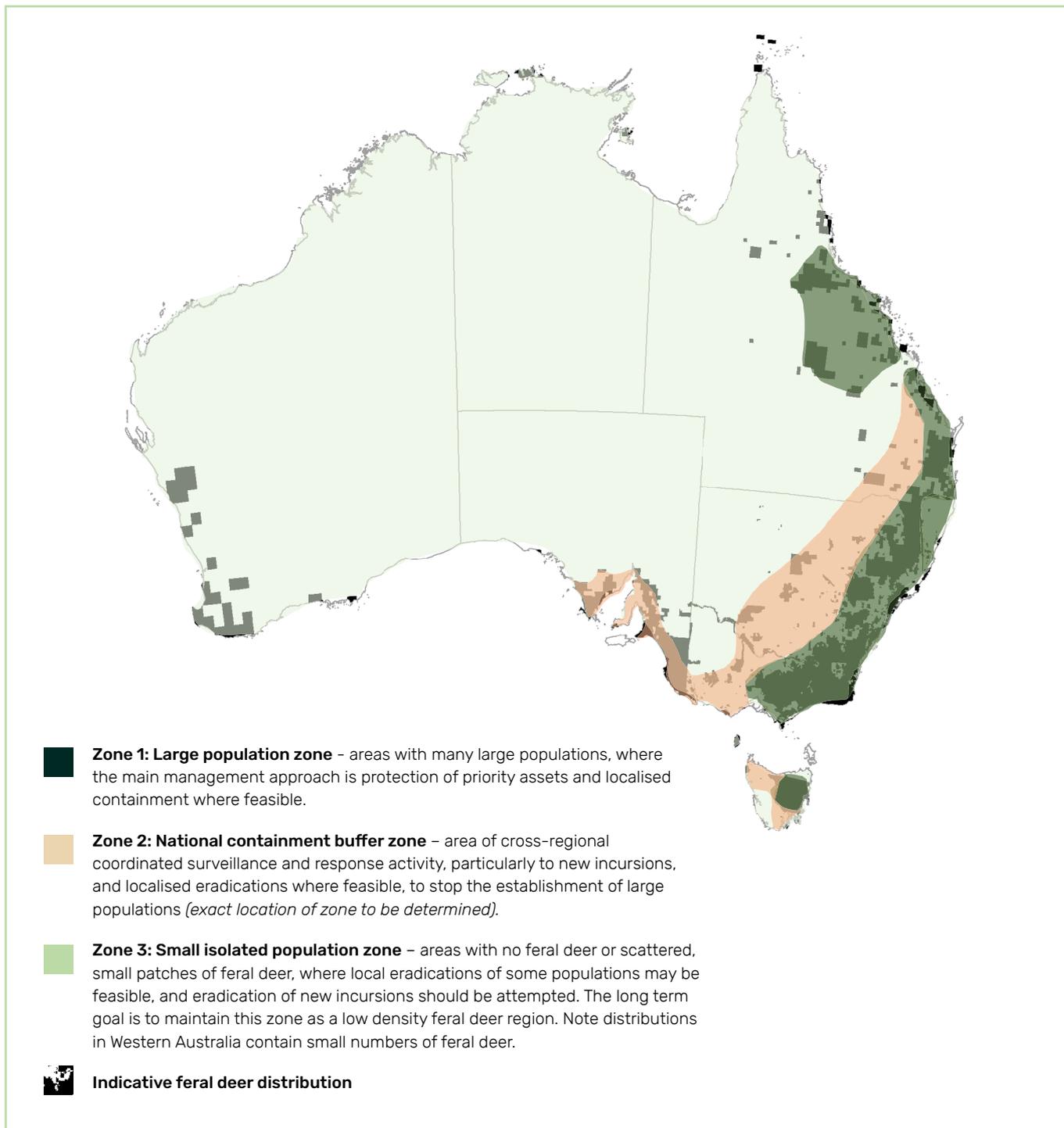


Figure 5. Distributions of feral deer are concentrated to different degrees in 3 zones across Australia

The plan proposes the containment buffer zone will be coordinated under a national program, facilitated by a coordinator. This will support consistency and collaboration across state and territory government agencies in surveillance, reporting, engagement with land managers, and rapid response plans to slow the spread of feral deer. Priority locations for activities will be determined by and aligned with legislation and State or local management plans that identify priority locations for feral deer control efforts. Activities, zone boundaries and program phases will be co-developed with regions, and coordinated by the National Deer Management Coordinator, during the first year of the plan (2023). The program will seek synergies with local feral deer plans, and will prioritise surveillance and response activities in areas of the zone that are likely pathways for spread, and that contain high value assets.



Photo of deer in an urban garden, by Ashley Carlson

The timing of program phases may vary between states. Some states are already developing plans for implementation of on-ground activities. Other states need to assess feasibility of activities, establish surveillance and reporting protocols, approaches to cross-tenure/ cross-border management within the zone, and complete regional plans to inform alignment with the zone.

Funding for the program will be sought using a co-investment model (government and non-government funds) that acknowledges the public benefit to everyone within and beyond the containment buffer zone.

The containment buffer zone program is intended to be complimentary to other containment, incursion response or eradication initiatives elsewhere, including the local management of individual deer species, which are priorities for states, territories and regions.

Control priority feral deer populations in the current distribution range

Feral deer populations can increase in size by 34–50% every year (Hone et al. 2010). To effectively stop population growth, the number of feral deer removed must be higher than the rate of population growth. Aerial culling is the primary control tool for quickly reducing population size in rural areas. Intensive ground culling can reduce impacts in small areas, but takes more time. Effective ground culling of large populations often focuses on small areas, and then moves out to adjoining areas. This approach makes sure the entire area is covered.

This plan urges states and territories to prioritise feral deer populations for strategic control programs. Priority populations are determined based on the following attributes:

- agricultural, environmental, and cultural value of the area these populations occur in
- feasibility of meeting annual culling targets (ongoing) that exceed natural population growth
- ability to reduce impacts, and maintain a low level of impact over time (some deer species may have higher impacts on valued assets than others, e.g. sambar impact alpine bogs)
- strong support and participation from communities across the distribution of the feral deer population
- sub-populations where priority assets are threatened, or rapid spread of feral deer is likely
- presence of new populations next to towns or cities, and small, isolated populations in other areas (including islands, see Goal 2).
- incursions of a new deer species into an area

What can community members do to help reduce the impact of feral deer?

Land managers: get together with your neighbours, to share knowledge, experiences and co-develop a coordinated plan to reduce impacts of feral deer. You can find resources to form a group, from your local or state land management agency, www.pestsmart.org.au or www.feraldeerplan.org.au. You can also:

- report sightings to FeralScan, Atlas of Living Australia, Victorian Biodiversity Atlas or iNaturalist
- cull feral deer on your land yourself (under firearm licences and laws) or by engaging a commercial harvester, volunteer or contract shooter
- permit coordinated aerial or ground culling programs (by agencies) to safely cull feral deer on your land
- together with neighbours, privately fund and coordinate aerial culling programs on your land
- involve a local pest management group, Landcare group or similar to govern a community-based control program.

Recreational hunters: consider becoming a volunteer shooter for a local feral deer control program (often on private land) that seeks to strategically coordinate efforts to reduce a target number of feral deer in a timeframe. Accreditations, membership to incorporated organisations, equipment and work conditions may apply. Please report and discourage illegal releases of deer or poaching to police.

Commercial harvesters: consider participating in the initial knock-down phases of community-led deer control programs, so the community can then maintain population suppression, or mop-up the remaining low numbers of feral deer. Harvesters may need to move to new areas or species once harvests are no longer feasible.

Peri-urban residents: report sightings of feral deer and provide your local land management agency or council access to your land, to manage feral deer before they encroach the adjoining township.

GOAL 2: Control or eradicate small populations before they spread

The most effective way to manage the impacts of feral deer is to act early to drive down feral deer densities as low as possible, or eradicate small populations before they spread. Many of the current isolated populations were initiated by escaped farmed deer and deer that were illegally released for recreational hunting.

Eradicate small populations beyond the containment zone

Early, rapid eradication of isolated populations of fewer than 1000 animals, that are separated from other feral deer by natural barriers or distance, is the most efficient way to avoid long-term control of feral deer. Island populations (e.g. King Island, Tasmania) with important environmental, agricultural or cultural values are also priority candidates for effective eradication programs because the risk of reinvasion is low.

Localised populations can be controlled by ground culling if there is enough community surveillance and effort. Land managers may not have the time, money or ability to cull feral deer that infrequently wander onto their land, so local land management agencies and organisations have an important role in coordinating control programs, including engaging skilled shooters (volunteer, paid or unpaid contractors), where feasible.

This plan prioritises eradication programs for some small feral deer populations (to be co-identified by states, regions and the Implementation Committee) that are impacting or pose a future risk to priority agricultural, environmental or cultural assets, and where the risk of re-invasion is low. Eradications will be determined by and aligned with state or local management plans, and only where feasible. Feral deer were successfully eradicated from kangaroo Island and offshore islands in New Zealand. A 11-year state-wide eradication plan is underway for 40,000 feral deer in South Australia, another on Wild Duck Island in Queensland, and plans are being developed to eradicate isolated populations in Western Australia and Tasmania. Programs will develop best practice, and build confidence in land management agencies to invest in further local eradications.

Local eradications can be achieved when: (1) the rate of removing the feral deer exceeds the rate of the population increase in the area, (2) there are no deer moving into the area, (3) all areas where the feral deer reside can be accessed for controlling them, (4) low densities can be monitored and proof of freedom can be determined, (5) the cost of eradication is less than the cost of on-going control and impacts of feral deer, and (6) there is a suitable socio-political environment to eradicate the feral deer (Bomford and O'Brien).

This plan also encourages strong disincentives, such as use of legislative penalties, for the deliberate release of deer (feral or farmed) for the purposes of establishing hunting populations, particularly where feral deer have been recently eradicated after considerable effort and cost.

Farmed deer must be effectively confined to reduce the risk of escapes, as they could form new feral populations. Regulations around confining farmed deer are in place in all states and territories, but where deer escapes are occurring at a higher than acceptable level, then regulations or compliance processes may need to be reviewed. Strategies such as fence standards, audits, mandatory ear tags and inclusion of deer in the National Livestock Identification System (to track livestock movements, pending support from industry) are options to alert authorities to locations of farmed deer, ensure confinement, and identify or reduce escapes.

It is particularly important to prevent farmed sika deer (*Cervus nippon*) from escaping, as there are no established feral sika populations in Australia.

Reduce the impacts of feral deer in peri-urban areas

New feral deer populations must be prevented – particularly in peri-urban areas. Prevention requires surveillance and rapid response plans. Local response plans should be widely promoted to the community, put into practice and reviewed regularly. They should include monitoring strategies, pre-emptive land access agreements, biosecurity protocols, standard operating procedures, carcass management, and agreements with skilled shooters (volunteers, paid or unpaid contractors) who can quickly attend to sightings.

Feral deer are already impacting some towns and cities, including Brisbane, Sydney, Melbourne, Wollongong, Rockhampton, Port Macquarie, Port Stephens, Launceston, the Sunshine Coast and the Gold Coast. Urban control programs are complicated and expensive, costing thousands of dollars per night in some cities. These programs need to navigate the safety and welfare concerns of residents, seek access to many small properties, and dispose of carcasses. Many operations are limited to areas that can be temporarily closed to the public, such as public parks and amenities.

Because of these challenges, feral deer must be prevented from establishing populations in peri-urban areas where they are not currently a problem, such as the regions surrounding Hobart, Adelaide, Perth and Darwin. Incursions around cities should be controlled quickly before they grow and spread.



Photo of tree guards to protect seedlings from deer, by Gaye Gadsden

GOAL 3: Protect significant sites from impacts (threatened species, ecological communities and cultural assets)

Protecting environmentally and culturally significant sites is challenging once feral deer are in the area. Restoration and revegetation efforts are expensive to maintain, as deer-proof fencing and vegetation guards are needed. Some areas, such as dense forest, are difficult to access to control feral deer. In these areas, aerial culling (with thermal technology), sometimes integrated with ground control using detection dogs, are practical tools. If aerial culling is needed in public areas such as national parks, public access will be restricted and the area closed during all operations.

Prevention of new populations and containment of existing populations are needed to protect nationally significant sites from ongoing impacts. Sites should be prioritised based on their risk of impacts, and their conservation and cultural value.

Review site management plans to protect nationally and internationally significant areas from impacts of feral deer

A priority action under this plan is the development of new, or assessment of existing site management plans to reduce the current or future impact of feral deer in significant areas, including where existing site plans do not address feral deer or pest animals. This plan identifies nationally and internationally important assets that are threatened by feral deer, including Ramsar wetlands (The Convention on Wetlands of International Importance), World Heritage, and National Heritage areas (Appendix 4, Figure 6). Internationally significant areas include the Tasmanian Wilderness, Gondwana Rainforests and The Coorong and Lakes Alexandrina and Albert wetland Ramsar site.

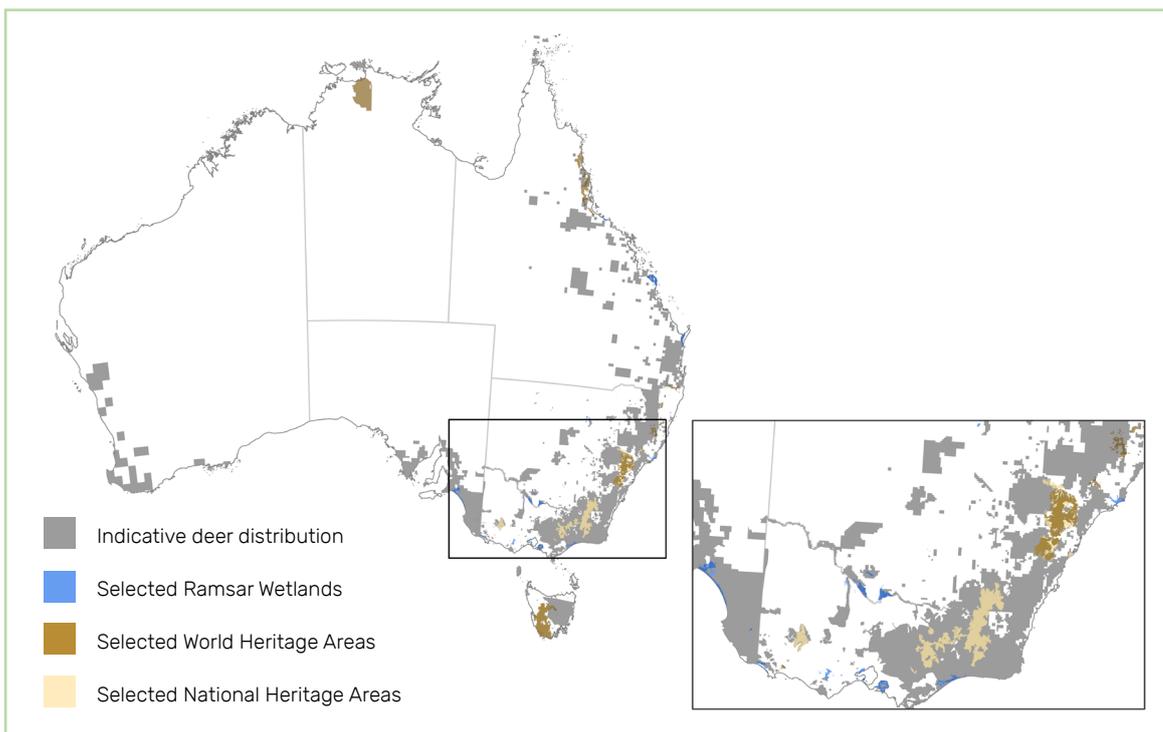


Figure 6. A map depicting where feral deer distributions overlap with, or are in the vicinity of nationally significant areas prone to the impacts of feral deer (selected for inclusion in Appendix 4).



Photo of rusa deer, by Ashley Carlson provided by Centre for Invasive Species Solutions

Protect threatened species and ecological communities

This plan identifies a minimum of 28 threatened plants, four threatened animals and four threatened ecological communities (listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)) that are considered to be particularly threatened by feral deer (Appendix 5, Table 5). Many more threatened species may be identified in the implementation of this plan. Excessive herbivory by feral deer can remove refuge for threatened animals with small distributions, thereby increasing the risk of predation on these animals by cats and foxes. Feral deer also trample habitats and pools that are breeding sites for threatened frogs.

The plan will also identify hotspot areas where feral deer are likely to have impacts on high numbers of threatened plant species.

Actions to protect these threatened species, ecological communities and hotspot areas in different zones are:

Zone 1: Large populations

- Reduce and maintain feral deer to low densities in and around the protection site.
- Intensively control feral deer in fire-affected protection sites, commencing within 18 months after a bushfire. Aerial culling is an effective way of intensively removing feral deer over large areas of recently burnt bushland.
- Fence the protection site, or install permanent tree guards around trunks of threatened trees and seedlings where culling is not effective. Deterrents may be used to augment fences or guards.

Zones 2 and 3: Containment buffer zone and small isolated populations

- Eradicate small population of feral deer, where feasible.
- Eradicate feral deer from an entire off-shore island, if the area needing protection is on an island.
- Where eradication is not feasible, reduce and maintain feral deer to low densities in and around the protected site.
- Fence a protected site, or install permanent tree guards around trunks of threatened trees and seedlings where culling is not effective.
- Enact a local surveillance plan to detect new feral deer incursions or increasing densities.
- Strengthen compliance measures to minimise escapes from local deer farms.

Agencies will identify additional control activities required in priority areas and seek resources as needed.

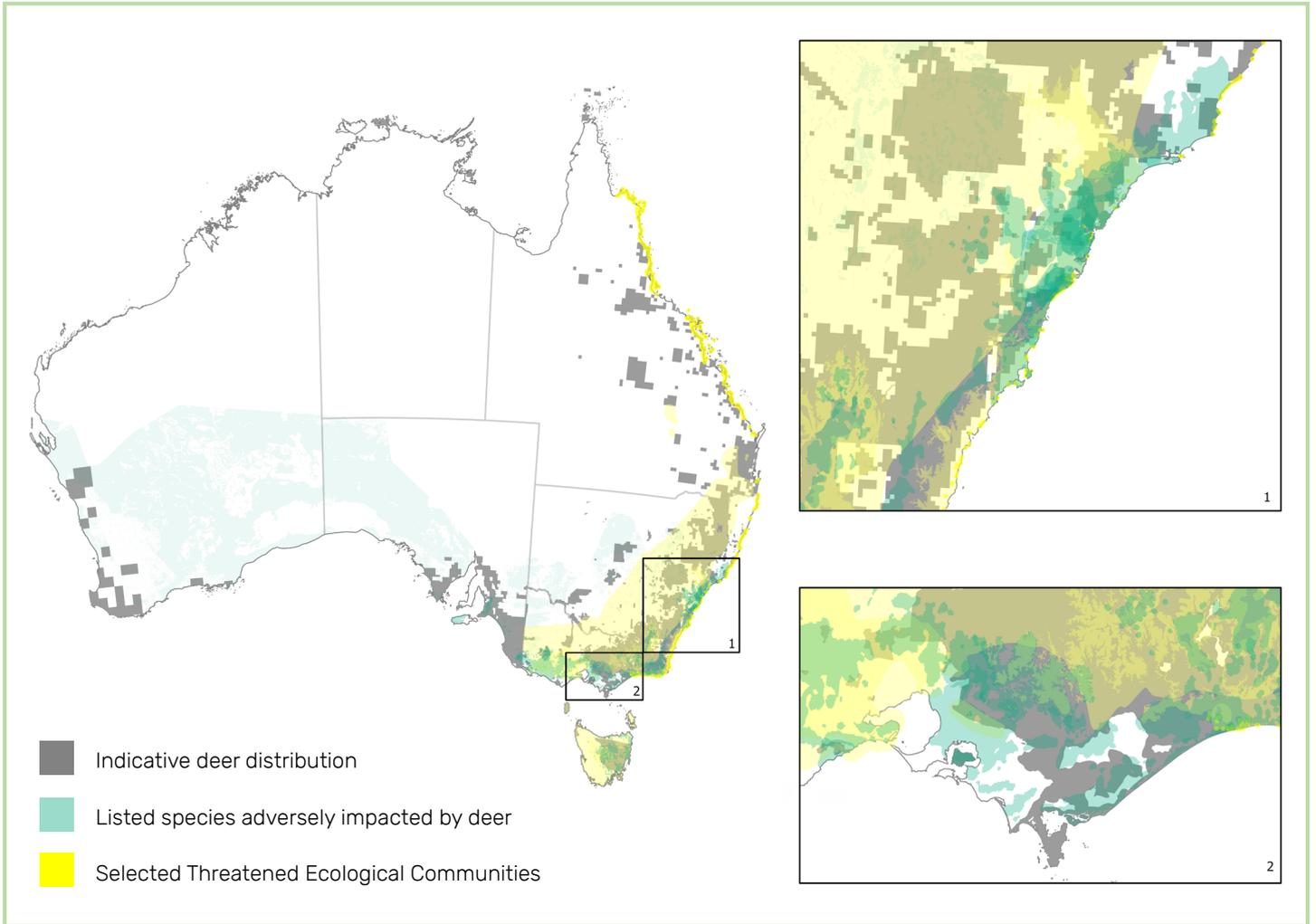


Figure 7. A map depicting where feral deer distributions overlap with threatened species (blue) and ecological communities (yellow) that are known (in the current literature) to be particularly vulnerable to damage by feral deer (selected for inclusion in Appendix 5). Highest concentrations of species and communities are in eastern Victoria and around Sydney. The light blue area across southern Australia shows the distribution of malleefowl, which are very sparse in this distribution.

Protect habitats recovering from bushfires

After major bushfires, feral deer are more likely to spread into new areas to seek food and new habitats (Figure 8). This causes significant damage to the recovering environment, as feral deer eat and trample the regenerating vegetation, and compete with native animals for palatable food.

Aerial culling may be useful to control feral deer in these areas, including areas burnt in the 2019-20 bushfires (Figure 9). Post-fire conditions provide a valuable opportunity to aerially cull more feral deer in these areas than at other times. This plan promotes the coordination of large-scale feral deer control programs as soon as possible following major bushfires (commencing within 18 months) when feral deer are more visible (particularly from the air), and when habitats are most vulnerable to browsing by deer. This will reduce the pressure on bushland and wildlife habitats recovering from bushfires.

Note, figures 6 and 7 were produced by the Commonwealth in 2022. While every effort has been made to ensure the maps of protected matters are accurate and complete, no guarantee is given, nor responsibility taken by the Commonwealth for errors or omissions, and the Commonwealth does not accept responsibility in respect of any information or advice given in relation to, or as a consequence of, anything containing herein.

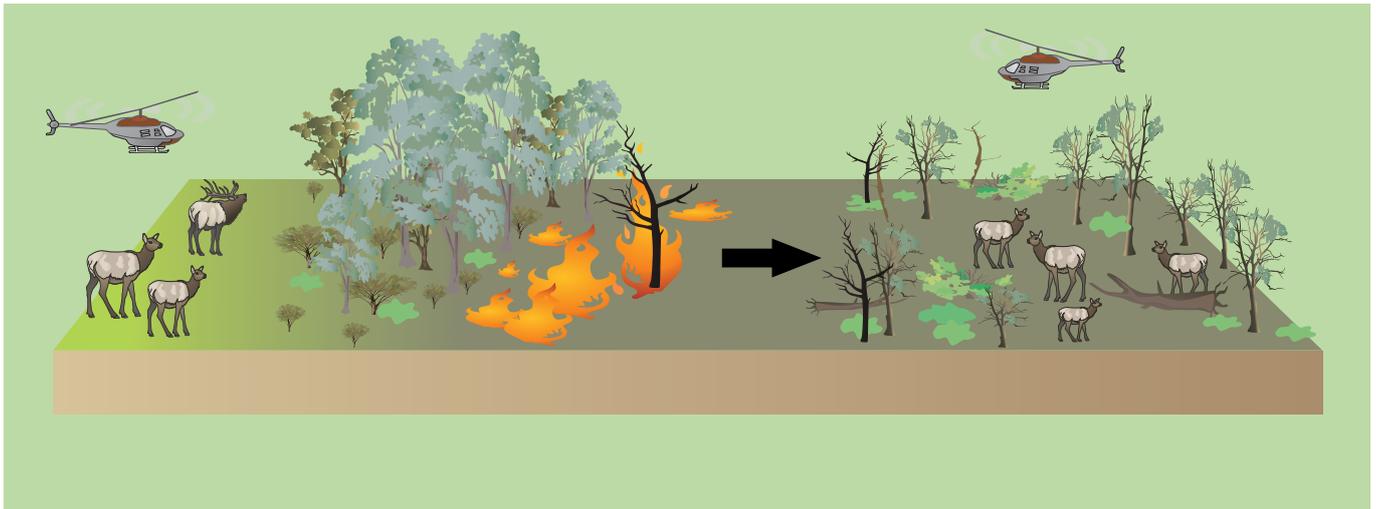


Figure 8. Feral deer often feed on the interface between healthy bushland and pasture, where control is effective. After bushfires, feral deer spend more time in the open burnt bushland understorey, grazing on vulnerable plant re-growth and seedlings, and hampering the recovery of habitats. Bushfires both exacerbate impacts by deer and provide opportunities for more effective and more cost-effective control. Habitats can be protected if feral deer are intensively culled in the bushland, within 18 months of a fire, followed by several years of less intensive culling to suppress impacts.

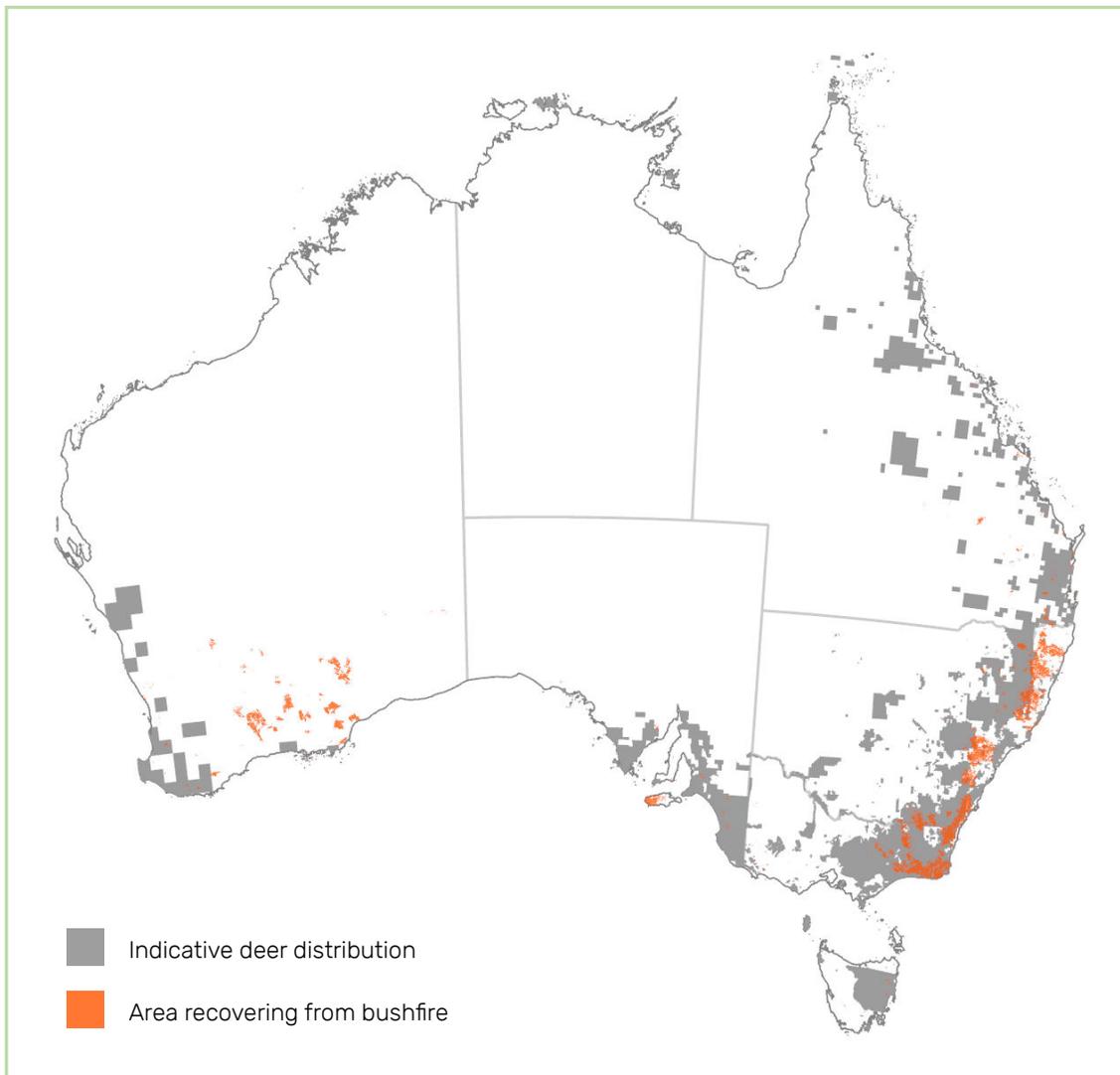


Figure 9. A map depicting where feral deer distributions overlaps with, or are in the vicinity of regenerating bushland that was recently affected by bushfires in 2019-2020.

Note. This map of deer distribution (and grey areas in figures 5,6,7) is indicative only. The most recent available sources of state and territory-level data (in 2022) have been compiled by the Commonwealth to produce a national map. For this reason, the national occurrence map is not consistent across jurisdictions in currency, resolution, or methodology and definitions of occurrence employed by each jurisdiction. This map should therefore be considered as a communication and engagement tool, rather than as a basis for further detailed analyses, and caution must be used in inferring the national distribution of feral deer using this map. Sources: NSW- Department of Primary Industries NSW 2020; Qld- Department of Agriculture and Fisheries Queensland 2018, 2014; Vic- Department of Environment, Land, Water and Planning Victoria 2020; Tas- Department of Natural Resources and Environment Tasmania 2021; SA- Department of Primary Industries and Regions South Australia 2021; NT and WA- National Land & Water Resources Audit 2008.

The Australian Google Earth Engine Burnt Area Map (orange layer in Figure 9) was developed by New South Wales Department of Planning, Industry and Environment.

Approach to achieve goals

The goals of the plan have been identified through collaboration with land managers across Australia. The approach to achieving these goals is based on:

- research and innovation for new control tools
- increasing awareness and capability
- national coordination and collaboration.

Research and innovation for new control tools and procedures

The efficacy of existing controls can be increased by using new and developing tools, such as the use of thermal imaging equipment, traps and attractants, spotlights, self-loading firearms and sound moderators or noise suppressors. This plan focuses on two new controls: toxic baits and thermally assisted control. The plan also identifies knowledge gaps and priority areas for research and development (Appendix 5).

Animal welfare is an important consideration in using and developing control tools for feral deer. This plan encourages further development of best-practice procedures for existing control tools for feral deer (similar to those developed for aerial and ground shooting by New South Wales Department of Primary Industries) as well as development of new tools. These need to strive to improve animal welfare outcomes (for feral deer), such as impacts on their health, behaviour and level of stress (Littin, Fisher, Beausoleil and Sharp, 2014).

Baits

Land managers and programs are often not able to shoot or trap enough feral deer to meet management goals, or to maintain suppressed populations at low densities. Baiting is a widely used, and cost-effective control technique to control other feral animals, such as rabbits, pigs, wild dogs and foxes, but Australia does not have a bait registered for feral deer.

This plan supports the development and registration of one or more baits for feral deer through the Australian Pesticides and Veterinary Medicines Authority, to augment other control tools for feral deer. The plan promotes trials of new baits to be used under strict directions to protect humans, domestic animals, wildlife, and the welfare of target species. Baits and baiting methods would be used according to relevant legislation in each state and territory and at the discretion of authorities, in consultation with landholders, recreational deer hunters and the commercial harvesting industry.



Figure 10. Thermal video cameras fitted to helicopters or drones can clearly and quickly detect feral deer in dense vegetation (right), compared with the ability of the human eye (left, circle). Photo from HeliSurveys (website).

Thermally-assisted control

Each year, more coordinated programs are investing in thermal technologies that can detect feral deer under tree canopies from the air (Figure 10) or through vegetation at ground level. This technology is advancing quickly, and can play an important role in feral deer surveillance and humane control in Australia. Thermal scopes and cameras can be used for both aerial and ground culling, with scopes attached to firearms, cameras attached to drones to inform ground shooters, or hand-held devices used from helicopters or vehicles. Thermal equipment is best in cooler parts of the day, or year, and sometimes is used to mop-up remaining feral deer after visual culling operations. This plan encourages programs to share operational, effectiveness and welfare outcomes of thermally-assisted control programs to maximise developments in this technology, and to support training of operators, and for operators to consider investing in this equipment.

Increase awareness and capability

This plan will help inform communities about the impacts of feral deer, the benefits of controlling small populations of feral deer early, and the need for neighbours to work together.

Implement a national awareness program

A priority action under this plan is to develop and implement a national awareness program to tailor social and digital media to peri-urban, agricultural and conservation audiences. The program will encourage the community to report feral deer sightings in areas with control programs, and where the population and spread are not well understood. It will also provide workshops and forums to build the capacity of land manager groups and agencies to implement best-practice control.

National coordination and collaboration

Coordinated control works best when there are local leaders who can motivate, liaise with and seek agreement from all land managers, including absentee managers, those not impacted by or unaware of feral deer, those with small holdings in peri-urban areas, and those who are motivated to sustain feral deer populations (e.g. to support recreational hunting). Local leaders play an important role in keeping the impacts of feral deer low, by monitoring impacts, and maintaining community vigilance, reporting and participation once feral deer numbers are reduced.

Coordinated control programs increase the effectiveness, efficiency and sustainability of control efforts by all land managers in an area (Figure 11), and reduce the areas where feral deer can seek refuge.

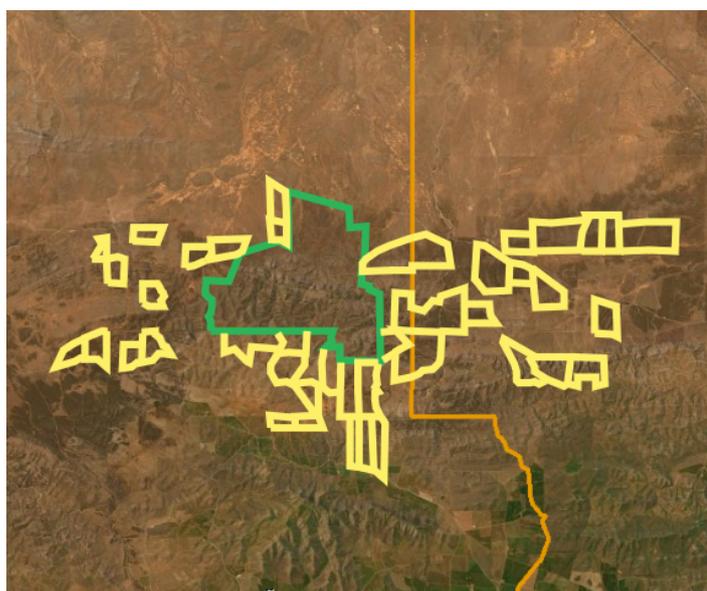


Figure 11. Coordinated control relies on participation by most private (yellow) and public (green) land managers around the distribution (white oval) of a small, isolated population of feral deer.

Actions in this plan will provide opportunities and forums to support a network of local and regional feral deer control leaders (from government, non-government organisations and communities), who can drive coordination, motivation and sharing of best practice and knowledge at local and regional scales. People wishing to facilitate a coordinated program at state, regional or local levels can access information, templates, guides and network support contacts (such as the Victorian Deer Control Community Network, or regional agencies), at www.feraldeerplan.org.au.

Governance to implement the plan

Following public consultation on this draft plan, the National Feral Deer Action Plan Working Group will finalise the plan and provide it to the Environment and Invasives Committee, a committee of the National Biosecurity Committee, for endorsement.

A National Feral Deer Action Plan Implementation Committee (NFDAPIC) will promote and oversee delivery of the final plan's actions over five years, with a progress review in year three. The committee will be guided by a terms of reference and members will consist of an independent chair, and 13 representatives across the various stakeholder groups, including agriculture, environment, government (at regional, state, commonwealth levels), indigenous, research, and professional and volunteer shooters. Every year, the committee will report to the Environment and Invasives Committee. This plan will be supported by a National Feral Deer Management Coordinator (and support officer), who will also deliver some of the plan's actions, and will report to the NFDAPIC annually. An overview of the governance arrangements is shown in Figure 12.

States will co-develop and coordinate reporting and performance indicators that are of benefit to the national plan, as well as state and local deer programs.

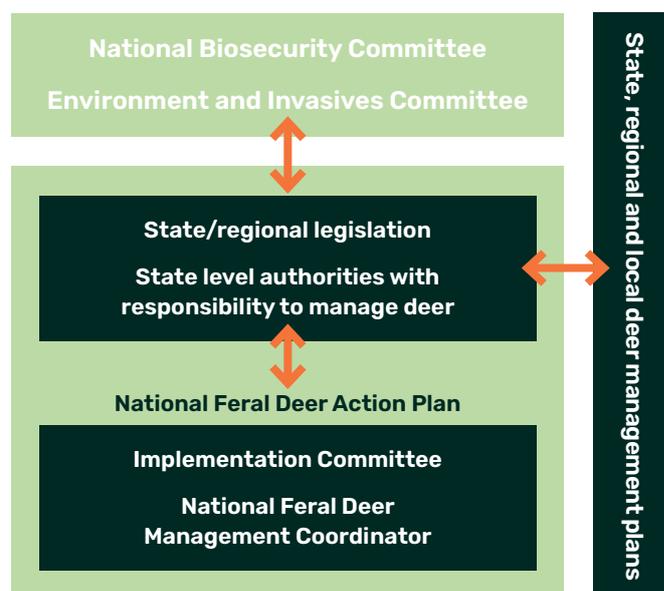


Figure 12. Governance arrangements to effectively implement this plan

Actions for 2022-27

Actions were developed by the Working Group, to achieve the goals of this plan (Table 1). Priority actions are shown in **bold**.

Table 1. Approach and actions to reduce, suppress and eradicate the impacts of feral deer.

Support for each action: NFDAPIC (National Feral Deer Action Plan Implementation Committee), NDMC (National Deer Management Coordinator), SG (stakeholder groups including agencies) and (RDC) regional feral deer coordinators. Performance measures will be collated by the NDMC.

ACTION	OUTCOME	PERFORMANCE MEASURE BY 2027 (OR EARLIER)
GOAL 1: Stop the spread of large feral deer populations and reduce their impact.		
APPROACH: Research and innovate new controls		
1.1 Develop and trial one or more lethal baits and delivery mechanisms for the control of feral deer, and seek registration of bait through APVMA. Lead: SG, Support: NDMC	Agencies and land managers have additional cost-effective options to control feral deer.	1. One or more lethal baits are registered nationally for control of feral deer, for use under strict directions to protect humans, domestic animals, wildlife, and the welfare of target species, and where other control methods are not effective.
APPROACH: Increase awareness and capability		
1.2 Develop a national awareness program (starting with a pilot) that identifies target audiences for tailored messages on feral deer management to the general public. Lead: NFDAPIC, Support: NDMC	Consistent messages are promoted to target audiences to help them understand the nature of the threat and to build and maintain social license to manage the impacts of feral deer.	1. More than 65 per cent of landholders in deer-affected areas, understand the need to manage feral deer (via surveys). 2. Social media awareness campaigns are implemented by NDMC and local groups. 3. Ratio of reporters to records of deer sightings via FeralScan and other reporting platforms increases (via annual reports).
1.3 Develop and disseminate targeted extension information (via Pestsmart or the Action Plan website and local networks) on the impacts of feral deer, the national plan objectives and options to manage them effectively. Lead: NDMC, Support: SG, RDC	Social license is built and maintained to manage the impacts of feral deer in cost effective, humane and timely ways to meet management goals.	1. Landholders, groups and agencies seeking to manage feral deer are satisfied with the availability and content of extension materials (via local coordinator reports).
1.4 Develop up-to-date maps of feral deer distributions, densities and impacts to communicate the extent, and trend of the feral deer problem. Lead: SG, Support: NDMC, RDC	Communities and land management agencies are informed to prioritise areas for feral deer management.	1. At least one national (ABARES, 2023) and two state distribution maps updated (on websites). 2. Trends in pest abundance, distribution and impact at state/territory scale (reported by annual state questionnaire).

ACTION	OUTCOME	PERFORMANCE MEASURE BY 2027 (OR EARLIER)
<p>1.5 Ensure current best practice tools and approaches for managing large feral deer populations, and those in peri-urban environments, are consistent and updated in COPs, SOPs, manuals, planning guides and cost-benefit summaries, and that best practice considers animal welfare and impacts on both feral deer and non-target wildlife.</p> <p>Lead: NDMC, Support: SG, RDC</p>	<p>Agencies and land managers can access best practice information to plan and implement effective and humane feral deer management programs.</p>	<ol style="list-style-type: none"> 1. Updated COPs, SOPs by 2024. 2. A review of information on state and national websites about feral deer management show best practice approaches are consistent (review by NDCM).
<p>1.6 Promote regulated use of firearm suppressors /sound moderators for feral deer control programs (accessibility differs under state laws).</p> <p>Lead: NDMC/SG, Support: SG</p>	<p>Best practice tools are available to maximise efficiencies of control programs and animal welfare.</p>	<ol style="list-style-type: none"> 1. All state agencies wishing to improve access to regulated use of firearm suppressors /sound moderators for coordinated feral deer control programs, are taking steps to seek access (as advised by state contacts).
<p>1.7 Identify research, development and extension (R,D&E) and training opportunities to improve best practice for feral deer management.</p> <p>Lead: NDMC, Support: SG, RDC</p>	<p>New tools and strategies are made available to improve deer surveillance and control.</p>	<ol style="list-style-type: none"> 1. Collaborative RD&E projects are funded. 2. Training events are delivered by NDMC and agencies (reported by annual state questionnaire).
<p>1.8 Identify options for accreditation of volunteer shooters (including landholders) or professional shooters in coordinated programs.</p> <p>Lead: SG, Support: NDMC</p>	<p>Recognised standards enable pools of accredited volunteer or professional shooters applying best practice control.</p>	<ol style="list-style-type: none"> 1. At least one best practice course is developed and/or promoted to coordinated feral deer control programs to enable participating shooters to be accredited (via training providers).
<p>APPROACH: National coordination and collaboration</p>		
<p>1.9 Establish a network of feral deer coordinators and practitioners in priority areas (including bushfire impacted conservation areas), to promote national consistency in cross-tenure best practice control, and shared responsibility.</p> <p>Lead: NDMC, Support: SG, RDC</p>	<p>Management of feral deer is coordinated at the local and regional level, and across jurisdictional borders and stakeholder groups.</p> <p>Feral deer management is consistent with the NFDAP, and is integrated into other pest animal management programs where efficient.</p>	<ol style="list-style-type: none"> 1. State and local feral deer coordinators and community group deer programs are listed on the NFDAP website (by NDCM). 2. At least three states have active deer control networks that host regular forums.
<p>1.10 Establish and support a priority cross-regional (national) containment program to prevent the current distribution of feral deer on the eastern seaboard, northern Tasmania and south-eastern South Australia from expanding and spreading.</p> <p>Lead: NFDAPIC, Support: NDMC, SG, RDC</p>	<p>The current large feral deer distributions are contained, and communities outside of these areas are protected.</p>	<ol style="list-style-type: none"> 1. A national containment zone plan is co-developed by participating regions, groups and states, including boundaries, activities, and databases to record incursions (2023). 2. Containment zone plan activities are delivered as per plan schedule (reported by annual plan progress report). 3. Funding is sought for implementing the first phase of the containment buffer zone plan.
<p>1.11 Facilitate processes to seek shared objectives for management of impacts of feral deer populations that cross state (or regional) borders.</p> <p>Lead: NFDAPIC, Support: NDMC, SG, RDC</p>	<p>The management of negative impacts of feral deer within cross-border populations (irrespective of state/territory/region) is consistent and effective.</p>	<ol style="list-style-type: none"> 1. At least three annual meetings are held with land management groups and agencies, and the NDMC, to facilitate coordinated management of cross-border feral deer populations (SA-VIC border, VIC-NSW border and NSW-QLD border).

ACTION	OUTCOME	PERFORMANCE MEASURE BY 2027 (OR EARLIER)
GOAL 2: Control or eradicate small populations before they spread.		
APPROACH: Research and innovate new controls		
<p>2.1 Establish best practice tools and approaches to prevent, eradicate or contain small feral deer populations in peri-urban areas. Lead: NDMC, Support: SG, RDC</p>	<p>Agencies and land managers can access best practice information to plan and implement effective feral deer prevention, eradication or containment programs in peri-urban areas.</p>	<ol style="list-style-type: none"> 1. A best practice guide is developed to manage feral deer in peri-urban areas. 2. Workshops are held on managing feral deer in peri-urban areas (via local coordinator reports). 3. The successes and outcomes of the Victorian Peri-Urban Deer Control Plan is promoted to other regions (via meetings and newsletters).
<p>2.2 Trial and promote effective use and benefits of thermal-assisted aerial control to knock down impacts of feral deer populations, particularly those in densely vegetated areas. Lead: SG, Support: NDMC, RDC</p>	<p>Agencies and land managers are effective users of new thermal technologies to quickly locate and control populations of feral deer.</p>	<ol style="list-style-type: none"> 1. At least three trials of thermal-assisted aerial control are implemented by state agencies, and promoted to other regions (via state questionnaire, and newsletters). 2. Training courses are delivered by states to build capacity for thermal-assisted aerial control (reported by annual state questionnaire).
APPROACH: Increase awareness and capability		
<p>2.3 Support agencies and groups to access current best practice tools, approaches, early response plans, reporting processes and engagement strategies to detect, suppress, eradicate or prevent new incursions. Lead: NDMC, Support: SG, RDC</p>	<p>Agencies and land managers can access best practice information to plan, detect and eradicate new incursions of feral deer</p> <p>Communities are aware of potential impacts of feral deer, are vigilant, report new incursions (e.g. via DeerScan, Atlas of Living Australia, Victorian Biodiversity Atlas or iNaturalist) and are prepared to participate in whole-community efforts to eradicate new incursions of feral deer.</p>	<ol style="list-style-type: none"> 1. All states have a central database for new incursion reports of feral deer. 2. Extension materials and operational templates relating to control of new incursions are available on Pestsmart or NFDAP websites. 3. Workshops are delivered by NDMC or states, on preventing, detecting or responding to early incursions of feral deer. 4. At least three regional campaigns completed or underway to prevent, detect, report and respond to early incursions of feral deer (via local coordinator reports)
<p>2.4 Prioritise eradication programs for small isolated populations of feral deer that pose a threat to priority agricultural or environmental assets. Lead: SG (state/local agencies) Support: NDMC</p>	<p>Small isolated populations are eradicated.</p> <p>(Note local eradication programs are underway in South Australia, western New South Wales and Western Australia)</p>	<ol style="list-style-type: none"> 1. At least three (state or regional) eradication plans developed, funded or underway in the small isolated population zone, and promote outcomes to other regions (via newsletters and meetings).
APPROACH: National coordination and collaboration		
<p>2.5 Investigate options to include farmed deer on the National Livestock Identification System (requiring that locations and movements of farmed deer are recorded). Note, including farmed deer on NLIS is dependent on support from the farmed deer industry. Lead: NFDAPIC Support: NDMC</p>	<p>Pending industry support for NLIS, escapes from farms can be better managed to prevent new populations from establishing.</p>	<ol style="list-style-type: none"> 1. Industry have been engaged (via meetings and a discussion paper) on options to include farmed deer on the NLIS (2024).

ACTION	OUTCOME	PERFORMANCE MEASURE BY 2027 (OR EARLIER)
GOAL 3: Protect significant sites from impacts (threatened species, ecological communities, and cultural assets).		
APPROACH: Increase awareness and capability		
<p>3.1 Assess existing site management plans for priority national and internationally significant places of high conservation or cultural value (listed in Appendix 4) to identify and address gaps in effective feral deer control planning.</p> <p>Lead: NFDAPIC, Support: SG, NDMC</p>	<p>Agencies proactively protect high value assets from the future impacts of feral deer.</p>	<p>1. A review by NDMC of existing management plans for the protection of priority places, provides recommendations on future amendments to plans (2024).</p>
<p>3.2 Support feral deer control programs to protect priority threatened species and ecological communities (listed in Appendix 5), and threatened plant hotspots (to be determined during 2024)</p> <p>Lead: SG, Support: NDMC, RDC</p>	<p>Impacts of feral deer on threatened species and ecosystems are recognised, and management of feral deer is integrated into conservation plans to reduce impact.</p>	<p>1. A map has been developed to prioritise threatened species, ecological communities and hotspot areas for protection from impacts of feral deer (by 2024).</p> <p>2. Agencies have considered the need for additional control activities and have sought investment for priority activities.</p> <p>3. The impact of deer is reduced in priority areas where deer control programs are funded, measured by the recovery of threatened species or ecological communities in the area.</p>
APPROACH: National coordination and collaboration		
<p>3.3 Collate information on the environmental impacts of feral deer to underpin inclusion of feral deer management in conservation planning.</p> <p>Lead: SG, Support: NDMC</p>	<p>Impacts of feral deer are well understood and accessible, and inform conservation planning.</p>	<p>1. Reports on environmental impacts of feral deer are available on the Pestsmart or NFDAP websites.</p>
ALL GOALS		
APPROACH: National coordination and collaboration		
<p>4.1 Adopt and maintain a clear governance structure to support coordination and delivery of actions in the Plan.</p> <p>Lead: NFDAPIC, Support: NDMC, SG, NDMC</p>	<p>The Plan's actions are driven and promoted to ensure actions are adopted.</p>	<p>1. An Implementation Committee is established with a Terms of Reference (2023), annual work plans, and a progress review (2025).</p> <p>2. A monitoring, evaluation, reporting and improvement plan is developed (2023).</p> <p>3. Investment is secured for activities that are led by the Committee, by 2023</p>
<p>4.2 Promote sharing and reporting of feral deer management outcomes, using consistent measures, at national, state and local scales.</p> <p>Lead: NDMC, Support: SG, RDC</p>	<p>Feral deer programs collect cost-effective and appropriate data to evaluate and improve control activities and effectiveness.</p> <p>Data relevant to the evaluation of the Plan will be reported using consistent templates.</p>	<p>1. An annual report by NDMC on the trends in state, regional and local management actions (including awareness, participation, adoption of best practice) and outcomes of actions (including spread, population growth and impacts), and progress of the plan towards the performance measures (in this column) provided to state agencies, commonwealth and NFDAPIC.</p>

Appendix 1

State and territory legislation and strategies relating to feral deer control

State and territory government agencies can support land managers to conduct feral deer control programs.

These agencies include:

- natural resource management regions in South Australia, New South Wales, Western Australia, the Northern Territory and the Australian Capital Territory
- local government associations in Queensland
- state government agricultural, biosecurity and conservation agencies in South Australia, Victoria, Western Australia and Tasmania.

Each state and territory has its own legislation and policies for feral deer control. These are listed in Table 2.

Table 2. State and territory policies relating to feral deer control.

LEGISLATION	INTENT RELATING TO DEER
STATE/TERRITORY: New South Wales	
<i>NSW Biosecurity Act 2015</i>	Invasive species management is a shared responsibility for all community members. For feral deer, landowners (both private and public) are required to control feral deer to the extent necessary to minimise the risk of any negative impacts on their lands or that of their neighbours. Priority areas to reduce the impacts of feral deer are guided by the NSW Biosecurity Strategy 2013-2021 https://www.dpi.nsw.gov.au/biosecurity/managing-biosecurity/nsw-biosecurity-strategy-2021 and regional strategic pest animal management plans https://www.ils.nsw.gov.au/help-and-advice/pests,-weeds-and-diseases/pest-control/pest-species-control/wild-deer
<i>Biosecurity Regulation 2017</i>	On specified public lands, deer may be hunted under a licence and with written permission issued by Department of Primary Industries NSW (via online booking system). Private land hunters, with permission to hunt from a landholder or occupier, do not require a game hunting licence, but do need a firearm licence (where firearms are used).
<i>Game and Feral Animal Control Act 2002</i>	Feral deer (all species) are listed as a Key Threatening Process for herbivory and environmental degradation. Various threatened species and ecological communities are impacted by feral deer.
STATE/TERRITORY: South Australia	
<i>Landscape South Australia Act 2019</i> <i>Landscape South Australia Regulations 2020</i>	Declarations and control notices (under regulations) for feral deer specify it is an offence to release deer into the wild; fencing and tagging standards are required for keeping of domestic deer; and land managers are required to destroy all feral deer on their land. https://www.pir.sa.gov.au/biosecurity/weeds_and_pest_animals/animal_pests_in_south_australia/established_pest_animals/feral_deer

LEGISLATION	INTENT RELATING TO DEER
STATE/TERRITORY: Western Australia	
<i>Agricultural and Related Resources Protection Act 1976</i>	There are requirements for the keeping of fallow and red deer https://www.agric.wa.gov.au/livestock-management/fallow-and-red-deer-keeping-requirements
<i>Biosecurity and Agricultural Management Act 2007</i>	Fallow, red deer (including wapiti and elk) and rusa deer are declared pests (s22). Fallow and red deer are classified as C3, requiring that landholders control them and keeping is restricted. Rusa are classified as C1 requiring them to be excluded, and they cannot be kept. Fallow and red deer (including wapiti and elk) may be kept with a permit. All other species are prohibited from being kept in Western Australia.
STATE/TERRITORY: Victoria	
<i>Flora and Fauna Guarantee Act 1988</i>	Sambar are listed as a Potentially Threatening Process for the reduction in biodiversity and survival of native plant taxa and ecological communities
<i>Wildlife Act 1975</i>	Hog, red, sambar, fallow, rusa, chital, sika and wapiti deer are defined as protected wildlife. Six species (hog, red, sambar, fallow, rusa, chital) are further declared game species for the purpose of the Wildlife (Game) Regulations 2012. Deer causing damage on public land can be destroyed under an Authority to Control Wildlife Permit. Deer (excluding hog deer) demonstrably causing damage on private property are subject to an 'unprotection order' and can be destroyed without a licence or permit in accordance with specified conditions.
<i>Wildlife (Game) Regulations 2012</i>	Deer declared to be game can be hunted under a licence where harvest method is specified (e.g. firearms, hounds). Year-long hunting season and unrestricted bag limit for all game deer species, except hog deer (one month season, limit of one male and one female). Other restrictions may apply on public land.
<i>Catchment and Land Protection Act 1994</i>	All deer except chital, hog, red, wapiti, sika, sika-red deer hybrids, fallow, rusa and sambar, are listed as prohibited pest animals.
<i>National Parks Act 1975</i>	Exotic fauna (including deer) in National and State parks, Wilderness Parks and other reserves, must be exterminated or controlled.
<i>Flora and Fauna Guarantee Act 1988</i>	Sambar are listed as a Potentially Threatening Process for the reduction in biodiversity and survival of native plant taxa and ecological communities
STATE/TERRITORY: Queensland	
<i>Biosecurity Act 2014</i>	Unless kept in a deer-proof enclosure, chital, fallow, red, rusa and hog deer are restricted invasive animals and are subject to control. They must not be, moved, fed, given away, sold, or released into the environment. All other deer species are prohibited matter subject to an eradication program if they are considered a significant biosecurity threat. It is an offence to deal with prohibited matter or fail to report its presence. Prohibited matter permits are available for a limited number of purposes. The Act requires everyone to take all reasonable and practical steps to minimise the risks associated with invasive plants and animals under their control (a general biosecurity obligation).
STATE/TERRITORY: Australian Capital Territory	
<i>Pest Plants and Animals Act 2005</i>	<i>Cervus</i> , <i>Dama</i> , <i>Axis</i> and <i>Rusa</i> species are listed as pests on the Pest Plants and Animals (Pest Animals) Declaration 2005 list. There is no obligation for land managers to undertake control programs for feral deer.
<i>Nature Conservation Act 2014</i>	Any deer species cannot be kept as livestock without a licence.

LEGISLATION	INTENT RELATING TO DEER
STATE/TERRITORY: Tasmania	
<i>Vermin Control Act 2000</i>	A Wild Fallow Deer Management Plan for Tasmania highlights a need to minimise impacts of deer in areas with significant natural values and in peri-urban areas, as well as manage impacts of deer where distributions are growing. https://dpipwe.tas.gov.au/agriculture/game-services-tasmania/wild-fallow-deer-management-plan
<i>Nature Conservation Act 2002</i>	Deer are classified as Wildlife under the Nature Conservation Act 2002 and partly protected wildlife under the Wildlife (General) Regulations 2010.
<i>Wildlife (General) Regulations 2010</i>	Fallow deer may be hunted under a licence in specified autumn hunting season (1 month antlered males, 2 months antlerless deer). Each hunter has a bag limit of 1 male and 1 antlerless deer or 2 antlerless deer. First-year males are protected and cannot be taken. Only rifle hunting is permitted. A crop protection permit (CPP) is required for controlling problem deer (or any sex or age) on private land where commercial crops are produced. CPPs for adult male deer require a site visit by the State Department to assess damage to land. CPP are generally not issued for antlerless deer between November to March when females are pregnant or have dependent young.
STATE/TERRITORY: Northern Territory	
<i>Territory Parks and Wildlife Conservation Act 2006</i>	Feral deer are classified as a pest (feral – prohibited entrant).
STATE/TERRITORY: Commonwealth	
<i>Biosecurity Act 2015</i>	Australian Pest Animal Strategy (2017- 2027) outlines principles for the management of pest animals https://www.agriculture.gov.au/pests-diseases-weeds/pest-animals-and-weeds
<i>Environmental Protection and Biodiversity Conservation Act 1999</i>	Deer species are included in the Key Threatening Process (KTP) for novel biota which highlights a need to manage their impacts on biodiversity https://www.environment.gov.au/biodiversity/threatened/key-threatening-processes/novel-biota-impact-on-biodiversity

Further details on legislation can be found here: <https://pestsmart.org.au/framework-overview/government-pest-animal-management-strategies/>

Appendix 2

Use of control tools for feral deer

Different tools are available to control feral deer. Below is a summary of the tools that are currently used across Australia, including information on when tools may be used, and how they could be improved. A comparison of these tools is provided in Table 3.

Aerial culling

Aerial culling (also known as aerial shooting) is used by New South Wales, South Australia, Victoria and Queensland government agencies to quickly cull large feral deer populations. Some culls have removed hundreds to thousands of feral deer, including thousands of feral deer culled in the Liverpool Plains of New South Wales in 2020. Culls need to be repeated to be effective.

Aerial culls are expensive in the short term, but can avoid higher ongoing costs of the impacts of feral deer and ground shooting programs. Cost-effectiveness of aerial culls is likely to improve as new strategies are trialled, more people are trained, and as resources are available for aircraft hire.

To make sure culling targets are met, surveys using remote camera or aerial counts may be used to predict the number of feral deer and the amount of aerial shooting required. Calculations may also be done after culling to estimate whether the target was met, by comparing the number of feral deer that were seen with the number that were shot (if filmed for later analysis), or by comparing the number of feral deer shot per hour of effort in subsequent operations ('catch per unit effort').

Aerial culling has the potential to nearly eradicate small, isolated populations of feral deer, particularly in areas where ground shooting is time-consuming for operators, or where the terrain is inaccessible by foot or vehicle. Ground shooting may be required for the last feral deer.

Aerial culling is the primary tool for controlling large populations, but it can be improved by better planning and repeat culls to drive densities to low levels, followed by secondary tools, such as coordinated, intensive ground culling across most of the properties in the area. Commercial harvesting of remaining low densities would not be feasible.

Ground culling

Ground culling (also known as ground shooting) is used to control feral deer in small and large populations, in both rural and urban areas. Effective ground culling relies on having sufficient time, the right licences and equipment, access to roads and an ability to remove large numbers of feral deer. Many land managers do not have the equipment, time, knowledge or money to conduct ground culling, or the trust to engage volunteer shooters, or the numbers of feral deer are just too high, so they seek help from government agencies. Some people believe that recreational hunting of a few feral deer is enough to control populations, but populations are spreading in many areas (Bengsen & Sparkes 2016).

Feral deer learn quickly, so ground culling is more effective if the techniques used are changed often. This includes changing the lighting and sounds involved in shooting, as feral deer learn to avoid spotlights, vehicle headlights and associated sounds. Self-loading firearms, suppressors or sound moderators (where legislation permits) and thermal optical equipment can be used to make shooting more effective. Timing of shooting should vary, as deer will learn to graze elsewhere during culling times.

Ground culling can be improved with new feed-based tools, which are being developed to attract feral deer to a desired location, or away from inaccessible or problematic locations, such as dense vegetation or urban streets. This makes ground shooting easier, faster and safer. Ground culling standard operating procedures will be developed (at national scale) and updated as tools or approaches are improved to maximise welfare and safety outcomes.

Trapping

Trapping is used to catch feral deer before they are shot.

Trapping is used to support ground or aerial culling on some properties with mixed success. It is used as a last option in urban areas where shooting is not permitted or safe.

Trapping is time consuming - it requires daily checking or monitoring by cameras, and feed attractants must be replaced regularly. Some land managers do not have the time or ability to maintain effective trapping.

Trapping strategies can be improved by making use of advances in remote monitoring systems, which reduces the need for manual checking, and also by the development of national standard operating procedures for trapping and shooting trapped deer.

Exclusion fences

Exclusion fences are used in New South Wales, Victoria, South Australia and Tasmania to protect crops, grazing paddocks, and small conservation areas of up to 100 hectares. These fences are useful where landscape scale control programs such as culling are not possible (Lorimer and Lorimer 2005).

Exclusion fencing protects the land within the fence, and can reduce movement of feral deer across the landscape, but does not reduce the wider impacts and numbers of feral deer. Exclusion fences can also restrict the movement of native wildlife.

Exclusion fences will improve as new developments become available (such as fence height extensions and virtual fencing technology), and as they are evaluated for welfare for feral deer and other animals.

Potential tool - Baiting

Baiting is commonly used to control many vertebrate pests in Australia, and can be effective in controlling large-scale populations of animals such as rabbits, foxes and feral pigs. There are no baits registered for control of feral deer in Australia, but research is underway to identify humane and effective baits for feral deer.

Comparison of control tools

Different control tools may be used depending on the size and location of the feral deer population, and the tools available to land managers. Table 3 compares the benefits, limitations and humaneness of control tools.

Table 3. Comparison of control tools used for feral deer in Australia

BENEFITS	LIMITATIONS	HUMANENESS
CONTROL TOOL: Aerial culling		
<ul style="list-style-type: none"> Effective for detecting and culling deer quickly over large areas, including areas inaccessible by vehicle Able to achieve a rapid knock-down in density. Up to 1,000 feral deer can be culled in 12 hours, at maximum densities and accessibility. 	<ul style="list-style-type: none"> Not suited for dense vegetation Each area may need multiple aerial culls per year Availability of accredited marksman and helicopters providers in some states High levels of coordination, consultation, engagement and operation planning required Cost per day is high 	<ul style="list-style-type: none"> Professional shooters are accredited and experienced to make sure culls are humane Humaneness assessments have validated this method (Hampton et al. 2022) A national standard operating procedure is being developed A NSW standard operating procedure exists Aerial views can confirm outcome of each shot
CONTROL TOOL: Aerial culling with thermal detection		
<ul style="list-style-type: none"> Most target animals can be detected, even in dense vegetation at landscape scales 	<ul style="list-style-type: none"> Not suited for warm days, or warm parts of the day or year, or in light rain, or in rocky terrain. Availability of accredited marksman with thermal experience and helicopter providers Experience has been focused on other pest animals Capability of technology varies High levels of coordination, consultation, engagement and operation planning required Cost per day is high 	<ul style="list-style-type: none"> Professional shooters are accredited and experienced to make sure culls are humane Thermal video can confirm the outcome of each shot and ensure animals are euthanised quickly Humaneness assessments will help validate this method and contribute to future standard operating procedures

BENEFITS	LIMITATIONS	HUMANENESS
CONTROL TOOL: Drones fitted with thermal cameras		
<ul style="list-style-type: none"> • Effective for detecting feral deer over property scales • Drones can guide ground shooters and reduce search effort 	<ul style="list-style-type: none"> • Drones do not remove feral deer; they are only used to detect if feral deer are present, identify their location and estimate numbers • Flight time is short and the swath width is narrow • Not considered effective for monitoring large areas 	<ul style="list-style-type: none"> • No culling • Practitioners report that drones do not generally scare feral deer or other animals
CONTROL TOOL: Ground culling by professional shooters		
<ul style="list-style-type: none"> • Effective for targeting small numbers or low densities of feral deer 	<ul style="list-style-type: none"> • Time-consuming for large operations • A level of coordination is sometimes needed • Cost varies • May not remove a net reduction in feral deer each year 	<ul style="list-style-type: none"> • Reports from coordinated program managers note that most professional shooters are generally skilled and experienced to make sure culls are effective and humane • Competency assessments may be used in coordinated programs to maximise humanness outcomes
CONTROL TOOL: Ground culling by volunteer pest controllers		
<ul style="list-style-type: none"> • Effective for targeting small numbers of feral deer, where volunteers meet program goals of culling a target number of the population (including targeting females) • Cost per day is low (excluding supervision, planning and coordination) 	<ul style="list-style-type: none"> • Time-consuming for large operations • A level of supervision and coordination of volunteers is sometimes needed • May not remove a net reduction in feral deer each year • Some may not be willing to cull throughout the night, or search at a distance from the road. • Some may not have access to high-definition detection equipment (thermal scopes, binoculars, monoculars, night vision) 	<ul style="list-style-type: none"> • Depends on the skill and experience of the volunteer • Incorporated shooting groups and programs (such as SSAA - Conservation and Wildlife Management or Conservation and Pest Management Branches, and Farmer Assist) follow standard operating procedures to make sure culls are humane • Some incorporated shooting groups have arrangements with agencies to undertake control operations, where evidence (photos of carcasses) of humane operations are reported
CONTROL TOOL: Ground culling by land managers		
<ul style="list-style-type: none"> • Effective for targeting small numbers of feral deer 	<ul style="list-style-type: none"> • Time-consuming for large operations 	<ul style="list-style-type: none"> • Depends on the skill and experience of the land manager
CONTROL TOOL: Commercial harvesting (shooting)		
<ul style="list-style-type: none"> • Effective for reducing high densities to moderate numbers of feral deer in small areas (property scale) , before other tools will be employed • Carcasses are removed for human or animal consumption • In some states, private landholders receive financial benefit for allowing commercial harvesting on their property 	<ul style="list-style-type: none"> • Limited to areas with vehicle access to enable carcasses to be hauled onto vehicles, and limited to areas within proximity of licensed storage or processing facilities. • Not feasible for the harvester when feral deer numbers are small • Some harvesters have managed feral deer for ongoing harvests, which does not reduce the impacts of feral deer. Well-coordinated programs with land access conditions may mitigate this • May only operate for limited periods during the year • Market trends and demands influence harvests 	<ul style="list-style-type: none"> • Professional harvesters are generally experienced to make sure culls are humane • Competency assessments are required by some processing companies to maximise humanness outcomes
CONTROL TOOL: Trapping		

BENEFITS	LIMITATIONS	HUMANENESS
<ul style="list-style-type: none"> Effective for small numbers of feral deer along known pathways in areas where shooting is not permitted or safe 	<ul style="list-style-type: none"> Feed must be regularly replenished, and traps monitored Carcasses must be removed Cost is high (hundreds to thousands of dollars per deer) 	<ul style="list-style-type: none"> Culls can be done in controlled situations (at night, from a distance) Humaneness assessments would contribute to a future national SOP
CONTROL TOOL: Attractants		
<ul style="list-style-type: none"> Feral deer can be attracted to a desirable area, or out of an inaccessible area, for control 	<ul style="list-style-type: none"> Attractants (including feeder devices) must be maintained and replenished Ground culling is needed 	<ul style="list-style-type: none"> Culls can be done in an optimal location for good welfare outcomes
CONTROL TOOL: Deterrents (lights, noises, chemical smells)		
<ul style="list-style-type: none"> Some effectiveness at small scales, such as points along a road, or around valued assets 	<ul style="list-style-type: none"> Feral deer can become habituated to deterrents Impacts are displaced elsewhere. This is not a limitation where the goal is to move impacts from a valuable asset to an area of less concern Populations are not reduced 	<ul style="list-style-type: none"> No culling
CONTROL TOOL: Sterilisation		
<ul style="list-style-type: none"> Chemical sterilisation treatments have not successfully reduced populations of feral deer, anywhere in Australia 	<ul style="list-style-type: none"> Some chemical sterilisation treatments wear off during for the reproductive lifetime of a deer (within 1-3 years), and so deer may still breed Cost is high to administer (dart) treatment Treated deer continue to have impacts 	<ul style="list-style-type: none"> No culling
CONTROL TOOL: Exclusion fencing		
<ul style="list-style-type: none"> Feral deer can be reliably excluded from assets 	<ul style="list-style-type: none"> Cost is high to erect and maintain Feral deer are displaced elsewhere Movement of native wildlife can be restricted 	<ul style="list-style-type: none"> No culling

Appendix 3

Other feral deer control strategies, principles and priorities that align with this plan

This plan aligns with relevant national, state and territory strategies, principles and priorities for feral deer control (Table 4).

Table 4. Relevant strategies and policies for feral deer control. Note draft deer strategies are still in development for New South Wales and Queensland

PRIORITIES
STRATEGY: Australian Pest Animal Strategy principles (relevant for deer)
<ol style="list-style-type: none">1. Prevention and early intervention is cost-effective to avoid establishment.2. Pest animal management is shared responsibility between landholders, community, industry and government.3. Management of mobile animals require coordinated approach across scales and land tenures.4. Management of established populations should protect priority assets, including a buffer.5. Management should be based on actual, rather than perceived impacts, and should be informed by measuring whether impact reduction targets are being achieved.6. Best practice management should balance efficacy, safety, humanness, community perceptions, logistics and emergency needs.7. Best practice should integrate a range of techniques, including commercial use where appropriate, consider interactions between species, animal welfare, and seasonal conditions.8. Cost of management should be borne by those who create the risk and those who benefit from its management. Governments should co-invest where there is public benefit.
APAS priorities
<ol style="list-style-type: none">2.1 Develop and Implement national action and coordination plans for species prioritised as nationally significant (not yet for deer).2.2 Develop and improve best practice management methods and increase overall adoption of these practices among landholders.2.3 Increase participation in coordinated management approaches across a range of scales and land tenures.3.1 Develop the knowledge, capacity and commitment of stakeholders to take responsibility for pest animal management.2.2 Improve information collection and sharing mechanisms to support effective pest animal management.2.3 Maintain and enhance long term research, development and extension capacity and capability
STRATEGY: Victorian Deer Management Strategy
<ul style="list-style-type: none">• The impacts of deer on key environmental, agricultural and Aboriginal cultural heritage values and public safety are reduced.• Deer control is more effective through partnerships and community collaboration.• Awareness, understanding and capacity to control deer is increased.

PRIORITIES

STRATEGY: Tasmanian Deer Management Plan 2022-27

- Provide increased options to farmers and land managers to effectively control the impacts of deer on their activities
- Continue to provide for responsible recreational deer hunting as a legitimate and valued activity in Tasmania
- Reduce public safety risks from deer
- Reduce the risks to the natural and cultural values of Tasmania's conservation reserve estate and other public and private lands
- Protect Tasmania's biosecurity by reducing the risks of deer as a potential disease vector.
- Avoid further potential spread of deer
- Reduce the abundance and geographic range of deer with a particular focus on areas outside the traditional range
- Support property-level management to provide for sustainable hunting in selected zones.

STRATEGY: South Australian Deer Strategy 2022-32 (not yet released)

- To build industry, government and community awareness of the impacts of feral deer and promote coordinated management.
- To build the capacity of agencies and public/private landholders to use best practice methods to collaboratively reduce the impacts of established feral deer populations at the landscape scale.
- To build the capacity of agencies and landholders to prevent, report, and contain, reduce or eradicate new incursions of feral deer.

STRATEGY: Queensland Feral Deer Management Strategy 2022-2027

- Feral deer are effectively managed using best practice management informed by research.
- Feral deer management is effective through partnerships, planning, and collaboration.
- Feral deer impacts are widely understood, and land managers have the practical knowledge and tools to control feral deer.

Appendix 4

Nationally and internationally significant assets at risk of impacts

World Heritage areas, intersecting with current range of feral deer

(<https://whc.unesco.org/en/statesparties/au>)

- Budj Bim Cultural Landscape
- Greater Blue Mountains Area
- Gondwana Rainforests of Australia including but not restricted to:
 - Barrington Tops
 - Focal Peak
 - Hastings-McLeay Group
 - Iluka Nature Reserve
 - Main Range Group
 - New England Group
 - Washpool and Gibraltar Range
- Kakadu National Park
- Tasmanian Wilderness
- Wet Tropics of Queensland

Australian National Heritage places, intersecting with current range of feral deer

(<https://www.dcceew.gov.au/parks-heritage/heritage/places/national-heritage-list>)

- Australian Alps National Park and Reserves
- Budj Bim National Heritage Landscape
 - Mt Eccles Lake Condah Area
 - Tyrendarra Area
- Grampians National Park (Gariwerd)
- Greater Blue Mountains
- Royal National Park and Garawarra State Conservation Area
- Tasmanian Wilderness

Ramsar - The Convention on Wetlands of International Importance, intersecting with current range of feral deer

(www.dcceew.gov.au/water/wetlands/australian-wetlands-database/australian-ramsar-wetlands)

- Barmah Forest
- Blue Lake
- Bool and Hacks Lagoon
- Bowling Green Bay
- The Coorong
- Edithvale-Seafood Wetlands
- Fivebough and Tuckerbil Swamps
- Ginini Flats Wetland Complex
- Gippsland Lakes
- Great Sandy Strait
- Gunbower Forest
- Gwydir Wetlands (Gingham and Lower Gwydir Big Leather Watercourses)
- Hunter Estuary Wetlands
- Interlaken
- Kerang Wetlands
- Little Llangothlin Nature Reserve
- The Macquarie Marshes
- Myall Lakes
- Narran Lake Nature Reserve
- NSW Central Murray State Forests
- Western District Lakes

Appendix 5

Threatened plants and animals impacted by feral deer

Table 5. The threatened species and ecological communities, listed under the EPBC Act 1999, that are highly impacted by feral deer

COMMON NAME	SCIENTIFIC NAME	STATUS IN 2022	IMPACT	REFERENCE
Swamp Bush-pea	<i>Pultenaea weindorferi</i>	Vulnerable	Browsing	Carter and Walsh, 2010
Shiny Nematolepis	<i>Nematolepis wilsonii</i>	Critically Endangered	Browsing, ringbarking	Bennett and Coulson 2011; Keith and Pellow, 2005; Lorimer and Lorimer 2005; Murphy et al. 2006; Conservation Advice and Recovery Plan database
Bynoe's wattle	<i>Acacia bynoeana</i>	Endangered	Browsing	Moriarty unpublished; NSW Key Threatening Process
Hairy Geebung	<i>Persoonia hirsuta</i>	Endangered	Browsing	Moriarty unpublished; NSW Key Threatening Process
Round-leaf Pomaderris	<i>Pomaderris vacciniifolia</i>	Critically Endangered	Browsing	Threatened Species Scientific Committee 2014; Conservation Advice and Recovery Plan database
Miena Cider Gum	<i>Eucalyptus gunnii</i> ssp. <i>divaricata</i>	Endangered	Browsing	Potts et al. 2001
Camfield's Stringbark	<i>Eucalyptus camfieldii</i>	Vulnerable	Browsing	Moriarty unpublished; NSW Key Threatening Process
Woronora Beard-heath	<i>Leucopogon exolasius</i>	Vulnerable	Browsing	Moriarty unpublished; NSW Key Threatening Process
Deane's Paperbark	<i>Melaleuca deanei</i>	Vulnerable	Browsing	Moriarty unpublished; NSW Key Threatening Process
Villous Mint-bush	<i>Prostanthera densa</i>	Vulnerable	Browsing	Moriarty unpublished; NSW Key Threatening Process
Prickly bush-pea	<i>Pultenaea aristate</i>	Vulnerable	Browsing	Moriarty unpublished;
Magenta Lilly Pilly	<i>Syzygium paniculatum</i>	Vulnerable	Browsing, ringbarking	NSW Key Threatening Process; Keith and Pellow 2005; NSW Scientific Committee 2004; The Office of Environment and Heritage 2012; Moriarty unpublished
Tall Astelia	<i>Astelia australiana</i>	Vulnerable	Browsing	Conservation Advice and Recovery Plan database
Grampians Pincushion-Lily	<i>Borya mirabilis</i>	Endangered	Browsing	Conservation Advice and Recovery Plan database
French Island Spider-Prchid	<i>Caladenia insularis</i>	Vulnerable	Browsing	Conservation Advice and Recovery Plan database
Illawarra Socketwood	<i>Daphnandra johnsonii</i>	Endangered	Browsing, ringbarking	Conservation Advice and Recovery Plan database
Fleurieu Leek Orchid	<i>Prasophyllum murfetii</i>	Critically Endangered	Browsing	Conservation Advice and Recovery Plan database
Grampians Globe-Pea	<i>Sphaerolobium acanthos</i>	Critically Endangered	Browsing	Conservation Advice and Recovery Plan database
Limestone Blue Wattle	<i>Acacia caerulescens</i>	Vulnerable	Browsing	Conservation Advice and Recovery Plan database
Pink-Lipped Spider-Orchid	<i>Caladenia behrii</i>	Endangered	Browsing	Conservation Advice and Recovery Plan database
Pomonal Leek-Orchid	<i>Prasophyllum subbisectum</i>	Endangered	Browsing	Conservation Advice and Recovery Plan database

COMMON NAME	SCIENTIFIC NAME	STATUS IN 2022	IMPACT	REFERENCE
Metallic Sun-Orchid	<i>Thelymitra epipactoides</i>	Endangered	Browsing	Conservation Advice and Recovery Plan database
Spiral Sun-Orchid	<i>Thelymitra matthewsii</i>	Vulnerable	Browsing	Conservation Advice and Recovery Plan database
Swamp Everlasting	<i>Xerochrysum palustre</i>	Vulnerable	Browsing	Carter and Walsh, 2010
Northern Corroboree Frog	<i>Pseudophryne pengilleyi</i>	Critically Endangered	Habitat removal, trampling on breeding sites	NSW Government, Office of Environment and Heritage
Long-footed Potoroo	<i>Potorous longipes</i>	Endangered	Habitat removal	NSW Key Threatening Process
Malleefowl	<i>Leipoa ocellata</i>	Vulnerable	Habitat removal, trampling on nests	Benshemesh, 2007; Benshemesh et al. 2020; Flora and Fauna Guarantee Scientific Committee, 2004; Hauser et al. 2014; Stockwell, 2003
Leadbeater's Possum	<i>Gymnobelideus leadbeateri</i>	Critically Endangered	Habitat removal	Macfarlane 1997.
Helmeted Honeyeater	<i>Lichenostomus melanops cassidix</i>	Endangered	Habitat removal	Yellingbo Investigation Draft Proposals Paper
Ecological community				
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (including yellowwood and lilly pilly, and plants of Fabaceae and Epacridaceae families)		Critically Endangered	Decrease in density and diversity through herbivory and ringbarking by rusa, sambar and hog deer	Bilney, 2013; Burns et al. 2021; Department of the Environment, 2015; Keith and Pellow 2005; Peel et al. 2005; Peel, 2010; Moriarty, 2009; Tapsell, 2019; Threatened Species Scientific Committee, 2008; NSW Key Threatening Process
Alpine Sphagnum Bogs and Associated Fens ecological community (including Southern Corroboree Frog, Northern Corroboree Frog, Baw Baw Frog, Booroolong Frog, Verreaux's Alpine Tree Frog)		Endangered	Disruption of soil and vegetation condition by trampling and wallowing, particularly by sambar deer	Brown et al. 2016; Department of the Environment 2015; Doolan et al. 2016; Threatened Species Scientific Committee, 2009; Wild and Magierowski, 2015
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland		Critically Endangered	Decrease in density and diversity through herbivory and ringbarking	Ward-Jones et al. 2019
River flat eucalypt forest on Coastal Floodplains		Critically Endangered	Decrease in density and diversity through herbivory and ringbarking	Burns et al. 2021
Eucalyptus ovata-Callitris oblonga Forest		Vulnerable	Decrease in density and diversity through herbivory and ringbarking	Threatened Species Scientific Committee
Grassy Eucalypt Woodland of the Victorian Volcanic Plain		Critically Endangered	Decrease in density and diversity through herbivory and ringbarking	Threatened Species Scientific Committee
Lowland Native Grasslands of Tasmania		Critically Endangered	Decrease in density and diversity through herbivory	Threatened Species Scientific Committee
Tasmanian Forests and Woodlands dominated by black gum or Brookers Gum		Critically Endangered	Decrease in density and diversity through herbivory and ringbarking	Threatened Species Scientific Committee

Appendix 6

Research and development priorities

This plan highlights research gaps where information is needed to support effective control of feral deer in Australia. These are informed by the Centre for Invasive Species Solutions Feral Deer RD&E Program Workshop for the Invasive Species Solutions 2030 Initiative (October 2021), and the National Wild Deer Management Workshop (November 2016). These gaps are listed in Table 1.

Table 6. Knowledge gaps and research and development needs to support feral deer control in Australia.

KNOWLEDGE GAP	Priority (H, M, L)
GOAL 1: Contain large populations and reduce their impacts	
Effectiveness of potential toxic baits (and registration of one or more) and delivery mechanisms	H
Assess animal welfare outcomes of control techniques	M
Optimal control strategies (ground vs aerial shooting, fencing, trapping, use of suppressors) for different settings, including peri-urban.	M
Cost-effective monitoring techniques	M
Criteria for prioritising control programs and strategies	M
Deer impacts in all landscapes, and damage-density relationships to inform control efforts	M
Understanding behaviour of feral deer to inform control techniques in rural and urban settings	M
Updated maps of deer distributions and modelling of future spread of deer	M
Habitat preferences for different species of feral deer	L
GOAL 2: Control small populations before they spread	
Tools for eradication (detection, delimitation, removal, proof-of-freedom), including artificial intelligence and automated cameras.	H
Protocols for eDNA sampling for presence/absence/proof of freedom	M
GOAL 3: Protect significant sites, threatened species and ecological communities from impacts	
Optimal control strategies (ground vs aerial shooting, fencing, trapping) for different settings.	M
Cost-effective monitoring	M
Environmental impacts of feral deer	M

Appendix 7

Communication messages

Table 6. Messages to support outcomes of this plan

MESSAGES
GOAL: Stop the spread of large populations and reduce their impacts
<ul style="list-style-type: none">• Feral deer are introduced species.• Feral deer have impacts on agriculture, the environment, threatened species, cultural assets, our special places, regenerating bushland, community safety, and they pose risks of disease transmission to livestock and wildlife.• Containing the current distributions now will save considerable management costs later.• Agencies, groups and landholders should share the load of managing feral deer.• Report sightings of feral deer in new areas, or new species of deer, to aid management of feral deer.• Landholders should participate in coordinated control programs, and work with neighbours to maximise control efforts.• Coordinated control is effective when:<ul style="list-style-type: none">– more feral deer are removed from their home range, than the recruitment rate (fawns born and immigrant deer to the area).– all landholders in the home range of the feral deer work together, irrespective of land use or tenure.• Aerial culling is the most effective way of reducing impacts quickly (outside of peri-urban areas).• Feral deer carcasses (from control activities) cannot always be recovered for other uses, when the time it takes to do so prevents minimum control targets from being met. Carcasses that need to be left, decompose quickly, returning nutrients to the soil. Large numbers of carcasses from intensive aerial culling operations do not sustain undesirable scavenger populations (such as foxes).• Coordinated programs adhere to high standards of safety, risk mitigation, welfare, training and skill.• There will always be opportunities for hunting in the current feral deer distribution area, because we cannot eradicate them here.
GOAL: Control or eradicate small populations before they spread
<ul style="list-style-type: none">• Prevention and early response is the most feasible and effective way to manage feral deer, particularly in peri-urban areas.• Report sightings of feral deer, particularly in new areas, and areas where the spatial extent is unknown.• Eradication or control of small populations requires proactive surveillance, rapid response, and no releases or escapes of deer.
GOAL: Protect significant sites, threatened species and communities from impacts
<ul style="list-style-type: none">• Control of important assets in the large population zone requires on-going (indefinite), sustained control of feral deer, or fencing.• Loss of, threatened species, ecological communities, and cultural assets is forever.• Prioritise protection where on-going control or eradication is feasible.
ALL GOALS: Tone and approach of messages for all goals
<ul style="list-style-type: none">• Be positive - focus on the values that the community wishes to protect or improve.• Encourage participation, be inclusive and sensitive, and bring all parties and jurisdictions together respectfully.• Raise the profile of feral deer issues and threats, without demonising or glorifying deer.• Provide up to date, trusted and accurate information.• Endorse best practice that reduces impacts most effectively and maximises welfare.

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National Feral Deer Action Plan

Draft National Feral Deer Action Plan 2022-2027
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