



Feral pig control

A practical guide to pig control in Queensland

Background information

The pig (*Sus scrofa*), was first introduced into Australia by the first fleet in May 1788, when 49 **hogs** were landed. As settlement spread, pigs were taken into new areas and **turned out** to fend for themselves, or escaped from insecure enclosures. Once established in the wild, populations of feral pigs rapidly built up and dispersed into favourable areas, usually following watercourses. Many feral pigs still exhibit some domestic breeding characteristics.

Some reports suggest that Captain Cook, when beached at Cooktown, either accidentally or deliberately released pigs into the wild—this has now been discounted as a popular myth. Other reports suggest that pigs were introduced into Cape York from New Guinea. However there is no Aboriginal word for pig and the first European explorers to this region saw no pigs. Domestic pigs were probably introduced into North Queensland initially during the Palmer River gold rushes from 1860 to 1870.

Feral pigs are now distributed throughout Queensland and are considered habitat generalists, colonising all bio-geographical regions including some urban areas. Population levels and distribution are influenced by environmental conditions (availability of water, food and cover) and the effectiveness of control programs.

The total number of feral pigs in Queensland is not accurately known, but estimates range from 3–6 million, with the majority in North Queensland. In Australia, estimates range between 3.5 and 23.5 million feral pigs (most estimates are around 13.5 million), with the majority living in New South Wales and Queensland. Population densities in the wet tropics were estimated at 3.1/km². Densities in the dry tropics range from 40/km² in some coastal wetland areas in Cape York, to 4/km² in freshwater lagoons and swamps, and 1/km² in drier woodland and savanna areas.

The feral pig is a declared Class 2 pest under the *Land Protection (Pest and Stock Route Management) Act 2002*. Landholders must control declared pests on the land under their control. Penalties are applicable to landholders for non-compliance with these provisions. Feral pigs are a declared pest because of the large economic impact they have on agricultural industries and the environmental degradation they cause. Economic damage to Queensland agricultural industries is estimated at \$80 million annually.

The general community attitude towards feral pigs varies considerably. Views range from pigs being a major agricultural and environmental pest and an exotic disease liability, to a food and recreational resource for aboriginal communities and an economic and recreational resource for rural communities. These contrasting opinions have sometimes lead to conflict within the community; however, there is an increasing acceptance that multiple-use management of feral pigs is both practical and appropriate, provided activities are undertaken in accordance with state legislation.

General ecology

Feral pigs are found in all habitats throughout Queensland, from closely settled areas of the south-east, to the semi-arid channel country of the south-west and the savannas and the tropical rainforests of the north.

The main habitat requirements are for food, cover and a reliable water supply. Pigs are omnivorous, opportunistic feeders and can thrive in a variety of habitats and on a variety of diets. Feral pigs prefer dense cover to avoid direct sunlight and high temperatures. Because pigs have few sweat glands they tend to drink more often, and wallow in water or mud to cool off in high temperatures.

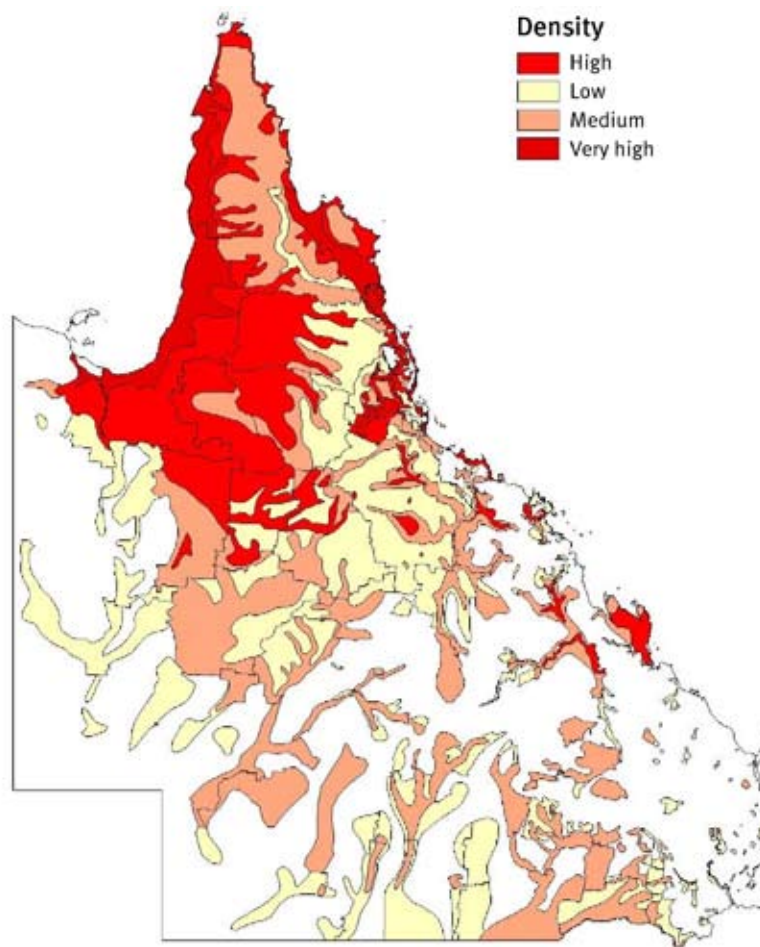
Feral pigs have a higher reproductive potential than other large mammals in Australia. In good conditions, populations may increase by 500% in a 12–15 month period as breeding can occur all year round. Piglets normally spend the first 1–5 days of life inside a grass nest, with the sow inside or close by. Weaning occurs after 2–3 months. Sexual maturity in sows is dependent on weight (25–30 kg) rather than age, similar to domestic pigs. Few pigs live longer than 5 years of age in the wild (usually males), but can live longer in domestic situations.

Adult females have a 21-day oestrus cycle, with a gestation period of about 113 days (3 months, 3 weeks and 3 days). Average litter size ranges between 4.9 and 6.3 piglets, but may be as high as 10 under favourable conditions and depending on the sow's age, weight and food supply. The time between birth of a litter and the next fertile mating is about 2–3 months. Sows can produce 2 litters per year in good conditions. Mortality of juvenile pigs is very high if dietary protein intake is low. There may be a 90–100% mortality of young pigs (on low-protein diets) in dry seasons. Juvenile mortality in the wet tropics has been measured at 81%. The mortality of adult pigs does not vary significantly with seasonal conditions, as with juveniles, but ranges between 25–50% per annum.



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Distribution of feral pigs in Queensland

The feral pig is an opportunistic omnivore and consumes a wide range of foods. The diet varies from region to region and the potential food sources are limited by availability rather than preference for any one food type. Pigs have a high energy requirement, particularly during lactation and for the growth of young pigs. Sows require about 15% of their diet to be crude protein in order to successfully suckle their young. This protein requirement can be obtained from plant material, but is more commonly acquired from animal matter such as earthworms, carrion, arthropods, frogs and reptiles (although animal matter rarely exceeds 5–18% of a pig's diet). Feral pigs will relocate in response to low food availability, when protein and energy requirements associated with reproduction and growth are not being met.

The social structure of feral pigs is based on a matriarchal society with the most common group (called a sounder) consisting of related sows (mother, daughters, sisters, aunt's etc.) and their young. Bachelor groups (usually siblings) form when sexually mature males leave or are chased from the group. Older males operate alone or in pairs (siblings) and join the female groups for mating purposes. Group size varies with age, gender, food and water availability, and disturbances (such as hunting or other control measures). Group size can range from solitary boars to groups of 100 or more sharing a scarce resource such as a single waterhole during droughts.

Feral pigs have a defined home range and habitually make use of trails, shelter areas, feeding and watering areas (subject to availability), rubbing and tusking trees, and wallows. Home ranges of groups and individual boars overlap considerably. There is no evidence that feral pigs, of either gender, actively defend territories.

The size of a feral pig's home range depends on a number of variables, including gender (males tend to have larger home ranges than females), resources and seasons. Generally, pigs in the tropics have a significantly larger home range size in the dry season compared to the wet season. Food availability and quality, and availability of water are thought to be the main determining factors influencing home range size. Home range size varies from as little as 0.16 km² for farrowing sows, to greater than 40 km² for individual boars in the semi-arid rangelands. Feral pigs are most active at dawn and dusk (called crepuscular activity) or during times of cooler temperatures (at night, during rainy or overcast conditions). They may also become less active during periods of disturbance from hunting or other human activities such as stock mustering.

See Case study 1: Altitudinal migration (North Queensland)



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Impacts of feral pigs

The potential for pig populations to rapidly increase in good seasons, combined with the pig's omnivorous feeding behaviour, has resulted in most agricultural industries being affected by pig damage. Pigs will feed on all types of seed, grain, fruit and vegetable crops, with the exception of safflower.

Grazing industries are affected by predation on young stock, damage to pasture by grazing and rooting, or damage to fences and watering facilities. Feral pig damage in Queensland is estimated to be tens of millions of dollars annually. Damage caused to all Australian agricultural industries is estimated at \$106 million annually.

The impact on livestock industries is basically limited to predation on lambs. Research has shown feral pigs can take as many as 40% of lambs. Some reports indicate that mature boars may also predate on calves and goats.

In the wet tropics, most damage to agriculture is on banana and sugarcane plantations. The pigs prefer older cane with a high sugar content (which is available during the dry season). Pigs can **camp** in a paddock for several weeks causing substantial damage, as they can obtain sufficient moisture from the cane.

[See Case study 2: Banana and sugarcane industries \(North Queensland\)](#)



The impact of feral pigs on banana and sugarcane plantations can be substantial

Individual farms can suffer substantial crop losses while neighbours receive little or no damage. In the southern and western Darling Downs, large-scale grain production is accompanied by suitable refuges for pigs. Feral pigs are a major pest in these areas. Pigs can also transport weeds and their diggings provide ideal conditions for weed establishment.

[See Case study 3: Pond apple and mesquite \(North Queensland\)](#)



Mesquite seedlings (a woody weed species) germinating from feral pig faeces

Weed seeds have been known to survive up to 8 days in a pig stomach. During this time, feral pigs could potentially move considerable distances and deposit seeds into new areas.



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Very little quantitative information on the ecological impacts caused by the feral pig throughout Australia is available. Degradation of habitats is probably the most obvious environmental impact of feral pigs. Soil disturbance caused by feral pigs searching for food is the most visual impact. This disturbance may also cause hidden ecological damage such as disrupting soil nutrient and water cycles, changing soil micro-organism and invertebrate populations, changing plant succession and species composition patterns, and causing erosion. Diggings may also spread undesirable plant and animal species and plant diseases. Feral pigs physically destroy vegetation by trampling, wallowing, digging up, tusking, rubbing and eating plants.



Environmental impacts of feral pigs

Diggings destroy soil structure; upset nutrient and water cycling; kill native animals, soil invertebrates and plant species; allow the introduction of weed species; change species succession patterns; and reduce biodiversity.

Feral pigs are known to prey on a wide range of native animal species including earthworms, insects, amphibians, reptiles, ground birds, small mammals, freshwater crayfish, frogs, and marine and freshwater turtles. There have been reports of tortoises killed in large numbers by feral pigs in receding swamps in the Northern Territory. Marine turtle nests suffer 100% predation rates on some beaches on the west coast of Cape York. Other potential impacts include pigs becoming hosts or vectors of endemic or exotic diseases, and the effects of pig control (particularly hunting) on non-target animals.



Feral pig predating on a marine turtle nest

The indirect impact on native species is also difficult to quantify. Feral pigs compete for resources with native species—competition with endangered or rare native species is of particular concern. The endangered southern cassowary (*Casuarius casuarius*), a specialist frugivore (primarily fruit-eating animal), is considered vulnerable to competition from feral pigs.

Pig activity also has a dramatic effect on creeks and lakes. In many areas concentrated rooting **ploughs** up the area around the waterline. Such disturbance of the natural vegetation affects not only water quality but the habitat of small aquatic and terrestrial animals. It also creates erosion and allows the establishment of exotic weeds.

[See Case study 4: Feral pig diggings \(North Queensland\)](#)



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Diseases

Feral pigs can carry many infectious diseases and internal and external parasites. Some are endemic (native) to Australia, while others are exotic. Many of the diseases can not only spread to domestic pigs but to other livestock and humans. Diseases naturally transmitted from animal to man are called zoonoses. Some of the more serious diseases include the following:

- **Brucellosis** is a bacterial disease causing severe long-term illness, undulating fever and possible infertility. Both strains are contracted by handling raw meat.
- **Sparganosis** is a parasite that can infest the muscles of humans, forming cysts. It is common in pigs from swampy areas and is contracted by ingesting raw meat.
- **Melioidosis** is a serious bacterial disease that causes abscesses and, in some cases, death. It can be contracted by handling infected animals.
- **Leptospirosis** is a serious bacterial disease. In humans it is called Weil's disease—causing very high temperatures, kidney trouble and jaundice—and it can be fatal. It is found in up to 20% of feral pigs in Queensland.
- **Q fever** is a disease that occurs in all animals and is well known to abattoir workers. It can cause a very high temperature resulting in heart problems, and can be fatal.

Most infection can occur through contact with pig blood, meat or urine through sores or broken skin; by consuming infected food or water contaminated by people that have handled feral pigs; by inhaling infectious airborne organisms during the butchering process (especially opening the abdominal cavity); or by eating undercooked feral pig meat. It is advisable to use suitable protective clothing and gloves when butchering feral pigs, and to wash hands thoroughly after handling feral pigs.

A major concern with feral pigs is their potential to harbour or spread exotic diseases. The introduction of foot and mouth disease to Australia would cost the Australian community an estimated \$9 billion in lost export trade, even if the outbreak was eradicated immediately. This would result in a major social upheaval in rural Australia.

Other exotic diseases of concern include the following:

- **Swine vesicular disease** is a viral disease that only affects pigs.
- **Aujeszky's disease** is a highly contagious herpes viral disease that affects several animal species, and kills up to 100% of affected piglets.
- **African swine fever** is a highly contagious viral disease that only affects pigs.
- **Classical swine fever** (CSF) or hog cholera, is a highly contagious viral disease in pigs. In acute form it kills up to 90% of infected animals.
- **Japanese encephalitis** is a virus spread from pigs to humans by mosquitoes, causing severe acute problems in the nervous system.
- **Rabies** is a serious disease affecting the brain that can be fatal to animals and humans.
- **Screw-worm fly** maggots can attack healthy flesh and, if untreated, can cause massive wounds to animals and humans.
- **Trichinosis** is a helminth (roundworm). All mammals are susceptible, with humans infected by eating improperly cooked meat.

Many international visitors travel through countries infected with exotic diseases before entering Australia. Feral pigs are known to frequent rubbish tips around tourist lodges and to scavenge human waste. There is a real danger that an exotic disease could enter Australia via this contact and remain undetected for some time. Such a time lapse could allow the disease to spread considerably, making eradication difficult or even impossible.



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Control techniques

A range of techniques are available to control feral pigs. Generally, control techniques should not be considered as stand-alone measures—some techniques will require follow up with other methods.

To effectively implement them, it is beneficial to understand the ecology of feral pigs (see [Background information](#)) and the reasons why they are difficult to control:

- Pigs are generally nocturnal, wary and camp through the day in thick inaccessible vegetation wherever possible.
- Their reproductive potential is such that repeated control programs are generally required to reduce pig damage to an acceptable level.
- Their omnivorous feeding habits give pigs a wide range of available food sources and make successful pre-feeding for an intended control program difficult.
- Home ranges can be large, therefore requiring control programs to be conducted over a large area (of several adjacent properties) to be effective.

An estimate of the abundance and distribution of the population to be controlled will also assist development of suitable control strategies. Sightings are the least reliable guide to feral pig presence. Careful observation of the signs of pig activity will allow an estimation of population densities. The following is a list of common pig signs:

- **Recent or fresh diggings** can be used as an indicator of population size to compare digging activity between areas or seasons. Old digging indicates pig distribution, but the area affected gives little indication of numbers as large areas can be dug by a small number of pigs. The age of diggings is difficult to estimate as changing environmental conditions affect the condition of the diggings. Diggings have also been related to seasonal cycles, so the number of diggings varies greatly throughout the year and does not represent a true indication of population size.
- **Pig tracks and faeces** on and off paths (such as dirt roads, cattle pads, dry creek beds, etc.) can provide an indication of the density of pigs (by undertaking counts along sections). Close inspection of the faeces may also indicate what the pigs are feeding on, which could help in the selection of suitable bait material.
- **Mud or hair** left hanging on barbed wire fences, where pigs have pushed through, will indicate pig distribution patterns.
- **Wallowing, tusk marking, mud rubs** on trees and fence posts, and nests in vegetation made by sows before farrowing will indicate the presence of feral pigs.

Spotlighting, aerial surveying and dogs can be used for actual pig counts.



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(A)



(B)



(C)



(D)

Monitoring an estimation of the pig population abundance and distribution are important factors in developing suitable control strategies.

Identification of pig signs such as (A) faeces, (B) footprints, (C) rubbing trees and (D) diggings is important in order to target control techniques.

Once an estimate of the pig population has been established, there are various techniques available to control feral pigs, including:

- poisoning
- trapping
- hunting
- exclusion fencing
- other control techniques.



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Poisoning

For reasons of economy, efficiency and accessibility, poisoning is generally considered the most appropriate for achieving large-scale control, but may not be suitable for all situations. When toxins can be safely used, this is the most effective method of removing the bulk of the pig population with the least effort and cost. Poisoning is also one of the few methods available that may reduce a pig population quickly. Key aspects associated with baiting are discussed below.

Bait material

Through the wise selection and presentation of bait material, landholders can target feral pigs when using poisons. The most essential aspect of poisoning is to make the toxic baits detectable and palatable. This is the most positive way of increasing the effectiveness of poisoning. Easily found and target-specific baits mean more baits will be available to pigs, thereby reducing the quantity required to be an effective control technique.

The local diet preference of pigs must also be considered during a poisoning campaign. Bait used successfully in one location may be ineffective in another due to the local food component availability. For example, in the dry tropics grain baits are ineffective if the pigs are scavenging cattle carcasses. Meat baits would be the most acceptable to pigs in this situation. In the wet tropics, where fruit is readily available and scavenging of carcasses is rare, meat baits are ineffective whereas fruits such as mangoes or bananas are highly acceptable.

In grain-growing areas, bait material should consist of the crop that the pigs are currently feeding on. Fermenting the grain, by soaking it in water for 3–5 days, will prove to be beneficial in attracting pigs and repelling non-target species. If the grain is then buried in shallow trenches and small amounts of grain placed on top, pigs will quickly take to rooting for the grain. Buried grain baits will endure and retain their attractiveness longer, and very few birds or animals (including sheep and cattle) will dig up and eat fermented grain. Feral pigs also appear to prefer rooting up the soil to uncover the spoiled grain, as this behaviour is part of their normal food gathering activity. If stock is present, a wire enclosure can be built to allow the passage of feral pigs but prevent stock from gaining access to the bait material.

To ferment grain, select a large drum and add sufficient water to cover the grain by 15–20 cm (6–8 inches). Do not fill the drum more than $\frac{3}{4}$ full as the grain will swell. If possible, add the stomach contents of a ruminant (sheep or cattle), as this contains a yeast and bacteria culture that will ferment the grain and produce a pronounced odour attractive to pigs. Fermentation should occur within 24 hours, but it's best to leave the grain for at least 3 days before using it for pre-feeding. When the process is working correctly, the grain will have a very pronounced (offensive) odour.

All grain, cereal or meal poisoned as bait must be coloured to distinguish it from un-poisoned material. If the toxin 1080 is used, the approved Department of Primary Industries and Fisheries (DPI&F) or local government officer will dye the baits green, which has been found to make baits less attractive to birds.

In intensive agricultural areas—such as banana and sugarcane plantations, tropical fruit orchards and vegetable crops—other bait types may be considered. Generally, whatever fruit the pigs are targeting can be used as bait material. In the wet tropics, the high acceptance of bananas by feral pigs and the abundance of waste bananas make this the principal bait material for this region.

In drier grazing areas, fresh meat baits are preferred due to meat being economical, easily obtained and readily accepted by feral pigs. Meat may be obtained from domestic cattle, sheep, goats or horses; offal from abattoirs; or kangaroo meat from pet abattoirs. No meat pieces can contain bone material. Meat must be cut up into approximately 500 g baits prior to injection with toxin.



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Under guidelines established for the use of 1080, meat baits must be approximately 500 g and injected with 72 mg of 1080. For grain, fruit and vegetables, 250 g of bait material is mixed with 72 mg of 1080.

Commercially produced pig baits are also now available for use in baiting operations. However, there is little experience using these in commercial situations.



Preparing feral pig baits

The toxin 1080 is injected into 500 g pieces of meat such as kangaroo (obtained from licensed abattoirs), cattle, horse, goat or offal (liver, heart etc.). No bone material may be present in the meat. In Queensland, only DPI&F and local government officers that have been approved by Queensland Health can prepare 1080 bait material for landholders (see 'Regulations for the use of 1080' below).

Attractants

Adding attractants to the bait material could decrease the problem of bait placement (i.e. attracting the pig to the bait and not taking the bait to the pigs). Attractants may also lead to a decrease in the density of baits or the total quantity of bait material required.

Attractants are predominantly used with grain-based bait material. The most effective attractant to use is extremely variable. A wide range of bait attractants have been tested throughout all habitats of Queensland. Most attractants will make the bait more palatable and detectable to pigs, but care should be exercised as the attractants may also increase consumption by non-target animals.

Adding meat meal or molasses to fermented grain is the most popular means of increasing attractiveness of baits to pigs. Additives such as vanilla, raspberry or banana essence, for example, will also increase the attractiveness of baits, but may become expensive in large baiting campaigns. Creosote, a wood preservative, has been found to make baits more detectable to pigs while deterring most non-target animals from consuming the bait. Only a small amount of creosote needs to be added to the bait.

Toxins

Poisoning with 1080 (sodium fluoroacetate) is the most widely used management technique for the control of feral pigs, and is used by all vertebrate pest control organisations within Australia. 1080 is a colourless, odourless substance which is produced naturally in over 30 species of native Australian plants, including Georgina gidgee (*Acacia georginae*) and heartleaf poison bush (*Gastrolobium grandiflorum*). Compound 1080 is converted in the body to fluorocitrate, which blocks a vital biochemical pathway known as the Krebs Citric Acid Cycle. This causes the energy supply in cells to be reduced to a point where they lose function and die.



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The **toxin 1080** does not accumulate in the food chain, and readily breaks down in the soil to a harmless substance as a result of fungal and bacterial action. Rain leaches the poison from baits and warm air temperatures assist in decomposition of the poison. Rapid leaching and decomposition of the bait might be expected in the wet seasonal conditions of the tropics. Principal advantages of this poison include the following:

- It has **high toxicity** to some vertebrate pest species (feral dogs, cats and foxes in particular).
- It is **odourless, tasteless and colourless**, making it hard for the target species to detect.
- It is **easy to handle**.
- It has a **latent period** that allows pigs to disperse from feeding areas prior to death, thereby reducing bait shyness and increasing effectiveness.

Toxic effects do not appear immediately after ingestion, even with massive doses of 1080, due to the time required for converting the fluoroacetate to fluorocitrate. In pigs, death results from heart or central nervous system disorders. There is considerable variation in susceptibility between various species of animals. In general, birds show considerably more resistance than mammals, and cold-blooded animals (such as reptiles and fish) are even more resistant. Dogs are the most susceptible to 1080.

A range of other toxins have been used to control feral pigs. These chemicals are not recommended by the Queensland Government for feral pig control due to adverse environmental, animal welfare and effectiveness concerns.

One of these toxins is phosphorus. It is sold as the commercially available CSSP pig poison. Phosphorus is a yellow, wax-like substance with a pronounced taste and garlic-like odour. It is absorbed through the skin but primarily through the gastrointestinal tract where it causes severe irritations. Symptoms include acute pains, convulsions, liver damage, bloody diarrhoea, skin eruptions, coma, collapse and death. CSSP is not soluble in water and does not break down readily in the environment. It is toxic to a wide range of bird and animal species, is generally slow acting and inhumane, and can cause secondary poisoning from the vomit or carcasses of poisoned animals. In pigs, death may take from 2 hours to 5 days following the ingestion of a lethal dose.

Regulations for the use of 1080

The use of 1080 is subject to strict regulatory control set down in the Health Regulation 1996, which is administered by Queensland Health. The following list is a summary of the guidelines for its use:

- All baits must be distributed only on the land described and must not be laid within 2 km of any habitation (habitation includes any dwelling excluding the owner's) or public amenity, or within 5 km of a town area without approval.
- No baits are to be laid within 5 m of a fenced property boundary without approval.
- No baits to be laid within 50 m of a centre line of a declared road.
- At least 3 days' notice of the intended laying of baits must be served by landholders on every resident and/or occupier of the land adjoining or having frontage to the holding, road or reserve whereon the poisoned baits are to be laid.
- Warning signs will be supplied to the landholder and must be placed at all points of entry to the property and adjoining public thoroughfares. This must be done even if the adjoining property is carrying out 1080 baiting. Warning signs must be erected and left in place for a minimum of 1 month.
- Wild game harvesters should also be notified of baits being laid for at least 28 days after the program, as they are required to declare that they have not removed feral pigs from areas where baiting has occurred.

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Bait presentation

Many of the unintentional effects of secondary poisoning can be largely overcome if landholders are sensible in the presentation of poisoned baits. A range of techniques are available to minimise the contact of non-target animals with baits, while maximising the contact with feral pigs:

- **Placement:** Burying baits, wiring baits to trees or placing baits under vegetation, etc., will minimise the number of non-target species taking the bait. Pigs have an acute sense of smell and will easily locate hidden baits.
- **Timing:** Distributing baits in the late afternoon will minimise the number of scavenger birds taking the bait.
- **Dying baits green:** This reduces the number of carnivorous birds taking the bait as they do not associate green material with food (meat). Drying the baits until they are black will also reduce the visibility of baits to scavenging bird species.
- **Bait stations:** Pre-feeding pigs will deter other species from feeding at bait stations.
- **Mechanical exclusion devices:** Devices such as loosely strung barbed wire fencing will prevent domestic stock accessing the bait but will allow pigs to push under the wire.
- **Marking the position of baits:** Uneaten baits can be collected and destroyed at the end of a poisoning program.
- **Size:** Using the recommended size of bait will deter non-target species as the recommended 500 g pig bait is too heavy for many non-target species to move. The large bait size also limits the amount of bait ingested, as small non-target species cannot ingest a sufficient amount of the bait to receive a lethal dose of the toxin.
- **Amount:** Using only the necessary amount of bait required to control the targeted pig population will limit the amount of bait material available to non-target species.

Pre-feeding

The number of feral pigs killed by a poisoning program is determined by the number of pigs that find and eat sufficient bait to ingest a lethal dose. Generally, pre-feeding unpoisoned bait material over a number of days will increase the likelihood of successful poisoning as pigs become used to feeding at the site, which increases the chance of the entire group being attracted to the bait material.

Pre-feeding meat bait is regarded as **swill feeding**, and is banned in Queensland due to concerns associated with the possible transmission of diseases. However, the smell from rotting meat in wire cages or encased in poly-pipe (that cannot be accessed by pigs) can be used to attract pigs to bait stations.

Pre-feeding of non-toxic grain, fruit or vegetable baits is permissible and essential to introducing the bait material to the pigs. Pre-feeding with unpoisoned bait should be performed for not less than 3 days prior to laying poisoned baits. If poisoned baits are distributed without pre-feeding, fewer pigs will be destroyed.

Pre-feeding can be achieved by setting up a number of bait stations (2 kg piles of unpoisoned bait) throughout the area and monitoring these for pig activity. Once feeding starts at a bait station it should be topped up each night, making sure that enough bait material is available for the estimated number of pigs feeding at each site. Ideally 1 kg of bait should be available for each pig. There should be enough bait material remaining each morning to ensure the pigs return the next night. If the pigs feed for 3 consecutive nights, poisoned bait can be introduced.

Poisoned meat and grain baits can be buried at, or surrounding, the bait stations to reduce the likelihood of non-target species finding and consuming the bait. Poisoning should continue for 4 or 5 days or until no more bait material is taken. Sometimes another mob of pigs may be in the area or individual pigs may disperse from the bait station for a few days. The continued availability of poison baits will control these pigs that missed the initial baiting. Bait should also be replaced when exposed to extreme weather conditions (such as rain) that may reduce the baits' toxin concentration.



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One worthwhile strategy, especially in cropping areas, is to establish permanent or semi-permanent feeding stations. Feeding stations should provide pigs with feed continuously and will allow landholders to monitor the local pig activity and poison or trap at a convenient time. This eliminates the time spent searching for good pre-feeding sites and fresh signs of pig activity.

Ground and aerial baiting

In addition to the use of bait stations, **ground baiting** is sometimes conducted from vehicles travelling along available roads and tracks. While it is fairly labour intensive, it can be useful for small areas, pig refuge areas or areas that have been directly affected by feral pigs. However, the restrictions associated with ground travel (i.e. limited to accessible areas) means that you can not always ensure an even coverage of bait or the availability of bait to all pigs in the control area.

Aerial baiting is the most effective and cost-efficient method of controlling pigs over extensive areas or in inaccessible areas. Bait uptake rates of 81% have been achieved in trials conducted in the dry tropics. Poisoned baits may be aurally distributed by helicopters or light planes. Modified light planes are available that have large bait bins and drop chutes incorporated in the fuselage. These planes can carry up to 350 kg of bait material at a time. Helicopters are expensive and can carry only small amounts of bait, but are useful for small area applications where accurate placement is required.

See [Case study 5: Aerial baiting \(North Queensland\)](#)



Aerial baiting is the most cost-efficient and effective method of pig control in extensive rural areas

Specially modified light planes have installed large bait hoppers and a chute through the floor to allow easy bait distribution.



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Trapping

Trapping can be an important technique for reducing pig populations, especially in circumstances where other control techniques are not possible (e.g. where poisoning is impractical), where more than 1 technique is necessary (e.g. as a follow up to poisoning), or where food or water resources are limited. Traps can be designed to be species selective and pose minimal danger to non-target animals. The key elements of a successful trapping campaign are appropriate trap design, suitable placement, maintenance of the door mechanism and regular inspection of the trap when set. Trapping is particularly suited to small areas of high significance, such as rare or endangered species reserves, or closely settled or high tourist visitation areas.

Trapping of feral pigs has gained increasing acceptance as trap designs improve, feeding behaviour is better understood and restrictions on the use of poisons increases.

Trapping is relatively expensive and labour-intensive, however, and is therefore not practical for large-scale control. Trapping is environmentally friendly, humane and costs can be defrayed over the long life of the traps and also, in some situations, against the sale of pig carcasses.

However, the success of trapping has been found to vary depending on the experience of the trap operator, local food abundance and the pig population size and distribution.

Additional advantages of trapping over other control methods are that:

- Trapping does not interfere with normal pig behaviour (unlike shooting or dogging) making it less likely that pigs will disperse from the control area.
- The number of pigs is known exactly and carcasses can be removed safely.
- It is a flexible technique that can be scheduled into routine property activities.
- Properly designed traps can be moved or re-used as necessary.
- Good trapping makes use of opportunities as they arise.
- Non-target species that are accidentally captured can be released unharmed.

Some of the disadvantages of trapping are that:

- Trapping is labour-intensive and is not a rapid method of population control.
- Eradication or sustained control of the population in sensitive, inaccessible areas may be difficult to maintain by trapping alone.
- natural increases in pig population due to immigration and breeding may make an existing trapping program ineffective. Increased trapping effort is required during seasons of high pig population growth.

The relative success and design of traps depends on the local environment, available materials, number of pigs to be trapped and presence of non-target species (particularly rare or endangered species). Other factors that may influence the decision to use trapping include the time and costs associated with building and maintaining traps.

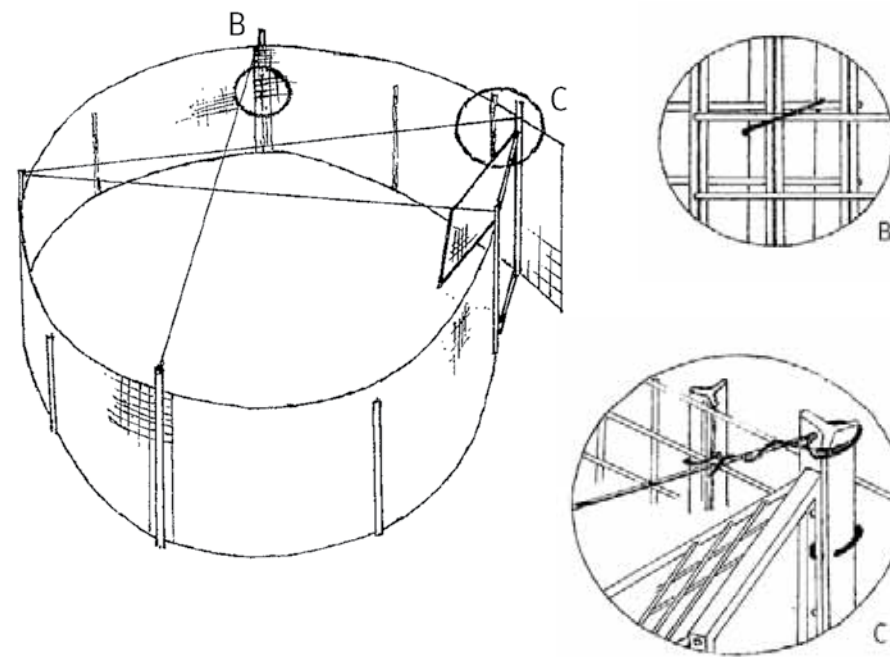
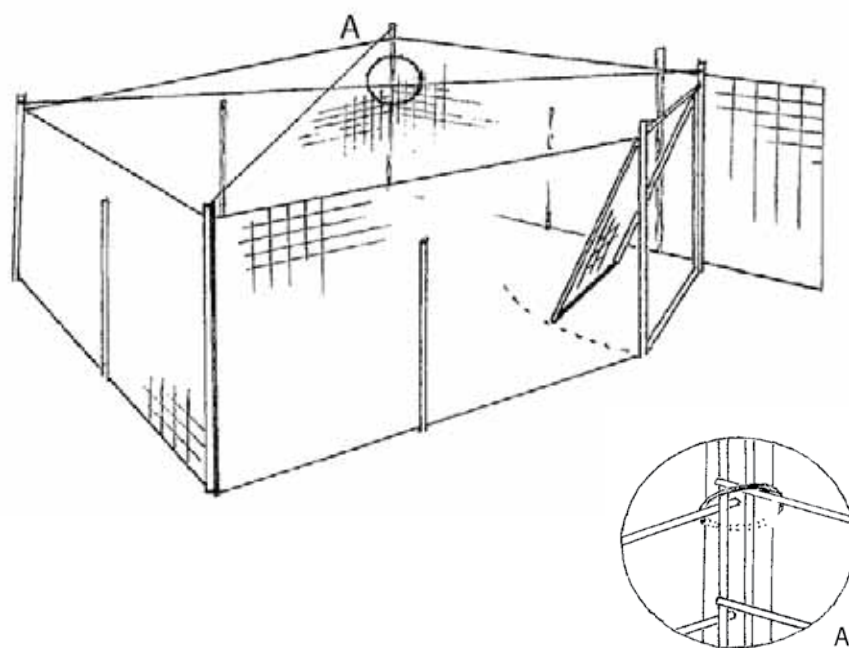


Feral pig control

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General trap design

There are several trap designs available with a multitude of variations to suit individual requirements or materials. They basically comprise a steel mesh live trap with a one-way gate.



Basic trap designs

Traps should be of robust construction incorporating steel mesh of at least 5 mm in diameter and at least 1.5 m in height. Mesh hole size cannot be more than 100 mm × 100 mm, as larger mesh will cause serious injury to charging pigs. Black or ungalvanised mesh is ideal as shiny mesh can reflect moonlight and may deter pigs from approaching the trap. A steel post should be placed on the outside of the trap and tied down to prevent the pigs lifting the mesh (A). For panel traps, extra strength can be obtained by overlapping the mesh panels (B). Traps incorporating detachable gates should be supported by securely wiring them to steel posts that are attached to the mesh (C).



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Some factors to consider when constructing a trap include the following:

- Traps should be constructed in stages to allow pigs to become accustomed to the unfamiliar odour of the trap material and humans.
- Bright colours or shiny materials should be avoided as much as possible as pigs have excellent colour vision.
- Mesh size should be no greater than 100 mm × 100 mm. A larger hole size will cause injury to the pigs.
- The steel posts should be placed on the outside of the mesh at the corners and weak spots. In soft soil, steel posts can be driven in at a 45 degree angle to help stop lifting. Traps should be at least 1.5 m high to prevent pigs jumping out.
- The mesh should be fastened (wired) securely to the steel posts to prevent the mesh panels being lifted. Mesh should be wired at ground level and at 20 cm, as this is the point of most impact from charging pigs hitting the mesh.
- Operation of the gate mechanism (tripping the trap) should be quiet and allow easy passage of pigs of all age groups.
- Trip mechanisms specific to pigs are recommended. Always use the prescribed trip bar, which is normally a straight branch about 10 cm in diameter. Ensure the slot on the door end is wide enough and releases freely, and the fixed end is tied down. Do not use trip wires as fewer pigs will be caught and non-target animals can also be captured.
- Place branches or vegetation over the trap to camouflage it and to provide shade for captured pigs. Placing branches and sticks across the top of the door will deter cattle. Rope hung in a loop across the top third of the door will deter cassowaries and emus from entering the trap.

Specific traps

Panel trap

The panel trap is constructed by a series of weldmesh panels (2–3 m × 1.5 m) wired together and supported at the corners and panel centres by steel posts. Panels may be further strengthened by cross wires from the top of the posts. Panel traps have the advantage of being relatively easy for one person to construct and dismantle, and can be transported easily. Adding or removing panels can change the size of the trap.



Panel trap constructed from four 2.4 m × 1.5 m panels of 100 mm × 100 mm × 5 mm mesh

Note the bait material (fermented grain) trail through the open trap gate. The door is wired back to allow pigs to pre-feed for 3 days before the door is set. The door is 1 m wide and 1.5 m high, made from 100 mm × 100 mm × 8 mm mesh.



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Silo trap

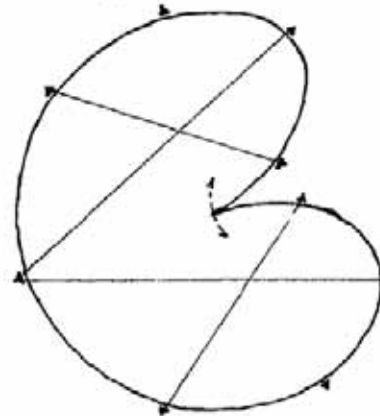
The silo trap is superior in strength and capacity to the panel trap. The silo trap is constructed from a continuous mesh panel (10–20 m × 1.5 m high) and may incorporate a funnel gate, side swinging gate, self-sprung panel gate, vertical gate or a lifting bar gate. The silo trap is more difficult for one person to construct, dismantle and transport than the other designs and is more suited to semi-permanent trap sites.

Traps can be further strengthened by stretching wire across the trap from the top of the steel posts. Steel posts can be driven in at a 45 degree angle in soft mud or sand to prevent lifting. Posts should be 1.5 m apart and can incorporate available trees to further strengthen the trap. The traps flexibility will prevent pigs from climbing out or breaking the mesh.

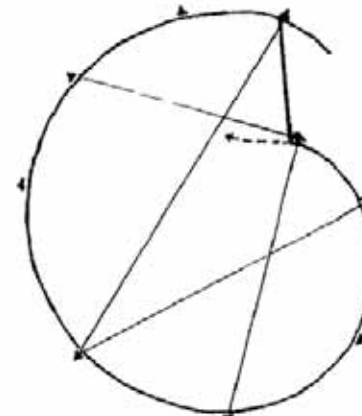


Silo trap incorporating a funnel gate design

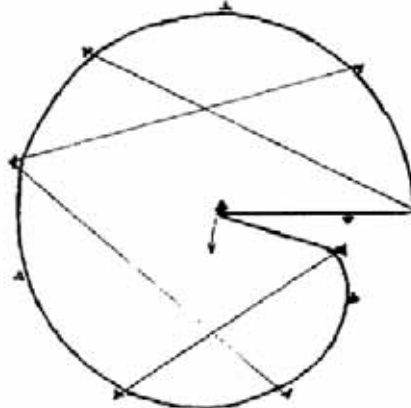
A. Funnel gate



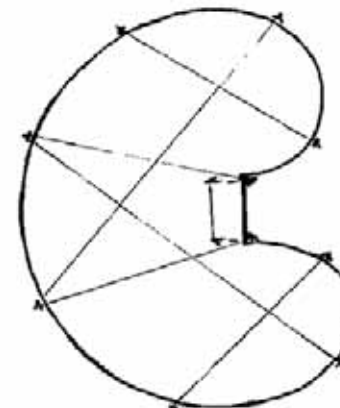
B. Side-swinging gate



C. Self-sprung panel gate



D. Vertical gate



Top view of silo traps that can incorporate a number of trap door designs

Wires can be tied across the top to strengthen the trap.



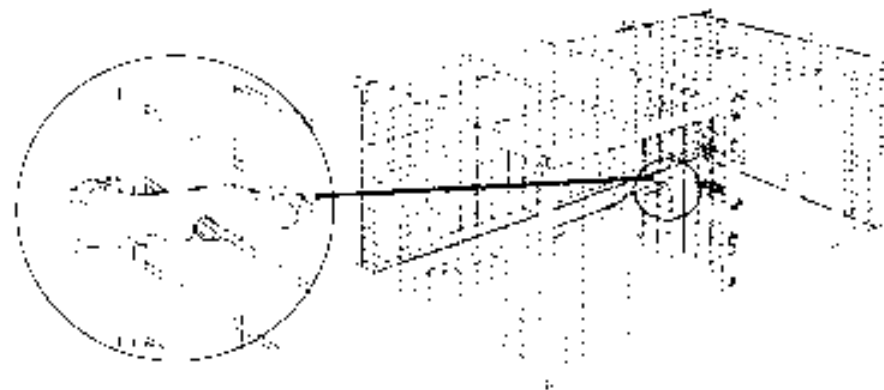
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Portable box trap

The portable box trap is readily transportable and is more suitable for small numbers of pigs. The frame can be built of timber or steel, and enclosed with mesh or wire netting. The trap is constructed to fit on the back of a 4WD tray. Steel posts at the corners will prevent pigs lifting the trap. Bars are placed on top to prevent pigs from jumping out. The target-specific gate design allows only pigs to close the door via a **trip** bar, which is designed to release when lifted. A pig will lift the bar with its back when it walks under it, which will release the spring-loaded gate. Non-target species will generally stand on or jump over the trip bar. The bar should be made of wood at least 10 cm in diameter or equivalent, and be set approximately 30 cm off the ground. The weight of the wood will ensure only pigs are able to lift the bar.

This trap has been designed as an efficient and environmentally acceptable method for the control of feral pigs, particularly on smaller properties. The traps are easily relocated so that seasonal movement and availability of food can be fully exploited, with a minimal outlay for materials. If used correctly, this trap is both humane to captured pigs and unlikely to capture non-target species.



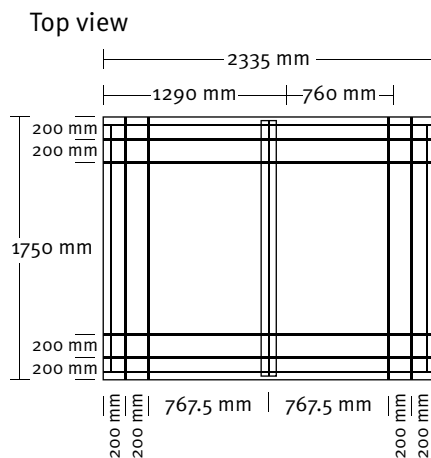
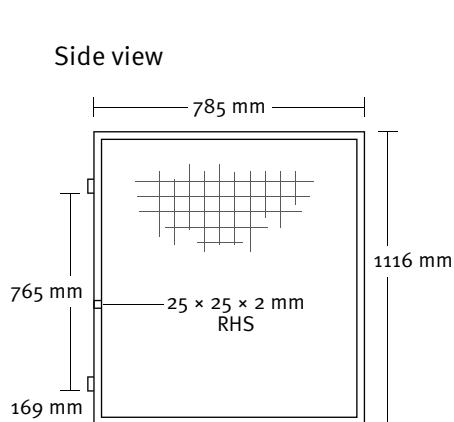
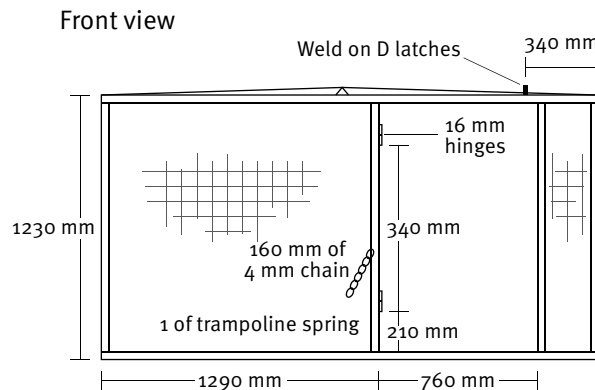
Portable box trap incorporating a pig-specific gate trip mechanism

In order to catch as many pigs as possible using a box trap, bait material should be spread around the trap with a small amount under or behind the lifting bar trip mechanism. This allows time for an entire group to enter the trap before a pig will attempt to eat the bait under the bar, thus catching the entire group.



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Dimensions of a portable box trap

Materials needed to construct a portable box trap

5 x 7.5 m lengths of 40 mm x 40 mm x 3 mm angle iron

1 x 6 m length of 25 mm x 25 mm x 2 mm RHS (box section)

3 x 6 m lengths of DB 12 bar (reo bar)

1.5 sheets of 3 m x 2.4 m WH423 mesh (75 mm x 50 mm x 4 mm) preferred

2 x 6 mm cattle gate hinges

1 D latch

1 gate spring (trampoline spring)

- Dimensions have been calculated to fit a standard 4WD tray and to minimise off-cuts. Consider these factors if changing sizes.
- Any available materials may be substituted; however, consideration should be given to weight and strength. Mesh size should not exceed 100 mm x 100 mm.
- Roof bars are designed to prevent pigs climbing out and could be changed to a 200 mm reo mesh sheet. No roof is required if the trap is higher than 1.5 m.
- A short piece of chain should be used between the spring and door frame, to allow tension adjustment and prevent damage to the spring.
- The gap below the door is important to prevent it catching on diggings.



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Gates

The importance of the design and action of the gate is often overlooked. Trapping efficiency is a function of site selection, acceptability of bait, length of pre-feeding and efficiency of the gate mechanism.

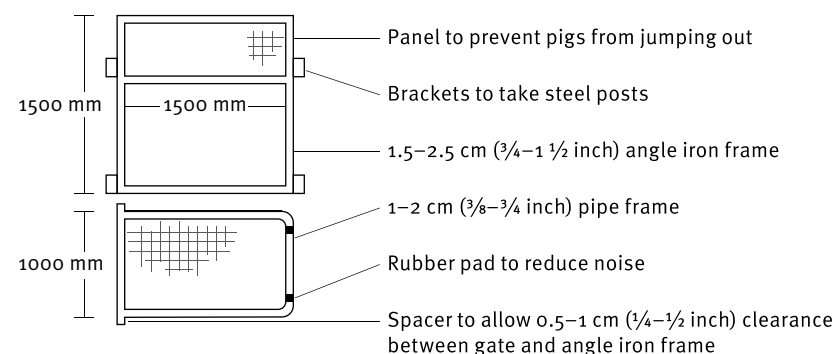
The **self-sprung funnel gate** and **panel gates** are ends of mesh constructed in a funnel shape and tied together at the top, which requires the pigs to push and squeeze their way between the mesh ends into the trap. The steel mesh should be cut so as to leave tynes at the end of the gate. These tynes should be pointed and turned slightly inwards to prevent pigs from backing out when they are part way through.

One common mistake made by those using this type of gate is having too much tension (spring) in the gate. Feral pigs need to be strong and hungry to negotiate some gates constructed to catch them. Many pigs lose interest and confidence when they have to force their way through such gates into the trap. Tension should be adjusted to facilitate easy opening and be just enough to return the tynes together after the pig has passed through. A small stick (15 cm long) can be placed between the mesh ends to keep the gate open too look more friendly to entering pigs. After the first pig enters, the stick falls trapping the pigs; however, a pig feeding inside the trap will encourage others to follow through the gate.

This gate is easy to construct, works quietly and is unlikely to be prevented from closing by debris around the trap if the sprung ends are at least 5 cm above the ground. However, it is not the best gate to trap timid or small pigs. For best results, these gates need to be removed or wired open during pre-feeding.

Vertical gates pivot at the top and close automatically. The gate can be extremely robust and easily modified for use with a trip for wary pigs. This gate is very good for small pigs because it requires little effort to open the gate. The disadvantage with the vertical gate is that it closes relatively noisily and this may frighten the pigs entering the trap and deter others feeding close by.

The **side-swinging gate** is similar in many respects to the other gates but has the advantage (when adjusted correctly) of opening and closing easily and quietly, and is perhaps the best pig gate design for these reasons. The closing mechanism can be a spring or pulley and counterweight. Either mechanism should be adjusted slightly so that the gate opens very easily and closes without slamming shut. This gate can also be incorporated into either a silo or panel trap. When setting a trap gate after the initial pre-feed, it is recommended that the gate be held partially open by a stick or wedge, which will fall away as the first pig enters the trap (thus allowing the gate to close).



Side-swinging gate



Funnel gate



Panel gate



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Location of traps

Selecting a site to locate the trap is one of the most important factors in successful trapping and should be given careful consideration. Inspections of likely feral pig habitats (such as swamps, creek lines and forests etc.) should reveal areas of recent pig activity and appropriate trap placement. Traps can also be erected close to major feral pig pads that usually lead to and from refuge and feeding areas. Preferably, the site should be in a shady area with as much natural vegetation cover as possible.

Vehicle access is essential, as carrying large amounts of bait to a trap on foot will soon become tiresome. Traps should also be located in a circuit to make for easy daily checking—this task could possibly be included in other daily routines or farming duties.

Number of traps

A major factor to consider is the number and distribution of traps in relation to the home range or movements of pigs. Sufficient traps are required to be distributed in a given area so pigs have a high probability of encountering a trap. Insufficient numbers of traps, or areas where traps cannot be placed, will ensure a proportion of the population will not encounter a trap. Research in the Canberra region has estimated that traps have a catchment area of approximately 800 m radius around each trap, so traps should not be set more than 1 km apart. However, the catchment area of traps in other regions has not been determined, so local knowledge and experience is essential in estimating the number of traps required.

Pre-feeding

Once potential locations for traps have been identified, pre-feeding should be undertaken in these areas by depositing small amounts of bait material throughout the immediate area or along trails. Monitor and replenish these sites for several days to allow the pigs to become accustomed to the bait material, and maximise the number of animals attracted to the area.

Once sufficient activity is observed at a site, trap materials can be deposited at the site for 2–3 days to familiarise the animals to the smell of the steel mesh. If feeding at the site continues, the trap may be partially erected (leaving a wide entrance way) and the bait material placed inside the trap. The door can be erected following signs that the pigs are confident to feed within the trap, but leave the gate wired open. After a few days of further feeding within the trap, the door can be set. This step-by-step method will maximise the number of animals captured.

If pigs are known to be trap shy, construct only 3 sides of the trap initially and continue to pre-feed. When pigs appear to be confident about feeding inside, construct the 4th wall but leave the gate wired open. If they continue to feed, set the trap.

If the pig trap has already been constructed (such as permanently located ones), a drum of fermenting grain or other bait material can be located inside the pig trap. The additional smell of the grain brewing or rotting meat in mesh containers hung on the trap walls will also attract the pigs to the trap.



Pre-feeding for a number of days is essential to allow the whole group to feed inside the trap, thus ensuring the whole group is captured.

Members of the group that avoid capture may become trap-shy. Note the pre-feeding bait (bananas) outside the trap and trailed through the door to encourage shy pigs into the trap.



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Suitable baits

Almost any biological material can be used as trap bait, as pigs have a wide omnivorous diet and will eat almost anything. However, it may take some time for pigs feeding on a natural food item to recognise an introduced **novel** bait item as food. Pigs have a tendency to stick to a locally abundant food source until it is exhausted and then switch to another food source. Patience and pre-feeding is required in this situation. It may be necessary to experiment with a few different baits before one is found that produces good results. Bait material should be readily available at low or no cost, as large quantities will be required.

Where pigs are eating carrion, the smell from fermented meat meal or meat pieces enclosed in a mesh container hung from the trap mesh will help attract pigs to the trap site.

Please note: The direct feeding of meat or meat products to feral pigs in traps is illegal.

If available, bananas or other waste fruit, especially mangoes, can produce good results. Fermented grain and molasses are also good trap bait. Pouring a small amount of creosote (a wood preservative) over the trap posts will sometimes attract pigs to the site.

Setting and monitoring traps

Leave the door open and re-feed until pigs have been feeding inside the trap for at least 2 nights. This will maximise the number of pigs captured. If they remain hesitant about entering the trap try:

- placing bait material outside the door or laying a bait trail to the trap
- disturbing the ground inside the trap with a hoe
- using aromatic attractants such as vanilla essence, aniseed and creosote or fish oil.

Once traps are set, they need to be inspected daily (preferably in the morning). Release non-target species, and destroy or remove trapped pigs as quickly and humanely as possible. During these daily visits, keep human activity to a minimum and avoid using dogs around trapping sites.

It is also advisable to continue to pre-feed at other sites so that when the first site is exhausted, the trap can be moved to another site and continue to catch pigs.



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Hunting

It has been estimated that recreational hunters may kill only 15–20% of the feral pig population annually in accessible areas. The use of recreational hunting to control pig numbers is seldom effective and may disperse pigs through regular disturbance. As a control method, hunting is only suitable in relatively small, easily accessible areas.

Limited information is available on the use of hunting as a technique in an integrated control program. Hunting is generally regarded as a mopping up exercise to eliminate residual populations after other techniques have been employed.

However the value of recreational hunters to the broader community must not be overlooked, as it can provide significant revenue to small communities. The sale of pig carcasses to commercial **pig boxes** is worth over \$20 million annually. Some rural communities benefit from the extra income generated from recreational or commercial pig hunting activities.



The feral pig is recognised as the most important game animal in Australia

There is a significant export of feral pig meat to European markets where it is sold as 'wild boar' meat. Accreditation for hunters and food safe practices have been introduced to enable wild pigs to be marketed as suitable for human consumption.

A negative consequence of hunting is that hunters have been known to introduce pigs to **clean** areas to provide themselves with hunting opportunities in the future. Hunters have also been known not to take small pigs or sows, or to castrate males or cut the ears off pigs to make them more difficult to catch with dogs, thus ensuring **sport** in future seasons. These actions are in direct opposition to effective pig control.

Hunting may be classified as aerial shooting, ground shooting or dogging.

Aerial shooting

Helicopter shooting is claimed to be effective in open terrain, remote locations or in inaccessible areas, such as broadacre crops or in swamps and marshes where pigs are in reasonable numbers and are observable from the air. The cost of control varies with pig density and the efficiency of the operators. The weapons most suitable are either automatic shotguns or semi-automatic large calibre (.308) rifles.

In suitable terrain, helicopter shooting is a popular and effective method of controlling pig populations for the short-term reduction of agricultural damage. This technique is also the principal technique advocated in contingency plans for eradicating feral pigs during exotic disease emergencies.

The increasing availability of small mustering helicopters has made aerial shooting a more economical option, particularly in inaccessible areas. Helicopter shooting still has some shortcomings, as some habitat types can conceal pigs from the air making them difficult to shoot.

The use of **Judas pigs**, similar to the **Judas goat** technique used in feral goat control, involves the use of a radio-collared individual to locate other animals after it is released and rejoins a group. Because pigs are not as gregarious as goats, this method has limited application and is seldom used.

Generally, as with all control options, helicopter shooting should not be considered as a stand-alone control measure, as it will only reduce the population by a limited amount and will require follow up with other control techniques.



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Ground shooting

Ground shooting includes individual hunters stalking pigs, groups of hunters chasing pigs into more accessible shooting terrain, spotlight shooting or opportunistic shooting from vehicles. Rifles, long bows and crossbows are used by different hunters.

Ground shooting is not effective in reducing the pig population unless shooting is extremely intensive—targeting a small, isolated population of pigs in an accessible area.

Shooting is a very labour intensive method and cannot be used to control pigs over large areas, particularly when pigs are at low densities. Shooting, both ground and aerial, can cause pigs to disperse and requires a great deal of skill for it to be cost-effective. Night vision scopes attached to rifles are effective in open terrain. Because the animals are not aware of where the firing originates, a number of animals in a group may be shot before they disperse.

Dogging

Dogging, as with ground shooting, is **very ineffective in reducing feral pig populations**. Dogging is best suited to removing the pigs that remain after poisoning and trapping campaigns. Hunting with dogs increases the probability of encountering feral pigs, particularly in dense vegetation. Dogs are used to locate and flush out pigs, which are then shot by the hunter. However, research has shown that even experienced dogs can miss concealed pigs.

See [Case study 6: Hunting with dogs \(Canberra\)](#)



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Exclusion fencing

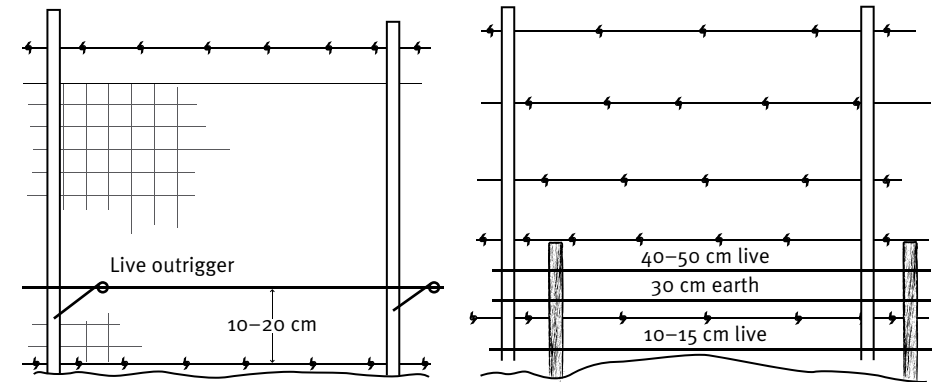
Fencing can be an expensive, but effective, method of pig control. Excluding pigs from high-value areas, such as high-value crops or animal enterprises, can be cost-effective over time. The prevention of animal or crop losses over time will generally offset the initial cost of the fence. Generally, the effectiveness of a pig-proof fence is related to how much the landowner is prepared to pay. Research indicates that the most successful fences are also the most expensive. The most effective fences include fabricated sheep mesh held close to the ground by plain or barbed wire and supported on steel posts.

Electrifying conventional, non pig-proof fences greatly improves their effectiveness as exclusion fencing. This can be achieved by incorporating a live outrigger, 20–30 cm high and approximately the same distance out from the fence. In dry soil conditions, an earth wire should be included below the single wire or conversely, midway between 2 live wires placed at heights of 10–15 cm and 45–50 cm offset from the netting or electric fence. The most effective fence design features 8/80/15 hinge joint, steel posts at 5 m intervals, 2 top barb wires and an electrified outrigger wire 25 cm above ground level. This electrified fence design costs near \$2500/km to construct.

Electrification is the cheapest and simplest method of modifying existing fences to pig-proof standard. Electrifying conventional sheep mesh fences greatly increases their effectiveness also, and minimises maintenance requirements due to pig damage. For fencing to be effective, the fence needs to be constructed prior to pigs becoming accustomed to crossing the area. Once the pigs are aware of a food or water source, placing a fence in their path will generally be unsuccessful. A combination of netting and electric wires is more successful in preventing pigs crossing.

The economics of fencing needs to be considered, and depends on the efficiency of the design, initial and annual costs, area enclosed, perimeter length, life of the fence and the value of the area being protected.

Continuous maintenance is required to repair breaches made in the fence by pigs, fallen timber or floods. Furthermore, electric fences require control of vegetation growing underneath the fence to prevent shorting. Pigs are also most active at night, when dew-covered grass is more likely to short out or drain the electric fence.



A. Pig-proof fence design

B. Electrified conventional fence

Exclusion fencing

Pig-proof fences (A) are expensive to construct but are very effective. Electrifying a conventional fence (B) greatly improves its effectiveness and will add years to its life. In moist soil conditions a single live wire as in (A) will suffice.



Exclusion fencing used for feral pig control in Hawaii



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Other control techniques

Pathogens and immunocontraception have been suggested as possible biological control methods for feral pigs. These methods have not been pursued, as it would be difficult, if not impossible, to stop the spread of any disease to domestic pigs. The feral pig industry and the associated export and flow-on revenue would also be significantly affected by any such disease.

Currently there is no work being carried out on producing immunocontraceptive baits for feral pigs. Because delivery methods are the same, it would be far more efficient to provide poisoned bait than immunocontraceptive bait. There are also potential problems involved in developing such a control method, including:

- a lack of long-acting contraceptive compounds (making repeat dosing necessary)
- high costs of delivery by baits (particularly when repeat dosing is needed)
- a decreased effect on population size (in comparison to an equivalent number of pigs being killed) due to repeat dosing requirements.

See [Case study 7: Trapping, aerial shooting and aerial baiting \(North Queensland\)](#)



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Implementing a management program

While the pages on **control techniques** have identified several methods that can be implemented to minimise the impact of feral pigs, it is important to note that no one method or combination of methods will be suitable for all situations. Each pig problem needs to be considered individually, with the most appropriate method or combination of methods selected based on the circumstances.

An effective management program involves reducing the density of feral pigs to a level where the benefits (known or perceived) are maximised compared to the cost involved. The benefits may include reduced economic losses, protection of conservation values or greater public participation in control operations.

Past control operations have generally concentrated on reducing the feral pig population as the major objective. Theoretically, effective control of a pig population requires that 70% of the population be removed for 3 consecutive years to bring the population down to very low levels. In practice this is difficult, due to changing environmental conditions and the resulting changes in pig population growth rates. In some cases where good seasons exist, pig population growth can exceed the reduction achieved by control programs.

Current management plans generally emphasise the need to reduce the impacts of feral pigs to acceptable levels. Therefore, simply reducing pig populations to very low levels may not be necessary, achievable or economically viable.

There are 4 essential stages involved in developing a strategic management program for feral pig control. Following this step-by-step approach will allow for the preparation of a dynamic plan that can be adapted to a variety of situations and changing circumstances.

1. Define the problem

This is the most important phase of the pest management process, but it is often overlooked. It is critical to determine whether there is an actual problem and not just a perceived one. The presence of pigs does not automatically mean that they are causing significant or long-term damage.

The scope and duration of the problem needs to be defined. Associated impacts (economic, environmental or social) caused by feral pigs should be compared with the benefits received by controlling them. It can be difficult to assess environmental impacts, which often require the costing of intangible factors such as biodiversity.

Often it is assumed that the impact of feral pigs is directly related to the size of the population that is present, and that any reduction in their numbers will achieve a proportional reduction in impact. However, this is not always the case. For example, removing a small number of feral pigs from a highly sensitive conservation area may result in maximising the protection of a threatened species. On the other hand, reducing a high proportion of feral pigs in a given area may not significantly reduce the economic impact to agricultural production if a few **rogue** individuals (such as solitary boars) are responsible for most of the damage and are not controlled by the management program.

Threshold levels may also vary between community groups, and due to seasonal conditions. For example, conservation and tourist groups may regard even a low population of feral pigs as unacceptable, whereas hunting groups may consider that reducing populations to low levels will reduce the quality of their sport. Some landholders' toleration of pig impacts is determined by the economic return of their produce or by the growth stage of their crop.

In some situations the cost of controlling pigs may be greater than the derived benefits, and not justify commencement of a management program.



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2. Develop a plan

The main components of developing a management plan include establishing a set of specific and realistic objectives (interim and long-term goals), a time frame to achieve goals and indicators for measuring performance. Depending on the situation, there are several options for the level of management required, ranging from local eradication, strategic management, commercial management or crisis management to no management. Strategic management offers the most flexible option, as it allows for changes in economic, environmental and pest circumstances. It is best to target key areas with adequate resources rather than take a more general approach.

Control techniques need to be included in the preparation of the plan, which will often require integration of a number of options in order to achieve the desired management objectives.

3. Implement the plan

For broadscale pig management over a wide area, a coordinated approach is generally required due to the wide distribution of pigs, overlapping home ranges and multitude of land tenures that may be affected. For example, pig management in the wet tropics usually requires control to be conducted by all stakeholders, government bodies and local producers to provide beneficial outcomes. A piecemeal approach will never achieve effective control over wide areas, as rapid re-infestation from uncontrolled areas will significantly reduce the effectiveness of the control program.

In order to effectively implement a management plan, it is essential to gain support from relevant stakeholders, and their involvement and ownership of the plan should be encouraged. This is best done by involving them in the planning, implementation, and monitoring and evaluation phases.

Formation of a stakeholder group is desirable and should encourage improved coordination and cooperation between landowners and other stakeholders (e.g. government and agricultural industry groups), and help empower all members with a sense of ownership of the process and the solution. Groups are also often in a better position to attract greater technical and financial resources than individuals. If necessary, peer pressure can also be applied to ensure that desired outcomes are achieved.

Effective group action depends upon the establishment and maintenance of cohesive groups. Some useful hints include the following:

- Start with a group of people that are comfortable together.
- Identify a prominent landowner from the group as the leader that is accepted by all, knows the social structure of the group and knows the common needs of the district.
- Use existing groups (e.g. Landcare or something similar) where possible to establish a feral pig control subcommittee.
- The group size must be a manageable size.
- Establish a sound communication structure within the group. Some members may feel left out of the planning and decision-making process if it is not communicated to all members of the group.
- If possible, establish communication with other established pig control groups.
- Establish a line of contact with relevant coordinators available in local councils or government agencies.

4. Monitor and evaluate

Monitoring of the operational (cost-effectiveness) and performance (effectiveness of the management plan) components of the plan are essential to ensure appropriate changes are made and mistakes rectified.



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Case study 1

Altitudinal migration (North Queensland)

A case study in the rainforests of the wet tropics region of North Queensland described the movements of 29 feral pigs in relation to altitudinal migration from the highland rainforest to the coastal lowland cane growing areas. Feral pigs were found to be non-migratory and stayed within their home range throughout the 4-year study period.

No altitudinal migration from the highlands to the lowlands was detected—pigs moved no more than a mean distance of 1 km from the centre of their calculated home ranges. There was no significant difference between the mean home range sizes for males (8.7 km²) compared to females (7.2 km²). The aggregate mean home range size for all pigs in this study was 7.9 km².

The study also found that home ranges varied in size between the tropical wet and dry seasons. With both sexes combined, the mean home range size in the dry season (7.7 km²) was more than twice the home range size in the wet season (2.9 km²). Large variations in home range sizes were found between the males. There was also a significant relationship between bodyweight and home range size for males—larger males had larger home range sizes.

Case study 2

Banana and sugarcane industries (North Queensland)

A case study of the banana and sugarcane agricultural industries in the wet tropics of North Queensland identified that feral pig's cause significant economic damage. Over a 28-month period, 30 farms were regularly surveyed to assess feral pig population levels in order to quantify the associated economic damage they cause in terms of actual on-farm dollar costs, and quantify the costs of control techniques.

Pig populations fluctuated in response to climate, crop maturity and control operations. Feral pigs were estimated to cause, on average, direct economic damage of \$1824 per banana farm per annum and \$5352 per cane farm per annum. This represents 0.08% of banana production value and 3.5% of cane production value of the sampled farms.

From sugarcane harvest data, feral pigs caused damage to 16 147 tonnes (valued at \$377 517) or 5.65% of the sugar crop. No significant relationship could be detected between pig population levels and the economic damage they cause.

The total on-farm costs of feral pig damage and costs of control averaged \$4099 per annum for each banana farm, and \$10,633 per annum for each cane farm. Control techniques cost, on average, \$4010 per farm per annum. The average cost to control an individual pig was estimated at \$250. The most cost-effective control technique employed was trapping conducted by the landholder.



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Case study 3

Pond apple and mesquite (North Queensland)

A case study on pond apple (*Annona glabra*), a serious weed of the wet tropics, found that feral pigs consumed fruits when available. Out of a total of 46 pig droppings collected in the vicinity of a pond apple infestation, an average of 15 seeds were retrieved. Of the pig droppings, 24 contained seeds and the maximum retrieved from an individual dropping was 288.

A captive feeding trial found that the majority of pond apple seeds pass through the gut of feral pigs within 3 days, although some were retained for up to 8 days. Approximately 23–48% of the seeds (depending on whether whole fruits or individual seeds were fed) retrieved from the droppings had been damaged and were no longer viable.

In the dry tropics, mesquite (*Prosopis* spp.) pods are a preferred diet of feral pigs when available. On average, 14% of mesquite seeds have been found to remain viable after passage through the gut. Most seed passes through the gut within 3–5 days. Because pigs like mesquite pods so much, they tend to stay in the vicinity of infestations until there are no more pods available. Therefore they are probably not going to disperse seeds over long distances, except perhaps solitary boars that may be just passing through.

Case study 4

Feral pig diggings (North Queensland)

A case study in the wet tropics examined the environmental impacts caused by feral pig diggings. Pig digging impacts were assessed using 5 ecological indicators:

1. survival of tree seedlings
2. amount of surface litter
3. amount of sub-surface plant biomass
4. earthworm biomass
5. soil moisture content.

A total of 12 recovery exclosures were established by fencing off areas of previous pig diggings. A total of 0.59 ha was excluded from further pig diggings, and compared to 1.18 ha of unfenced controls. Over the 2-year study, seedling numbers increased by 7% within the protected exclosures and decreased by 37% within the unprotected controls. Seedling survival significantly increased in line with the increasing time of protection from diggings.

Feral pig diggings had no significant effect on surface litter biomass, sub-surface plant biomass, earthworm biomass or soil moisture.



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Case study 5

Aerial baiting (North Queensland)

A case study in the dry tropics compared the uptake rates of aurally distributed baits under 2 bait placement strategies:

1. blanket baiting, where baits are placed along set transect lines over the whole area
2. strategic baiting, where baits are placed in concentrated, high pig-usage areas (water and feed sources).

Bait uptake was assessed under wet and dry seasonal conditions. Results indicated that seasonal conditions play an important part in bait uptake rates, primarily due to bait encounter rates. Pigs dispersed in wet conditions and foraged widely, as water availability does not restrict their movements. This dispersal ensured that pigs encountered baits that had been aurally blanket distributed. During the dry season, pigs are concentrated around available water sources so baits that are widely distributed are not found. In this situation strategic baiting or intense baiting in the pig refuge areas are the best options.

Case study 6

Hunting with dogs (Canberra)

A case study in Canberra studied the effect hunting with dogs had on the pig population in a national park. Radio tracking of pigs, hunting dogs and hunters showed that only 27% of the pigs seen were captured by the dogs. In some instances, hunters passed within 100 m of pigs without the dogs scenting the pigs. This control technique only removed 13% of the pig population present.

Case study 7

Trapping, aerial shooting and aerial baiting (North Queensland)

A case study in the dry tropical savannas of North Queensland (Burdekin River catchments) examined the control and cost-effectiveness of 3 feral pig management techniques—trapping, aerial shooting and aerial baiting.

In total, 203 pigs were controlled over a 2-month period—81 by trapping, 65 by aerial shooting and 57 by aerial baiting. Estimated population reductions of 74%, 64% and 59% were achieved for trapping, aerial shooting and aerial baiting respectively. Aerial shooting was the most cost-effective at \$25.90 per pig controlled. Aerial baiting was ranked next (\$34.19 per pig) and trapping was the least cost-effective (\$62.90 per pig).

The Department of Primary Industries and Fisheries (DPI&F) seeks to maximise the economic potential of Queensland's primary industries on a sustainable basis.

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