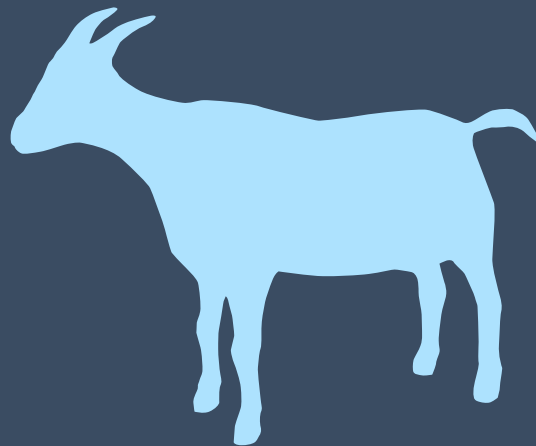




Department of
Primary Industries

NSW Code of Practice and Standard Operating
Procedures for the Effective and Humane
Management of Feral Goats



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© State of New South Wales through Regional NSW 2022. The information contained in this publication is based on knowledge and understanding at the time of writing (March 2022). However, because of advances in knowledge, users are reminded of the need to ensure that the information upon which they rely is up to date and to check the currency of the information with the appropriate officer of the Department of Regional NSW or the user's independent adviser.

Preface

This document (Code of Practice (COP) and relevant Standard Operating Procedures (SOPs)) provides current information and guidance to government agencies, land managers and pest animal controllers involved in the management of feral goats in NSW. Feral goats are also managed as a valuable and sustainable resource to landholders, rather than simply being controlled as a pest species. This COP and associated SOPs are equally relevant and applicable for both the management and control of feral goats. The aim is for control programs to be conducted in a way that reduces the negative impacts of feral goats using the most humane, target-specific, economic and effective techniques available.

Previously published and endorsed COPs and SOPs ¹ available via the PestSmart website (<https://www.pestsmart.org.au/>) can provide general guidance for national use, but some of the content may now be out-of-date. This revision of NSW-specific COPs and SOPs ² has been developed to provide the most relevant and up-to-date information to support best practice pest animal management in NSW. Outdated information has been removed, while new information has been added to reflect the advancements and changes specific to feral goat management within NSW. For ease of use, the COP and SOPs for each species have been consolidated into one document; however, links are provided to allow printing of individual SOPs as required.

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Introduction

All pest animal management must aim to minimise individual animal suffering while at the same time optimising the population impact of a control program. This requires use of the most humane methods that will achieve the control program's aims. Consideration of animal suffering should occur regardless of the status given to a particular pest species or the extent of the damage or impact they create. While the ecological and economic rationales for the control of pests such as the feral goat are frequently documented, of equal importance is an ethical framework under which these pests are controlled.

A **Code of Practice** (COP) provides overarching context and brings together the SOP procedures in context, and now in one document that specifies humane control options and their implementation. In this way, COPs encompass 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 control technique and how to most effectively implement management programs.

This COP provides state-wide guidance and is based on current knowledge and experience in the area of feral goat control. It will be revised as required to take into account advances in knowledge and development of new control techniques and strategies.

Standard Operating Procedures (SOPs) ensure that an ethical approach (including the recognition of, and attention to, the welfare of all animals directly or indirectly affected by control programs) is uniformly applied to each pest animal control option. The SOPs are written in a way that describes the procedures involved and animal welfare issues applicable for each control technique, thus acting as a detailed guide to support best practice control programs.

Definitions and terms

Best practice management – a structured, consistent and adaptive approach to the management of pest animals in an attempt to achieve enduring and cost-effective outcomes. 'Best practice' is defined as the agreed principles and specific techniques at a particular time following consideration of scientific information and accumulated experience³.

Euthanasia – literally means a 'good death' and usually implies the ending of suffering for an individual; however, when used in regard to animals it usually refers to the means by which an animal is killed rather than the reason for killing it^{4,5}.

Humane – refers to an absence of (or minimal) pain, suffering and distress (e.g., a relatively more humane euthanasia method will cause less pain, suffering and distress than a relatively less humane euthanasia method).

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

Humane killing – the killing of animals using relatively humane methods in certain situations (e.g., animals used in research or pest management) for reasons other than to reduce their suffering.

Humane vertebrate pest control – the development and selection of feasible control programs and techniques that avoid or minimise pain, suffering and distress to target and non-target animals ⁶.

Pest animal – (also referred to as vertebrate pest) native or introduced, wild or feral, non-human species of animal that is currently troublesome locally, or over a wide area, to one or more persons, either by being a health hazard, a general nuisance, or by destroying food, fibre, or natural resources ⁷. Refer to Vertebrate Pesticide Manual ⁸ for relevant governance and legislation information as applied to the control of vertebrate pests.

Welfare – an animals' state as regards its attempts to cope with its environment ⁹. Welfare includes the extent of any difficulty in coping or any failure to cope; it is a characteristic of an individual at a particular time and can range from very good to very poor. Pain and suffering are important aspects of poor welfare, whereas good welfare is present when the nutritional, environmental, health, behavioural and mental needs of animals are met. When welfare is good, suffering is absent ¹⁰.

Best practice in pest animal management

From an animal welfare perspective, it is highly desirable that pest animal control programs are efficient, effective and sustained so that pest populations are reduced to low levels and not allowed to recover, thereby avoiding the need for repeated large-scale killing. Over the last decade, the approach to managing pest animals has changed ³. Rather than focussing on inputs, it is now realised that like most other aspects of agriculture or nature conservation, pest management needs to be carefully planned and coordinated with the aim of reducing to an acceptable level the damage due to pest animals i.e., the focus is on measurable economic and environmental outcomes. Pest animal control is just one aspect of an integrated approach to the management of production and natural resource systems and management of other factors may also be required to achieve the desired result. For example, for a lamb producer with limited resources, other factors influencing lamb production may include weed control, cover for lambs, ewe nutrition or rams that give a higher twinning rate. Unless pest animal control actions are well planned, collaborative and coordinated at the right temporal and spatial scales, individual control programs are unlikely to have long term benefits. When planning pest animal management, there are some important steps that should be considered (Braysher and Saunders, 2015 ¹¹):

1. Identify the trigger to undertake pest animal management. Is there a community or political pressure for action on pests and an expectation that pest animals should be controlled? Pest control is unlikely to be effective unless there is strong local or political will to take action and commit the necessary resources.
2. Identify the key group to take responsibility for bringing together those individuals and groups that have a key interest in dealing with the pest issue.
3. Identify the problem. In the past the pest was usually seen as the only problem. We now know that the situation is more complex. First, determine what the problem is. For example, it may be effects on native fauna, reduced levels of agricultural production, and complaints from neighbours or emotional stress from worrying about pest impacts. Several factors impact on each of these problems and control of pests are often only part of the solution.

4. Identify and describe the area of concern. Sometimes it helps to remove agency and property boundaries (nil tenure) so that the problem can be viewed without the tendency to point blame at individuals, groups or agencies. Property and agency boundaries can be added later once agreement is reached on the best approach.
5. Try to break the area into smaller management units for planning. These smaller units may be determined by water bodies, mountain ranges, fences, vegetation that is unsuitable for a particular pest or other suitable boundaries that managers can work to. While it is best to work to boundaries that restrict the movement of pests, this may not be practicable and jurisdictional boundaries, for example, the border of a Landcare group, may have to be used in combination with physical boundaries. Once the management units are identified:
 - a. Identify as best you can, the pest animal distribution and abundance in each management unit.
 - b. Estimate as far as is practicable, the damage caused by the pest or pests to production and to conservation.
 - c. Gather and assess other relevant planning documents such as Catchment Management Plans, Recovery Plans for threatened species and Property Management Plans. Identify any key constraints that may prevent the plan being put into operation and identify all the key stakeholders.
 - d. Develop the most appropriate pest management plans for each of the management units.

Implementing effective and humane pest animal control programs requires a basic understanding of the ecology and biology of the targeted pest, other species that may be affected directly (non-targets) or indirectly (e.g., prey species) by a control program. Managers should take the time to make themselves aware of such information by reading the recommended texts included in this document.

The *Biosecurity Act 2015* and pest animal management

From 1 July 2018, the management of pest animals in NSW needs to account for the requirements and obligations under the NSW *Biosecurity Act 2015*. Everyone in NSW who deals with pest animals, including land managers (public and private), recreational land users, other community members and even visitors to the state must manage those pest animals where they present a risk to biosecurity in NSW.

There are some specific requirements relating to some pest species outlined under the *Biosecurity Regulation 2017*. For example, under the Biosecurity Regulation, it is illegal for a person to keep, move or release a feral pig, wild rabbit, feral deer or European red fox.

A number of documents are available to help land managers and other community members to understand which pest animals they must manage and how. Central to these are the *Regional Strategic Pest Animal Management Plans* that set out the requirements for managing the impacts of pest animals.

Specific members of the Local Land Services' team can investigate if they suspect a person or organisation is not managing pests properly and are able to provide educational material outlining the biosecurity risks presented by the pest animals, and management actions that must be taken to manage the risk posed. If appropriate management action is not taken to

manage the pest animals, trained and authorised staff from [Local Land Services](#) can undertake enforcement action.

Animal welfare and humaneness

Pest animals continue to cause significant damage and risks to the environment, agricultural production and to public health. Each year hundreds of thousands of pest animals are trapped, poisoned, shot or otherwise destroyed because of the harm they cause¹². Historically, pest animal control has focussed on killing as many pests as cheaply as possible. For most people in today's society the management of pest animals is considered acceptable provided that such management is *humane* and *justified*¹³. However, many of the methods used to control pest animals in Australia are far from being humane. Deficiencies need to be addressed, inhumane techniques replaced and new, more humane, alternatives developed. For further detail refer to [RSPCA Policy E02](#).

The humaneness of an individual pest control technique is highly dependent on the way the technique is applied and on the skill of the operator involved. Attention to details such as timing and coordination of control, bait delivery, lethal dose rates, type of firearm and ammunition have significant effects on animal welfare and target outcomes of control programs. By standardising the way control methods are applied, many of the negative welfare impacts can be reduced or even prevented. This document (COP and SOPs) has been specifically developed to address this issue.

It also contains a summary of the results of humaneness assessments for all individual techniques included as SOPs. The full assessments can be found on the PestSmart website. (<https://www.pestsmart.org.au/>). These assessments were carried out using a model developed by Sharp and Saunders (2008, 2011)^{14, 15}. The model provides a practical, general means of assessment that can be applied to any control technique. The goal of humaneness assessment is to evaluate the impact of a control technique on individual animals and to use this assessment to determine which methods are more or less humane compared to others.

Assessment of humaneness using the Sharp and Saunders model is based on the five domain approach to welfare assessment as developed by Mellor and Reid (1994)¹⁶. According to this approach, potential or actual welfare compromise is identified in four physical or functional domains and one mental domain:

- 1: Nutrition – water or food deprivation, malnutrition.
- 2: Environmental – exposure to excessive heat or cold.
- 3: Health – disease or physical injury.
- 4: Behaviour – spatial or interactive restriction.
- 5: Mental or Affective State – 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 challenges leading to negative affective states.

When considering the humaneness or welfare impact of a control method, impacts are assessed in relation to nutrition, the animal's environment, its health or functional status, its behavioural needs and its overall mental status. As described by Sharp and Saunders (2008, 2011)^{14, 15} and Beausoleil and Mellor (2015)¹⁷ when data is available, actual impacts in each of

the four domains are evaluated using a range of quantitatively assessed changes in behaviour and physiology along with pathophysiological indicators of functional disruption. Compromise in one or all of the physical domains is then used to infer potential negative affective impacts in the fifth domain. As welfare is generally considered to be a state within an animal that most directly relates to what the animal experiences, the overall impact of a control method on the animal's welfare generally reflects impacts in Domain 5.

When the model is applied to a range of different methods, these can be compared, thus allowing an informed decision on control method choice based on relative humaneness.

Humaneness assessment using the Sharp and Saunders model follows a two-part process: Part A examines the impact of a control method on overall welfare and the duration of this impact; and Part B examines the effects of the killing method on welfare (so is only applied to lethal methods). For example, with live trapping followed by shooting, both Part A and Part B are applied, but with fertility control only Part A is applied.

In Part A, overall welfare impact is assessed by looking at the impacts in each of the five domains as described above. In Part B, the killing method is assessed by examining the level of suffering and the duration of suffering based on the time to insensibility criteria described by Broom (1999)⁹. Matrices are then used to determine the score for each part and then the two scores are combined to obtain the overall humaneness score.

Feral goat management

Background

Feral goats (*Capra hircus*) occur in all Australian states and on many offshore islands but are most common in the rocky or hilly semi-arid areas of western New South Wales, South Australia, Western Australia and Queensland. Nationally there is an estimated 2.5–5.5 million goats of which 90% are feral or unmanaged¹⁸. Feral goat populations occur across approximately 28% of Australia and have grown from an estimated 1.4 million feral goats in 1997 to 3.59 million in 2016-2018. Numbers have particularly grown in NSW with an estimated 3.4 million managed and feral goats in the Southern Rangelands in 2016-2018¹⁹.

Feral goats live in herds, with females breeding twice a year from one year of age, and twins and triplets are common. They have a major impact on native vegetation through soil damage and overgrazing which can cause erosion and prevent regeneration. They also compete with domestic livestock for food, foul waterholes, spread weeds through their dung, and compete with native animals for food, water and shelter²⁰. Feral goats carry footrot, which makes it difficult to cure sheep of the disease due to reinfection.

Management of feral goats is a complex issue. While they are a major environmental and agricultural pest, they are also a valuable resource for landholders due to high demand for goat meat worldwide. This leads to varying attitudes towards goats, ranging from controlling them as a pest, to opportunistic harvesting to boost cash flow, or managing them to maximise profitability. They are harvested commercially for meat and are either mustered or captured for processing through abattoirs or exported live. Australia is the world's largest exporter of goat meat, with around 90% of Australia's goat meat derived from feral goats²¹,²². The value of Australian goat meat and live goat export increased from \$125 million in 2010-11 to \$257 million in 2017²². While commercialisation is an important aspect of feral

goat management, this document primarily focuses on management actions for the purpose of impact reduction.

For further information (including commercial use) please see:

- Threat abatement plan for competition and land degradation by unmanaged goats: <http://www.environment.gov.au/biodiversity/threatened/threat-abatement-plans/approved>
- PestSmart: <https://www.pestsmart.org.au/pest-animal-species/feral-goat/>
- Local Land Services: https://archive.ils.nsw.gov.au/_data/assets/pdf_file/0009/496665/archive-feral-goat-ecology-and-management-in-the-western-nsw-rangelands-review.pdf
- MLA: <https://www.mla.com.au/extension-training-and-tools/going-into-goats/>

Primary and supplementary control methods

Pest control programs must be cost-effective. The techniques used within a control program need to be complementary to each other 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 indefinitely. This leads to a situation where the need for ongoing control is minimised and rates of 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 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 goats, aerial shooting is a primary method of control and supplementary techniques are used as a follow-up, e.g., Judas goats. Regional variations can occur, e.g., aerial mustering of feral goats would be considered a primary technique in the western division where visibility is good and the terrain is flat whereas in the more timbered east, primary control would consist of shooting and trapping. For effective control at least one primary control method and one supplementary control method should be utilised to help satisfy general biosecurity duty requirements.

Spatial scale is also important. To achieve cost efficiencies and depending on the movement behaviour of the target pest, the area under control may need to be a collaboration of many adjoining land managers.

Poorly executed control programs can simply become sustained culling 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. A rotation of primary and supplementary techniques can also be important. Pest animals can become familiar to a particular technique (e.g., shooting) that may require switching to another lethal method (e.g., trapping). Another 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. Alternatively, application of control can align with when the commodity being protected is most vulnerable (e.g., winter pastures). In the case of goats, there is a particular

opportunity for cost-effective management when they are congregated around resources during prolonged hot and dry periods.

Feral goat management methods

The most commonly used feral goat management techniques are mustering, trapping at water, aerial shooting, ground shooting and total grazing pressure exclusion fencing. 'Judas' goats fitted with radio collars are sometimes used to help locate difficult to find groups of goats during control or eradication programs. Feral goats are common on offshore islands. Their eradication in these situations can be achieved using a combination of control techniques as recently demonstrated on Kangaroo Island ²².

Mustering and trapping are used in cases where goats are intended for commercial slaughter. The efficiency and effectiveness of mustering and trapping are affected by the terrain, density of the vegetation, operator experience, vehicles and mob size. Efficiency and economy generally increase with higher goat densities. Management of low-density herds, those in rough or densely vegetated areas, or of remnant or colonising herds, relies on lethal techniques such as aerial or ground shooting, or trapping and on-site euthanasia. The use of Judas goats can improve the efficiency of some of these latter control techniques. Cost-effectiveness, humaneness and efficacy for each control technique are useful in deciding the most appropriate strategy. A brief overview of control technique applications and welfare considerations follows:

Humaneness of management techniques

Shooting

Shooting is considered more humane than capture and removal as the animals are not subject to the stresses of mustering, yarding, and long-distance transportation.

Ground shooting

Shooting can be a humane control method for feral goats 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 shots are the preferred point of aim when prevailing conditions are appropriate e.g., stillness of target.

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

Aerial shooting

All aerial shooting programs in NSW managed by Government agencies must adhere to the instructions and requirements of the NSW Feral Animal Aerial Shooting Team (FAAST) Manual ²⁴. Private or commercial operators in NSW that are not conducting shooting as part of a FAAST program must still adhere to all relevant regulatory and legislative requirements.

Aerial shooting of feral goats 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 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 species 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 species 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 (outside of head (brain) and chest (heart-lung) target zones) 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 much better opportunity for rapid follow-up shots for any injured animals. There must be a minimum of two shots per animal – one of which must be a chest shot.

Mustering for capture and removal

Mustering is mainly suitable in areas of flat terrain and can be achieved with either helicopter or light aircraft, or on horse or motorbikes. To avoid heat stress, mustering should be carried out when conditions are cool or mild. Feral goats should be handled quietly without force to avoid panic and trampling. The tail end of the mob should set the pace rather than being forced to keep up with the leaders. Goats that fail to keep up with the mob should be allowed to drop back. Does that continually break away from the mob may have left a kid behind and should be allowed to leave. Distances that the goats need to be mustered should be kept to a minimum e.g., by using portable yards.

Capture and handling of goats should be avoided when females are kidding or have young-at-foot. Dependent young will experience significant negative welfare impacts (including dying from dehydration or starvation) if they are separated from their mother during mustering or yarding. In addition, kids can get trampled underfoot when there are large numbers of adults in the yards.

Trapping at water

Traps are goat-proof enclosures that surround a watering point such as a trough or dam and have a one-way gate or jump-down ramp as an entrance. Traps are effective during drought when water sources are limited. Traps must be well designed and constructed and monitored daily to minimise animal distress and suffering.

Water must always be available within the trap and appropriate feed should be provided if captured goats with kids at foot are to be held for more than 24 hours. Feed should be provided for non-breeding goats if held for more than 48 hours. More frequent checking may be necessary during extreme weather conditions or when large numbers of goats are expected to enter the trap. Traps should be constructed to provide goats with shade and shelter and should be large enough to avoid overcrowding.

Capture and handling of goats should be avoided when females are kidding or have young at foot. Kids that do not accompany their mother into the trap can get separated and die of dehydration or starvation or if trapped in the enclosure with large numbers of adult goats, can get trampled underfoot.

Goat traps can have significant negative impacts on native non-target species (especially macropods) if they access the enclosure but can't get out or are excluded from water sources. As such, gates and jump down ramps should be designed to minimise these non-target impacts.

Holding goats in paddocks or yards

Mustering, capture, handling and holding increase stress in feral goats as they are not used to confinement or close contact with humans. Consequently, these procedures can result in mismothering, feeding disruption, social disruption, heat stress and also abortion in heavily pregnant females. Metabolic, nutritional and parasitic diseases as well as changes in environmental conditions are common causes of mortality and morbidity in confined feral goats, especially when confined for long periods.

Goats in a confined space require increased husbandry to ensure that they have adequate food and water and are not exposed to disease. Goats should be drafted to minimise dominance behaviour when confined to holding yards or goat paddocks. Older males and goats with significant horns should be separated to avoid dominance behaviour and injury. Does and unweaned kids should be kept together.

Transport of captured or mustered goats

The removal of trapped feral goats off-property for either sale to abattoirs, live export, or for other management, involves considerable additional stress to animals. Goats captured by mustering and confined to yards or a goat paddock should be allowed a minimum of 48 hours rest with adequate shelter, food and water before they are transported long distances. It is important to ensure that all goats have fed and watered and are fit to load prior to transportation.

Dependent kids that are less than approximately 7 days old should not be transported unless necessary nor should they be left to fend for themselves. Rather, they must be humanely euthanased to prevent suffering.

Specific requirements for the transportation of goats can be found in the [Australian Animal Welfare Standards and Guidelines — Land Transport of Livestock](#)²⁵.

Use of Judas goats

A captured 'Judas' goat is fitted with a tracking collar and released so that it can locate and join a herd of feral goats. 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 goats 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 goats may cause fear and anxiety as goats are highly social animals. Tracking and the nearby shooting of cohorts may also be another source of distress.

The lightest collar/transmitter available should always be used (<5% of the body weight of the animal). The collar must 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 must also be sufficiently loose as to be comfortable and not interfere with swallowing or panting. Efforts should be made to reduce the possibility of the collar getting caught up in vegetation.

Exclusion fencing

Despite being expensive to establish, goat-proof enclosures or barriers can provide long term environmental and production benefits to pastoral properties and conservation estate e.g., protecting pastures 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.

Although fencing can act as a barrier to goats it can also have negative effects on non-target species (such as kangaroos 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 (or electrocution with electric fences) 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., wombat 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 web sites of commercial fencing manufacturers.

Lethal baiting

No pesticides are currently approved or registered for use in the control of feral goats in NSW. Recent research in New Zealand and Australia has identified a number of potential bait presentation techniques which may have future application for feral goat management²⁶. Prior to any approval or adoption of baiting as an additional control method the technique would be required to demonstrate a high level of target selectivity, be matched with an approved toxicant and produce consistent and humane results during approved field research trials.

Table 1: Humaneness, Efficacy, Cost-effectiveness and Target Specificity of Feral Goat Control Methods

Control Technique	Acceptability regarding humaneness* and Relative humaneness score (Part A [1-8], Part B [A-H]**)	Efficacy	Cost-effectiveness	Target Specificity	Comments
Aerial shooting <i>Primary</i>	Acceptable Score: 4C	Effective	Relatively expensive. Can be cost-effective when goat density is high	Target specific	Used for control at both high and low densities especially in rugged or inaccessible terrain. Effective for eradicating small numbers of goats remaining after the use of other control methods. Useful for achieving broad scale reductions when goat prices are low.
Mustering <i>Primary</i>	Acceptable Score: 4	Effective	Cost-effective	Target specific	Efficient and cost-effective where goats are present in high densities, the terrain is relatively flat and goat prices are high. Welfare concerns associated with capture and transport of goats.
Trapping at water <i>Primary</i>	Acceptable Score: 5	Effective	Cost-effective	Can have a significant impact on non-target animals, especially macropods and emus. Trapped non-target species must be removed as quickly as possible to avoid undue stress. Traps at natural water holes may severely restrict access by native species.	Most effective during dry times. Cost-effective when prices for goats are high

Control Technique	Acceptability regarding humaneness* and Relative humaneness score (Part A [1-8], Part B [A-H]**)	Efficacy	Cost-effectiveness	Target Specificity	Comments
Exclusion fencing <i>Supplementary</i>	Acceptable Score: N/A	Effective in suitable areas	Expensive	Can impact on non-target species by restricting movement or denying access to water sources.	Expensive, therefore impractical for large scale application. Fences will not permanently stop the movement of all goats and should only be used as a tactical technique in a management program.
Ground shooting <i>Supplementary</i>	Acceptable Score: Head – 3A; Chest – 3D	Not effective	Not cost-effective	Target specific	Labour intensive, only suitable for smaller scale operations. Has variable efficiency dependent upon climatic conditions. Can be cost-effective when densities are high. However, if goat prices are good then it may be more cost-effective to trap/muster and sell the goats rather than shoot them.
Use of Judas goats <i>Supplementary</i>	Acceptable Score: N/A	Effective	Relatively cost-effective compared with searching for goats from helicopters or on foot	Target specific	Can be a useful adjunct to other control methods. Effective if local eradication is the aim. Requires expensive equipment and skilled operators
Lethal baiting Not available	Acceptable Score: N/A	Unknown	Unknown	Depends on agent used	No products currently registered

Footnotes for 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.

Methods that are not acceptable are considered to be inhumane. The welfare of the animal is very poor before death, often for a prolonged period

** 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: For assessment worksheets and matrix of relative humaneness scores see: <https://www.pestsmart.org.au/animal-welfare/humaneness-assessment/feral-goat/>

N/A = Humaneness score not available.

Control techniques are classified as primary (maximum effect), supplementary (follow-up) or 'not available'. In some situations, techniques can alternate between primary and supplementary.

Relevant legislation

All those involved in pest animal control should familiarise themselves with relevant aspects of the appropriate federal and state legislation. The table below lists relevant legislation. This list is by no means exhaustive and was current at the time of writing.

Commonwealth	<i>Agricultural and Veterinary Chemicals Code Act 1994</i> <i>Environment Protection and Biodiversity Conservation Act 1999</i>
New South Wales	<i>Biodiversity Conservation Act 2016</i>
Wales	<i>Biosecurity Act 2015</i> <i>Game and Feral Animal Control Act 2002</i> <i>Local Government Act 1993</i> <i>Local Land Services Act 2013</i> <i>National Parks and Wildlife Act 1974</i> <i>Pesticides Act 1999</i> <i>Prevention of Cruelty to Animals Act 1979</i>
Other relevant legislation	<i>Civil Aviation Act 1988</i> <i>Civil Aviation (Carriers' Liability) Act 1967</i> <i>Firearms Act 1996</i> <i>Dangerous Goods (Road and Rail Transport) Act 2008</i> <i>Firearms Act 1996</i> <i>Work Health and Safety Act 2011</i>

Note: copies of the above legislation and relevant regulations may be obtained from federal and state publishing services.

Further information

Local Land Services	https://www.lls.nsw.gov.au/biosecurity/pestplan
NSW Department of Primary Industries	https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests https://www.environment.nsw.gov.au/topics/animals-and-plants/pest-animals-and-weeds/pest-animals
NSW Environment Protection Authority	https://www.epa.nsw.gov.au/your-environment/pesticides/pesticides-nsw-overview/pesticide-control-orders
PestSmart Connect	https://www.pestsmart.org.au/

References

1. Sharp, T. & Saunders, G. (2011). *Humane pest animal control: codes of practice and standard operating procedures*. New South Wales Department of Primary Industries, Orange. Available at: <https://www.pestsmart.org.au/animal-welfare/humane-codes/>
2. Sharp, T. & Saunders, G. (2005). *Humane Pest Animal Control: Codes of Practice and Standard Operating Procedures*. New South Wales Department of Primary Industries, Orange.
3. Braysher, M. (2017). *Managing Australia's Pest Animals: A Guide to Strategic Planning and Effective Management*. CSIRO Publishing, Melbourne.
4. Morton, D. B. (2010). Euthanasia. Pp. 232, in *The Encyclopedia of Applied Animal Behaviour and Welfare*. D. S. Mills & J. N. Marchant-Forde. CABI Publishing, Wallingford, UK.
5. American Veterinary Medical Association (AVMA). (2013). *AVMA guidelines for the euthanasia of animals: 2013 edition*. American Veterinary Medical Association. Available at: www.avma.org/KB/Policies/Documents/euthanasia.pdf
6. RSPCA (2004). *A national approach towards humane vertebrate pest control*. Discussion paper arising from the proceedings of an RSPCA Australia/AWC/VPC joint workshop, August 4–5, Melbourne. RSPCA Australia, Canberra.
7. Koehler, J. W. (1964). *Opening remarks*. Proceedings of the 2nd Vertebrate Pest Control Conference. 4-5 March 1964, Anaheim, California.
8. Anon. (2018). *Vertebrate Pesticide Manual*. NSW Department of Primary Industries, Orange. Available at: <https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests/publications/nsw-vertebrate-pesticide-manual>
9. Broom, D. (1999). The welfare of vertebrate pests in relation to their management. Pp. 309-329, in P. Cowan and C. Feare (eds.) *Advances in Vertebrate Pest Management*. Filander Verlag, Fürth.

10. Littin, K., Mellor, D., Warburton, B. & Eason, C. (2004). Animal welfare and ethical issues relevant to the humane control of vertebrate pests. *New Zealand Veterinary Journal*, 52: 1-10.
11. Braysher, M. & Saunders, G. (2015). *Best Practice Pest Animal Management*. NSW Department of Agriculture. Available at: <https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests/publications/best-practice-pest-animal-mgt>.
12. Olsen, P. (1998). *Australia's Pest Animals: New Solutions to Old Problems*. Bureau of Resource Sciences, Canberra.
13. Mellor, D. & Littin, K. (2004). Using science to support ethical decisions promoting humane livestock slaughter and vertebrate pest control. *Animal Welfare*, 13: 127-132.
14. Sharp, T. & Saunders, G. (2008). *A Model for Assessing the Relative Humaneness of Pest Animal Control Methods*. Australian Government Department of Agriculture, Fisheries and Forestry, Canberra, ACT
15. Sharp, T. & Saunders, G. (2011). *A model for assessing the relative humaneness of pest animal control methods (second edition)*. Department of Agriculture, Fisheries and Forestry, Canberra, ACT. Available at: <http://www.daff.gov.au/animal-plant-health/welfare/aaws/humaneness-of-pest-animal-control-methods>.
16. Mellor, D. & Reid, C. (1994). Concepts of animal well-being and predicting the impact of procedures on experimental animals. *Improving the Well-being of Animals in the Research Environment*: 3-18.
17. Beausoleil, N. & Mellor, D. (2015) Advantages and limitations of the Five Domains model for assessing welfare impacts associated with vertebrate pest control. *New Zealand Veterinary Journal*, 63: 37-43.
18. Kimball, NP & Chuk, M. (2011). Feral Goat Ecology and Management in the Western NSW Rangelands: A review. Western Catchment Management Authority.
19. Waters C, Reseigh-O'Brien J, Pahl L, Atkinson T, Burnside D & Revell D (2018). *Addressing feed supply and demand through total grazing pressure management; Appendix 1*. NSW Department of Primary Industries. Available at: <https://www.mla.com.au/research-and-development/search-rd-reports/final-report-details/Addressing-feed-supply-and-demand-through-total-grazing-pressure-management/3858>
20. Department of the Environment, Water, Heritage and the Arts (DEWHA). (2008). *Threat abatement plan for competition and land degradation by unmanaged goats*. DEWHA, Canberra. Available at: <http://www.environment.gov.au/biodiversity/threatened/tap-approved.html>
21. MLA (Meat & Livestock Australia) (2017). *Goat Meat Industry Summary*. MLA Industry Insights. MLA, Sydney.
22. Plumbe, M., Atkinson, T. & Turnbull, G. (2019). *Rangeland Goat Production in Western NSW: Where are they now?* Local Land Services, NSW.
23. Masters, P., Markopoulos, N., Florance, B. & Southgate, R. (2018). The eradication of fallow deer (*Dama dama*) and feral goats (*Capra hircus*) from Kangaroo Island, South Australia. *Australasian Journal of Environmental Management*, 25: 86-98.

24. Office of Environment and Heritage (2019 Draft). *NSW Feral Animal Aerial Shooting Team (FAAST) Manual*. Office of Environment and Heritage, Sydney.
25. Animal Health Australia (AHA). (2012) *Australian Animal Welfare Standards and Guidelines — Land Transport of Livestock*. Canberra. Available at: <http://www.animalwelfarestandards.net.au/land-transport/>
26. Hunt, R. J., Claridge, A. W., Fleming, P. J., Cunningham, R. B., Russell, B. G., & Mills, D. J. (2014). Use of an ungulate-specific feed structure as a potential tool for controlling feral goats in Australian forest ecosystems. *Ecological Management & Restoration*, 15(3), 231-238.

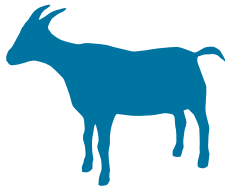
Recommended reading

- Bengsen, A.J., Forsyth, D.M., Harris, S., Latham, A.D., McLeod, S.R., and Pople, A. (2020). A systematic review of ground-based shooting to control overabundant mammal populations. *Wildlife Research*, **47**: 197-207.
- Forsyth, D. M., Parkes, J. P., Woolnough, A. P., Pickles, G., Collins, M., & Gordon, I. (2009). Environmental and economic factors determine the number of feral goats commercially harvested in Western Australia. *Journal of Applied Ecology*, 46: 101-109.
- Heriot, S., Asher, J., Williams, M. R., & Moro, D. (2019). The eradication of ungulates (sheep and goats) from Dirk Hartog Island, Shark Bay World Heritage Area, Australia. *Biological Invasions*, 21: 1789-1805.
- Khairo S.A., Hacker R.B., Atkinson T.L. & Turnbull G.L. (2013) Alternative strategies for management of feral goats: implications for natural resource management policies in New South Wales rangelands. *The Rangeland Journal*, **35**: 201-210.
- Letnic, M., et al. (2015). Artificial watering points are focal points for activity by an invasive herbivore but not native herbivores in conservation reserves in arid Australia. *Biodiversity and Conservation*, 24: 1-16.
- Long, K. & Robley, A. (2004). *Cost Effective Feral Animal Exclusion Fencing for Areas of High Conservation Value in Australia*. Australian Government, Department of the Environment and Heritage, Canberra.
- Meat & Livestock Australia (2006) *Going into Goats: Module 12 - A practical guide to producing goats in the rangelands*. Available at: https://www.mla.com.au/globalassets/mla-corporate/generic/extension-training-and-tools/gig_rangelands_module.pdf
- Parkes, J., Henzell, R., Pickles, G. & Bomford, M. (1996). *Managing Vertebrate Pests: Feral Goats*. Australian Government Publishing Service, Canberra.
- Pople, T. & Froese, J. (2012). Distribution, abundance and harvesting of feral goats in the Australian rangelands 1984–2011. *Final Report to ACRIS Management Committee*. Queensland Department of Employment, Economic Development and Innovation, Brisbane, Qld.

- Russell, B.G., Letnic, M., and Fleming, P.J.S. (2011). Managing feral goat impacts by manipulating their access to water in the rangelands. *The Rangeland Journal*, 33: 143-152.
- van Bommel, L. (2010). *Guardian Dogs: Best Practice Manual for the use of Livestock Guardian Dogs*. Invasive Animals Cooperative Research Centre, Canberra.

Standard Operating Procedures

- Ground shooting of feral goats (NSWGOAT SOP1)
- Aerial shooting of feral goats (NSWGOAT SOP2)
- Mustering of feral goats (NSWGOAT SOP3)
- Trapping of feral goats (NSWGOAT SOP4)
- Use of Judas goats (NSWGOAT SOP5)



NSWGOAT SOP1

Ground shooting of feral goats

Background

Ground shooting of feral goats is undertaken by government vertebrate pest control officers, landholders and professional or experienced amateur shooters. It is best suited to accessible areas with high feral goat populations and is mainly used in forested areas and open pastoral areas, often as a follow-up after initial reduction of goat numbers by mustering or aerial shooting. Shooting from a helicopter is considered a more humane control method, as mobile wounded animals can be promptly located and killed. It is also a more effective method of quickly reducing feral goat populations. Refer to *NSWGOAT SOP2 Aerial shooting of feral goats*.

Shooting can be a humane method of killing feral goats when it is carried out by experienced, skilled shooters, the animal can be clearly seen and is within range, the correct firearm, ammunition and shot placement is used, and wounded animals are promptly located and killed.

This standard operating procedure (SOP) is a guide only. It does not replace or override the relevant NSW legislation. The SOP should only be used subject to the applicable legal requirements (including WHS) operating in the relevant jurisdiction.

Individual SOPs should be read in conjunction with the overarching Code of Practice for that species to help ensure that the most appropriate control techniques are selected and that they are deployed in a strategic way, usually in combination with other control techniques, to achieve rapid and sustained reduction of pest animal populations and impacts.

Application

- Ground shooting should only be used in a strategic manner as part of a coordinated program designed to achieve sustained, effective control.
- Ground shooting is not suitable in inaccessible or rough terrain where sighting of target animals and accurate shooting is difficult, or when wounded animals cannot easily be followed up and killed.
- Ground shooting is time consuming and labour intensive, often with low efficiency especially during moist climatic conditions. It is therefore not considered an effective method for large-scale control.
- The optimal period for ground shooting is during dry seasons or droughts, when many groups of goats are forced to congregate around areas with limited access to water and feed. The effectiveness of ground shooting becomes limited when animals have dispersed after rain and/or the number of goats becomes low.

- The use of radio-collared Judas goats to locate feral herds increases the effectiveness of ground shooting control operations. Refer to *NSWGOAT SOP5 Use of Judas goats*.
- Trained dogs are sometimes used to detect, herd or flush out feral goats prior to shooting. It is unacceptable to set a dog onto a goat with the intention of bringing it down, holding or attacking it.
- Shooting of feral goats should only be performed by skilled operators who have the necessary experience with firearms and who hold the appropriate licences and accreditation.
- Storage and transportation of firearms and ammunition must comply with relevant legislative requirements (See, [Firearms Regulation 2017](#)).

Animal welfare implications

Target animals

- The humaneness of shooting as a control technique depends almost entirely on the skill and judgement of the shooter. If properly done, it is one of the most humane methods of killing feral goats.
- Shooting must be done with the appropriate firearms and ammunition and in a manner that aims to cause immediate insensibility and quick death.
- When shooting an animal, it must be clearly visible and able to be killed with a single shot due to the difficulty of follow-up shots from the ground, particularly in difficult terrain. A solid rest or support should be utilised to ensure accurate shot placement.
- Only head (brain) or chest (heart-lung) shots must be used. A well-placed shot to the head to destroy the brain will result in instantaneous insensibility and a quicker death compared to a well-placed shot to the chest. Chest shots to destroy the heart can present challenges for accurate placement and may not always result in rapid death. For this reason, under ideal conditions, head shots are preferred over chest shots, however in some situations (e.g., where close approach is not possible; the head is obstructed or cannot be targeted; the animal is already wounded; or a second 'follow-up' shot can be quickly taken), because the chest is a larger target, a chest shot may be the most suitable option. Shooting at other parts of the body is unacceptable.
- Correctly placed head shots cause brain function to cease, and insensibility will be immediate. Death from a shot to the chest is due to massive tissue damage and haemorrhage from major blood vessels. Insensibility will occur sometime after, from a few seconds to a minute or more. If a shot stops the heart functioning, the animal will lose consciousness very rapidly.
- The shooter must be certain that each animal or defined group of animals is dead by physical inspection before another is targeted.
- Wounded goats must be located and killed as quickly and humanely as possible with a second shot, preferably directed to the head. If left, wounded animals can escape and suffer from pain and the disabling effects of the injury (including sickness due to infection).

- If lactating females are shot, reasonable efforts should be made to find dependent young and kill them quickly and humanely with a shot to the brain. Note that kids are not always easy to find — approximately half of mothers ('stayers') tend to stay in the vicinity of the newborn kid, while others ('leavers') leave them alone to forage. Lactating females tend to be found away from the mob. If kids are bigger, they will often be found with the mother.
- If herding/sheep dogs are used to flush feral goats out from heavily forested areas, they must be muzzled and/or adequately controlled to prevent them from attacking goats. If a dog fastens onto a goat and causes injury, the dog must be restrained and where necessary if the injuries are severe, the goat immediately killed by shooting.

Non-target animals

- Shooting is relatively target specific and does not usually impact on other species. However, there is always a risk of injuring or killing non-target animals, including livestock, if shots are taken only at movement, colour, shape, or sound.
- Only shoot at the target animal once it has been positively identified and never shoot over the top of hills or ridges as other animals or people may be out of sight beyond the hill in the danger zone.
- Shooting should be used with caution around lambing paddocks as it might disturb the lambing flock and cause mismothering. Also avoid paddocks containing sensitive livestock e.g., horses or farmed deer. They are easily frightened by spotlights and gunshots and could injure themselves by running into fences and other obstacles.

Workplace health and safety considerations

- Firearms are hazardous. Everyone should stand well behind the shooter when an animal is being shot. The line of fire must be chosen to prevent accidents or injury from stray bullets or ricochets.
- Firearm users must strictly observe all relevant safety guidelines relating to firearm ownership, possession and use.
- Firearms must be securely stored in a compartment that meets state legal requirements. Ammunition must be stored in a locked container separate from firearms.
- The shooter and others in the immediate vicinity should wear adequate hearing protection to prevent irreversible hearing damage, and safety glasses to protect eyes from gases, metal fragments and other particles.
- Care must be taken when handling goats as they can carry diseases such as Q fever and scabby mouth (also known as orf virus) that can affect humans and other animals. Routinely wash hands after handling goats or goat carcasses.
- Operators working with goats and goat carcasses are at risk of contracting Q fever. They can become infected when they inhale droplets of urine, milk, faeces or birth products from infected animals. Infection can also occur from inhalation of aerosols created during slaughter of infected animals or dust from contaminated materials. Blood testing of personnel is recommended to assess previous exposure, followed by vaccination for susceptible individuals.

Equipment required

Firearms and ammunition

- Large calibre, high velocity centre-fire rifles fitted with a telescopic sight must be used. The minimum firearm and ammunition requirements for the ground shooting of feral goats are:
 - calibre: .243 inches
 - bullet weight: 80 grain
 - muzzle energy: 1819 (ft-lbs)
- Examples of acceptable firearm and ammunition combinations with maximum shooting distances are included in the table below:

Cartridge *	Bullet weight (gr)	Muzzle velocity (ft/sec)	Muzzle energy (ft-lbs)	Maximum distance (metres)
.243	80	3200	1819	200
25-06 Rem	90	3350	2243	200
.308 Win	150	2820	2649	200

Source: <https://press.hornady.com/assets/pctumbs/tmp/1410995911-2019-Standard-Ballistics-Chart.pdf>

*Smaller calibres (.222 or .223) with 55 grain ammunition can be adequate in skilled hands for smaller goats (less than 40 kg)

- Rifle bullets must be of an expanding type designed to deform in a predictable manner e.g., hollow point, soft-point, polymer tip.
- 12-gauge shotguns with heavy shot sizes of SG or SSG, may be effective, but only up to a distance of 20 metres from the target animal.
- The accuracy and precision of firearms should be tested against inanimate targets before any shooting operation.

Other equipment:

- If shooting at night, a handheld spotlight, or a helmet or headband mounted 12-volt spotlight.
- Thermal/night vision monocular and scopes.
- First aid kit.
- Lockable firearm box.
- Lockable ammunition box.
- Personal protective equipment (hearing and eye protection).
- Appropriate maps identifying access trails and land tenure.
- Communication devices (2 way/mobile etc.) are recommended for safety reasons.

Procedures

- Feral goats must NOT be shot from a moving vehicle as this can significantly detract from the shooters' accuracy.
- The best time to shoot feral goats is when they are most active; that is, in the early morning and late afternoon.
- A feral goat should only be shot at when:
 - it is stationary and can be clearly seen and recognised
 - it is within the effective range of the firearm and ammunition being used
 - a humane kill is probable.
- If in doubt, do NOT shoot.

Target animal and point of aim

- The objective is to fire over the closest range practicable in order to reduce the risk of non-lethal wounding. Accuracy with a single shot is important to achieve an immediate and therefore humane death.
- Although feral goats are comparatively large animals, the vital areas targeted for clean killing are small. Shooters should be highly skilled and experienced at shooting and be able to accurately judge distance, wind direction and speed and have a thorough knowledge of the firearm and ammunition being used.
- The shooter must aim either at the head, to destroy the major centres at the back of the brain near the spinal cord, or at the chest, to destroy the heart, lungs and great blood vessels. This can be achieved by one of the following methods (see also Figure 1)

Head Shot

- The horn structures on adult goats make the temporal (side-on) or rear head (poll) shots the preferred points of aim. Shots to the front of the head can be used on kids, but this method is not recommended for mature goats as the brain is located well back in the skull.

Temporal position (side view)

- The firearm should be directed at the side of the head so that the bullet enters the skull midway between the eye and the base of the ear. The bullet should be directed horizontally.

Rear of the head (poll)

- The firearm should be aimed at the back of the head at a point between the base of the horns and directed towards the throat and mouth.

Chest Shot

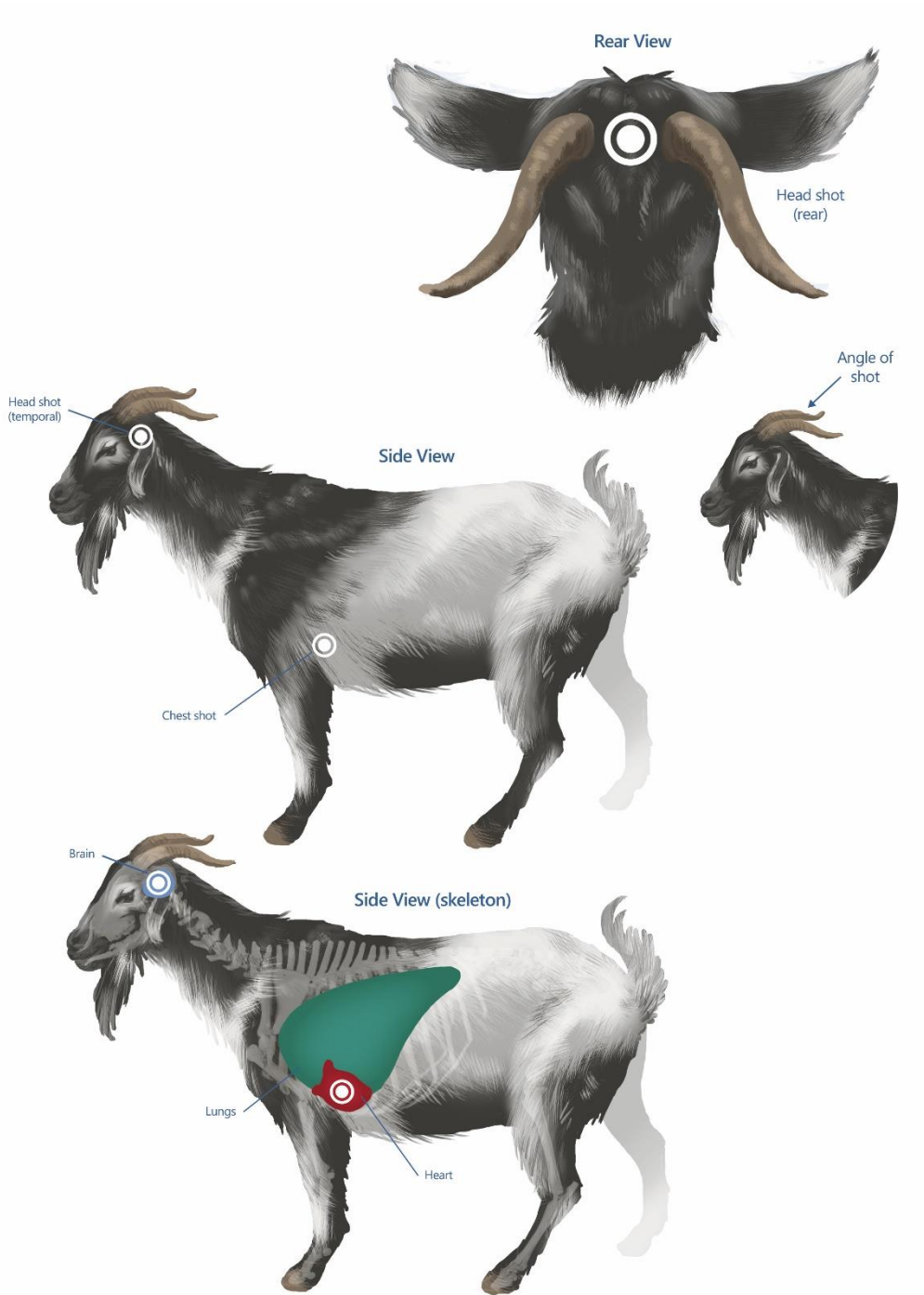
Front view

- The firearm is aimed horizontally at the point midway between the forelegs and immediately below the base of the throat. Frontal shots should only be used for animals in the 'head high' position.

Side view

- The animal is shot from the side so that the bullet enters the chest at a point behind the foreleg, slightly above and immediately behind the elbow joint.
- When using a rifle, the target animal must be stationary and within a range that permits accurate placement of the shot. Shots to the head are preferred over chest shots.
- When using a shotgun, the target animal can be stationary or mobile, but must be no further away than 20 metres from the shooter. The pattern of shot should be centred on the head or chest. It is essential that the distance to the target animal is accurately judged. To achieve adequate penetration of shot, the animal must be in range. It is recommended that shooters practise estimating distances before a shooting operation.
- Shoot the dominant and mature animals first or the leading animals if goats are escaping.
- The target animal should be checked to ensure it is dead before moving on to the next animal. *Always approach the animal from the dorsal (or spinal) side to prevent injury from the involuntary kicking legs.* Death of shot animals can be confirmed by observing a combination of the following:
 - no heartbeat
 - no breathing
 - no corneal reflex (no blinking when the eyeball is touched)
 - no response to a painful stimulus (e.g., a pinch of the ear tip).
- If death cannot be verified, a second shot to the head should be taken immediately.

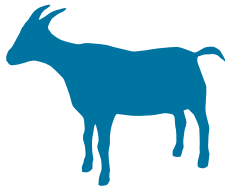
Figure 1: Shot placement for the ground shooting of feral goats



Note that shooting an animal from above or below the horizontal level as depicted here will influence the direction of the bullet through the body. Adjustment to the point of aim on the external surface of the body may need to be made to ensure that the angled bullet path causes extensive (and therefore fatal) damage to the main organs in the target areas.

References

- Aebischer N., Wheatley C. & Rose H. (2014). Factors associated with shooting accuracy and wounding rate of four managed wild deer species in the UK, based on anonymous field records from deer stalkers. *Plos One*, 9: e109698
- American Veterinary Medical Association (AVMA) (2013). *AVMA guidelines for the euthanasia of animals: 2013 edition*. American Veterinary Medical Association. Available at: www.avma.org/KB/Policies/Documents/euthanasia.pdf
- American Veterinary Medical Association (AVMA). (2016). *AVMA Guidelines for the Humane Slaughter of Animals*. Available at: <https://www.avma.org/KB/Resources/Reference/AnimalWelfare/Documents/Humane-Slaughter-Guidelines.pdf>
- Bengsen, A.J., Forsyth, D.M., Harris, S., Latham, A.D., McLeod, S.R., and Pople, A. (2020). A systematic review of ground-based shooting to control overabundant mammal populations. *Wildlife Research*, 47: 197-207.
- Department of the Environment, Water, Heritage and the Arts (DEWHA). (2008). *Threat abatement plan for competition and land degradation by unmanaged goats*. DEWHA, Canberra. Available at: <http://www.environment.gov.au/biodiversity/threatened/tap-approved.html>
- Finnie, J. (1997). Traumatic head injury in ruminant livestock. *Australian Veterinary Journal*, 75: 204-208.
- Gregory, N. (2004). *Physiology and behaviour of animal suffering*. Blackwell, Oxford, UK.
- Lambooj, B. & Algers, B. (2016). Mechanical stunning and killing methods. In: Verlade A, Raj M (eds.) *Animal Welfare at Slaughter*. 5M Publishing, Sheffield, U.K.
- Longair, J., et al. (1991). Guidelines for euthanasia of domestic animals by firearms. *The Canadian Veterinary Journal*, 32: 724-726.
- Parkes, J., Henzell, R., Pickles, G. & Bomford, M. (1996). *Managing Vertebrate Pests: Feral Goats*. Australian Government Publishing Service, Canberra.
- Smith, G. (1999). *A Guide to Hunting & Shooting in Australia*. Regency Publishing, South Australia.
- Woods, J., Shearer, J.K. & Hill, J. (2010). Recommended on-farm euthanasia practices. Pp 186-213, in T. Grandin (ed.) *Improving Animal Welfare: A Practical Approach*. CABI Publishing, Wallingford, Oxfordshire, U.K.



NSWGOAT SOP2

Aerial shooting of feral goats

Background

Aerial shooting of feral goats from a helicopter is used in inaccessible areas, and to manage low-density populations or remove survivors from other control programs. It is also used for broad scale population reductions when prices for goats are low and mustering is not economic. Teams involved in shooting from a helicopter require (at a minimum) a shooter (seated immediately behind the pilot), an observer and the pilot. The observer or navigator primarily looks for and reports hazards plus keeps the helicopter within the approved shooting area, identifies target animals for the pilot, and records locations, species and animals killed. The pilot aligns the helicopter for the optimum shot, advises the shooter when to shoot and can also confirm kills and advise on requirements of additional shots for humaneness purposes.

Aerial shooting is a humane method of killing feral goats when it is carried out by experienced and skilled shooters and pilots, the animal can be clearly seen and is within range, the correct firearm, ammunition and shot placement is used, and wounded animals are promptly located and killed.

This standard operating procedure (SOP) is a guide only. It does not replace or override the relevant legislation that applies in NSW. The SOP should only be used subject to the applicable legal requirements (including WHS) operating in NSW.

Individual SOPs should be read in conjunction with the overarching Code of Practice for that species to help ensure that the most appropriate control techniques are selected and that they are deployed in a strategic way, usually in combination with other control techniques, to achieve rapid and sustained reduction of pest animal populations and impacts.

Application

- All aerial shooting programs conducted by Government Agencies - National Parks and Wildlife Service (NPWS) or Local Lands Services (LLS) - in NSW must be planned and implemented under the NSW Feral Animal Aerial Shooting Team (FAAST) framework and in accordance with the procedures of the NSW FAAST Manual.
- Private or commercial operators in NSW that are not conducting shooting as part of a FAAST program must still adhere to all relevant regulatory and legislative requirements.
- Shooting of feral goats should only be performed by competent, trained personnel who have been tested and accredited for suitability to the task and marksmanship and who hold the appropriate licences and accreditation (e.g., accredited through the FAAST

training course or other approved competency, e.g., AHCPMG311 – Use firearms for pest control activities from aircraft, AHCPMG304 – Use firearms to humanely destroy animals).

- Aerial shooting should only be used in a strategic manner as part of a coordinated program designed to achieve sustained effective control. A shooting operations plan must be prepared and approved by the relevant agency for each FAAST aerial shooting program.
- Aerial shooting is a cost-effective method where goat density is high. Costs per animal increases greatly as goat numbers decrease. Also, feral goats learn to avoid helicopters, so successive shoots can become less effective.
- Aerial shooting is effectively used to control feral goats in inaccessible or rough terrain. In areas of heavy cover (e.g., vegetated creek lines, woodlands and forest), effectiveness is limited since goats might be concealed and difficult to locate from the air.
- The optimal period for aerial shooting is during dry seasons or droughts when goats are forced to congregate around remaining areas of water and feed. Shooting during drought reduces the number of goats that would otherwise die slowly of hunger or thirst.
- For safety reasons, shooting from a helicopter must not be undertaken in adverse weather conditions (e.g., strong wind, rain, low cloud, hot days that cause unpredictable thermals).
- Aerial shooting should comply with all relevant federal and state legislation, policy and guidelines.
- Operators (including helicopters, pilots, shooters and navigators) must hold the appropriate licences and permits and be skilled and experienced in aerial shooting operations. Where managed by Government Agencies they must also be approved by FAAST.
- Helicopter operators must have approval from the Civil Aviation Safety Authority to undertake aerial shooting operations.
- Storage use and transportation of firearms and ammunition must comply with relevant legislative requirements.

Animal welfare implications

Target animals

- The humaneness of aerial shooting as a control technique depends on the skill and judgement of both the shooter and the pilot. If properly done, it can be a humane method of killing feral goats.
- Only chest (heart-lung) or head (brain) shots must be used. Although well-placed head shots result in instant insensibility, a more realistic target point for aerial shooting of feral goats is the larger heart-lung zone. The initial shot must be followed up with a further accurate heart-lung shot once the animal has collapsed. This deliberate 'overkill' policy is aimed at ensuring a quick death given the difficulty in confirming death from the air.
- Death from a shot to the chest is due to massive tissue damage and haemorrhage from major blood vessels. Insensibility will occur sometime after the shot, ranging from a few seconds to a minute or more. If a shot stops the heart functioning, the animal will lose

consciousness very rapidly. Correctly placed head shots cause brain function to cease, and insensibility will be immediate.

- Shooting must be conducted in a manner that maximises its effect thus causing rapid death. This requires the use of appropriate firearms and ammunition.
- A target animal can only be shot when:
 - it is clearly visible and recognised
 - it is within effective range of shooter and the firearm and ammunition being used; and
 - a humane kill is probable. If in doubt do NOT shoot.
- The pilot must offer the shooter the best opportunities for a humane kill. This includes maintaining a stable shooting platform and to ensure that the helicopter is always aligned so that the shooter can maintain accuracy and to avoid shots to unacceptable parts of the body e.g., spine or neck shots. Aerial shooting should not be carried out if the nature of the terrain reduces accuracy resulting in too many wounding shots and prevents the humane and prompt despatch of wounded animals.
- To minimise the animal welfare implications of leaving dependent kids to die, where possible they should be targeted first.
- If lactating females are shot, reasonable efforts should be made to find dependent kids and kill them quickly and humanely.
- Aerial shooting programs by their nature must be highly accountable. Apart from maintaining absolute animal welfare standards, records should be kept of number and location of animals killed, hours flown, ammunition used and details of fly-back procedures.

Non-target animals

- Shooting is relatively target specific and does not usually impact other species. However, there is always a risk of injuring or killing non-target animals, including livestock, if shots are taken before an animal has been positively identified.
- Sensitive livestock such as horses and farmed deer are easily frightened by gunshots, helicopter rotor noise, wind and so on and might injure themselves by running into fences and other obstacles. Avoid shooting in areas where these livestock occur or organise their removal from the area before the shooting program.

Workplace health and safety considerations

- The potentially hazardous nature of aerial shooting requires that safety protocols be strictly followed. Each team member must be aware of and trained in all aspects of helicopter and firearm safety.
- The helicopter pilot must perform a thorough pre-flight briefing with all personnel to establish communication protocols between the shooter and the pilot including pre-shot manoeuvre, commands for firing and emergency procedures.
- Shooting from a helicopter can be hazardous, particularly in areas of rugged topography. The combination of low-level flight, close proximity to obstacles (trees, rocks, wires) and the use of firearms makes this task extremely hazardous.

- It is essential that ejected ammunition cases do not interfere with the safe operations of the helicopter. It might be necessary to fit a deflector plate (mandatory for FFAST operations) to the firearm to ensure shells are ejected safely.
- Firearm users must strictly observe all relevant safety guidelines relating to firearm ownership, possession and use.
- When not in use, firearms must be securely stored in a compartment that meets state/territory legal requirements. Ammunition must be stored in a locked container separate from firearms.
- Adequate hearing protection should be worn by the shooter and others in the immediate vicinity of the shooter. Repeated exposure to firearm noise can cause irreversible hearing damage.
- Safety glasses are recommended to protect the eyes from gases, metal fragments and other particles.
- Refer to the current version of the FFAST Manual for further details on workplace health and safety requirements.

Equipment required

Firearms and ammunition

- Firearms should be:
 - Reliable, well maintained and capable of good accuracy.
 - Fitted with a red dot scope with zero magnification.
 - Rifles should be semi-automatic .308 calibre.
 - Shotguns should be 12-gauge and either pump action or semi-automatic.
- Ammunition:
 - Hollow point, 130gn -135gn or SG, SSG (large goats) and AAA, BB (smaller goats and kids).
 - Firearm and ammunition combinations for rifles with maximum shooting distances are included in the table below:

Cartridge *	Bullet weight (gr)	Muzzle velocity (ft/sec)	Muzzle energy (ft-lbs)	Maximum distance (metres)
.308 Winchester	130	3050	2685	70
.308 Winchester	135	3000	2699	70

Source:

<https://www.federalpremium.com/rifle/american-eagle/american-eagle-varmint-and-predator/11-AE308130VP.html>

<https://www.osaaustralia.com.au/products/ammunition/centrefire-rifle/308-win/osa-ammo-308win-135gr-sierra-20-pack/>

*With aerial shooting, most shots are taken at 20 to 50 metres and the maximum range would be about 70 metres

- Specifying ammunition based on species alone rather than individual body mass is problematic. Shooters should select ammunition (from those specified) that best suits

their situation, and which is justifiable on animal welfare grounds. This may particularly apply to situations where multiple species are being controlled in the one operation.

- To provide a backup in case of firearm/ammunition malfunction, at least two firearms should be carried by shooters at all times.
- The accuracy and precision of firearms should be tested against inanimate targets before any shooting operation.

Aircraft

- Aircraft used for aerial shooting should be manoeuvrable, fast and responsive to allow quick follow-up of any wounded animals.
- The FFAST governance structure has compiled a list of helicopter operators, aircraft and pilots who are approved for FFAST operations. Only helicopter operators and aircraft deemed appropriate to the particular task will be selected for FFAST operations. Approved operators can be sourced through the State Air Desk (LLS) or through the Flight Operations Unit (NPWS).
- GPS (global positioning systems) and computer mapping equipment such as GIS (geographic information systems) must be used to assist in the accurate recording of information (e.g., where animals are shot) and to eliminate the risk of shooting in off-target areas.

Other equipment

- Flight helmet (with intercom).
- Fire-resistant flight suit.
- Safety harness.
- Other personal protective equipment including lace-up boots, gloves and appropriate eye and hearing protection.
- Survival kit (including a first aid kit).
- Emergency locating beacon.
- Lockable firearm box.
- Lockable ammunition box.
- Refer to the current FFAST Manual for further information.

Procedures

- Shooters must not shoot at an animal unless they are confident of cleanly killing it without unnecessary pain, distress or suffering. Only chest (heart-lung) or head/brain shots must be used. Shooting at other parts of the body is unacceptable.
- Wounded animals can suffer from pain and the disabling effects of the injury (including sickness due to infection). The cost of ammunition and extra flying time must not deter operators from applying fly-back procedures.

- Where target animals are encountered in a group, they should typically be shot from the back of the group first (the last one shot is furthest away from the helicopter). This may not always be possible e.g., when an animal breaks away from a group. In this case the shooter and pilot need to communicate so they focus on the same animal.
- Each animal must be shot *at least* twice with at least one bullet placed in the heart/lung—and before shooting further animals. The only exemption to two shots is when the heart/lung is completely destroyed after the first shot as may be the case with smaller animals.
- The shooter must shoot an animal *more* than twice in the following circumstances:
 - where directed by the pilot or if the shooter considers it necessary.
 - until a bullet is placed in the heart/lung of the animal.
 - if the animal doesn't appear dead (signs of life could include attempting to lift its head, any coordinated body movement, eye blinking or breathing).
- Each animal shot must be considered dead by the shooter and pilot, and verbally announced as a 'kill' by the pilot before shooting further animals. This procedure allows for both the shooter and pilot to make a judgement of each animal shot being dead, by the animal exhibiting no sign of life and/or by observing the placement of a bullet into the heart/lung.
- A flyback procedure is required after shooting a group of animals and must be applied at all times. The procedure is as follows:
 - fly back over each animal of the group shot
 - hover over each animal long enough to assess that the animal doesn't exhibit any sign of life
 - where there is any doubt by the shooter or pilot that the animal is dead or that there is a bullet in the heart/lung, the shooter is to shoot further bullet/s into the heart/lung of the animal.
- When large groups of animals are encountered or when groups are encountered in heavy vegetation, the shooter and pilot must consider the ability to conduct an effective flyback procedure. If an effective flyback is likely to be hampered by continuing to shoot further animals in a group or when animals already shot are unlikely to be found, shooting should temporarily cease, and a flyback conducted over animals already shot.
- The best time to shoot feral goats is when they are most active and away from cover; that is, in the early morning, late afternoon and evening. When the weather is very hot, goats will often be found near water (e.g., around creek lines, gullies). If the weather is cold, goats are likely to be found on the eastern aspects of hills during the early morning.
- Target goats should be mustered away from watercourses and areas of dense vegetation before being shot, as wounded animals will be difficult to locate if they go down in these locations.
- Once a target is sighted and has been positively identified, the pilot should position the helicopter as close as is safe to the target animal to permit the shooter the best opportunity for a humane kill.
- The pilot should aim to provide a shooting platform that is as stable as possible.

Aiming points

- Aiming points for head and chest shots are as follows (see also Figure 2)

Chest Shot

Side view

- The firearm is aimed at the centre of a line encircling the minimum girth of the animal's chest, immediately behind the forelegs. The shot should be taken slightly to the rear of the shoulder blade (scapula). This angle is taken because the scapula and humerus provide partial protection of the heart from a direct side-on shot.

Head Shots

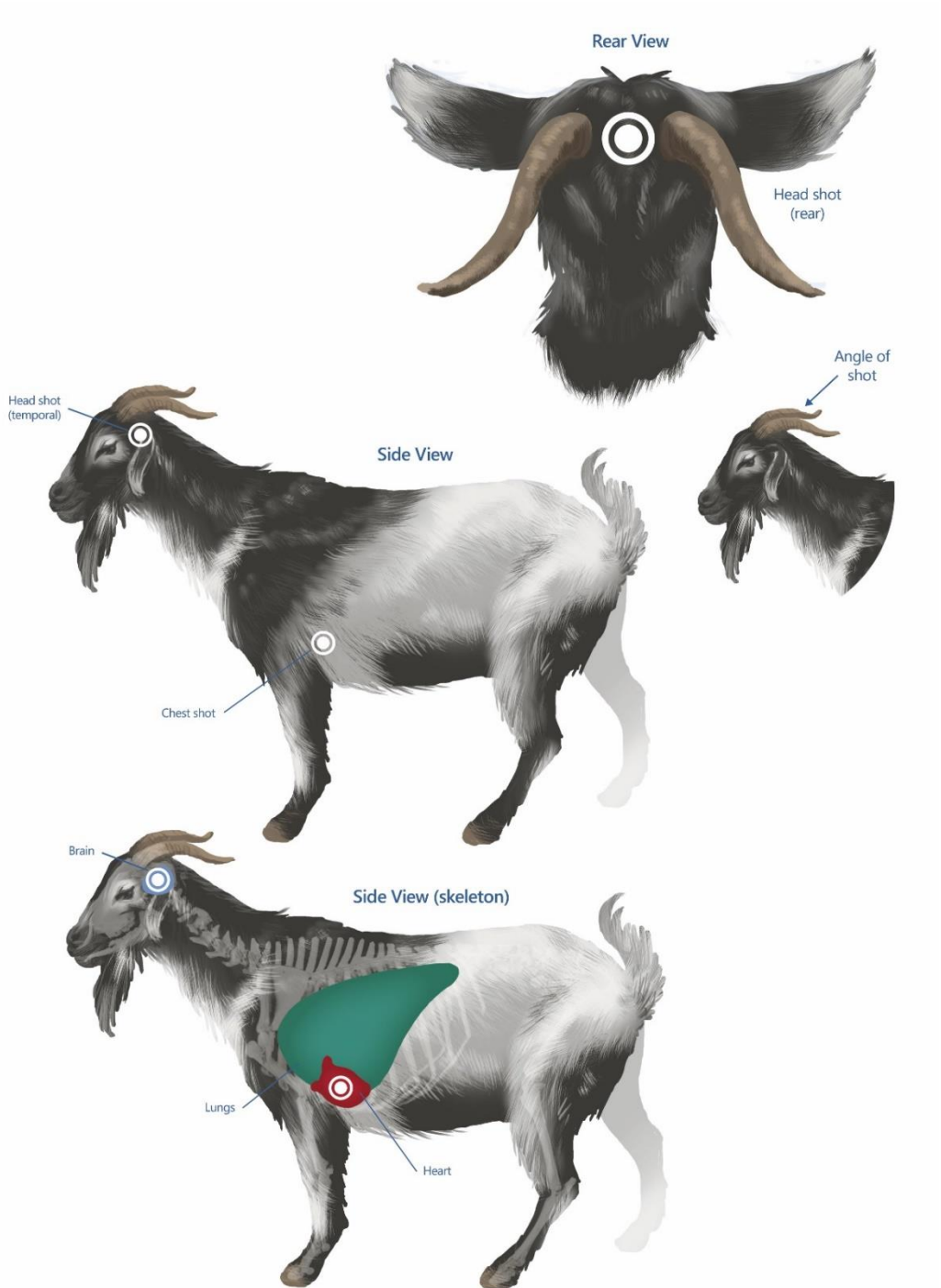
Poll position (rear view)

- When aerial shooting, most head shots will be taken at this position as animals are running away from the helicopter. The firearm should be aimed at the back of the head at a point between the base of the ears and directed towards the throat and mouth.

Temporal position (side view)

- This shot is occasionally used where a second shot needs to be delivered to an injured animal that is lying on its side. The goat is shot from the side so that the bullet enters the skull at a point midway between the eye and the base of the ear.

Figure 2: Shot placement for aerial shooting of feral goats

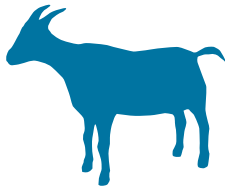


Note that shooting an animal from above or below the horizontal level as depicted here will influence the direction of the bullet through the body. Adjustment to the point of aim on the external surface of the body may need to be made to ensure that the angled bullet path causes extensive (and therefore fatal) damage to the main organs in the target areas.

References

- Aebischer, N.J., Wheatley, C.J., & Rose, H.R. (2014). Factors associated with shooting accuracy and wounding rate of four managed wild deer species in the UK, based on anonymous field records from deer stalkers. *PLoS One*, 9: e109698.
- American Veterinary Medical Association (AVMA). (2013). *AVMA guidelines for the euthanasia of animals: 2013 edition*. American Veterinary Medical Association. Available at: www.avma.org/KB/Policies/Documents/euthanasia.pdf
- American Veterinary Medical Association (AVMA). (2016). *AVMA Guidelines for the Humane Slaughter of Animals*. Available at: <https://www.avma.org/KB/Resources/Reference/AnimalWelfare/Documents/Humane-Slaughter-Guidelines.pdf>
- Bayne, P., Harden, B., Pines, K. & Taylor, U. (2000). Controlling feral goats by shooting from a helicopter with and without the assistance of ground-based spotters. *Wildlife Research*, 27: 517-523.
- Cockram, M.S., D.J. Shaw, E. Milne, R. Bryce, C. McClean, & M.J. Daniels. (2011). Comparison of effects of different methods of culling red deer (*Cervus elaphus*) by shooting on behaviour and post mortem measurements of blood chemistry, muscle glycogen and carcass characteristics. *Animal Welfare*, 20: 211-224.
- DeNicola, A. J., Miller, D. S., DeNicola, V. L., Meyer, R. E., & Gambino, J. M. (2019). Assessment of humaneness using gunshot targeting the brain and cervical spine for cervid depopulation under field conditions. *PLoS One*, 14: e0213200.
- Department of the Environment, Water, Heritage and the Arts (DEWHA). (2008). *Threat abatement plan for competition and land degradation by unmanaged goats*. DEWHA, Canberra. Available at: <http://www.environment.gov.au/biodiversity/threatened/tap-approved.html>
- Ferris, B. (2010). The 2008 - 2009 Aerial Feral Pig and Feral Goat Shooting Program: A Case Study in Northern New South Wales, Australia. *Proceedings of the Vertebrate Pest Conference*, 24.
- Finnie, J. (1997). Traumatic head injury in ruminant livestock. *Australian Veterinary Journal*, 75: 204-208.
- Gregory, N. (2004). *Physiology and behaviour of animal suffering*. Blackwell, Oxford, UK.
- Lambooj, B. & Algers, B. (2016). Mechanical stunning and killing methods. In: Verlade A, Raj M (eds.) *Animal Welfare at Slaughter*. 5M Publishing, Sheffield, U.K.
- Longair, J., et al. (1991). Guidelines for euthanasia of domestic animals by firearms. *The Canadian Veterinary Journal*, 32: 724-726.
- Office of Environment and Heritage (2019). *NSW Feral Animal Aerial Shooting Team (FAAST) Manual*. Office of Environment and Heritage, Sydney. Draft.
- Parkes, J., Henzell, R., Pickles, G. & Bomford, M. (1996). *Managing Vertebrate Pests: Feral Goats*. Australian Government Publishing Service, Canberra.

- Smith, G. (1999). *A Guide to Hunting & Shooting in Australia*. Regency Publishing, South Australia.
- Stokke, S., Arnemo, J. M., Brainerd, S., Söderberg, A., Kraabøl, M., & Ytrehus, B. (2018). Defining animal welfare standards in hunting: body mass determines thresholds for incapacitation time and flight distance. *Scientific Reports*, 8: 13786.
- Urquhart, K. A. & McKendrick, I. J. (2003). Survey of permanent wound tracts in the carcasses of culled wild red deer in Scotland. *Veterinary Record*, 152: 497-501.
- Woods, J., Shearer, J.K. & Hill, J. (2010). Recommended on-farm euthanasia practices. Pp 186-213, in Grandin T (ed.) *Improving Animal Welfare: A Practical Approach*. CABI Publishing, Wallingford, Oxfordshire, U.K.



NSWGOAT SOP3

Mustering of feral goats

Background

Mustering of feral goats is usually carried out on motorbike or horse with the aid of trained dogs, however light aircraft or helicopters are also used over more extensive terrain. Once mustered, the goats are usually held in enclosures and managed until they are sold for slaughter at abattoirs or for live export. Meat for export is the main product from feral goats, with sales providing an additional source of income to landowners, while also reducing pest density and environmental impact. Where removal may be costly or impractical (e.g., in conservation areas or areas without access to transportation), aerial shooting may be more efficient for reducing goat numbers (see *NSWGOAT SOP2 Aerial shooting of feral goats*).

This standard operating procedure (SOP) is a guide only. It does not replace or override NSW legislation. The SOP should only be used subject to the applicable legal requirements (including WHS) operating in NSW. This SOP covers up to the stage of livestock loading; refer to the [Australian Animal Welfare Standards and Guidelines — Land Transport of Livestock](#) thereafter.

Individual SOPs should be read in conjunction with the overarching Code of Practice for that species to help ensure that the most appropriate control techniques are selected and that they are deployed in a strategic way, usually in combination with other control techniques, to achieve rapid and sustained reduction of pest animal populations and impacts.

Application

- Mustering should only be used in a strategic manner as part of a coordinated program.
- Mustering is relatively labour intensive compared to trapping and can be more stressful to the goats.
- Mustering is only efficient and economic when goat densities are high. Many landholders therefore opportunistically muster when they notice large groups of goats on their land.
- Monitoring of goat numbers and resource degradation should determine the most suitable time to conduct goat control. In tablelands there might be times (usually in winter) when goats form larger mobs and so are more accessible.
- In relatively flat and accessible country, mustering is usually done on horseback or motorbikes and with the aid of dogs. In rough, hilly country and more extensive areas, helicopters or light aircraft can be used to drive the goats towards a set of yards where a ground team completes the muster.
- Not all goats from an area will be mustered. Some animals will be left behind, including does with young kids, and others that might have become scattered.

- The use of radio-collared Judas goats to locate feral herds increases the effectiveness of mustering control operations, particularly when eradication is the aim of the program (refer to *NSWGOAT SOP5 Use of Judas goats*).
- Trained herding/sheep dogs are sometimes used to muster feral goats. It is unacceptable to set a dog onto a goat with the intention of bringing it down, holding or attacking.
- To ensure that mustering, capture and handling is done with the least stress to the goats, operators must have a good knowledge of goat behaviour, including their movement patterns. They should also be familiar with the terrain they are to cover, so that dangerous areas can be avoided.
- Aircraft operators must ensure that their flying operations comply with requirements of the Civil Aviation Safety Authority.
- Where euthanasia is required, shooting of goats should only be done by skilled operators who have the necessary experience with firearms and who hold the appropriate licences and accreditation.
- Storage and transportation of firearms and ammunition must comply with relevant legislation requirements.

Animal welfare implications

Target animals

- Mustering, capture and handling increase stress in feral goats, as they are not used to confinement or close contact with humans. As a result, these procedures can lead to mismothering, feeding disruption, social disruption, heat stress and also abortion in heavily pregnant females. Metabolic, nutritional and parasitic diseases and changes in environmental conditions are common causes of mortality and morbidity in confined feral goats.
- Mustering can have a significant negative impact on dependent young; therefore, mustering should be avoided when there is a high proportion of does in late pregnancy or with small kids at foot. Alternately if mustering has to occur, then allowing heavily pregnant does or does with young at foot to drop out of the mob will help to avoid or at least minimise severe animal welfare impacts. If unweaned kids are left behind when their mothers are mustered, they will suffer and likely die from starvation, predation or disease. Dependent young can also be trampled or injured in the yard or during transport. If females with dependent young are inadvertently mustered with a mob, or kids are born within the yard then dependent young must be euthanased quickly and humanely.
- Mustering should be carried out in the cooler months to avoid heat stress.
- The tail end of the mob should set the pace rather than being forced to keep up with the leaders. Distances that the goats have to be mustered should be kept to a minimum (e.g., by using portable yards).
- Feral goats should be handled quietly and without force, to avoid panic and trampling. Electric prods can only be used on animals that are over 6 months of age and must not be used on pregnant animals.

- Goats that are severely injured during mustering or confinement must be killed quickly and humanely with a rifle shot to the head or captive bolt gun where appropriate.
- Only trained working dogs are to be used to assist in the handling of feral goats. Trained sheep dogs such as kelpies are preferred, as they are not usually aggressive. As a precaution, muzzles can be fitted to dogs to prevent them causing bite injuries.
- Normal social groups should be maintained whenever possible and there should be sufficient holding yards to avoid mixing different groups of stock as this can result in fighting, stress and injury. Older males and goats with significant horns should be separated to avoid dominance behaviour and injury. Does and unweaned kids should be kept together.
- Only fit and healthy animals should be selected for transport. Heavily pregnant, very young or weak/sick/injured animals must either be euthanased or given proper veterinary assistance and moved at a later date when they are more suitable for transportation.
- The loading, transport, unloading, holding and slaughter of feral goats must be done with the minimum amount of stress, pain or suffering. Guidelines on these procedures can be found in relevant state or federal government guidelines. For example:
 - [Australian Industry Welfare Standards and Guidelines for Goats](#)
 - [Australian Animal Welfare Standards and Guidelines — Land Transport of Livestock](#)
 - [Australian Standards for the Export of Livestock](#)

Non-target animals

- Mustering is target specific and has minimal impact on other species.
- Dogs used for mustering must receive adequate care at all times. This includes food, water, shelter, safe and comfortable transportation, current vaccinations, worming, flea, tick and heartworm prevention, where appropriate. For more details refer to [GEN002: The care and management of dogs used for pest animal control](#).

Workplace health and safety considerations

- Care must be taken when handling goats, as they can carry diseases such as Q fever and scabby mouth (also known as orf) that can affect humans and other animals. Routinely wash hands and other skin surfaces after handling goats or goat carcasses.
- Operators working with goats and goat carcasses are at risk of contracting Q fever. They can become infected when they inhale droplets of urine, milk, faeces or birth products from infected animals. Infection can also occur from inhalation of aerosols created during slaughter of infected animals, or dust from contaminated materials. Blood testing of personnel is recommended to assess previous exposure, followed by vaccination for susceptible individuals.
- The mustering, trapping and handling of feral goats is not without risk to the operators involved. A first aid kit should be carried at all times and motor bike riders should wear helmets.

- Firearms are hazardous. All people should stand well behind or beside the shooter when an animal is being shot. The line of fire must be chosen to prevent accidents or injury from stray bullets or ricochets.
- Firearm users must strictly observe all relevant safety guidelines relating to firearm ownership, possession and use.
- Firearms must be securely stored in a compartment that meets state legal requirements. Ammunition must be stored in a locked container separate from firearms.
- The shooter and others in the immediate vicinity should wear adequate hearing protection to prevent irreversible hearing damage, and safety glasses to protect eyes from gases, metal fragments and other particles.

Equipment required

Yards

- Either portable or fixed holding yards can be used.
- The materials used must minimise the risks of injury or escape of goats once inside the enclosure. Projections such as loose wire or sharp edges likely to cause injury should be eliminated and fences should be secure and high enough to prevent goats escaping.
- Gates must be wide enough to allow the easy flow of animals, particularly bucks with large horns.
- Yards should be designed to minimise both dust and boggy conditions.
- If possible, yards should be positioned in a shady area with as much natural vegetation as possible. If mustering in extremes of climate (hot or cold) is unavoidable, shelter must be provided for goats. This is particularly important for young goats or animals in poor body condition during cold, windy and rainy conditions.
- Details of yard specifications and construction can be obtained from relevant state guidelines (e.g., [Yard Design for Goats](#)).

Firearms/ammunition and captive bolt guns

- Smaller calibre rifles such as .22 magnum rimfire with hollow/soft point ammunition are adequate for euthanasia of goats at short range (within 5 m). If shooting animals from a greater distance refer to *NSWGOAT SOP1 Ground shooting of feral goats* for more detailed information.
- Penetrating captive bolts guns (e.g., Cash Special .22, Blitz Kerner .38) are suitable for euthanasia of restrained goats when used by trained and confident operators. The cartridge power and length/diameter of bolt must be appropriate for the species and age of animal.
- Captive bolts should be regularly cleaned and maintained in optimal working condition according to the manufacturer's instructions. Cartridge blanks must be stored properly so that the propellant does not deteriorate.

Fixed wing aircraft or helicopter

- The aircraft must be suited to the purpose and must fulfil Civil Aviation Safety Authority (CASA) requirements for the task of mustering.
- The pilot must be suitably experienced and licensed and hold the appropriate endorsements for aerial mustering of stock.
- Aircraft operators must ensure that their flying operations comply with requirements of CASA.

Procedures

Choosing a yard site

- Yards should be located close to suitable water.
- A suitable yard site needs to be sufficiently flat to enable the erection of portable yards. If designed to be serviced by trucks, the yard should be set up in close proximity to suitable haulage roads and adjacent to sufficient space for trucks to turn.
- Yards should be set up in a location that prevents the goats from seeing them until it is too late for evasion, for example on the other side of scrub through which the goats are being pushed.
- Where possible, yards should be positioned in a shady area with as much natural vegetation as possible. However, avoid having trees near the entrance of the yards if using a helicopter.
- Yards must be well drained to allow goats to sit down in areas free of surface water after rainfall.

Mustering

- Goats should not be chased but moved steadily with the slowest animals setting the pace. Goats should never be driven to the point of collapse.
- Only muster the number of goats that can be comfortably handled. The fewer goats that are included in any one operation and the shorter the distance travelled, the less stress will be placed upon the animals.
- Heavily pregnant females, females with small kids and other goats, such as those in poor condition, should be allowed to drop out of musters if the safety and welfare of the animals is at risk. Also, if a female goat continually breaks away and will not move along with the group, it is possible that she has a dependent kid/s hidden somewhere. It is best to let her go and move on with the rest of the group.

Holding goats in yards

- Goats captured by mustering should be allowed at least 3–4 days rest with adequate shelter, food and water so that they become accustomed to lot-feeding before transport to a feedlot or depot. During this time they must be assessed daily for signs of injury,

disease, loss of appetite, illness or distress. Account must be taken of their possible unwillingness to drink and eat from troughs.

- Goats to be transported longer than 24 hours should be fed and watered during holding in the yards, and within five hours before loading.
- Goats should not be held in the holding yards for extended periods. If goats are being held for longer than 24 hours, they should be provided adequate shelter, food and water.
- Older males and goats with significant horns should be separated to avoid dominance behaviour and injury. Does and unweaned kids should be kept together.

Transporting goats

Detailed requirements for the land transport of goats can be found in Animal health Australia (AHA) 2012, [Australian Animal Welfare Standards and Guidelines— Land Transport of Livestock](#).

Euthanasia of goats in the yards

- It might be necessary to humanely kill goats in the following situations:
 - when there is no market for the captured goats (including smaller animals that are of no commercial value)
 - if goats have sustained serious injury during capture or in the holding yards
 - if there are dependent young that are separated from their mother
 - if there is a pre-existing disease or condition that would prevent the animal from being transported, slaughtered or domesticated.
- When large numbers of animals are to be killed in the holding yard, provisions should be made to dispose of carcasses in an appropriate manner (i.e., by burying and/or burning). Numerous guidelines are available that describe disposal methods.

Shooting

- Shooting is the most acceptable method of euthanasia for goats and must be done to cause sudden and painless death with minimum distress to the animal. Only head shots are acceptable.
- The shooter should approach the animals in a calm and quiet manner. To prevent unnecessary agitation of the yarded goats, other people should keep away from the area until shooting is completed.
- To maximise the impact of the shot and to minimise the risk of misdirection, the range should be as short as possible.
- Never fire when the goat is moving its head. Be patient and wait until the goat is motionless before shooting. Accuracy is important to achieve a humane death. One shot should ensure instantaneous loss of consciousness and rapid death without resumption of consciousness.
- Shots must be aimed to destroy the major centres at the back of the brain near the spinal cord. The horn structures on adult goats make the rear (or poll) head shot the preferred

point of aim. Shots to the front of the head can be used on kids but this method is not recommended for mature goats as the brain is located well back in the skull.

- Rear (or poll) shots are performed by aiming the firearm at the back of the head at a point between the base of the horns and directed towards the throat and mouth.
- To ensure maximum impact and the least possibility of misdirection, projectiles should be fired at the shortest range possible, but not with the barrel in contact with the animal's head.
- Death of shot animals can be confirmed by observing a combination of the following:
 - no heartbeat
 - no breathing
 - no corneal reflex (no blinking when the eyeball is touched)
 - no response to a painful stimulus (e.g., a pinch of the ear tip).
- If death cannot be verified, a second shot to the head should be taken immediately.

Captive bolt gun

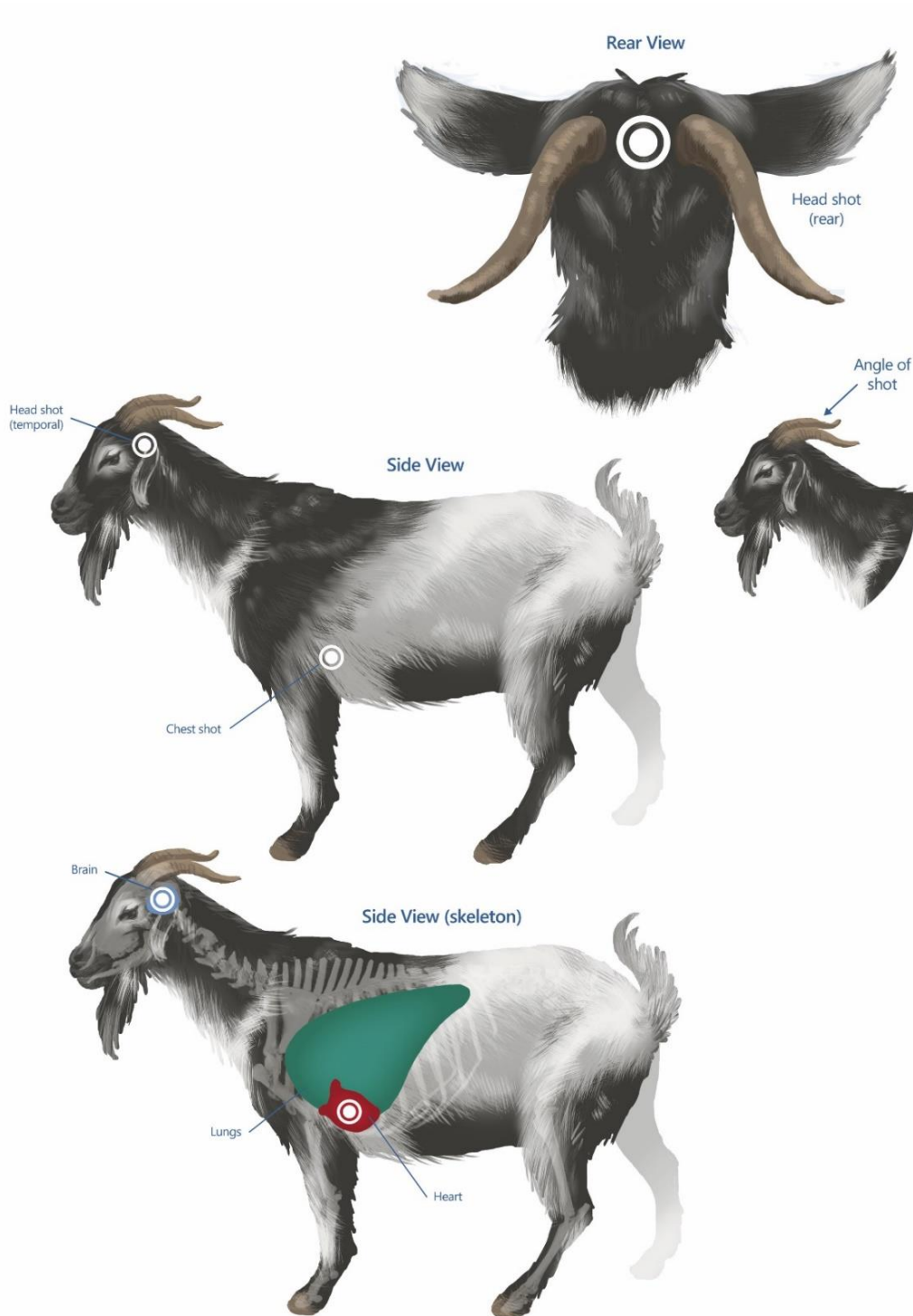
- In some situations (e.g., where it is unsafe to use a firearm) it may be more appropriate to use a captive bolt gun for euthanasia of goats.
- Captive bolts cause insensibility by disrupting the cerebral cortex, with death occurring due to disruption to the brain stem.
- Captive bolts must only be used by suitably trained operators who can confidently handle and operate the device and know the correct anatomical landmarks on the head. They must also be able to confirm death, recognise ineffective shots and take quick action when a shot goes wrong.
- A penetrating captive bolt gun is recommended because it is more reliable at delivering an effective stun.
- The animal must be well-restrained, and the captive bolt gun pressed firmly on the head in the *poll* position before being discharged. Frontal and crown shots must not be used.
- Captive bolt guns can only cause stunning, or loss of insensibility, that may be temporary and not lead to death. Stunning must therefore be followed by a secondary method to cause death, such as bleeding-out.

Euthanasia of neonatal dependent young

- In some situations (e.g., when it is unsafe to use a firearm) it will be necessary to use an alternative method for euthanasia of dependent young that can be caught by hand. Acceptable methods are:
 - A penetrating captive bolt gun as described above.
 - A percussive, non-penetrating captive bolt device (e.g., CASH Small Animal Tool with a 1 grain cartridge; propane-powered TED device) - is effective for achieving stun/kill of neonatal goats (up to 48 hours old) when applied to the skull on the midline between the ears with the chin tucked into the neck.
 - A percussive blow to the head - can be used when a captive bolt device is not available but only on kids that are less than 24 hours old. Following the percussive

blow—when the animal is unconscious—bleeding out should be performed to ensure death.

Figure 3: Shot placement for feral goats. Head shot (rear/poll) should be used for euthanasia at close range. See text for details.

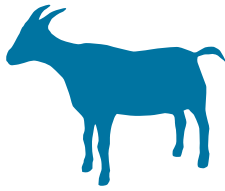


Note that shooting an animal from above or below the horizontal level as depicted here will influence the direction of the bullet through the body. Adjustment to the point of aim on the external surface of the body may need to be made to ensure that the angled bullet path causes extensive (and therefore fatal) damage to the main organs in the target areas.

References

- Aebischer, N.J., Wheatley, C.J., & Rose, H.R. (2014). Factors associated with shooting accuracy and wounding rate of four managed wild deer species in the UK, based on anonymous field records from deer stalkers. *PLoS One*, 9: e109698.
- American Veterinary Medical Association (AVMA). (2013). *AVMA guidelines for the euthanasia of animals: 2013 edition*. American Veterinary Medical Association. Available at: www.avma.org/KB/Policies/Documents/euthanasia.pdf
- American Veterinary Medical Association (AVMA). (2016). *AVMA Guidelines for the Humane Slaughter of Animals*. Available at: <https://www.avma.org/KB/Resources/Reference/AnimalWelfare/Documents/Humane-Slaughter-Guidelines.pdf>
- Animal Health Australia (AHA) (2012). *Australian Animal Welfare Standards and Guidelines — Land Transport of Livestock*. Animal Health Australia (AHA), Canberra.
- Animal Health Australia (2015). Operational manual: Disposal (Version 3.1). *Australian Veterinary Emergency Plan (AUSVETPLAN), Edition 3*. National Biosecurity Committee, Canberra, ACT.
- Animal Health Australia (AHA) (2016). *Australian Industry Welfare Standards and Guidelines - Goats*. Animal Health Australia.
- Burton, R. (2011). *Humane Destruction of Stock*. Primefact 310. NSW Government, Orange.
- DeNicola, A. J., Miller, D. S., DeNicola, V. L., Meyer, R. E., & Gambino, J. M. (2019). Assessment of humaneness using gunshot targeting the brain and cervical spine for cervid depopulation under field conditions. *PLoS One*, 14: e0213200.
- Department of Agriculture and Water Resources (2011). *Australian Standards for the Export of Livestock (Version 2.3)*. Australian Government, Canberra.
- Finnie, J. (1997). Traumatic head injury in ruminant livestock. *Australian Veterinary Journal*, 75: 204–208.
- Gregory, N. (2004). *Physiology and behaviour of animal suffering*. Oxford, UK: Blackwell
- Grist, A., Lines, J., Knowles, T., Mason, C., & Wotton, S. (2018). Use of a Non-Penetrating Captive Bolt for Euthanasia of Neonate Goats. *Animals*, 8: 1-13.
- Joshua, E. (2003). Yard Design for Goats. *Agfact A7.7.2*. NSW Agriculture. Available at: https://www.dpi.nsw.gov.au/_data/assets/pdf_file/0010/178543/yard-design-goats.pdf
- Jubb, T. (2013). How to use a penetrating captive bolt gun. Proceedings of the Australian Veterinary Association (AVA) Annual Conference (Cattle/Sheep/Welfare), Cairns.
- Lambooj, B. & Algers, B. (2016). Mechanical stunning and killing methods. In: Verlade A, Raj M (eds.) *Animal Welfare at Slaughter*. 5M Publishing, Sheffield, U.K.
- Longair, J., et al. (1991). Guidelines for euthanasia of domestic animals by firearms. *The Canadian Veterinary Journal*, 32: 724-726.
- NSW DPI. (2017). *Animal carcass disposal. Primefact 1616, first edition*. NSW Government. Available at: www.dpi.nsw.gov.au

- O'Flynn, M. (1992). Animal Welfare Considerations. Pp. 39-55, in D. Freudenberger (ed). *Proceedings of the National Workshop on Feral Goat Management: Planning for Action, Dubbo, New South Wales*. Bureau of Resource Sciences, Canberra.
- Parkes, J., Henzell, R., Pickles, G. & Bomford, M. (1996). *Managing Vertebrate Pests: Feral Goats*. Australian Government Publishing Service, Canberra.
- Ramsay, B. J. (1994). *Commercial Use of Wild Animals in Australia*. Australian Government Publishing Service, Canberra.
- Sutherland, M. A., Watson, T. J., Johnson, C. B., & Millman, S. T. (2016). Evaluation of the efficacy of a non-penetrating captive bolt to euthanase neonatal goats up to 48 hours of age. *Animal Welfare*, 25: 471-479
- Woods, J., Shearer, J.K. & Hill, J. (2010). Recommended On-farm Euthanasia Practices. Pp 186-213, in T. Grandin (ed.) *Improving Animal Welfare: A Practical Approach*. CABI Publishing, Wallingford, Oxfordshire, U.K.



NSWGOAT SOP4

Trapping of feral goats

Background

Feral goats are often trapped by landholders and this involves the use of self-mustering technology that was originally developed for the management of sheep and cattle in rangeland areas. Trapping involves the construction of goat-proof fences around water points with a number of one-way gates or ramps. The gates/ramps allow goats to enter the trap and have access to water but prevent them leaving. Once trapped, the goats are usually sold for live export, to abattoirs for slaughter or less commonly for domestication, which offsets the costs of capture. Where there is no market for them or where removal might be costly or impractical (e.g., in conservation areas or remote areas without access to transportation), the goats are usually destroyed by shooting in the trap yard.

This standard operating procedure (SOP) is a guide only. It does not replace or override the relevant NSW or federal legislation. The SOP should only be used subject to the applicable legal requirements (including WHS) operating in NSW.

Individual SOPs should be read in conjunction with the overarching Code of Practice for that species to help ensure that the most appropriate control techniques are selected and that they are deployed in a strategic way, usually in combination with other control techniques, to achieve rapid and sustained reduction of pest animal populations and impacts.

Application

- Trapping should only be used in a strategic manner as part of a coordinated program.
- Trapping is mainly used in semi-arid and arid rangelands where there are no alternative watering points for goats.
- Although traps can be expensive to establish, trapping is more cost-effective than mustering and is also less stressful for the goats. Trapping is the preferred method of control when goats are at low densities.
- Trapping is most effective during dry periods, when goats drink regularly and congregate around water holes. It becomes less effective and sometimes impractical during periods of wet weather when water is plentiful, and goats are dispersed.
- Trapping at water can have significant negative impacts on non-target species, especially macropods and emus.
- Maintaining traps is time consuming. Therefore, it is only suitable to use traps in situations where the operator has time to check them on a regular basis.

- Traps can also be used as self-mustering yards for domestic stock such as sheep and cattle.
- Operators should try to keep stress on the goats to a minimum during capture and handling. Prolonged stress not only has a negative impact on an animal's welfare but can also decrease carcass and meat quality.
- Shooting of goats should only be done by skilled operators who have the necessary experience with firearms and who hold the appropriate licences and accreditation. Storage and transportation of firearms and ammunition must comply with relevant legislation requirements.

Animal welfare implications

Target animals

- Capture and handling increase stress in feral goats, as they are not exposed to being confined or in close contact with humans. Because of this, these procedures can result in mismothering, feeding disruption, social disruption, heat stress and abortion in heavily pregnant females. Metabolic, nutritional and parasitic diseases and also sudden changes in environmental conditions are common causes of mortality and morbidity in confined feral goats.
- There should be sufficient yards to avoid mixing different or unfamiliar groups of stock as this can result in fighting, stress and/or injury.
- Traps should be:
 - large enough to avoid overcrowding and allow all goats to access the water point
 - constructed to include trees, other vegetation and logs (located away from the edge of the fence line) to provide goats with shade and shelter. Goats can suffer when exposed to extremes of heat and cold
 - constructed in a way so that it will not cause injury from loose wire, sharp edges or malfunctioning gates. The trap gates should be large enough to allow big animals and those with large horns to enter the trap. The trap yard should be large enough so that each goat has enough space to avoid social stress.
- Feral goats should be handled quietly without force, to avoid panic and trampling.
- To avoid heat stress, mustering should be done in the cooler months.
- Capture and handling should be avoided when female goats are kidding or have dependent young at foot. Kids that do not accompany their mother into the trap can be separated and die of starvation or, if trapped, can get trampled underfoot. Although feral goats have been observed to breed at all times of the year, generally, spring is the time of year when there is a greater proportion of does in late pregnancy or with young kids at foot.
- To minimise the possibility of starvation and stress, all traps must be inspected at least once each day. More frequent checking might be necessary during extreme weather conditions.

- The supply of water should be checked daily and appropriate feed must be made available if captured goats are to be held for more than 24 hours. Account must be taken of their possible unwillingness to drink and eat from troughs. Animals being held for any length of time must be checked daily for ill thrift and signs of injury and disease.
- Fencing off alternative watering points to force goats to water at the trapped points has welfare implications. Some animals might not leave their preferred water source and will die of thirst rather than move and search for another.
- Goats that are found severely injured inside the trap must be killed quickly and humanely with a rifle shot to the head.
- Electric prods can only be used on animals that are over 6 months of age and must not be used on pregnant animals.
- Only trained working dogs are to be used to assist in the handling of feral goats. Trained sheep dogs such as kelpies are preferred, as they are not usually aggressive. As a precaution, muzzles can be fitted to dogs to prevent them causing bite injuries.
- Only fit and healthy animals should be selected for transport. Heavily pregnant, very young or weak/sick/injured animals must either be destroyed, given proper veterinary assistance or be transported at a later date when they are more suitable for transportation.
- The loading, transport, unloading, holding and slaughter of feral goats must be done with the minimum amount of stress, pain or suffering. Guidelines on these procedures can be found in relevant state or federal government guidelines. For example:
 - [Australian Industry Welfare Standards and Guidelines for Goats](#)
 - [Australian Animal Welfare Standards and Guidelines — Land Transport of Livestock](#)
 - [Australian Standards for the Export of Livestock](#)

Non-target animals

- Goat traps can have a significant negative impact on native species, such as macropods, by inadvertently trapping them and by excluding them from water sources. For example, traps that are closed from dusk to dawn will exclude macropods from drinking at a time when they mostly seek water. Macropods may be reluctant to enter a trap but will remain around the perimeter rather than moving on to another water source. Those that do enter will become trapped and may rush at fences or become caught and injure themselves while trying to escape. Injuries and stress can also be caused when trying to release trapped animals through the gates.
- Traps that would exclude large numbers of native species from natural springs and waterholes should not be constructed.
- If a trap continually catches numerous non-target animals, it should be constructed at another site where it will have minimal effect on other species, or another goat control method could be used.
- A barrier can be used on the external mesh fence to prevent kangaroos from getting their hind legs caught if they attempt to jump over. Chicken wire, rubber belting or shade cloth placed on the top 20 cm of the mesh acts as both a physical and visual barrier. The fence should be no more than 1.2 m high (preferably 90 cm).

- Small escape gates can be incorporated at intervals around the fence to allow macropods to escape under the fence.
- A protected water source could be provided nearby that would allow access to wildlife species, but not to stock and feral goats.
- Traps could be activated only during the day when goats and stock tend to water. This will help to avoid capture of macropods, which tend to water at night.
- Moving macropods out of a trap should be done during the coolest part of the day to prevent them from overheating. Females should be closely monitored to see if they drop their pouch young. Macropods are very susceptible to capture myopathy, so they should be moved gently and quietly out of the yard through the trap gate before any other work is done in the vicinity of the trap.
- Trapped native non-target animals and livestock that are still watering at the trapping point will need to be drafted from the trapped goats on a daily basis.
- To reduce the risk of injury to livestock, it is preferable to plan trapping sessions for times when livestock are out of the paddock (e.g., during shearing, lambing/calving, spelling). Trapping should be avoided during lambing/ calving, as ewes and cows can become separated from their young when they enter the trap for a drink.
- Non-target animals caught in traps must be examined for injuries and signs of illness or distress and dealt with as follows:
 - Animals that are unharmed or have only received minimal injuries such as minor cuts or abrasions should be immediately released at the site of capture.
 - Animals with more severe injuries or that are suffering from thermal stress should receive appropriate attention. An animal suffering from thermal stress can be placed in a suitable quiet holding area that provides warmth or shade to allow recovery before release. Animals with treatable injuries that cannot be immediately released, or those failing to recover from thermal stress, should be presented to a vet or a registered wildlife carer for treatment.
 - Animals with injuries that are untreatable or that would compromise their survival in the wild should be euthanased using a technique that is suitable for the species. For more information on euthanasia techniques, refer to [GEN001 Methods of Euthanasia](#).

Workplace health and safety considerations

- Care must be taken when handling goats as they can carry diseases such as Q fever and scabby mouth (also known as orf) that can affect humans and other animals. Routinely wash hands after handling goats or carcasses.
- Operators working with goats and goat carcasses are at risk of contracting Q fever. They can become infected when they inhale droplets of urine, milk, faeces or birth products from infected animals. Infection can also occur from inhalation of aerosols created during slaughter of infected animals or dust from contaminated materials. Blood testing of personnel is recommended to assess previous exposure, followed by vaccination for susceptible individuals.

- During construction of traps, operators should be wary of the risks of injury from lifting heavy items. Leather gloves and eye protection will help prevent injuries from wire, steel posts and hammers.
- Firearms are hazardous. All people should stand well behind the shooter when an animal is being shot. The line of fire must be chosen to prevent accidents or injury from stray bullets or ricochets.
- Firearm users must strictly observe all relevant safety guidelines relating to firearm ownership, possession and use.
- Firearms must be securely stored in a compartment that meets state legal requirements. Ammunition must be stored in a locked container separate from firearms.
- The shooter and others in the immediate vicinity should wear adequate hearing protection to prevent irreversible hearing damage, and safety glasses to protect eyes from gases, metal fragments and other particles.

Equipment required

Traps

Several trap designs exist, differing mainly in the one-way entrance. The three most commonly used traps are:

Jump-down traps

- The entrance consists of an earth ramp sloping up to approximately 1 m high that allows the goats to access the trap by jumping down into it. A heavy-gauge wire or baulking bar is placed approximately 30 cm above the top of the ramp to prevent the goats from jumping back out of the trap.
- The width of the ramp depends on the number of goats in the area.
- A gate is placed next to the ramp and this is left open when the traps are not in use, to encourage the goats to use the traps.
- Jump-down ramps are best suited to areas that are free of livestock. Cattle and sheep that are in poor condition, and also lambs can suffer injuries when jumping from the ramp into the trap.
- Timid and small animals can be reluctant to use the ramp.

Spear gate traps

- The entrance consists of a V-shaped, four-barred gate with flexible spears. Goats have to squeeze through the spears to enter the yard to drink.
- Goats must be trained to go through the gates by gradually closing the spears to get them used to squeezing through.
- Big billies and other goats with large horns can have difficulty squeezing through this type of gate.

Swinging one-way gate traps

- These gates allow the goats to push through one way into the yard, but do not move in the opposite direction when they push to get out.
- Trap yards should be large enough to comfortably handle the work they are expected to do.
- The most appropriate size will depend on the size of the water point, number and type of livestock using the water point, whether livestock and feral animals will be in the yard together and whether the animals will be held in the trap yard or drafted into holding yards.
- Large trap sizes give the goats enough room to move away from people entering the trap, allow for effective handling and will also reduce the pressure on (and therefore damage to) the fences.
- An adequate size to handle a large number of goats would be 50 x 50 m.
- It is preferable to incorporate loading pens and holding yards in the trap design that allow for onsite animal handling.
- The yard fencing must be strong enough to withstand the pressure of animals bumping into it. The most effective and economic fencing material used is ringlock or hingelock mesh.
- The most commonly used fence configuration is of prefabricated 8/90/15 hingelock with plain wires top and bottom to tie the hinged panels together (i.e., the fence is 90 cm high, has 8 horizontal wires and a gap of 15 cm between vertical wires).
- The fence can also be topped with one or two plain wires and a strip of shade cloth material to increase the height of the fence (to no greater than 1.2 m high).
- Self-mustering trap yards can be built as squares, triangles and rounded yards. Round yards provide advantages over the other designs, as the round shape provides the largest trap for material used, there are no corners to accumulate animals and the rounded shape aids in the flow of animals in and through the yard.
- Choice of trap design will depend on habitat, material available and accessibility to site.
- Knowledge of other species that might be at risk from inappropriately designed traps should be used to identify the most suitable trap designs and usage.
- Details of trap specifications and construction can be obtained from NSW state agriculture guidelines, for example:
 - [*Cost Effective and Multipurpose Self-mustering Enclosures for Stock*](#)
 - [*Yard Design for Goats*](#)
 - [*Going into Goats: A practical guide to producing goats in the rangelands*](#)
 - [*Total Grazing Management Field Guide: Self-mustering Systems for Cattle, Sheep and Goats*](#)
 - [*Improving the development of effective and humane trapping systems...in Australia*](#)

Firearms / ammunition and captive bolt guns

- Smaller calibre rifles such as .22 magnum rimfire with hollow/soft point ammunition are adequate for euthanasia of goats at short range (within 5 m). If shooting animals from a greater distance refer to *NSWGOAT SOP1 Ground shooting of feral goats* for more detailed information.
- Penetrating captive bolts guns (e.g., Cash Special .22, Blitz Kerner .38) are suitable for euthanasia of restrained goats when used by trained and confident operators. The cartridge power and length/diameter of bolt must be appropriate for the species and age of animal.
- Captive bolts should be regularly cleaned and maintained in optimal working condition according to the manufacturer's instructions. Cartridge blanks must be stored properly so that the propellant does not deteriorate.

Procedures

Selection of trap sites

- Construct the trap at a site where there are limited numbers of watering points that can be fenced off easily. The trap should be situated on animal trails coming into the water point so that the gates are encountered on the usual path to water — this will make it more likely the target species will quickly accept and continue to use it.
- If possible, choose a site that is in a shady area, with as much natural vegetation as possible.
- Monitor the use of other watering points so that they can be fenced off if necessary, to force goats to use the trap yard.
- Strategic placement is essential to reduce impact on local native species.

Setting the trap

- If goats are being removed from the property for live sale, suitable transport must be arranged and confirmed before trapping begins.
- Before setting the trap, an adequate training period (around three weeks) must be allowed so that the animals can become familiar with watering inside the trap yard. This period should be extended if any animals are showing difficulties in adapting.
- Once the goats are used to watering at the trap, the exit gate/s should be closed, and trapping can begin.
- The trap should be checked at least once daily to avoid stress to the goats and to remove any domestic stock or non-target animals. Once trapped, goats are usually drafted into separate holding yards with access to feed and water. It is preferable to activate the trap each morning and then check it in the evening.
- If bucks are fighting they should be drafted into separate yards.

- When checking the trap, always approach from the direction of the gate. This will prevent the goats being forced into the gate area of the trap where the fence is lowest and there is a chance they will escape.
- Traps can be left at permanent sites with the gates open and reactivated when further trapping is needed.

Holding goats in yards

- Captured goats should be allowed at least 3–4 days to rest with adequate shelter, food and water before they are transported on journeys longer than 8 hours. This will also allow them to become accustomed to lot feeding before transport to a feedlot or depot. During this time they must be assessed daily for signs of injury, disease, loss of appetite, illness or distress. Account must be taken of their possible unwillingness to drink and eat from troughs.
- Goats should not be held in the holding yards for extended periods. If goats are being held for any length of time (no longer than four days) they should be drafted into a large holding paddock that contains adequate shelter, food and water.
- Older males and goats with significant horns should be separated to avoid dominance behaviour and injury. Does and unweaned kids should be kept together.

Loading and transporting goats

Specific requirements for the land transport of goats can be found in [Australian Standards and Guidelines for the Welfare of Animals — Land Transport of Livestock](#)

Euthanasia of goats in the yards

- It might be necessary to humanely kill goats in the following situations:
 - when there is no market for the captured goats (including smaller animals that are of no commercial value)
 - if goats have sustained serious injury during capture or in the holding yards
 - if there are dependent young that are separated from their mother
 - if there is a pre-existing disease or condition that would prevent the animal from being transported, slaughtered or domesticated.
- When large numbers of animals are to be killed in the holding yard, provisions should be made to dispose of carcasses in an appropriate manner (i.e., by burying and/or burning). Numerous guidelines are available that describe disposal methods.

Shooting

- Shooting is the most acceptable method of euthanasia for goats and must be done to cause sudden and painless death with minimum distress to the animal. Only head shots are acceptable.
- The shooter should approach the animals in a calm and quiet manner. To prevent unnecessary agitation of the yarded goats, other people should keep away from the area until shooting is completed.

- To maximise the impact of the shot and to minimise the risk of misdirection, the range should be as short as possible.
- Never fire when the goat is moving its head. Be patient and wait until the goat is motionless before shooting. Accuracy is important to achieve a humane death. One shot should ensure instantaneous loss of consciousness and rapid death without resumption of consciousness.
- Shots must be aimed to destroy the major centres at the back of the brain near the spinal cord. The horn structures on adult goats make the rear (or poll) head shot the preferred point of aim. Shots to the front of the head can be used on kids but this method is not recommended for mature goats as the brain is located well back in the skull.
- Rear (or poll) shots are performed by aiming the firearm at the back of the head at a point between the base of the horns and directed towards the throat and mouth.
- To ensure maximum impact and the least possibility of misdirection, projectiles should be fired at the shortest range possible, but not with the barrel in contact with the animal's head.
- Death of shot animals can be confirmed by observing a combination of the following:
 - no heartbeat
 - no breathing
 - no corneal reflex (no blinking when the eyeball is touched)
 - no response to a painful stimulus (e.g., a pinch of the ear tip).
- If death cannot be verified, a second shot to the head should be taken immediately.

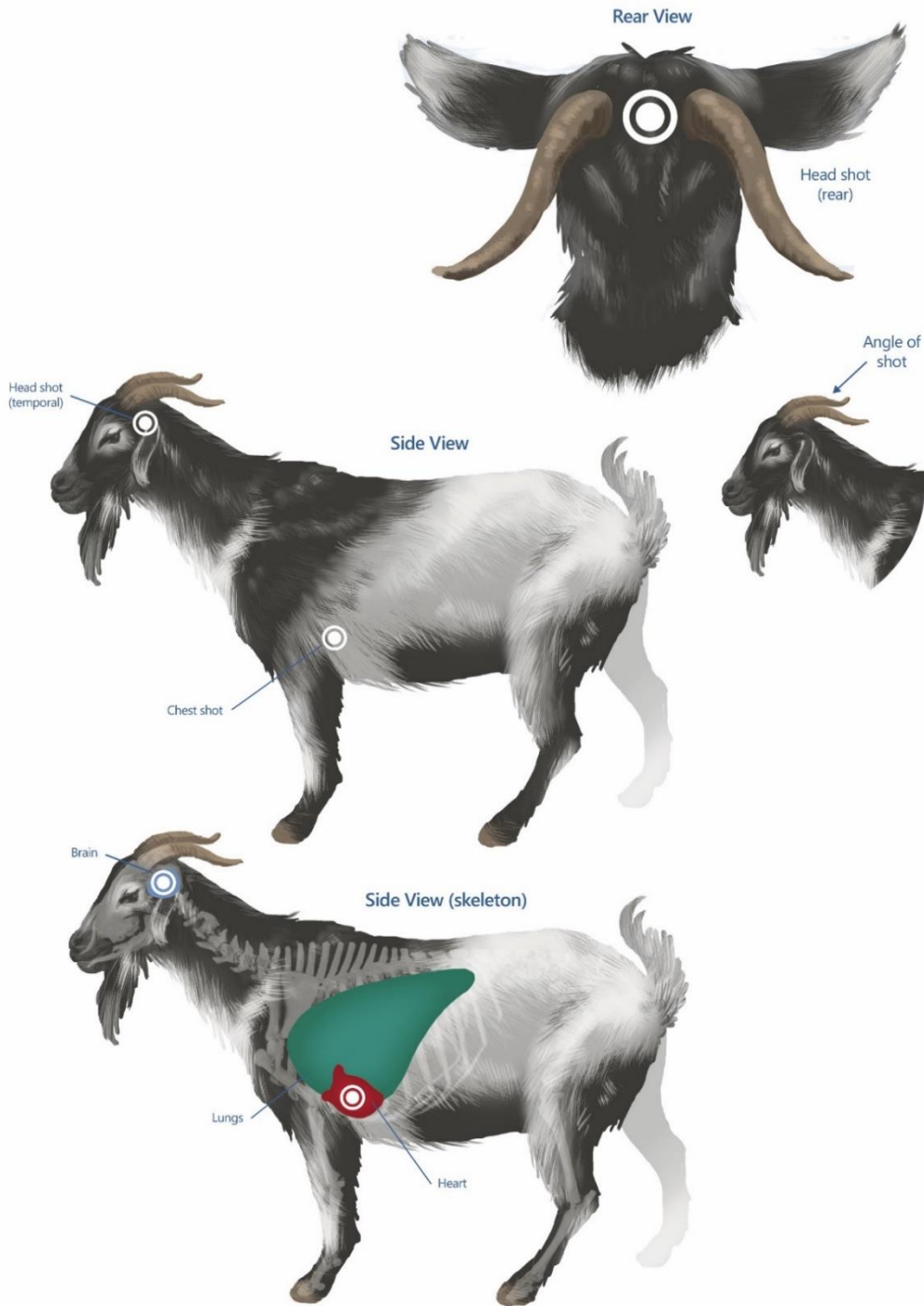
Captive bolt gun

- In some situations (e.g., where it is unsafe to use a firearm) it may be more appropriate to use a captive bolt gun for euthanasia of goats.
- Captive bolts cause insensibility by disrupting the cerebral cortex, with death occurring due to disruption to the brain stem.
- Captive bolts must only be used by suitably trained operators who can confidently handle and operate the device and know the correct anatomical landmarks on the head. They must also be able to confirm death, recognise ineffective shots and take quick action when a shot goes wrong.
- A penetrating captive bolt gun is recommended because it is more reliable at delivering an effective stun.
- The animal must be well-restrained and the captive bolt gun pressed firmly on the head in the *poll* position before being discharged. Frontal and crown shots must not be used.
- Captive bolt guns can only cause stunning, or loss of insensibility, that may be temporary and not lead to death. Stunning must therefore be followed by a secondary method to cause death, such as bleeding-out.

Euthanasia of neonatal dependent young

- In some situations (e.g., when it is unsafe to use a firearm) it will be necessary to use an alternative method for euthanasia of dependent young that can be caught by hand. Acceptable methods are:
 - A penetrating captive bolt gun as described above.
 - A percussive, non-penetrating captive bolt device (e.g., CASH Small Animal Tool with a 1 grain cartridge; propane-powered TED device) - is effective for achieving stun/kill of neonatal goats (up to 48 hours old) when applied to the skull on the midline between the ears with the chin tucked into the neck.

Figure 4: Shot placement for feral goats. Head shot (rear / poll) should be used for euthanasia at close range. See text for details.

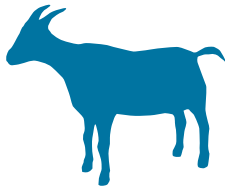


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References

- Aebischer, N.J., Wheatley, C.J., & Rose, H.R. (2014). Factors associated with shooting accuracy and wounding rate of four managed wild deer species in the UK, based on anonymous field records from deer stalkers. *PLoS One*, 9: e109698.
- American Veterinary Medical Association (AVMA). (2013). *AVMA guidelines for the euthanasia of animals: 2013 edition*. American Veterinary Medical Association. Available at: www.avma.org/KB/Policies/Documents/euthanasia.pdf
- American Veterinary Medical Association (AVMA). (2016). *AVMA Guidelines for the Humane Slaughter of Animals*. Available at: <https://www.avma.org/KB/Resources/Reference/AnimalWelfare/Documents/Humane-Slaughter-Guidelines.pdf>
- Animal Health Australia (AHA). (2012). *Australian Animal Welfare Standards and Guidelines — Land Transport of Livestock*. Animal Health Australia (AHA), Canberra. Available at: <http://www.animalwelfarestandards.net.au/land-transport/>
- Animal Health Australia (2015). Operational manual: Disposal (Version 3.1). *Australian Veterinary Emergency Plan (AUSVETPLAN), Edition 3*. National Biosecurity Committee, Canberra, ACT.
- Animal Health Australia (AHA) (2016). *Australian Industry Welfare Standards and Guidelines - Goats*. Animal Health Australia.
- Bellchambers, K. (2004). *Improving the Development of Effective and Humane Trapping Systems as a Control Method for Feral Goats in Australia*. Department of the Environment and Heritage, South Australia.
- Burton, R. (2011). *Humane Destruction of Stock. Primefact 310*. NSW Government, Orange.
- Connelly, P., Horrocks, D., Pahl, L. & Warman, K. (2000). *Cost-effective and Multipurpose Self-mustering Enclosures for Stock*. Queensland Department of Primary Industries.
- DeNicola, A. J., Miller, D. S., DeNicola, V. L., Meyer, R. E. & Gambino, J. M. (2019). Assessment of humaneness using gunshot targeting the brain and cervical spine for cervid depopulation under field conditions. *PLoS One*, 14: e0213200.
- Department of the Environment, Water, Heritage and the Arts (DEWHA). (2008). *Threat abatement plan for competition and land degradation by unmanaged goats*. DEWHA, Canberra. Available at: <http://www.environment.gov.au/biodiversity/threatened/tap-approved.html>
- Department of Agriculture and Water Resources (2011). *Australian Standards for the Export of Livestock (Version 2.3)*. Australian Government, Canberra.
- Finnie, J. (1997). Traumatic head injury in ruminant livestock. *Australian Veterinary Journal*, 75: 204–208.
- Gregory, N. (2004). *Physiology and behaviour of animal suffering*. Blackwell, Oxford, UK.
- Grist, A., Lines, J., Knowles, T., Mason, C., & Wotton, S. (2018). Use of a Non-Penetrating Captive Bolt for Euthanasia of Neonate Goats. *Animals*, 8: 1-13.

- Joshua, E. (2003). *Yard Design for Goats. Agfact A7.7.2*. NSW Agriculture. Available at: https://www.dpi.nsw.gov.au/_data/assets/pdf_file/0010/178543/yard-design-goats.pdf
- Jubb, T. (2013). How to use a penetrating captive bolt gun. Proceedings of the Australian Veterinary Association (AVA) Annual Conference (Cattle/Sheep/Welfare), Cairns.
- Lambooj, B. & Algers, B. (2016). Mechanical stunning and killing methods. In: Verlade A, Raj M (eds.) *Animal Welfare at Slaughter*. 5M Publishing, Sheffield, U.K.
- Longair, J., et al. (1991). Guidelines for euthanasia of domestic animals by firearms. *The Canadian Veterinary Journal*, 32: 724-726.
- Meat & Livestock Australia. (2018). *Going into Goats: A practical guide to producing goats in the rangelands*. Meat & Livestock Australia. Available at: <http://www.rangelandgoats.com.au/>
- NSW DPI. (2017). *Animal carcass disposal. Primefact 1616, first edition*. NSW Government. Available at: www.dpi.nsw.gov.au
- O'Flynn, M. (1992). Animal Welfare Considerations. Pp. 39-55, in D. Freudenberger (ed.) *Proceedings of the National Workshop on Feral Goat Management: Planning for Action, Dubbo, New South Wales*. Bureau of Resource Sciences, Canberra.
- Parkes, J., Henzell, R., Pickles, G. & Bomford, M. (1996). *Managing Vertebrate Pests: Feral Goats*. Australian Government Publishing Service, Canberra.
- Ramsay, B. J. (1994). *Commercial Use of Wild Animals in Australia*. Australian Government Publishing Service, Canberra.
- Sutherland, M. A., Watson, T. J., Johnson, C. B., & Millman, S. T. (2016). Evaluation of the efficacy of a non-penetrating captive bolt to euthanase neonatal goats up to 48 hours of age. *Animal Welfare*, 25: 471-479
- Underwood, C. (2002). *Total grazing management field guide self-mustering systems for cattle, sheep and goats. Bulletin No. 4547*. Department of Agriculture, Western Australia.
- Woods, J., Shearer, J.K. & Hill, J. (2010). Recommended on-farm euthanasia practices. Pp 186-213, in T. Grandin (ed.) *Improving Animal Welfare: A Practical Approach*. CABI Publishing, Wallingford, Oxfordshire, U.K.



NSWGOAT SOP5

Use of Judas goats

Background

Radio-collared 'Judas' goats can be used to locate groups of feral goats that are difficult to find by other methods. This technique involves attaching a radio collar to a feral goat and releasing it with the expectation that it will join up with other goats. Goats are particularly suited to the Judas method as they are a highly social species and will seek the companionship of any other feral goats in the area. Once the position of the feral herd is established, the goats accompanying the Judas animal are either mustered or destroyed by shooting (refer to NSWGOAT SOP1 *Ground shooting of feral goats*, NSWGOAT SOP2 *Aerial shooting of feral goats* and NSWGOAT SOP3 *Mustering of feral goats* for further details on these methods of control). The Judas goat is usually allowed to escape, so that it will search out other groups of feral goats. Once eradication is achieved the Judas goat is located, shot and the radio collar retrieved.

This standard operating procedure (SOP) is a guide only. It does not replace or override the relevant federal and NSW legislation. The SOP should only be used subject to the applicable legal requirements (including WHS) operating in NSW.

Individual SOPs should be read in conjunction with the overarching Code of Practice for that species to help ensure that the most appropriate control techniques are selected and that they are deployed in a strategic way, usually in combination with other control techniques, to achieve rapid and sustained reduction of pest animal populations and impacts.

Application

- The Judas technique is commonly used to locate remnant individual animals or groups of feral goats in low-density populations. The technique may also be useful for quickly locating populations of goats in areas where the terrain is rugged, or the vegetation is thick. Group sizes are smaller in thick vegetation and even when populations are dense, small groups are harder to locate than larger groups.
- It is most effective when used to 'mop up' remnant populations of feral goats, particularly in rough country, that are proving difficult or costly to control. The technique is not efficient where there are large numbers of feral goats in the area.
- The use of Judas goats to locate feral herds increases the effectiveness of ground and aerial shooting and mustering control operations, particularly when eradication is the aim of the program.
- The Judas technique requires expensive equipment and skilled operators.

- It is preferable to use local feral goats that are familiar with the area and are already part of the social structure of the target population. However, in some situations, feral goats from other areas or introduced farmed goats are used. Most goats that are moved into an unfamiliar area appear to quickly settle into the new herd, but there is a risk of causing some stress for the translocated animal. There is also a chance that they may not join up with the local animals or that they may move out of the target area.
- Trained herding/sheep dogs are sometimes used to detect, herd or flush out feral goats so that they can be captured and used as Judas goats. It is unacceptable to set a dog onto a goat with the intention of bringing it down, holding or attacking it.

Animal welfare implications

Target animals

- This technique can have negative impacts on the Judas goat through the following:
 - Capture, handling and restraint can cause anxiety and sometimes pain and injury when an animal struggles to escape.
 - Nearby shooting of cohorts can distress Judas goats, and the sound of gunshots and presence of people is likely to cause further fear and anxiety.
 - Repeatedly being isolated and having to find other goats can also cause fear and anxiety, as goats are highly social animals.
- The collar can have negative impacts on the Judas goat if not fitted correctly, causing chafing or constriction. The collar or antenna can occasionally become snagged or entangled in branches/vegetation and impede movement.
- The collar must be fitted correctly to allow it to move up the tapered neck if the animal grows or gets fat. As the neck gets larger, the collar will shift higher up the neck, which prevents constriction. If the collar is initially too tight this movement can't happen, or if it is too loose it can catch in vegetation. Adverse effects of wearing the collar should be monitored, by looking for skin irritation or hair loss under the collar.
- The lightest collar/transmitter available should always be used (less than 5% of the animal's body mass), however, the weight of the collar and transmitter will not normally have a significant impact on the Judas goat, as goats are relatively large animals.
- To prevent hyperthermia, it is preferable to avoid catching and restraining goats when the weather is hot and/or there is high relative humidity.
- Goats that sustain injuries during capture/restraint that would compromise their survival in the wild should be euthanased quickly and humanely by a rifle shot to the brain.
- If dogs are used to locate and flush feral goats out from heavily forested areas, they must be adequately controlled to prevent them from attacking goats. Only trained working dogs are to be used to assist in the handling of feral goats. Trained sheep dogs such as kelpies are preferred as they are not usually aggressive. As a precaution, muzzles can be fitted to dogs to prevent bite injuries.
- Whenever possible, avoid capturing and handling when female goats are kidding or have young at foot. Although feral goats have been observed to breed at all times of the year,

there are periods when the majority of kidding occurs (e.g., in semi-arid areas, most kids are produced in the cooler months of the year).

- If the goats must be transported to another area, it must be done with the minimum amount of stress, pain or suffering. Guidelines for these procedures can be found in relevant state or federal government guidelines; for example:
 - [Australian Industry Welfare Standards and Guidelines for Goats](#)
 - [Australian Animal Welfare Standards and Guidelines — Land Transport of Livestock](#)
 - [Australian Standards for the Export of Livestock](#)

Non-target animals

- The use of Judas goats is target specific and has minimal impact on other species.
- If dogs are used for locating feral goats they must receive adequate care at all times. This includes food, water, shelter, safe and comfortable transportation, current vaccinations, worming, flea, tick and heartworm prevention, where appropriate. For more details refer to [GEN002 The care and management of dogs used for pest animal control](#).

Workplace health and safety considerations

- Take care to avoid accidental injury when capturing and restraining animals. Hands can be injured if fingers get caught between the horns of two goats. Goats can bruise your legs with their horns if they try to run past you. Protective clothing and footwear can reduce the chances of injury. Covering the goat's eyes while handling will calm the animal. Raising one of goat's back legs will also prevent the risk of injury to both handlers and the goat, because it cannot suddenly struggle to escape.
- Most transmitters run on a lithium cell. When lithium is exposed to air, it reacts violently and emits highly toxic fumes. If the lithium cell is accidentally ruptured (e.g., by a bullet when shooting goats), then the area should be avoided for a few hours to allow the fumes to disperse.
- Firearms are hazardous. All people should stand well behind the shooter when an animal is being shot. The line of fire must be chosen to prevent accidents or injury from stray bullets or ricochets.
- Firearm users must strictly observe all relevant safety guidelines relating to firearm ownership, possession and use.
- Firearms must be securely stored in a compartment that meets state legal requirements. Ammunition must be stored in a locked container separate from firearms.
- The shooter and others in the immediate vicinity should wear adequate hearing protection to prevent irreversible hearing damage, and safety glasses to protect eyes from gases, metal fragments and other particles.
- Care must be taken when handling goats, as they can carry diseases such as Q fever and scabby mouth (also known as orf) that can affect humans and other animals. Routinely wash hands after handling goats or goat carcasses.
- Operators working with goats and goat carcasses are at risk of contracting Q fever. They can become infected when they inhale droplets of urine, milk, faeces or birth products

from infected animals. Infection can also occur from inhalation of aerosols created during slaughter of infected animals or dust from contaminated materials. Blood testing of personnel is recommended to assess previous exposure, followed by vaccination for susceptible individuals.

Equipment required

Transmitting system

- The basic system includes a transmitter, power supply, antenna, material to protect the electronic components and a collar to attach the transmitter to the animal.
- Collars and transmitters should be as lightweight as possible. The total weight (collar, transmitter, battery, aerial and bonding material) must be less than 5% (ideally 3 %) of the animal's bodyweight. Detailed information and advice regarding size and suitability of collars can be obtained from retailers of radiotelemetry equipment.
- Collars should be made of materials that are durable, comfortable and safe for the animal, can withstand extreme environmental conditions, do not absorb moisture, and maintain their flexibility in low temperatures. Common materials used include flat nylon webbing, butyl belting, urethane belting, PVC plastic and tubular materials. The collar is closed with one or two clamps.
- Radio transmitters should always be tested before and after attachment to the animal (before release) to ensure they are functioning correctly.
- Reliable radio transmitters with the longest battery life possible (i.e. around 5 years) should be used. It is preferable that they be fitted with mortality sensors.
- Whip antennae should be incorporated into the collar wherever possible, to prevent them snagging on vegetation.

Receiving system

The receiving system detects and identifies signals from transmitters. A basic system consists of a battery-powered receiver, a receiving antenna, a recorder (human or mechanical) and accessories such as cables, a speaker or headphones. Although not a complex skill, some training in the interpretation of signal strength and direction is required.

Firearms/ammunition and captive bolt guns for euthanasia

- Smaller calibre rifles such as .22 magnum rimfire with hollow/soft point ammunition are adequate for euthanasia of goats at short range (within 5 m). If shooting animals from a greater distance refer to *NSWGOAT SOP1 Ground shooting of feral goats* for more detailed information.
- Penetrating captive bolt guns (e.g., Cash Special .22, Blitz Kerner .38) are suitable for euthanasia of restrained goats when used by trained and confident operators. The cartridge power and length/diameter of bolt must be appropriate for the species and age of animal.

- Captive bolt guns should be regularly cleaned and maintained in optimal working condition according to the manufacturer's instructions. Cartridge blanks must be stored properly so that the propellant does not deteriorate.

Procedures

Capture of goats

- Animals to be used as Judas goats should be caught without causing them injury and excessive stress.
- It is preferable to capture and release animals from, and to, familiar surroundings. However, in some instances when the goat population is already very low, goats might have to be captured and brought in from other areas.
- Judas goats are usually selected from a herd of goats that have been captured during trapping or mustering. Sometimes, individuals are caught using dogs. Trained working dogs such as kelpies are preferred, as they are not usually aggressive. As a precaution, a muzzle can be fitted to the dog to prevent bite injuries. Once the goat is caught, the dogs should be restrained while the collar is being attached.
- Adult goats (i.e., those with 4, 6 or 8 permanent teeth) are preferred for use as Judas animals. Both female and male goats have previously been used successfully as Judas goats.
- Females can be sterilized and then put into a chemically induced oestrus (termed Mata Hari goats) to stimulate sex pheromone production and lure wary males and their mixed-gender social groups from hidden locations.
- Heavily pregnant females, females with young at foot, very young, very old or weak/sick/injured animals must not be used as Judas animals.

Fitting of collar and releasing of Judas goat

- At least two people should be present when fitting a collar, one to restrain the animal and one to fit the collar. It should not be necessary to anaesthetise the animal for fitting of collars providing the procedure is done quickly. Blindfolding the animal should help to keep it calm.
- The collar should be fitted snugly on the neck to ensure that no irritating movement or rubbing occurs. At the same time, enough space should be left to allow the animal to behave normally and for it not to experience any discomfort while moving or feeding. As a general guide, you should be able to slip two fingers between the animal's neck and the collar.
- To reduce the risk of irritation on the neck, the collar should be fastened at the side and any metal fitting should be covered or at least smoothed on the inside.
- The Judas goats should be clearly identifiable (e.g., with brightly coloured paint, highly visible collar or ear tags), so that they can be easily distinguished from other goats in the herd.
- Remove magnet (battery stop) or turn on the collar if it is fitted with a magnetic switch and check transmitter frequency before releasing goat.

- Once the collar has been attached, and before release, observe the animal for any unusual behaviour that could indicate that the collar might cause a problem (e.g., affecting balance, impeding movement or causing irritation to the skin).
- In some situations it may be appropriate to give the Judas goats prophylactic vaccinations and anthelmintic treatment.
- The collared Judas goat is relocated and released in the target area. If the animal needs to be transported in a vehicle, it must be appropriately restrained to prevent it from jumping out. Tying only its back legs together so that it can sit up will help to prevent the formation of bloat. Animals should not be tied up for more than one hour and they must be protected from extremes of temperature during transportation.
- It is recommended that the number of Judas goats released is equivalent to at least 20%, and preferably 30%, of the number of herds initially in the population. However, no more than two Judas goats should be released into a herd area because groups of three will stick together and possibly not join other goats.
- Comprehensive information on the use of radio collars can be found in [A Manual for Wildlife Radio Tagging](#).

Location of feral goat herds

- The Judas goats should be given enough time to meet up with other feral goats. The time needed will vary with the season and how far away the herds are. Release time should therefore be planned to precede the control program by the time expected for Judas goats to meet and settle with a herd.
- Radio tracking is then begun and when the position of the feral herd is known, the goats are either mustered or destroyed by shooting. Refer to the appropriate SOP for further details:
 - *NSWGOAT SOP1 Ground shooting of feral goats*
 - *NSWGOAT SOP2 Aerial shooting of feral goats*
 - *NSWGOAT SOP3 Mustering of feral goats*
- The process of tracking down the herd, and then shooting or mustering, is repeated every four to six months until only the Judas goat/s remain in the area. Those goats are then destroyed by shooting and the collar retrieved.

Euthanasia of goats

Shooting

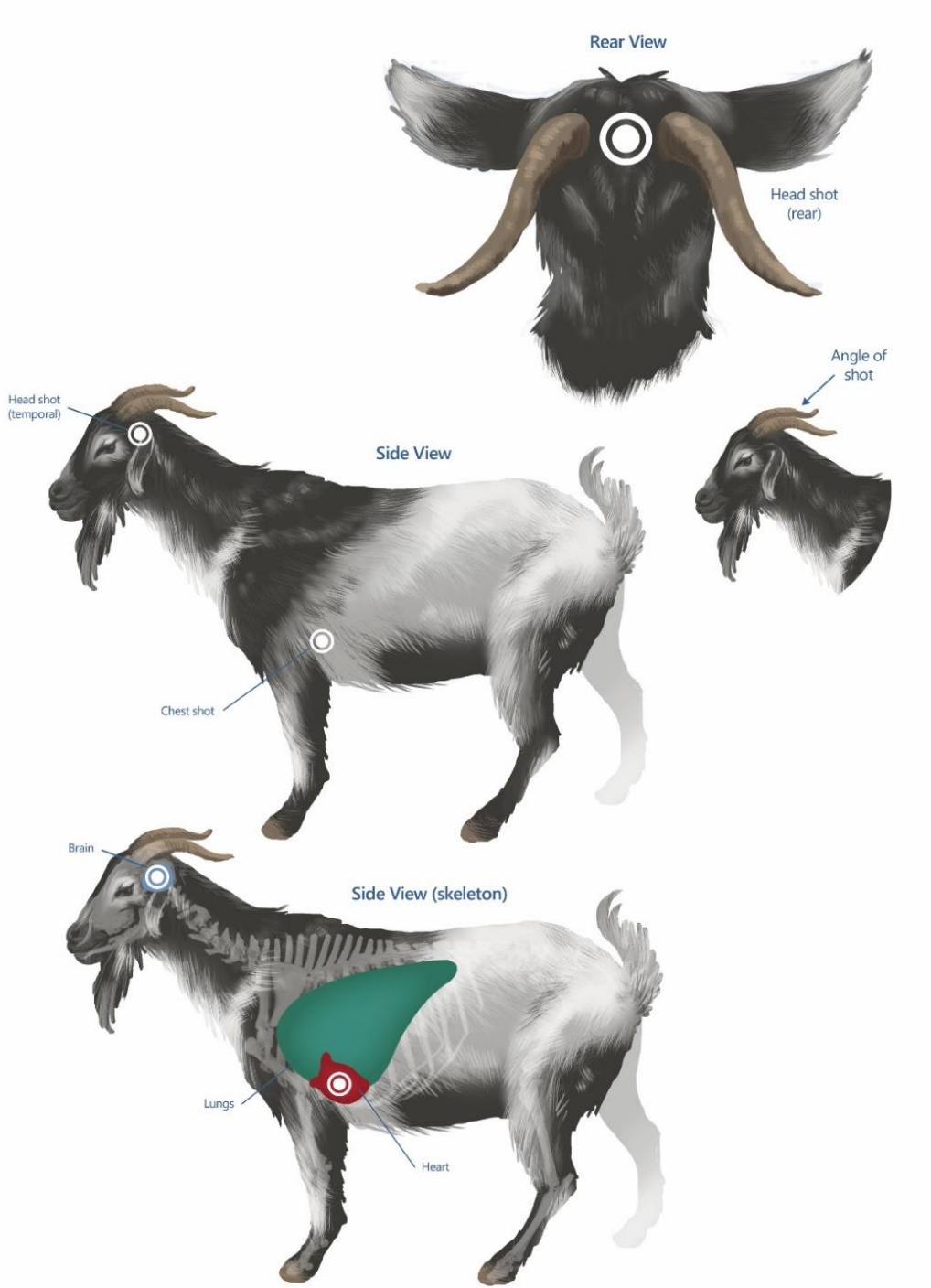
- Shooting is the most acceptable method of euthanasia for goats and must be done to cause sudden and painless death with minimum distress to the animal. Only head shots are acceptable.
- The shooter should approach the animals in a calm and quiet manner. To prevent unnecessary agitation of the yarded goats, other people should keep away from the area until shooting is completed.
- To maximise the impact of the shot and to minimise the risk of misdirection, the range should be as short as possible.

- Never fire when the goat is moving its head. Be patient and wait until the goat is motionless before shooting. Accuracy is important to achieve a humane death. One shot should ensure instantaneous loss of consciousness and rapid death without resumption of consciousness.
- Shots must be aimed to destroy the major centres at the back of the brain near the spinal cord. The horn structures on adult goats make the *rear (or poll)* head shot the preferred point of aim. Shots to the front of the head can be used on kids but this method is not recommended for mature goats as the brain is located well back in the skull.
- Rear (or poll) shots are performed by aiming the firearm at the back of the head at a point between the base of the horns and directed towards the throat and mouth.
- To ensure maximum impact and the least possibility of misdirection, projectiles should be fired at the shortest range possible, but not with the barrel in contact with the animal's head.
- Death of shot animals can be confirmed by observing a combination of the following:
 - no heartbeat
 - no breathing
 - no corneal reflex (no blinking when the eyeball is touched)
 - no response to a painful stimulus (e.g., a pinch of the ear tip).
- If death cannot be verified, a second shot to the head should be taken immediately.

Captive bolt gun

- In some situations (e.g., where it is unsafe to use a firearm) it may be more appropriate to use a captive bolt gun for euthanasia of goats.
- Captive bolts cause insensibility by disrupting the cerebral cortex, with death occurring due to disruption to the brain stem.
- Captive bolts must only be used by suitably trained operators who can confidently handle and operate the device and know the correct anatomical landmarks on the head. They must also be able to confirm death, recognise ineffective shots and take quick action when a shot goes wrong.
- A penetrating captive bolt stunner is recommended because it is more reliable at delivering an effective stun.
- The animal must be well-restrained, and the captive bolt gun pressed firmly on the head in the *poll* position before being discharged. Frontal and crown shots must not be used.
- Captive bolt guns can only cause stunning, or loss of insensibility, that may be temporary and not lead to death. Stunning must therefore be followed by a secondary method to cause death, such as bleeding-out.

Figure 5: Shot placement for feral goats. Head shot (rear / poll) should be used for euthanasia at close range



Note that shooting an animal from above or below the horizontal level as depicted here will influence the direction of the bullet through the body. Adjustment to the point of aim on the external surface of the body may need to be made to ensure that the angled bullet path causes extensive (and therefore fatal) damage to the main organs in the target areas.

References

- American Veterinary Medical Association (AVMA). (2013). *AVMA guidelines for the euthanasia of animals: 2013 edition*. American Veterinary Medical Association. Available at: www.avma.org/KB/Policies/Documents/euthanasia.pdf
- American Veterinary Medical Association (AVMA). (2016). *AVMA Guidelines for the Humane Slaughter of Animals*. Available at: <https://www.avma.org/KB/Resources/Reference/AnimalWelfare/Documents/Humane-Slaughter-Guidelines.pdf>
- Animal Health Australia (AHA). (2012). *Australian Animal Welfare Standards and Guidelines — Land Transport of Livestock*. Animal Health Australia (AHA), Canberra. Available at: <http://www.animalwelfarestandards.net.au/land-transport/>
- Animal Health Australia (AHA). (2016). *Australian Industry Welfare Standards and Guidelines - Goats*. Animal Health Australia. Available at: www.animalwelfarestandards.net.au
- Campbell, K. J., Baxter, G. S., Murray, P. J., Coblenz, B. E., & Donlan, C. J. (2007). Development of a prolonged estrus effect for use in Judas goats. *Applied Animal Behaviour Science*, 102: 12-23.
- Department of the Environment, Water, Heritage and the Arts (DEWHA). (2008). *Threat abatement plan for competition and land degradation by unmanaged goats*. DEWHA, Canberra. Available at: <http://www.environment.gov.au/biodiversity/threatened/tap-approved.html>
- Department of Agriculture and Water Resources (2011). *Australian Standards for the Export of Livestock (Version 2.3)*. Australian Government, Canberra.
- Gregory, J., Kyle, B. & Simons, M. (2002). Judas Workshop. *Proceedings of a workshop on the use of radio telemetry for animal pest control*. NZ Department of Conservation, Dunedin, New Zealand.
- Keegan, D. R., Coblenz, B. E. & Winchell, C. S. (1994). Feral goat eradication on San Clemente Island, California. *Wildlife Society Bulletin*, 22: 56-61.
- Kenward, R. E. (2000). *A manual for wildlife radio tagging*. Academic Press. Available at: <https://sora.unm.edu/sites/default/files/p00812-p00815.pdf>
- Longair, J., Finley, G. G., Laniel, M. A., MacKay, C., Mould, K., Olfert, E. D., Rowsell, H. & Preston, A., (1991). Guidelines for euthanasia of domestic animals by firearms. *The Canadian Veterinary Journal*, 32: 724-726.
- Mech, L. D. & Barber, S. M. (2002). *A critique of wildlife radio-tracking and its use in national parks*. Northern Prairie Wildlife Research Center.
- O'Flynn, M. (1992). Animal Welfare Considerations. Pp. 39-55, in D. Freudenberger (ed.) *Proceedings of the National Workshop on Feral Goat Management: Planning for Action, Dubbo, New South Wales*. Bureau of Resource Sciences, Canberra.
- Parkes, J., Henzell, R., Pickles, G. & Bomford, M. (1996). *Managing Vertebrate Pests: Feral Goats*. Australian Government Publishing Service, Canberra.

- Putman, R. (1995). Ethical considerations and animal welfare in ecological field studies. *Biodiversity and Conservation*, 4: 903-915.
- Robertson, B. A., Ostfeld, R. S. & Keesing, F. (2017). Trojan females and Judas goats: Evolutionary traps as tools in wildlife management. *BioScience*, 67: 983-994.
- Samuel, M. D. & Fuller, M. R. (1996). Wildlife radiotelemetry. Pp 370-418, in T. Bookhout (ed.) *Research and Management Techniques for Wildlife and Habitats*. The Wildlife Society, Washington DC.
- Taylor, D. & Katahira, L. (1988). Radio telemetry as an aid in eradicating remnant feral goats. *Wildlife Society Bulletin*, 16: 297-299.

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