



NATIONAL CODE OF PRACTICE FOR THE EFFECTIVE AND HUMANE MANAGEMENT OF FERAL PIGS

Endorsed by the Terrestrial Vertebrate Working Group (TVWG)

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Available for download at pestsmart.org.au/toolkits/feral-pigs/

Associated documents relating to the National Code of Practice for the Effective and Humane Management of Feral Pigs include:

- NATSOP-PIG001 National Standard Operating Procedure: Trapping of Feral Pigs
- NATSOP-PIG002 National Standard Operating Procedure: Aerial Shooting of Feral Pigs
- NATSOP-PIG003 National Standard Operating Procedure: Ground Shooting of Feral Pigs
- NATSOP-PIG004 National Standard Operating Procedure: Poisoning of Feral Pigs with Sodium Monofluoroacetate (1080)
- NATSOP-PIG005 National Standard Operating Procedure: Poisoning of Feral Pigs using PIGOUT 1080 Baits
- NATSOP-PIG006 National Standard Operating Procedure: Poisoning of Feral Pigs with HOGGONE® Sodium nitrite Baits

This document outlines best practice guidelines for the effective and humane management of feral pigs in Australia.

The Code of Practice (CoP) outlines humane control strategies and their implementation while National Standard Operating Procedures (NATSOPs) describe control techniques, their application, and strategies to minimise any harmful impacts.

The national CoP and NATSOPs comprise model guidelines that set minimum animal welfare standards. They do not override CoPs and SOPs in jurisdictions where these documents have been developed, prior to or after the endorsement of these documents, to address specific management issues or to comply with relevant legislation. For example, the national-level CoP and NATSOP for the management of feral pigs are not relevant in New South Wales, which currently has both state-level CoP and SOPs in place (Sharp *et al.* 2022).

This CoP along with associated NATSOPs will be reviewed by the Terrestrial Vertebrate Working Group (TVWG) within 12 months of when they were endorsed, to manage any potential risks to operations throughout the country.

Jurisdictions conducting operations for feral pig control are encouraged to submit reports to the TVWG secretariat for discussion at either the 12 monthly review, or sooner if there are urgent matters that need to be raised. The reports should include:

- whether the national CoP and NATSOPs were implemented in their jurisdiction
- whether the national CoP and NATSOPs were effective
- apparent mistakes or oversights in the national CoP and NATSOPs
- unintended consequences or adverse events that occurred when implementing the national CoP and NATSOPs
- new techniques or modifications to existing techniques as a result of research or registration.

These reports will form the basis of reviews by the TVWG.

Acknowledgements

This document is based on the original work by Sharp, Cope and Saunders titled 'NSW Code of Practice and Standard Operating Procedures for the Effective and Humane Management of Feral Pigs' published in 2022. Much of the text presented here is a direct reproduction of the original source. This version primarily involves minor edits and formatting changes to adapt the original material for a national audience.

The TVWG acknowledges the significant research conducted by Trudy Sharp, Holly Cope and Glen Saunders which forms the basis of this text and acknowledge that the intellectual property and creative credit for most of this content remain with them.

Guidance, input and reviews were provided by the multi-jurisdictional membership of the TVWG.

Consultation and input were also provided by animal welfare NGOs, National Feral Pig Action Plan's Implementation Committee and Scientific Advisory Panel, Centre for Invasive Species Solutions, and operational and policy government staff.

Coordination was managed by the National Feral Pig Management Coordinator, Dr. Heather Channon.

Definitions and terms

Authorised officer (AO) – means a person trained and authorised as an authorised officer under relevant state or territory legislation to buy, possess, store, use, supply and dispose of restricted chemical products, including baiting products containing fluoroacetic acid for invasive animal control. Note: the nomenclature used to describe authorised officers may differ between states and territories.

Best practice management – a structured, consistent and adaptive approach to the humane management of pest animals aimed at achieving enduring and cost-effective outcomes. ‘Best practice’ is defined as the principles and techniques based on both scientific information and experience (e.g. Braysher 2017).

Distress – when the body responds to threats, uncertainty, or noxious stimuli to avoid significant detrimental impacts on the body.

Euthanasia – meaning ‘good death’ when used on pest animal control terms, it refers to the means by which an animal is killed that causes a rapid and irreversible loss of consciousness with minimum pain and distress to the animal rather than the reason for killing it (Morton 2010; American Veterinary Medical Association 2020).

Humane – the ‘humaneness’ of a pest animal control method refers to the overall welfare impact that the method has on an individual animal. A relatively more humane method will have less impact than relatively less humane method (see PestSmart 2021).

Humaneness – level of welfare impact or welfare cost (e.g., assessing level of humaneness is equivalent to assessing welfare impact or cost).

Humane vertebrate pest control – the development, selection and application of feasible control programs and techniques that avoid or minimise pain, suffering and distress to target and non-target animals⁶.

Pest animal – native or introduced, wild or feral, non-human species of animal that is troublesome locally, or over a wide area, to one or more persons, either by being a health and/or biosecurity hazard, a general nuisance, or by destroying food, fibre, or natural resources.

Sentient – an animal is sentient if they have the capacity to have negative and positive feelings, perceptions or subjective experiences that matter to the animal and that affects its welfare (Ledger and Mellor 2018).

Welfare – the physical and emotional state of an animal; pain and suffering are important aspects of poor welfare outcomes; assessing welfare of animals will consider their nutritional, environmental, health, behavioural, and mental needs (e.g., Broom 1999; Littin et al. 2004).

Preface

This Code of Practice (CoP), and relevant National Standard Operating Procedures (NATSOPs), provides current information and guidance to government agencies, land managers and pest animal controllers involved in the control of feral pigs in Australia. The aim is for control programs to be conducted in a way that reduces the negative impacts of feral pigs using the most humane, target-specific, economic and effective techniques available.

This revision of national CoPs and SOPs builds on the extensive work conducted by NSW over several years (see Sharp et al. 2022), which provided the springboard for expansion to a national approach. This national CoP and associated NATSOPs provide the most relevant and up-to-date information to support best practice feral pig management.

Outdated information has been removed, while new information has been added to reflect the advancements and changes specific to feral pig management across Australia.

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INTRODUCTION

All pest animal management activities must aim to minimise individual animal suffering while optimising the goals of the control program. This requires the use of the most humane methods that will achieve the control program's aims. Animals subjected to control programs are sentient, meaning that they can experience both positive and negative emotions such as pain and fear. Minimising animal suffering is a priority regardless of the status given to a particular pest species or the extent of the damage or impact they cause.

While the ecological and economic rationales for the control of pests such as the feral pig are frequently documented, of equal importance is an ethical framework under which these pests are controlled.

A Code of Practice (CoP) provides overarching context for the management of feral pigs in Australia. The CoP encompasses all aspects of controlling a pest animal species as determined by best practice principles, relevant biological information, guidance on choosing the most humane and appropriate pest control technique, and how to effectively implement management programs.

This CoP provides national guidance and is based on current knowledge and experience of feral pig control. It will be revised as required to include advances in knowledge and the development of new control techniques and strategies.

The National Standard Operating Procedures (NATSOPs) associated with this CoP provide procedural details for pest animal control and ensure that an ethical and humane approach (including the recognition of, and attention to, the welfare of all animals directly or indirectly affected by pest control programs) is uniformly applied. The NATSOPs are written for each pest control technique in a way that describes the procedures involved for specific control methods, as applied to a nominated pest animal species, and the relevant animal welfare issues applicable. They provide a guide to support and improve pest control programs.

BEST PRACTICE IN PEST ANIMAL MANAGEMENT

From an animal welfare perspective, it is highly desirable that pest animal control programs are efficient, effective, coordinated and sustained. These attributes are required to reduce, or eradicate, pest populations and avoid the need for repeated large-scale killing for pest control. The approach to managing pest animals continues to evolve as lessons are learned and new tools and information become available. The emerging best-practice approach aims to reduce or eradicate pests based on measurable economic and environmental parameters.

Pest animal control is one aspect of an integrated approach to the management of production and natural resource systems; management of other factors may be required to achieve a desired result. For example, lamb production may be affected by weed control and nutrition in addition

to predators. When planning pest animal management, important steps to consider include identifying:

1. triggers for undertaking pest animal management. Are there community or political pressures to act or not act on pests, an expectation that pest animals should or should not be controlled? Pest control is unlikely to be effective unless strong local or broader will exists for action, including committing the necessary resources
2. the lead agency to take responsibility for bringing together and engaging with all stakeholders including other relevant government departments, animal welfare regulators, relevant community groups, landholders, shooting associations
3. the problem. Pest management is complex and understanding the nature of the problem is important for planning purposes. For example, the problem could be impacts on native plants or animals, agricultural productivity, or aesthetic impacts (e.g., landscaping). Many factors, in addition to pest control, will intersect with the problem
4. the area of concern. It can help to remove agency and property boundaries (nil tenure) so that the problem is viewed at the landscape-level, rather than at the level of individuals, groups, or agencies. Landscape-scale assessment is also required because pest animals move large distances and can cross jurisdictions. Property and agency boundaries (tenure-blind approach) can be addressed when agreement is reached on the approach.
5. management units for planning and prioritising efforts. Units will be determined by water bodies, mountain ranges, fences, habitat preferences, vegetation, resources, urban density, and other landscape features. While it is preferable to work in units that will restrict the movement of pests, it may not be practicable.

Implementing effective and humane pest animal control programs requires a basic understanding of the ecology and biology of the targeted pest, and other species that may be affected directly (non-targets) or indirectly (e.g., prey species) by a control program. Managers should make themselves aware of such information (see references at the end of this document for recommended reading). Pest animal control programs are usually not implemented until the impacts of the pest animal are no longer tolerated. However, pest animal control programs that are implemented prior to this point, when the population of the target pest is low, are more likely to achieve eradication from that area. Proactively targeting pests with low population densities also reduces the overall number of animals controlled, compared to reactive controls, which is an important animal welfare consideration.

ANIMAL WELFARE AND HUMANENESS

Pest animals cause significant damage and risks to the environment, agricultural production and to public health. The humaneness and effectiveness of a pest control technique is influenced by the experience and skills of the pest controller. Attention to detail is necessary for delivering effective

programs with humane outcomes. Details should be followed for the timing and coordination of the pest control, bait delivery methods, lethal dose rates, and type or calibre of firearm and ammunition used in pest control programs. This COP and the associated NATSOPs provide a guide to the application of pest control methods, which will minimise and prevent the risk of negative welfare impacts for target and non-target animals.

Sharp and Saunders (2008; 2011) and PestSmart (2021) provide resources for assessing the relative humaneness of each pest animal control method. The assessment can be applied to any pest control technique. A 'humaneness assessment' can also be conducted to evaluate the impact of a pest control technique on individual animals; the humaneness assessment is based on the Five Domains Model developed by Mellor and Reid (1994) and include:

1. Nutrition – water or food deprivation, malnutrition
2. Environmental – exposure to excessive heat or cold or other elements
3. Health – disease or physical injury
4. Behaviour – spatial or interactive restriction
5. Psychological – includes impacts from the first four domains (e.g., thirst, hunger, anxiety, fear, nausea, pain, boredom, depression, frustration, loneliness, distress) and any other cognitive awareness of external factors.

Compromise in one or all the physical indicators (i.e., nutrition, environment, health, behaviour) is used to infer potential negative psychological impacts. The assessment can be applied to different methods and the outcomes used to inform management.

Another important animal welfare consideration when conducting pest control programs is to target the pest populations when numbers are low, as appropriate. This approach will reduce the overall number of animals destroyed in the pest control, compared to enacting programs only after the impacts become problematic. Most people consider the management of pest animals to be acceptable if the activities are humane and justified (e.g., Mellor & Littin 2004). Pest controllers also need to continuously improve their approach to pest control, including trialing and updating techniques with new, increasingly humane, and cost-effective methods. There is also a continuing need to improve current control methods or replace them with more humane and effective alternative approaches where possible as they emerge.

FERAL PIG MANAGEMENT

Background

Feral pigs (*Sus scrofa*) are estimated to inhabit 45% of Australia (as at 2008), occurring in all states and territories, but most abundantly in New South Wales and Queensland. Population size

estimates vary between 3.0 million and 4.4 million, but their distribution and abundance can vary markedly from year to year according to environmental conditions¹⁸. They can increase their population size at a rate of 86% per year in good seasons but can also reduce by 50% in periods of drought. Long term and consistent action are required by land managers, with at least 70% of the population needing to be removed at least annually to prevent rapid population recovery. Feral pigs are habitat generalists, their prime requirements being an adequate supply of water, food and cover. The reproductive potential of feral pigs is more similar to that of rabbits than to that of other large mammals in Australia. Fecundity increases with age and body weight but can be strongly affected by seasonal conditions.

Under favourable conditions, breeding can occur throughout the year and sows can produce two weaned litters every twelve to fifteen months, with an average of six piglets per litter.

This gives feral pigs the capacity to recover quickly from the effects of management programs or other setbacks such as droughts.

Feral pigs are responsible for many types of agricultural damage. They prey on newborn livestock, eat and destroy crops, damage fences, infrastructure and water sources, reduce yields of sugarcane and horticultural crops, and compete with stock for feed by eating and/or damaging pasture. There are no reliable estimates of the national cost of feral pig damage to agricultural production, although it is likely significant but highly variable dependent on seasonal conditions. The most important environmental impacts of feral pigs are habitat modification through selective feeding, trampling damage and rooting for underground parts of plants and invertebrates, as well as predation on, competition with, or disturbance of, a range of native animals. They also spread weeds, fungal diseases of plants and can act as hosts or vectors of several endemic and exotic diseases and parasites that can affect other animals, including domestic livestock and humans. Their preference for wetlands and riparian ecosystems also leads to decreased water quality.

Feral pig management activities on privately owned and jointly managed land (e.g. Indigenous Protected Areas) land by third parties should only be conducted once consent has been obtained from land managers, including Traditional Owners.

For further information please see:

- Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs:
<http://www.environment.gov.au/biodiversity/threatened/threat-abatement-plans/approved>
- PestSmart: <https://pestsmart.org.au/toolkits/feral-pigs>

Primary and supplementary control techniques

Pest control programs should be cost-effective to ensure ongoing support and adoption by stakeholders. The techniques used within a control program need to be complementary and lead

to a maximum impact reduction, which often requires reducing pest animal densities to low levels over a large scale and maintaining this level of population suppression. This leads to a situation where the need for ongoing control is minimised and rates of re-population and re-invasion reduced. Follow-up control programs, where the initial reduction is maximised, are also much cheaper to implement as the target population is relatively small.

Control techniques can be seen as primary or supplementary based on the following general principles:

Primary techniques are those that can achieve rapid pest population knockdown over large areas in a cost-effective way.

Supplementary techniques are generally only effective in helping to maintain pest population suppression once densities have already been reduced to low levels. For example, in the management of feral pigs, ground baiting may be viewed as a primary method of control and supplementary techniques are used as a follow-up, e.g., ground shooting.

State and territory legislation differs in relation to aircraft specifications, training and operational requirements for aerial shooting as well as for 1080 baiting. Regional variations can also occur within species. For example, aerial shooting of feral pigs would be considered a primary technique in extensive or inaccessible areas where visibility is good. In areas that can be reached by vehicle and free feeding can be successfully used to attract pigs, primary control of populations could be baiting and trapping. For effective control, regionally appropriate selection of at least one primary control technique and one supplementary control technique should be utilised to help satisfy general biosecurity duty requirements.

Spatial scale of control programs is important. To achieve cost efficiencies and accommodate the movement behaviour of the target pest, the area under control may need to be a tenure blind collaboration of many adjoining land managers. This is particularly the case for highly mobile pest animals such as feral pigs.

Poorly executed control programs can simply become sustained shooting operations that do little to achieve long-term successful outcomes. This in turn can lead to sporadic implementation of crisis management programs where pest numbers have become unacceptable, but the outcome usually becomes sub-optimal. Programs that achieve large population knockdowns and prevent rapid population recovery, followed by sustained suppression at low densities, will destroy fewer animals over the long term than repeated shooting operations that require larger numbers of animals to be removed each time.

A rotation of different combinations of primary and supplementary techniques can also be important. Pest animals can readily become habituated to a particular technique (e.g., bait aversion) that may require inclusion of another method (e.g., aerial shooting). A critical factor to consider is timing of control operations. Time of the year can mean targeting a biological weakness in the pest animal (e.g., a period of food and water stress within the environment) when bait

uptake might be maximised. Alternatively, application of control can align with the need for the asset to be protected when it is most vulnerable e.g., prior to lambing.

Feral pig management methods

Integrated management using a range of control techniques produces the best results, but a lack of reliable information on control costs and/or damage being caused is a barrier to adoption of some techniques by land managers. This lack of reliable data also impacts on the participation of some land managers in locally coordinated management groups. In the case of feral pigs there is also the complication that they can be viewed by some as a major pest of the environment and agriculture, and by others as a resource and source of income. Control strategies should consider both of these viewpoints.

The most commonly used feral pig control techniques are lethal baiting, shooting, trapping and exclusion fencing. There are currently no biological or fertility control agents available for use against feral pigs in Australia. Cost-effectiveness, humaneness, efficacy and efficiency of each control technique as well as operator capability and capacity need to be evaluated by every program.

All control methods should be avoided during the farrowing period, where possible. Dependent young will experience significant negative welfare impacts if they are not killed humanely if their mother is killed.

Please note: For all control methods, relevant state and territory legislation, product label requirements and any permit conditions must be adhered to and will take precedence over this CoP.

A brief evaluation of the humaneness of control techniques follows:

Humaneness of control techniques

Lethal baiting

Lethal baiting is a cost-effective method of feral pig control in extensive rangeland areas; however not all poisons are considered equally humane. Depending on the poison used, target animals can experience pain and suffering, sometimes for an extended period, before death. Non-target animals including native species, such as quolls, working dogs and livestock could also potentially be exposed to poisons either directly by eating baits intended for pest animals (primary poisoning) or through the scavenging of tissues from a poisoned animal (secondary poisoning). Sodium fluoroacetate (1080) is currently used for feral pig control in Australia. Yellow phosphorus (CSSP) and warfarin have previously been used but are considered to be inhumane. Warfarin is not registered for feral pig control in Australia. Yellow phosphorus is only registered for use in NT; a NATSOP for yellow phosphorus is therefore not included in this document. Microencapsulated sodium nitrite has been

developed as a toxin and is now registered as HOGGONE meSN Feral Pig Bait with the Australian Pesticides & Veterinary Medicines Authority (APVMA) for feral pig control.

1080

Initial signs of poisoning from 1080 in feral pigs will typically appear 1-2 hours after being ingested, and is typified by salivation, jaw chomping, vomiting, increased lethargy, and laboured respiration often with white froth around the mouth and nostrils. Some pigs exhibit signs of central nervous system disturbance including hyperexcitability, squealing, manic running, paralysis or convulsions, followed by coma and then death. Other animals may lie quietly, breathing slowly and laboriously until death. Time to death is variable depending upon the amount of 1080 absorbed but is usually around 4 to 6 hours after ingestion under field conditions.

There is presumed to be minimal pain or distress from when the bait is eaten until first signs of toxicity; however, nausea and discomfort are likely before and during vomiting and retching. In the later stages, when severe central nervous system (CNS) dysfunction has developed, it is unknown if animals are perceiving pain. If animals are conscious during the convulsive episodes or if they become conscious afterwards it is possible that they may experience pain and anxiety. There is also potential for injuries to occur after the appearance of clinical signs.

Relatively large amounts of 1080 must be used in baits to kill feral pigs, creating a potentially serious risk of primary poisoning in non-target species which may otherwise have an innate tolerance to 1080.

Meat baits can be used to control feral pigs in South Australia, Northern Territory and selected local government areas in Queensland and in Western New South Wales, in accordance with permit conditions approved by the APVMA. Bait size, composition, and placement density requirements, together with time of year, are key factors to minimise risks to non-target species from meat baiting and to maximise bait uptake by feral pigs¹⁹.

Individual PIGOUT baits are also of potential concern as they contain a high concentration of 1080 (72 mg per bait) in the core of each bait, which is more than 10 times the concentration used for wild dog baits (6 mg). The majority of 1080 in these baits is encapsulated within a waxy core that reduces non-target exposure and increases target specificity. When baiting with field-dosed grain or pellets (or meat and fruit baits in some regions as permitted by the APVMA), there is potential for dose variability based on the amount of toxic bait consumed per pig.

Sodium nitrite (HOGGONE)

Sodium nitrite, a common human food preservative, is fast-acting, highly toxic to pigs, and is relatively more humane than 1080^{20, 21}. Ingestion of sodium nitrite leads to the formation of methaemoglobin in red blood cells resulting in anoxia, which is similar to carbon monoxide poisoning, resulting in unconsciousness before death. HOGGONE baits containing micro-encapsulated sodium nitrite are less hazardous for operators and do not cause secondary poisoning through muscle tissue. Other livestock and native species cannot access HOGGONE bait from pig-

specific feeders (bait boxes) required to be used by the APVMA, but sometimes they can access small crumbs of HOGGONE, likely non-toxic amounts, that pigs have pulled out from the feeder and dropped on the ground outside of the feeder.

Sodium nitrite is fast acting, resulting in unconsciousness and death within about two hours in the pig. This is a much shorter timeframe than other toxins currently used for feral pig control in Australia e.g. sodium fluoroacetate (1080; 4-6 hours). Sodium nitrite does not cause severe clinical symptoms, and animals appear to show signs of distress for only a short period (5 to 10 minutes) prior to reduced consciousness. Signs of sodium nitrite poisoning progress rapidly in pigs and are limited to progressive lethargy, in-coordination, limited vomiting in some animals, increased respiratory rate, difficulty breathing when close to death, limited terminal seizures, and coma.

Trapping

Fixed panel or mesh traps must be inspected at least once daily and should be set up to provide shade and shelter. Pigs have poor thermoregulation and can suffer greatly when exposed to extremes of heat and cold. In hotter areas, setting the trap in the evening and checking early in the morning will minimise some of the suffering associated with thirst and heat-stress. Duration of feral pigs being confined in the trap should be less than 12 hours and maximum time held is 24 hours. The trap should be constructed in a way so as not to cause injury from loose wire, sharp edges or malfunctioning gates. Also, a small mesh size should be used to minimise injuries to the pigs' snouts if they charge at the trap when attempting to escape. Trap selection needs to be appropriate to the size of the group being targeted to ensure that all pigs in the group are trapped.

A patented, double-walled net system can also be used for trapping feral pigs. Nets are initially suspended to allow feral pigs to move underneath the net to consume free feed. Once the net is lowered or dropped, pigs cannot escape from the trap.

Remotely activated 'drop-down' gates, where the gate is dropped behind pigs after they have been detected by cameras and motion detectors, must only be operated by a trained and experienced operator, following instructions from trap manufacturers, to minimise any risks of crushing or striking pigs and causing serious injuries. The use of cameras allows for the remote monitoring of trap sites and checking of traps. The use of remotely activated drop-down traps where the whole perimeter is dropped around feral pig(s) after they have been detected by cameras and motion detectors are not preferred due to risks of serious injuries from crushing or striking pigs. These traps must only be operated by trained and experienced operators to avoid negative welfare impacts. Pigs injured by 'drop-down' traps will experience considerable suffering as they can't be quickly and humanely euthanased since they will usually be some distance away from the remote operator.

Pigs trapped in fixed panel, mesh or net traps must be destroyed by a single fatal head (brain) shot as quickly and humanely as possible.

Young piglets may be trampled underfoot especially when the adult animals are stressed or panic (e.g., in the presence of humans). Very small piglets (<5kg) can be shot or alternatively caught by

hand and humanely killed with a concussive blow to the head after the larger pigs have been shot. If lactating sows are caught in a trap without their young, efforts should be made to find dependent piglets and kill them quickly and humanely.

Although pig traps are designed for the capture of feral pigs, there is still a risk of capturing other species. Use of a pig-specific gate trip mechanism minimises the risk of catching some species e.g., wallabies, whilst the placement of a steel post across a funnel trap entrance at a height of 1 metre above the ground will prevent cattle from entering.

Non-target animals that are caught but not injured should be released at the trap site. If they are injured, appropriate advice should be sought immediately to determine if treatment is feasible.

Severely injured non-target animals must be euthanased using an appropriate method (see [NATSOP-GEN001 National Standard Operating Procedure: Methods of Euthanasia](#)).

Shooting

Ground shooting

Shooting can be a humane control method when: it is carried out by competent, accurate and responsible shooters; the correct combination of firearm and ammunition and optimum shot placement are used; the target animal can be clearly seen and is within range; and all wounded animals are promptly located and euthanased humanely. Head (brain) shots are the preferred shot placement when prevailing conditions are appropriate, e.g., stationary target.

Dependent young will experience significant negative welfare impacts if they are not euthanased immediately after their mother is shot. Shooting may also have negative effects on surviving animals in the same social groups.

Trained dogs are sometimes used to seek out, contain and/or bail pigs prior to shooting. When undertaking pest control using ground shooting, it is unlawful to set a dog onto a feral pig with the intention of bringing down, holding or attacking. Dogs may not be muzzled in order that the dog may be able to defend itself and/or the dog handler if attacked. Permission must be granted by relevant landholders before using dogs on their property. As soon as the feral pig is safely bailed up with no direct physical contact by authorised personnel and/or the dog(s) then the feral pig shall be immediately euthanized by using appropriate calibre and /or type of firearm. At all times, the dog handler should ensure that his/her actions are appropriate to the situation including, but not limited to, safety to themselves: safety and wellbeing of the dog(s) and ensuring that the feral pig is treated humanely.

Ground shooting programs may be enhanced through the use of thermal imaging and night vision equipment (e.g. thermal spotters, thermal or night vision scopes, and thermal drones). These tools can increase detection rates and reduce disturbance to target animals (e.g. compared to traditional spotlighting). They can increase the probability of being able to locate and target undisturbed animals, thereby increasing control effectiveness and welfare outcomes.

Aerial shooting

All aerial shooting programs in Australia must adhere to the relevant state and territory instructions, and regulatory and legislative requirements. Aerial shooting of feral pigs from a helicopter can be a humane control method when: it is carried out by highly skilled and experienced shooters and pilots; the correct firearm, ammunition and shot placement is used; and if wounded, animals are promptly located and euthanased.

With shooting, initial shots to the chest do not render the animal instantaneously insensible and time to death is slower whereas a well-placed initial shot to the head to destroy the brain will result in instantaneous insensibility and a quicker death. However, with aerial shooting, chest shots are generally preferred for smaller individuals since the heart and lungs are the largest vital area and accurate shots to the head to destroy the brain can be difficult to achieve. This is particularly the case for animals that move quickly and erratically.

Head shots should only be attempted when conditions are ideal to avoid wounding. Shooting at other parts of the body is unacceptable.

Compared with ground shooting, aerial shooting allows the delivery of multiple shots in quick succession to ensure a rapid death. There is also a greater opportunity for rapid follow-up if an animal is wounded. There must be a minimum of two shots per animal – one of which must be a chest shot.

Thermal assisted aerial culling (TAAC) is a new aerial shooting technique²² utilised in some states and territories. This technique usually incorporates a dedicated thermal camera operator (or thermographer) into the aerial shooting crew to search for and identify target animals. In suitable environments and habitats, this method can increase feral pig detections, particularly in dense vegetation. TAAC can also improve the efficacy and efficiency of aerial shooting programs aiming to remove low-density feral pig populations from the landscape to achieve localised eradication. In addition to dedicated TAAC operations, conventional aerial shooting programs can also be enhanced by using thermal imaging equipment (e.g. thermal binoculars or monocular), when environmental conditions are suitable.

Use of Judas pigs

A captured 'Judas' pig is fitted with a tracking collar and released so that it can locate and join feral pig groups. This method is useful to find difficult to locate groups, animals in low- density populations, or survivors of other control methods that have become wary. Capture, handling and restraint of pigs for use as Judas animals can cause anxiety and sometimes pain or injury if they struggle to escape. Repeatedly being isolated and having to find other pigs may cause fear and anxiety. Tracking and the nearby shooting of cohorts may also be a source of distress.

The lightest collar/transmitter available should always be used (<5% of the body weight of the animal). The collar should be properly fitted for the comfort and safety of the animal. It should fit snugly enough to prevent it from coming off or chafing the neck, but it should also be sufficiently

loose as to be comfortable and not interfere with swallowing or panting. The fitting of a collar to a feral pig is not recommended without the use of sedatives. This makes the technique generally unsuitable for routine management and it is best restricted to use as a research technique. For research studies, animal ethics approval needs to be obtained prior to fitting of any movement tracking collars to feral pigs.

Exclusion fencing

Despite being expensive to establish, pig-proof enclosures can provide long term environmental and production benefits to properties e.g., protecting lambing paddocks, high value crops or threatened ecosystems.

Exclusion fencing over large areas is an option for landholders to reduce and share fencing costs by enclosing an entire group of neighbouring properties within the one perimeter fence. However, fences need to be designed appropriately for the animals that are being excluded, as well as those being enclosed, to maximise efficacy and reduce animal welfare impacts. There is also the caveat that exclusion fencing is only effective where the fencing itself is regularly inspected and repaired where required. Otherwise, they will be breached.

Although fencing can act as a barrier to pigs it can also have negative effects on non-target species (such as kangaroos, turtles and emus) that are excluded from or contained within a fenced area. Fences will prevent access to familiar sources of food, water and shelter and potentially disrupt social groups and alter natural dispersion. Entanglement in fences can also cause significant injuries and death and they can prevent the movement of animals to safer areas during bushfires or flooding.

A number of actions can be taken to prevent the impacts of fencing on non-target animals. Fences can be designed to allow movement of some species by incorporating species-specific access points (e.g., turtle gates) or to minimise entanglement (e.g., by using highly visible top wires). Fences should also be checked frequently, especially in the immediate period after construction, to allow prompt removal or euthanasia of entangled animals. If non-target animals are enclosed and their abundance needs to be reduced, they must be culled using an acceptable and humane technique (i.e., shooting). In addition, if animals congregate around a new fence and are exhibiting signs of distress (e.g., pacing, not eating or drinking) it may be necessary to euthanase them using a humane method.

Refer to the following RSPCA website for further perspectives on the humaneness of exclusion fencing:

<https://kb.rspca.org.au/knowledge-base/what-are-the-risks-to-wildlife-associated-with-barrier-and-cluster-fencing/>

For further information on pest exclusion fence design, please refer to sites such as:

<https://www.wool.com/globalassets/wool/sheep/pest-animals/wild-dog-exclusion-fencing--australian-wool-innovation/kondinin-group-research-report---exclusion-fencing.pdf>

Similar pest fence designs are also available from the websites of commercial fencing manufacturers.

Table 1: Humaneness, efficacy, cost-effectiveness and target specificity of feral pig control methods

Control techniques	Acceptability regarding humaneness and Relative humaneness score (Part A [1-8], Part B [A-H]**)	Efficacy regarding population reduction	Cost-effectiveness	Target specificity	Comments
Ground baiting with 1080 <i>Primary</i>	Acceptable Score: 1E-1F	Effective	Cost-effective	Relatively large amounts of 1080 are required to kill pigs; risks to non-target species can be minimised by removing susceptible animals from baiting areas, dyeing bait in accordance with legislative requirements, using feral pig-specific feeding systems, timing and time of distribution and covering bait ¹⁹ . Strategic ground baiting uses fewer baits than aerial baiting programs. Uneaten baits can be collected and destroyed.	Currently the most cost-effective technique available. 1080 ingestion can also kill non-target native and introduced vertebrate species, including commercial livestock. 1080 is toxic to humans; operators need to take precautions to safeguard against exposure.
Aerial baiting with 1080 <i>Primary</i>	Acceptable Score: 1E-1F	Effective	Cost-effective	Relatively large amounts of 1080 are required to kill pigs; ensure compliance with permit conditions (including bait size (500g) and bait density) and consider time of year for meat baiting of feral pigs ¹⁹ . Uneaten baits cannot be collected.	Effective for broad scale control in remote areas under permit conditions in specified state and local government areas. 1080 ingestion can also kill non-target animals; ensure compliance with permit conditions for meat baiting. 1080 is toxic to humans; operators need to take precautions to safeguard against exposure.
Sodium nitrite baiting <i>Primary</i>	Acceptable Score: 1D	Effective	More expensive than 1080 ground baiting	Lower risk of primary poisoning in non-target animals as other species are less sensitive to sodium nitrite poisoning and bait must be deployed in a pig-specific bait station.	Feral pigs are particularly susceptible to sodium nitrite. It is more effective and faster acting than 1080, and there are fewer restrictions on who can use and be supplied with the baits. Sodium nitrite baits must be deployed in a pig specific bait station and free feeding procedure followed.

Aerial Shooting <i>Open country: Primary</i> <i>Closed country: Supplementary</i>	Acceptable Score: 4B (chest)	Effective	More cost-effective when pig density is high. Cost also dependent on type of helicopter used.	Target specific	Provides high level reductions in feral pig populations. Use in combination with on-ground management methods to remove remaining animals as they become aware of helicopters over time. Monitoring of population change by aerial crew over time is important. Thermal assisted aerial culling (TAAC) may be useful, particularly in closed country, to remove remnant individuals. This method may be more expensive over conventional aerial shooting due to the number of personnel involved, different type of helicopter required (at a higher cost /hour), shorter time in the air due to the use of thermal imaging equipment and therefore increased downtime.
Ground shooting <i>Supplementary</i>	Acceptable Score: 2A (head), 2D (chest)	Not effective	Not cost-effective	Target specific	Labour intensive, only suitable for smaller scale operations.
Trapping with fixed mesh/panel traps <i>Supplementary</i>	Acceptable Score: 4A	Can be in certain situations	Can be in certain situations	May catch non-target animals	Important control technique in areas where baiting or aerial shooting is not possible. Not practical for large scale control.
Trapping with remotely activated drop-down doors	N/A	Can be in certain situations	Can be in certain situations	May catch non-target animals if not seen before activating trap door remotely.	Important control technique in areas where baiting or aerial shooting is not possible. Not practical for large scale control. Reliable mobile coverage must be available

<i>Supplementary</i>					If used, operator should be trained and experienced.
Trapping with drop-down traps <i>Supplementary</i>	N/A	Unknown	Expensive	May catch non-target animals if not seen before activating trap door remotely.	Other trap designs are available that are more humane, effective, simple to use and much cheaper. Reliable mobile coverage must be available If used, operator should be trained and experienced.
Use of Judas pigs <i>Supplementary</i>	N/A	Effective	Relatively cost-effective compared with searching for pigs from helicopters or on foot	Target specific	Can be a useful adjunct to other control methods. Effective if local eradication is the aim. Requires specialised equipment and skilled operators
Exclusion fencing <i>Supplementary</i>	N/A	Limited	Expensive	Can be in certain situations	Fencing can be effective for small, critical (economically or environmentally) areas, though the maintenance costs are high.

Footnotes Table 1

* Acceptable methods are those that are relatively humane when used correctly in accordance with the applicable Standard Operating Procedure. Conditionally acceptable methods are those that, by the nature of the technique, may not be consistently humane. There may be a period of poor welfare before death.

** From assessments conducted using a model to assess the relative humaneness of pest animal control methods (Sharp and Saunders 2011)¹⁵. Humaneness score (AB) consists of Part A - welfare impact prior to death, scale of 1 – 8, less suffering to more suffering and Part B - mode of death, scale of A – H, less suffering to more suffering. For assessment worksheets and matrix of relative humaneness scores see: <https://pestsmart.org.au/toolkit-resource/feral-pig-control-methods-humaneness-matrix/>

N/A = Humaneness score not available.

Control techniques are classified as primary (maximum effect) or supplementary (follow-up). In some situations, techniques can alternate between primary and supplementary.

† Research required to assess relative humaneness and potential welfare impacts

RELEVANT LEGISLATION

Vertebrate pest controllers should familiarise themselves with relevant Commonwealth, state, or territory legislation (Table 2).

Table 2 The most relevant legislation for each jurisdiction and strategic plans for the management of feral pigs.

Legislation	Intent relating to feral pigs
Commonwealth	
<i>Environmental Protection and Biodiversity Conservation Act 1999</i>	<p>Feral pigs are included under the EPBC Act-listed Key Threatening Process (KTP) 'novel biota and their impacts on biodiversity' due to competition, herbivory and habitat degradation impacts. A process is considered a KTP, and eligible for listing under the EPBC Act, if it threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community</p> <p>https://www.dcceew.gov.au/environment/biodiversity/threatened/key-threatening-processes/novel-biota-impact-on-biodiversity</p> <p>Predation, habitat degradation, competition and disease transmission by feral pigs was listed as a key threatening process under section 168 of the EPBC Act in 2002.</p> <p>https://www.dcceew.gov.au/environment/biodiversity/threatened/key-threatening-processes/feral-pigs</p>
<i>Airspace Act (2007)</i>	Relevant legislation to aerial shooting of feral pigs and other vertebrate pest species.

<i>Civil Aviation Act 1988</i> and Part 138 (Aerial Work Operations) – Manual of Standards 2020	
Australian Capital Territory	
<i>Pest Plants and Animals Act 2005</i>	Feral pigs are listed as pests on the Pest Plants and Animals (Pest Animals) Declaration 2005 list
<i>Nature Conservation Act 2014</i>	Feral pigs cannot be kept as livestock
<i>Animal Welfare Act 1992</i> <i>Animal Welfare Regulations 2001</i>	Prohibits cruelty to all animals; ensures animals are controlled in a humane way
New South Wales	
<i>NSW Biosecurity Act 2015</i> <i>Biosecurity Regulation 2017</i>	Invasive species management is a shared responsibility for all community members. For feral pigs, landowners (both private and public) are required to control feral pigs on lands they own, occupy or manage to minimise the risk of any negative impacts on their lands or those of their neighbours. It is illegal in NSW for a person to keep, move or release a feral pig. The NSW Biosecurity and food Safety Strategy 2022-2030 (https://www.dpi.nsw.gov.au/biosecurity/managing-biosecurity/nsw-bfs-strategy-2022-2030) sets the strategic vision for biosecurity and food safety in NSW. Regional strategic pest animal management plans outlines priority pest animals needing to be managed and how this can be done (https://www.lls.nsw.gov.au/help-and-advice/pest-control/vertebrate-pest-animals/feral-pigs)
<i>Game and Feral Animal Control Act 2002</i>	On specified public lands, feral pigs 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>Biodiversity Conservation Act 2016</i>	Feral pigs are listed as a Key Threatening Process for predation, habitat degradation, competition and disease transmission
<i>Prevention of Cruelty to Animals Act 1979</i> <i>Prevention of Cruelty to Animals Regulation 2012</i>	Prohibits cruelty to all animals; ensures animals are controlled in a humane way
Northern Territory	
<i>Territory Parks and Wildlife Conservation Act 2006</i>	Feral pigs are classified as a pest (feral – prohibited entrant)
<i>Animal Welfare Act 1999</i> <i>Animal Protection Act 2018</i> <i>Animal Welfare Regulations 2000</i>	Prohibits cruelty to all animals; ensures animals are controlled in a humane way
Queensland	

<i>Biosecurity Act 2014</i>	The feral pig is a category 3, 4 and 6 restricted invasive animal under the Biosecurity Act 2014. These categories mean that feral pigs cannot be distributed, gifted, sold, traded or released into the environment (category 3), moved (Category 4) or fed (category 6). This 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).
<i>Animal Care and Protection Act 2001</i> <i>Animal Care and Protection Regulation 2012</i>	Prohibits cruelty to all animals; ensures animals are controlled in a humane way.
<i>Nature Conservation Act 1992</i>	Applies (primarily) to National Parks, and also other classes of protected areas. National Parks are to be managed “to provide, to the greatest possible extent, for the permanent preservation of the area’s natural condition and the protection of the area’s cultural resources and values” including the management of non-native species. Activities related to the management of non-native species, including feral pigs, must have written approval of the Chief Executive.
<i>Forestry Act 1959</i>	Applies (primarily) to State forests, and also other classes of protected forest areas. State forests are to be managed for “the permanent reservation of such areas for the purpose of producing timber and associated products in perpetuity and of protecting a watershed therein” including the management of pest species. Activities related to the management of pest species, including feral pigs, must have written approval of the Chief Executive.

<i>Medicines and Poisons Act 2019</i>	This Act is regulated by the Queensland Department of Health and commenced on 27 September 2021. It allows for landholders, their adult employees, and agents to be authorised to control invasive animals with poisons classed as restricted S7 poisons and included in schedule 1 of the Medicines and Poisons (Poisons and Prohibited Substances) Regulation 2021. Landholders, their employees and agents, dealing with RS7 poisons for invasive animal control must comply with the requirements of the Queensland Health Departmental Standard – Dealing with restricted S7 poisons for invasive animal control.
South Australia	
<i>Landscape South Australia Act 2019</i> <i>Landscape South Australia Regulations 2020</i>	Declarations and control notices (under regulations) and the Declared Animal Policy – Feral pigs (2002) for feral pigs specify it is an offence to move, sell, keep or release feral pigs into the wild; identification, fencing and movement standards are required for keeping of domestic pigs; and all land managers are required to destroy all feral pigs on their land https://www.pir.sa.gov.au/biosecurity/introduced_pest_animals/legal_requirements
<i>Animal Welfare Act 1985</i> <i>Animal Welfare Regulations 2012</i>	Prohibits cruelty to all animals; ensures animals are controlled in a humane way
<i>Controlled Substance Act 1984</i>	The Controlled Substances Act 1984 and regulations include controls over the manufacture, sale, supply, possession and use of some of these substances (controlled substances). The aim of the controls is to protect public health and safety.
<i>Livestock Act 1997</i>	To regulate matters relating to livestock
<i>National Parks and Wildlife Act 1972</i>	The Act provides for the conservation of wildlife in a natural environment and for other purposes

Tasmania	
<i>Nature Conservation Act 2002</i>	Feral pigs are not defined in Tasmanian legislation. Domestic pigs are listed as domestic stock pursuant to the Wildlife (General) Regulations 2010.
<i>Wildlife (General) Regulations 2010</i>	As above
<i>Animal Welfare Act 1993</i> <i>Animal Welfare (General) Regulations 2013</i>	Prohibits cruelty to all animals; ensures animals are controlled in a humane way
<i>Biosecurity Act 2019</i>	<p>The Biosecurity Act 1999, through its regulations (r4 Declaration of pests and diseases) contains provisions for declaring feral pigs. A risk assessment would need to determine there is a significant biosecurity impact, and the distinction between domestic and feral pigs defined. A biosecurity Program (Part 9 of the Act) would be developed so as to define the regulatory framework under which the control and management of feral pigs would operate.</p> <p>The Biosecurity Act also has a General Biosecurity Duty, which could be applied to situations where an owner of a pig(s) is allowing it to roam and therefore create biosecurity impacts such as spread of disease, impacts to native species and potentially form feral populations. Penalties apply for failing to meet their general biosecurity duty.</p> <p>Additionally, A person must not without reasonable cause, move, damage or otherwise interfere with any device, trap, bait or equipment placed on premises (section 67 of the Act)– this would apply in situations where feral pig control and management were occurring.</p>

<i>Local Government Act 1993</i>	<p>Section 199 of the Local Government Act 1993 has provisions for preventing nuisance to caused, including potential or real danger or harm, safety or welfare of the public; or potential or real risks to public health – this would apply in the instance of domestic pigs being allowed to roam freely of the owner’s property.</p> <p>Local Government by-laws could also be developed that seek to control this from happening.</p> <p>Section 194 allows a Council to impound any animal found straying or at large on any highway or land owned or managed by council.</p>
Victoria	
<i>Catchment and Land Protection Act 1994</i>	<p>Pigs (feral or wild) are declared as established pest animals in the state of Victoria under this legislation.</p> <p>https://agriculture.vic.gov.au/biosecurity/protecting-victoria/legislation-policy-and-permits/invasive-species-laws-and-the-catchment-and-land-protection-act-1994</p>
<i>National Parks Act 1975</i>	<p>Requires the extermination or control of exotic fauna in areas reserved under the National Parks Act. This includes National and State parks, Wilderness Parks and other reserves. Under the National Parks Act (s 17(2)(a)), Parks Victoria is the agency responsible for implementing extermination or control of exotic fauna in these areas.</p>
<i>Prevention of Cruelty to Animals Act 1986</i> <i>Prevention of Cruelty to Animals Regulations 2019</i>	<p>The purpose of this Act is to prevent cruelty to animals, encourage considerate treatment of animals and improve the level of community awareness about the prevention of cruelty to animals. This has relevance to selection and implementation of methods to manage feral pigs.</p> <p>These regulations specify conditions for some practices, for example trapping, that may be used in feral pig control.</p>
<i>Agricultural and Veterinary Chemicals (Control of Use) Act 1992</i>	<p>Sets out controls for the use of chemicals and poisons.</p>

<i>Firearms Act 1996</i> <i>Firearms Regulations 2018</i>	Control and regulation of the licensing, ownership, storage, possession and use of firearms and ammunition, which may be used in management of feral pigs. The use of firearms on private property requires permission of the landowner/manager under the Firearms Act.
<i>Occupational Health and Safety Act 2004</i> <i>Occupational Health and Safety Regulations 2017</i>	Seek to protect the health, safety and welfare of employees and other people at work. It also aims to ensure that the health and safety of the public is not put at risk by work activities. Employers of those undertaking feral pig control programs must ensure they are meeting their OH&S obligations. This includes the identification of hazards and risks and determining suitable risk control measures as required by the OH&S Regulations.
<i>Public Health and Wellbeing Act 2008</i>	Designed to protect the health of Victoria's population, including implications for pest control operators and the management of infectious diseases
Western Australia	
<i>Biosecurity and Agriculture Management Act 2007</i> <i>Biosecurity and Agriculture Management Regulations 2013</i> <i>Biosecurity and Agriculture Management (Identification and Movement of Stock and Apiaries) Regulations 2013</i>	<p>Feral pigs are declared pests in WA and have been assigned to the C3 control category under the Biosecurity and Agriculture Management Regulations 2013. This legislation requires that feral pigs be managed to alleviate their harmful impact, reduce their numbers or distribution and contain their spread. All landholders including jurisdictions, Traditional Owners, pastoralists and private land managers are required under the Biosecurity and Agriculture Management Act 2007 to control feral pigs on land under their management.</p> <p>WA has a mandatory livestock ownership, identification and movement system. In some circumstances, livestock identification requirements can be useful in differentiating between feral pigs and domestic pigs.</p>
<i>Animal Welfare Act 2002</i> <i>Animal Welfare (General) Regulations 2003</i>	Prohibits cruelty to all animals; ensures animals are controlled in a humane way

FURTHER INFORMATION

PestSmart Connect	https://www.pestsmart.org.au/
Australian Capital Territory	https://www.environment.act.gov.au/nature-conservation/wildlife-management
New South Wales	Local Land Services https://www.lls.nsw.gov.au/biosecurity/pestplan
	NSW National Parks and Wildlife Service https://www.environment.nsw.gov.au/topics/animals-and-plants/pest-animals-and-weeds/pest-animals
	NSW Department of Primary Industries https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests
	NSW Environment Protection Authority https://www.epa.nsw.gov.au/your-environment/pesticides/pesticides-nsw-overview/pesticide-control-orders
Northern Territory	https://nt.gov.au/environment/animals/feral-animals/feral-pig
Queensland	Queensland Government Department of Agriculture and Fisheries https://www.daf.qld.gov.au/business-priorities/biosecurity/invasive-plants-animals
	Queensland Government Department of Health https://www.health.qld.gov.au/system-governance/licences/medicines-poisons/poisons/invasive-animal-control/landholder-authorisations
South Australia	South Australian Department of Primary Industries and Regions https://pir.sa.gov.au/biosecurity/introduced-pest-feral-animals
	Landscape Board South Australia https://www.landscape.sa.gov.au/
Tasmania	https://nre.tas.gov.au/biosecurity-tasmania
Victoria	Agriculture Victoria https://agriculture.vic.gov.au/biosecurity/pest-animals/priority-pest-animals/pig-feral-or-wild

<https://agriculture.vic.gov.au/biosecurity/pest-animals/invasive-animal-management/integrated-feral-pig-control>

Department of Energy, Environment and Climate Change

<https://www.environment.vic.gov.au/invasive-plants-and-animals/invasive-species-on-public-land>

Western Australia

<https://www.agric.wa.gov.au/pest-mammals/feral-pigs>

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