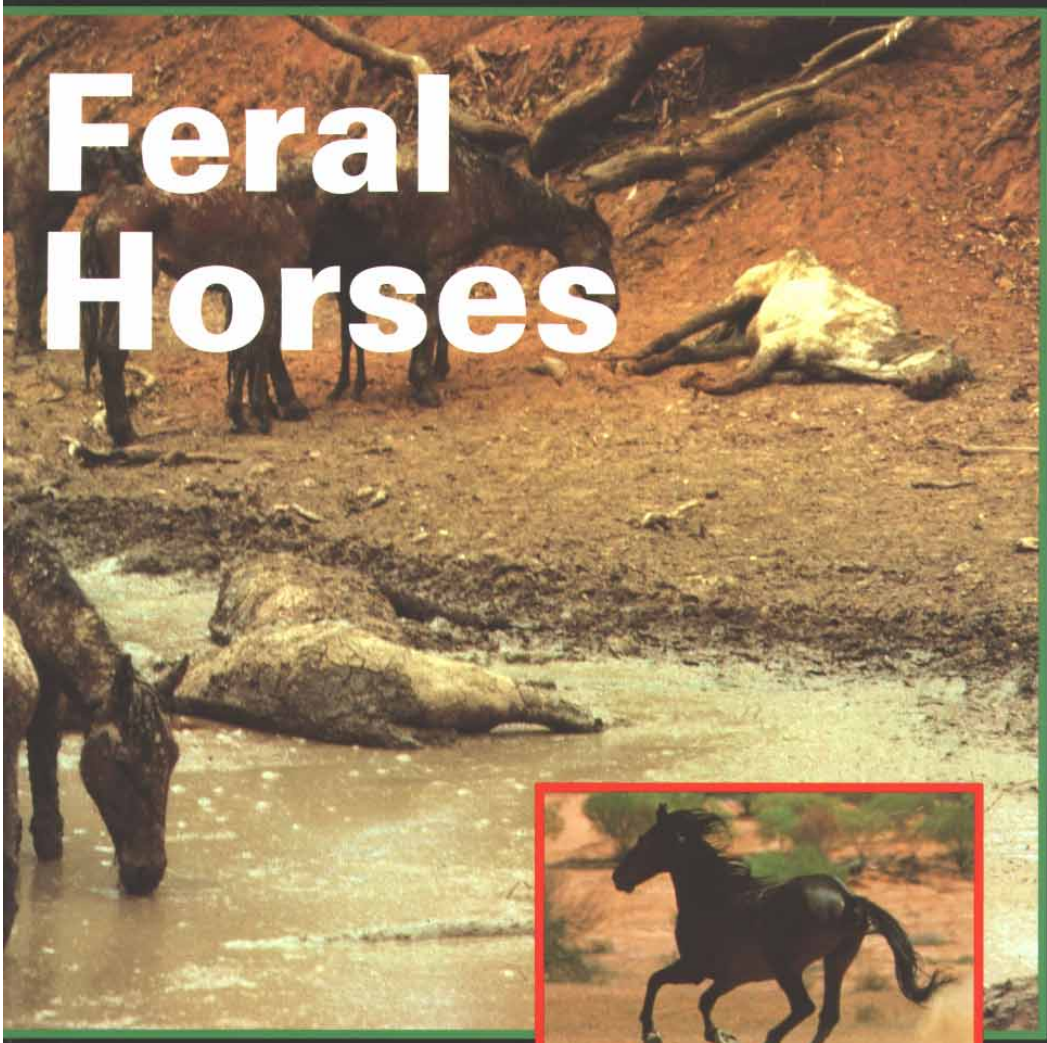
Managing Vertebrate Pests

Feral Horses



B R S

Department of Primary Industries and Energy
Bureau of Resource Sciences

Managing Vertebrate Pests: Feral Horses

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The Bureau of Resource Sciences is a professionally independent Bureau in the Department of Primary Industries and Energy. It was formed in October 1992 from the existing Bureau of Rural Resources and the resource assessment branches of the former Bureau of Mineral Resources.

The Bureau's role is to support the sustainable development of Australia's agricultural, mineral, petroleum, forestry and fisheries industries by providing scientific and technical advice to government, industry and the community.

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FOREWORD

This publication, which is one in a series of titles, provides land managers with 'best practice' national guidelines for managing the agricultural and environmental damage caused by feral horses. Others in the series include guidelines for managing rabbits, foxes, feral goats, feral pigs and rodents.

Australia has an estimated 300 000 feral horses which are mainly in the extensive cattle-raising districts of the Northern Territory and Queensland, but there are also feral horse populations in all other parts of Australia except Tasmania and the Australian Capital Territory. Feral horses are a complex management problem because they are widespread, often occur in relatively inaccessible country, are a major pest of both agriculture and the environment, and are a commercial resource and an animal welfare concern. This book outlines the techniques and strategies for managing the damage caused by feral horses. The Bureau of Resource Sciences' book *Managing Vertebrate Pests: Principles and Strategies* (Braysher 1993), on which this and other guidelines are based, emphasises the need to concentrate on pest damage rather than simply reducing pest density. In principle, therefore, the level that feral horse density should be reduced to would be based on the quantified relationship between feral horse density and damage. This information is difficult and expensive to obtain. Consequently, in practice, it is recommended that for much of the rangelands, feral horse density be reduced to 0.1 horses a square kilometre, which is the density that experience and observation indicate is appropriate for controlling feral horse damage. It is also a density that is readily achievable with available techniques.

The Conservation Commission of the Northern Territory and the Bureau of Resource Sciences developed this book in cooperation with the Vertebrate Pests Committee, which consists of senior officers from State and Territory pest animal authorities. To ensure that the guidelines are widely accepted as the basis for feral horse management, the Bureau sought comment from government and private land managers, community and other organisations, including the Australian Conservation Foundation, the National Farmers' Federation, the National Consultative Committee on Animal Welfare, Aboriginal Land Councils, relevant Research and Development Corporations, and the State, Territory and Commonwealth agriculture and resource management agencies. The Standing Committee on Agriculture and Resource Management has endorsed the approach to managing feral horse damage set out in this publication.

The book emphasises the need for all relevant groups with an interest in feral horse management to be involved in the development and, where appropriate, implementation of feral horse management programs. These include all landholders such as conservation agencies, pastoralists and Aboriginal people, the commercial feral horse industry and animal welfare organisations. This helps to set achievable objectives and to develop ownership of the pest problem, which makes effective feral horse management likely.

These guidelines will help land managers to reduce agricultural losses and environmental damage through the use of scientifically based management that is humane, cost-effective, and integrated with ecologically sustainable land management.

Neil Williams

Executive Director
Bureau of Resource Sciences

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ACRONYMS AND ABBREVIATIONS

ANZFAS	The Australian and New Zealand Federation of Animal Societies
APB	Agriculture Protection Board (Western Australia)
APCC	Animal and Plant Control Commission (South Australia)
AQIS	Australian Quarantine and Inspection Service
AUSVETPLAN	Australian Veterinary Emergency Plan
BTEC	Brucellosis and Tuberculosis Eradication Campaign
CCNT	Conservation Commission of the Northern Territory
DCNR	Department of Conservation and Natural Resources (Victoria)
DEH	Department of Environment and Heritage (Queensland)
DELM	Department of Environment and Land Management (South Australia)
D of L	Department of Lands (Queensland)
DPI	Department of Primary Industries (Queensland)
DPIE	Department of Primary Industries and Energy (Commonwealth)
DPIF	Department of Primary Industry and Fisheries (Tasmania)
NSW	New South Wales
pers. comm.	personal communication
RSPCA	Royal Society for the Prevention of Cruelty to Animals
SCARM	Standing Committee on Agriculture and Resource Management
SCAW	Subcommittee on Animal Welfare
SSCAW	Senate Select Committee on Animal Welfare
VPC	Vertebrate Pests Committee

SUMMARY

Australia has an estimated 300 000 feral horses. Most are in the extensive cattle-raising districts of the Northern Territory and Queensland, with many in parts of Western Australia and South Australia, and small scattered populations in New South Wales and Victoria. No feral horses are recorded in Tasmania or the Australian Capital Territory.

Feral horses pose a complex management problem in Australia. They cause damage to the environment and are a pastoral pest, an export meat resource and a significant animal welfare concern. As a result, there are diverse views about how best to manage Australia's feral horses.

Why develop national guidelines?

The national guidelines described here for managing the feral horse impact have been developed under a project managed and funded by the Bureau of Resource Sciences and coordinated by the Vertebrate Pests Committee. The guidelines aim to promote more effective management of feral horses through better coordination, planning and implementation of control programs based on best-practice and current scientific information.

This document should be read and used with the bulletin *Managing Vertebrate Pests — Principles and Strategies* (Braysher 1993) which explains why national pest guidelines were developed, their aims, the development process, their use and the principles on which pest management should be based. The need to focus on pest impact and not the pest *per se*, and to consider all major factors that influence the desired outcome, is stressed. Factors include climate, other plant and animal pests, grazing pressure, soil degradation and commodity prices. Failure to identify the major factors and involve major interest groups in planning and management may result in inappropriate management as a result of different groups pursuing conflicting objectives.

Why do horses do so well in Australia?

Horses are well adapted to the sparsely distributed and unpredictable resources of arid and semi-arid Australia. They can move up to 50 km a day to food or water. They have few predators or diseases. Mortality is mainly associated with drought, which causes starvation, lack of water and consumption of usually avoided toxic plants. Thousands die slowly in drought. Mares breed in spring to summer and produce, on average, one foal every two years. Under good conditions the population can increase by 20% a year.

'Feral horses damage the environment, are a pastoral pest, an export meat resource and a significant animal welfare concern.'

What damage do feral horses cause?

Environmental

Although not well quantified, there is much anecdotal and qualitative information to suggest that horses cause significant environmental damage. Impacts include fouling waterholes, accelerating gully erosion along pads, trampling and consuming native vegetation, and possibly excluding macropods from preferred habitats. Effects are most extreme during droughts when horses reach remaining food and water before cattle. Areas used by feral horses during drought are thought to be important for the persistence of many native plants and animals.

The relationship between horse density and impact needs to be quantified.

Economic

The diets of feral horses and cattle are similar, but during good seasons there appears to be little competition. During drought, when pastoralists de-stock or move animals to conserve breeding stock and protect the land from overgrazing, horses and other feral animals can have a major impact on scarce resources. Again the impact is not quantified, but based on studies and the experiences of pastoralists, feral horse impact is considered significant. In addition, horses are a potential reservoir of exotic diseases such as equine influenza and African horse sickness. They are also a major nuisance to pastoralists because they disturb cattle musters and damage fences and troughs. Their total impact needs better quantification, although it is likely to be difficult and expensive to obtain this information.

Are feral horses of any value?

Feral horses are used for human consumption (export) and pet meat. The average price at the farm gate is about $100 an animal, although this depends on the proximity to abattoirs. Feral horses are also a source of stock and recreation horses, although demand is low, and some, including Walers, have potential as a tourist attraction.

Society attitudes to feral horses

Animal welfare

Feral horses and their management have developed a high public profile. Major concerns centre on mustering, transport to and slaughter at abattoirs and shooting from helicopters. These concerns were reinforced by some groups when commenting on a draft of these guidelines—most notably by The Australian and New Zealand Federation of Animal Societies, who see the primary aim of feral horse management as being the eradication of feral horses across their distribution using humane techniques such as fertility control. Although desirable, this aim is not practicable. Reduction to and maintenance of feral horse populations at low densities is the best level of population control achievable. A Senate inquiry into the welfare of feral horses and other large feral animals concluded, reluctantly, that feral horses need to be controlled using techniques such as helicopter shooting. To minimise suffering, efficient control techniques need to be undertaken by trained operators. This will reduce the suffering feral horses endure during droughts and the need for repeated application of helicopter shooting and other potentially inhumane techniques. Commercial use of feral horses, at least in the initial stages, is essential. Without the revenue it produces many land managers would not undertake control. Nevertheless, the capture and long-distance transport of horses can cause unacceptable suffering if done poorly. The humaneness of long-distance transport of feral horses requires investigation to develop and enforce an appropriate code of practice.

More generally, these guidelines for managing feral horses stress the need for acceptable standards of animal welfare as an integral part of feral horse management.

Aboriginal attitudes

Aboriginal people control significant areas of land inhabited by feral horses. There is considerable variation in attitude between groups, but many see horses as potential revenue provided that the land is not destroyed. Governments and other land managers need to negotiate and consult closely with traditional owners when developing feral horse management programs.

Walers and tourist herds

Horses exported from Australia for the Indian Army remount trade between 1861 and 1931 were called Walers. The Waler Horse society was established in 1986 to recreate Waler Horses from feral stock. Some central Australian properties which are inhabited by feral horses today, once bred horses for the remount trade. The extent to which true to type Waler horses occur amongst feral horses is disputed. Feral horses may possess characteristics worthy of preservation, but if these horses are to be selected out and kept, they need to be effectively managed.

Some feral horses have been relocated to tourist herds or sanctuaries.

Control techniques

Major control techniques include trapping, helicopter mustering and shooting from helicopters or ground. Fertility control, while appealing to some as a humane control technique, is currently not practicable on a large scale.

Although there are animal welfare concerns over some of the recommended control techniques, these can be minimised. Managers, or people contracted to undertake control on their behalf, should be required to follow the *Model code of practice for the welfare of animals: Destruction or capture, handling and marketing of feral livestock animals*, the Northern Territory's *Procedures and guidelines for shooting feral animals*, and other relevant codes of practice as they are developed.

How are feral horses managed now?

Under State and Territory legislation, land managers are responsible for managing feral animals including feral horses. Management of feral horse impact is poor in most parts of Australia, and horses are often tolerated because they are considered too difficult or too costly to remove. Lack of control and sporadic partial control are common, resulting in only short-term relief from feral horse impact.

How should feral horses be managed?

The objective of feral horse management is to use humane techniques to reduce the damage they cause to an acceptable level. However, feral horse damage is poorly quantified and it will be very difficult and expensive to obtain the information. Without it, the best assessment a manager can now make is to assume that the level of feral horse damage correlates with horse density and that reducing damage therefore involves reducing density. The three control options are:

Local eradication

Eradication is appealing because it offers freedom from damage and the ongoing cost of control and, once achieved, freedom from potential cruelty. However, no widespread pest has ever been eradicated except on offshore islands. Local eradication is the best that can be achieved, but it is usually not possible due to the high cost and the difficulty of finding horses in highly dissected hill country. Sometimes, however, it is practical. Commercial harvesting followed by helicopter shooting can reduce horse numbers to very low densities. Local eradication may then be possible, given suitable conditions such as the concentration of horses at watering points during drought.

High level of control

Where eradication is not possible or desirable, sustained high level control is necessary. It is recommended that land managers reduce horse density to the level the land can sustain during drought.

This is the time when uncontrolled grazing by feral horses and other pests can negate destocking and other action by pastoralists to conserve scarce feed and protect the land. High feral horse populations due to lack of control can also lead to undue suffering of feral horses during drought through thirst, starvation and consumption of toxic plants. For central Australia, based on experience and observation, high level control is action which reduces horse density to 0.1 horses a square kilometre in feral horse areas. Commercial harvesting is an integral part of the management strategy for initial reduction and can provide funds for necessary follow-up action. Maintenance at low density requires that about 30% of the population be removed each year. Emphasis should be on the harem groups which contain the breeding mares.

Maintenance at higher densities

Where commercial harvesting is not practicable, land managers may tolerate feral horses at densities higher than 0.1 horses a square kilometre because the costs outweigh the benefits of control. This is not the preferred option of land managers because they need to reduce stocking rate to protect the land. Extreme cases may be 'no control', but economic losses and/or unsustainable environmental damage and suffering of horses during drought would be expected.

Assessment and monitoring

Ideally, land managers should monitor changes in the extent of feral horse damage as a result of reducing their density. However, this is difficult and can be expensive for those areas of the rangelands where horses are common. In addition, reliable and practical indicators of rangeland condition have not been developed. In the absence of reliable, cheap techniques for assessing impact before and after control, changes in horse density must be used. Aerial survey is the most accurate method, but is expensive and requires experienced operators. Simple, inexpensive techniques are needed for estimating density and assessing impact.

Implementing management plans

Most government land management agencies, private land managers and members of the public have only a little knowledge or understanding of feral horse impact and how to manage it effectively. A better awareness and understanding by interest groups is essential for more effective feral horse management. Community-based groups are effective mechanisms for governments to distribute information and provide advice, training and other assistance.

At government agency level, officers should have appropriate expertise and experience in feral horse management.

Future research and investigations

The Vertebrate Pests Committee is responsible for overseeing the implementation of the feral horse and other pest animal guidelines. The extent to which resources should be used to help address the deficiencies identified for managing feral horses will depend upon the priority for action based on an overall assessment of the guidelines for subsequent species.

Recommendations for further action include:

- quantification and evaluation of the costs and benefits of feral horse control;
- development of simple, inexpensive techniques for assessing feral horse density and impact;
- forming a register of experienced and qualified contract musterers and helicopter pilots and shooters;
- development of a computer-based

decision-support system to help the preparation of local management programs;

- strategic, regional surveys of feral horse density every five years;
- investigation of the biology and environmental impact of feral horses in the wet and dry tropics;
- legislation to mark all domestic horses more than one year old; and
- investigation of the effectiveness of fertility control for controlling populations in feral horse sanctuaries.

Commercial use of feral horses is an important element in encouraging effective management. However, many factors influence the application of commercial use. These include:

- animal welfare concerns over the mustering, transport and slaughter of feral horses. An appropriate and enforceable animal welfare code of practice is needed;
- legal barriers in some States to the field slaughtering of horses for pet meat; and
- the stability of markets.

INTRODUCTION

These guidelines give 'best practice' procedures and rationale for controlling the impact of feral horses on pastoralism and the environment. The document first outlines the history of feral horses in Australia, tracing the sources of feral populations, and provides an analysis of where the main concentrations occur. This is followed by a summary of feral horse biology, problems caused by feral horses, past and current management, and attitudes of interest groups that influence management. Recommended management techniques and strategies for control are presented, with methods to monitor the effectiveness of control programs. Implementation of feral horse management is discussed, and deficiencies in knowledge and areas for further research identified.

The guidelines are principally for State and Territory land management agencies who, in conjunction with landholders, will use them to manage feral horse damage through better coordination, planning and implementation of regionally and locally targeted management programs. Landcare and other similar community based groups provide an effective mechanism for developing a coordinated approach to pest animal management.

These management guidelines for feral horses are part of a series developed under the Strategic Vertebrate Pests Project by the Bureau of Resource Sciences. Other animals studied include the rabbit, fox, feral goat, feral pig and rodents. The document should be read and used in conjunction with the first in the series, *Managing Vertebrate Pests: Principles and Strategies* (Braysher 1993), which gives the history of the development of national guidelines for managing pest animals and the principles on which pest management should be based. The need to focus on damage caused by the pest and not the pest *per se* is stressed.

Guidelines for managing feral horses and other pest animals are based on the following elements:

- defining the problem in terms of impact;
- determining objectives and performance indicators;
- identifying and evaluating management options;
- implementing the control program; and
- monitoring and evaluating the efficiency of the program and program objectives.

The need to manage pest impact by considering the whole land system and links between its elements is emphasised. Factors that need to be considered in this process include other plant and animal pests, climate and grazing pressure, and social and economic factors. Ensuring that animal welfare standards are acceptable is an integral part of managing feral horse damage.

PART ONE

HISTORY, DISTRIBUTION AND BIOLOGY

1. History of Introduction and Spread

Section summary

Horses were first introduced to Australia in 1788. Irregular shipments of horses followed, mostly from the Cape Colony. Mortality was high during the early voyages and presumably only the hardiest horses survived. The start of recognised horse racing in 1810 prompted an influx of quality thoroughbreds from England. Horses adapted well to conditions in eastern Australia, and the number grew to about 3500 by 1820.

Initially, the demand for riding horses was low and they served mainly as utility horses or working farm horses. The number of horses in eastern Australia rose sharply between 1830 and 1850 from 14 000 to 160 000, largely by natural increase. Draught horses began to replace bullocks for transport in the 1850s and 1860s. The opening up of pastoral lands owed much to horses.

The first record of horses either escaping into the bush or being abandoned was made in 1804. Minimal fencing combined with infrequent musters led to the growth of feral herds of abandoned and stray stock. Feral herds were first recognised as pests in the 1860s. Many horses became redundant with the increase in mechanisation, giving rise to large unmanaged herds, particularly in the extensive cattle-raising areas.

1.1 Arrival of horses in Australia

Horses were introduced into Australia in 1788 with the arrival of the First Fleet (Australian Encyclopaedia 1983; Kennedy 1986). One stallion, three mares and three juveniles of Arab/Barb stock were shipped from Cape Colony and arrived in Sydney Cove in good condition (Barrie 1956; Kennedy 1986).

'Horses arrived with the First Fleet in 1788.'

Irregular shipments followed, mostly from the Cape Colony, and some stallions of Arab blood were imported from India to help improve stock (Barrie 1956). Early government reports indicate that horses adapted well to conditions in eastern Australia. By 1800 there were about 200 horses, and by 1820 around 3500 (Kennedy 1986). Saddle breeds, predominantly Arab and cross-bred Arabs, strongly dominated imports before 1820 (Barrie 1956; Kennedy 1986). The demand for riding horses was low and they served mainly as utility horses or working farm horses. Government priorities in the new colony focused on livestock production for meat (cattle, sheep, pigs) rather than for riding (horses) (Barrie 1956; Kennedy 1956; Lang et al. 1983). Improvement in horse stocks relied largely on the private settlers (Kennedy 1986).

Before 1820, about 20% of shipped horses died during the voyage, with only the most hardy surviving. Importers learnt the value of selecting robust stock to reduce losses. After 1820, imports of horse breeds were more varied, and included ponies, saddle, harness and draught horses (Kennedy 1986).

Recognised horseracing began in Sydney in 1810 and prompted an influx of quality thoroughbreds from England (Barrie 1956; Australian Encyclopaedia 1983). This led to an improvement not only in racehorses, but also in stock and work horses, as thoroughbred bloodlines began to dominate (Australian Encyclopaedia 1983).

The number of horses in eastern Australia rose sharply between 1830 and 1850 from 14 000 to 160 000, largely by natural increase. Draught horses began to replace bullocks for transport in the 1850s

and 1860s (Kennedy 1986). As the colony matured and expanded, horse-breeding became an important rural industry (Kennedy 1986).

1.2 Horses in exploration and pastoral development

Settlement was confined to the Sydney region until the early 1800s. There were four horses on the first crossing of the Blue Mountains (Barrie 1956) in 1813 which promoted a general expansion of the colony (Australian Encyclopaedia 1983). Grazing lands were opened up and the need for fast and enduring saddle horses increased (Lang et al. 1983).

Most of Australia's explorers relied on horses and bullocks for transport (Kennedy 1986). Camels were not used until 1860, when they were imported especially for the Burke and Wills expedition (Australian Encyclopaedia 1983).

During the nineteenth century, Australia developed a pastoral economy and grazing gradually occupied all but the harsh deserts. Horses were important for cattle and sheep droving. Much of the better-watered land was occupied by 1850, with further expansion into the more remote and arid regions in the latter half of the century (Kennedy 1986).

1.3 The process of becoming feral

A feral animal is an exotic animal which was initially introduced for domestic purposes, but which now has populations which survive and reproduce in the wild state (Berger 1986). This compares to non-feral pests such as foxes, which were never domesticated in Australia, but deliberately introduced as a free living animal. Domesticated horses can become feral simply by being left to fend for themselves (Berger 1986). Unmanaged horses and their descendants revert to a wild pattern of behaviour (McKnight 1976), ranging freely to feed and reproduce without human interference.

'Little or no fencing and incomplete musters led to wild populations of domestic livestock including horses.'

1.4 Sources of feral herds

Extensive pastoralism in Australia encouraged the establishment of feral herds. Little or no fencing, combined with infrequent and incomplete musters, led to feral populations of domestic livestock, including horses. Feral horse herds had many sources, including horses that strayed or were abandoned when stations failed, and horses that were lost from droving plants (McKnight 1976).

The decline of the Indian army remount trade after World War I created a further source of unwanted horses. Increasing mechanisation led to low prices for horses and most inland horse breeding stations switched to cattle, leaving their horses unmanaged. Further contributions to feral herds came from the deliberate release of stallions into the feral mobs to upgrade the herds from which stock horses were taken (McKnight 1976).

Conditions in Australia were generally suitable for horses, drought being the main factor restricting their dispersal (McKnight 1976). Fortunately, horses brought early into Australia were free of disease (Kennedy 1986). The long sea voyage and poor transport conditions meant that only the healthiest horses survived. Subsequent quarantine laws reduced the likelihood of disease entering the country. It is believed that the near absence of disease and large predators enabled feral horse numbers to increase relatively unchecked except for the degradations due to drought.

1.5 Spread of feral horses

Pastoral activities spread outward from the Sydney region in the early 1800s. The first records of horses escaping into the bush or of being abandoned date from 1804 (Rolls 1969). 'Bush horses' were

plentiful in the hills around Sydney by the 1830s (Sidney 1854, cited in McKnight 1976). Feral herds gained recognition as pests during the late 1860s (Rolls 1969).

The initial appearances of feral horses in the broad regions of Australia (Table 1) are linked to the spread of settlement and grazing.

Date	Region	Reference
Early 1800s	Eastern Tasmania	McKnight 1976 Australian Encyclopaedia 1983
1820s	Northern Australia (Cobourg Peninsula)	Letts 1962
1830s	Victoria	Australian Encyclopaedia 1983
1840s	Southern Queensland Southern South Australia Southern Western Australia	Australian Encyclopaedia 1983 Implied – Australian Encyclopaedia 1983 Long 1988
1860s	Northern Queensland	McKnight 1976
1870s	Southern and northern Northern Territory	Australian Encyclopaedia 1983
1880s	Kimberley, Western Australia	Australian Encyclopaedia 1983

Table 1: First occurrence of feral horses in various parts of Australia.

2. Distribution and Abundance

Section summary

Australia has the largest number of feral horses in the world. Most feral horses occur in remote, usually rugged, semi-arid areas.

The total Northern Territory feral horse population was estimated at 206 000 based on aerial surveys in the early 1980s. Queensland was estimated to have 100 000 feral horses in 1982, mainly in the northern and western regions. Most are on extensive pastoral country, particularly in unfenced areas and on stations with absentee landlords. In Western Australia, the main concentrations of feral horses are in the Kimberley, the east Pilbara and northern Goldfield districts.

South Australia's feral horses are mainly in the arid northern pastoral zone, in some national parks and on some stations. The major concentration of feral horses in New South Wales is in the south-eastern subalpine areas. Many small herds inhabit national parks and State forest. In Victoria most feral horses are found in alpine regions.

2.1 World distribution

'Australia has the world's largest population of feral horses, approximately 300 000.'

Australia has the largest population of feral horses in the world (estimates range from 300 000 to 600 000) (Berman and Jarman 1987; Clement et al. 1990) followed by the western United States of America with an estimated 40 000 (Berger 1986). Small populations also occur on islands off the east coast of North America, on the North Island of New Zealand (approximately 1100) (Rogers 1989), in South Africa and possibly other countries, although information is scant. Most feral horses occur in remote semi-arid areas with natural water supplies and sparse human settlement.

2.2 Domestic horses in Australia

Clement et al. (1990) estimated that there were approximately 650 000-700 000 domesticated horses in Australia. Most are on agricultural properties in Queensland and New South Wales, followed by Western Australia and Victoria (Pilkington and Wilson, in press). Although modern domestic horses are a potential source of feral populations, most are unlikely to become feral because of their location and management. Those in extensive pastoral districts present the greatest risk of contributing to feral populations.

2.3 Australian feral horse populations, distribution and abundance

Feral horses occupy most of the habitat to which they are suited in Australia. Populations are dynamic, fluctuating in response to seasonal conditions and human intervention (McKnight 1976). Numbers increase in wetter seasons and decline during drought, when many horses die of starvation or thirst, or from eating toxic plants (Berman and Jarman 1987). Increases of around 20% a year have been recorded in North America under good conditions (Eberhardt et al. 1982). Drought is a common feature of extensive pastoral areas and is the main limit, apart from human intervention, on horse numbers. Organised control operations have been used to reduce feral horse numbers in some areas.

Feral horses are widely dispersed and most common throughout most of the extensive cattle-raising districts of the Northern Territory and Queensland and, to a lesser extent, Western Australia. They are uncommon in extensive sheep-raising districts because the stations are generally

smaller and more intensively fenced, and also because the original numbers of domestic horses, from which the feral herds were derived, were small (McKnight 1976). Information on feral horse distribution and abundance for each State and Territory follows.

The major concentrations of feral horses are in Queensland and the Northern Territory. Substantial numbers occur also in Western Australia and South Australia, with smaller populations in New South Wales and Victoria. There are reportedly none in Tasmania or the Australian Capital Territory. Table 2 presents available data, much of which is either of questionable reliability or old.

From a land management perspective, it is sufficient to know the feral horse density for a given region rather than the total numbers. Maximum densities for whole properties of one horse a square kilometre, approximately 30% of cattle density, have been recorded in the Alice Springs region (Berman 1991). Approximate feral horse densities in various Australian regions are shown in Figure 1.

2.3.1 Northern Territory

The total Northern Territory feral horse population in the early 1980s was estimated at 206 000, based on aerial surveys by the Conservation Commission of the Northern Territory (CCNT) between 1981 and 1984. Horses are common in the Victoria River District, Gulf Country, Arnhem Land/Darwin region and Alice Springs region. The central ranges area of the Alice Springs region was resurveyed in 1988 and numbers had declined to approximately 23% of their level four years earlier (Low and Hewett 1990). Dry seasonal conditions and feral horse control contributed to the decline. The population could return to high levels within three or four years with favourable rainfall and pasture growth.

State or Territory	Estimated population	Method	Source
Northern Territory	206 000	Aerial survey	Graham et al. 1982 a,b
		Aerial survey	Graham et al. 1986
Queensland	100 000	Interview	Mitchell et al. 1982
Western Australia	10 000–20 000	Subjective assessment by authors	Various pers. comms.
South Australia	3000–10 000	–	Various pers. comms.
New South Wales	5000–10 000	Questionnaire or interview	McKnight 1976
Victoria	1000–3000	–	Dyring 1990
Tasmania	Nil	–	Gregory, Department of Primary Industry and Fisheries (DPIF) Tasmania, pers. comm. 1991
Australian Capital Territory	Nil	–	Dyring 1990

Table 2: Estimated sizes of feral horse populations within each State and Territory of Australia.

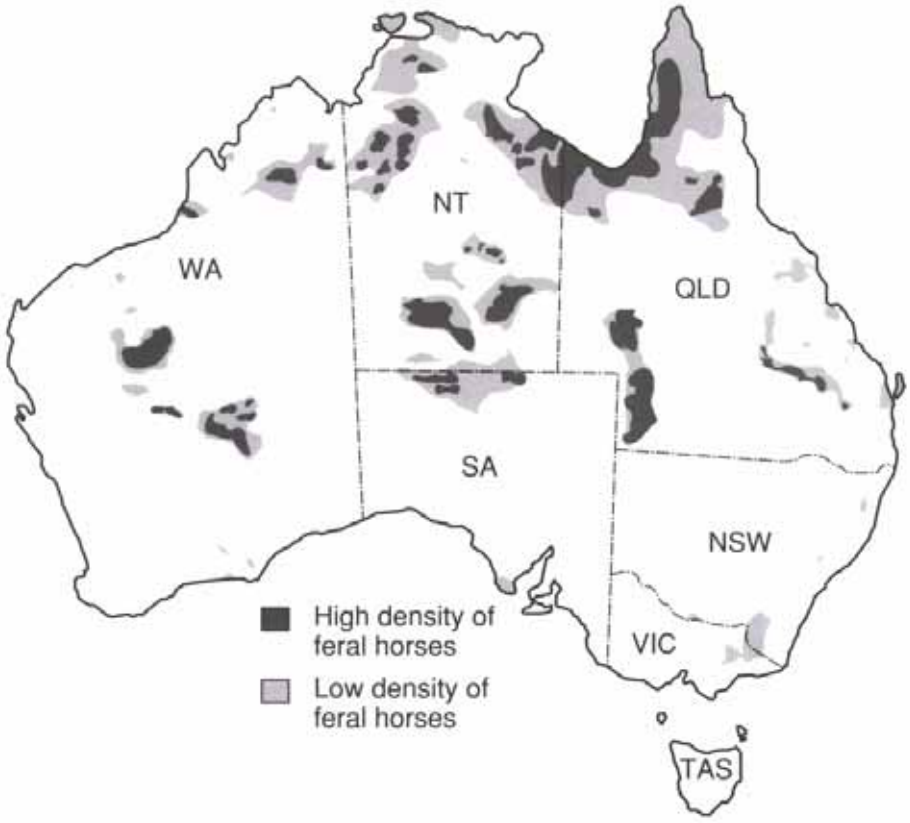


Figure 1: The main concentrations of feral horses in Australia based on the data in Table 2. Other small scattered populations probably exist in the extensive pastoral districts.

'Some properties in central Australia had more than one feral horse to every three cattle.'

Analyses of aerial survey data for the Alice Springs district indicated a low density of both horses and cattle in sand dune and sand plain spinifex areas (Bowman 1985). Horse density was highest in spinifex hills and scrubby hills and near natural waterholes or dams. Cattle were more commonly found in areas with bores or dams.

During the early 1980s, some properties in central Australia had more than one feral horse to every three cattle (Graham et al. 1986). Estimates by pastoralists of feral horse numbers per station indicated that 8% of 38 stations surveyed supported more than 2000 feral horses each (Bowman 1987b).

Feral horses are common in the north of Vanderlin Island in the Gulf of Carpentaria (Johnson and Kerle 1991), and also occur on Bathurst and Melville Islands off Darwin (B. Walsh, CCNT, pers. comm. 1991). There are about 400 Timor ponies on the Cobourg Peninsula (Letts et al. 1979).

2.3.2 Queensland

Based on a questionnaire, Mitchell et al. (1982) estimated that approximately 100 000 feral horses inhabit Queensland, mostly in the northern and western regions. Main concentrations are in the Gulf region (particularly the north-west), the west of Cape York Peninsula, near Hughenden, Georgetown and Croydon, and in far south-west Queensland. East of the Great Dividing Range there are a few small scattered populations. Most are in extensive pastoral country, particularly in unfenced areas and on stations with absentee landlords. Scrub or open forests fronting a creek were reported as favoured habitat, although in the western division mulga plains and sandhill country are also favoured (Mitchell et al. 1982). Water availability was reported as a strong influence on their distribution.

Feral horse numbers in Archer Bend and Rokeby–Croll Creek National Parks were reduced a few years ago by shooting, and currently horses persist in low to moderate densities (B. Vincent, Department of Environment and Heritage (DEH), pers. comm. 1991). Substantial numbers probably occur in Staaten River National Park, with few in Lakefield National Park.

In the Mareeba Shire they occupy rough hilly country (B. Toms, Department of Lands (D of L), pers. comm. 1991).

Several hundred feral horses were reported to be on Fraser Island (McKenzie et al. 1990) although, more recently, park rangers report the horse population to be around 40. Only four horses remain on Moreton Island, off the coast of Brisbane, where for environmental reasons there was recent culling (C. Pollitt, DEH, pers. comm. 1991).

Low numbers occur in the Mount Moffat section of Carnarvon National Park, mostly in remote tableland country (M. Pyke, DEH, pers. comm. 1991). Some pastoral properties in the district also contain feral horses.

Feral horses are present in low numbers in Mount Elliott National Park near Townsville. A 'few hundred' are thought to inhabit parts of the Leichhardt Range near Mackay, mostly south of Collinsville, and a few are reported from the Clarke Range. About 200 to 300 occur in Shoalwater Military Training Area near Rockhampton, mainly in mountainous terrain and high plains, but they have also been seen on saltplains and near mangroves (Warrant Officer Brearley, Department of Defence, pers. comm. 1991).

Low numbers exist in White Mountains National Park to the west of Charters Towers (P. Hartney, DEH, pers. comm. 1991).

2.3.3 Western Australia

In Western Australia the main concentrations of feral horses are in the Kimberley, the east Pilbara and northern Goldfields districts (Campbell 1989). There is no recent, reliable population size estimate.

In the Kimberley the number is low. Raw data yet to be analysed from aerial surveys in the central Kimberley District indicate a possible population of 2500-4000 feral horses (S. Wheeler, Agriculture Protection Board (APB), pers. comm.) whereas landholder estimates range from 6000 to 8000 (Diver 1991). The number and distribution in the Kimberley appear to be severely restricted by the widespread occurrence of a plant toxic to horses, *Crotalaria* spp., which can cause what is locally known as Kimberley horse disease. Feral horses are locally abundant (more than 1000) on at least three stations (L. Ward, APB, pers. comm. 1991). Smaller scattered populations (50 to 500) occur on several pastoral properties and Aboriginal land. The potential for their numbers to increase exists on some Aboriginal lands recently destocked of both donkeys and cattle but not horses (L. Ward, APB, pers. comm. 1991).

Up to 5000 feral horses are estimated to inhabit the east Pilbara, mostly east and south of Newman (A. Cook, APB, pers. comm. 1991). In addition, a significant number inhabit the southern section of Karijini (Hamersley Range) National Park (P. Kendrick, Department of Conservation and Land Management, pers. comm. 1991).

There were about 2500 feral horses in the north-eastern Goldfields district in 1986–87 (A.J. Stevens, APB, pers. comm. 1991). However, more than 1700 horses were culled in 1987, and subsequent dry seasons have suppressed population recovery. Horses are known to frequent sandy country fringing large salt lake systems. Elsewhere in the district, feral horse numbers are low (fewer than 150 a station).

Some small mobs are present in the south of the State. There are between 20 and 60 feral horses in mallee country approximately 70 km south of Balladonia on the fringe of pastoral land. About 20 are seen frequently near the highway between Esperance and Kalgoorlie. There are few horses in Cape Le Grand National Park near Esperance, perhaps only half a dozen. A sparse population occurs in a strip east of Eneabba from near the Arrowsmith River to south of Jurien Bay area (K.R. Dean, APB, pers. comm. 1991). At the southern end of Lake Muir south-east of Manjimup there are about 50 (G. Power, APB, pers. comm. 1991).

2.3.4 South Australia

Feral horses are present in the northern pastoral zone of South Australia. A questionnaire of station managers in 1986 indicated that feral horses were present on 70% of the 30 northern region stations surveyed (Gibson 1986). According to managers' estimates, about 3200 were reported in the northern cattle-raising districts. There were major concentrations in the North-West District (approximately 1300), Strzelecki District in the north-east (approximately 950) and Oodnadatta District in the State's central north (about 750) (Gibson 1986). Relatively few were reported from the Birdsville Track (approximately 200) and Marree districts (fewer than 50). The survey did not include land under Aboriginal freehold in the far north-west where feral horses are abundant (R. Breckwoldt, NSW landholder, pers. comm. 1991). Approximately half the surveyed stations reported populations of over 100 feral horses; the highest estimate on a single lease was 600.

In Coffin Bay National Park, there are about 70 feral horses, often called Coffin Bay ponies (G. Saunders, Department of Environment and Land Management (DELM), pers. comm. 1991). The ponies, said to be of Timor, thoroughbred and Arab descent, apparently have inhabited the area since the early 1900s. The largest herd is in the Point Sir Isaac area.

2.3.5 New South Wales

'Kosciusko National Park contains several hundred feral horses.'

Feral horse populations exist in several localities in New South Wales, although there has been no population estimate within the last 20 years. The major concentration is in the south-eastern subalpine region. Several hundred horses are reported in southern Kosciusko National Park near the Victorian border (Dyring 1990). Fewer horses occur in the northern section of the Park (more than 70), and in the Byadbo region east of the Snowy River. Other small, localised mobs occur within the Park.

Geographical barriers prevent these mobs from migrating between various regions of the Park. Feral horses also occur outside Kosciusko National Park on adjoining forested land (Dyring 1990). About 60 are thought to inhabit Maragle

and Bago State Forests to the west, with about ten at Muzzlewood Flat to the south-east.

Feral horses also occur in Barrington Tops National Park (Dyring 1990) and in hill country east of Armidale, although numbers appear to be low. Small numbers also occur in the Pilliga forest on the western side of the nature reserve (D. Buggan, National Parks and Wildlife Service (NPWS) NSW, pers. comm. 1991). There is an unconfirmed report of feral horses in Morton National Park near Nowra.

2.3.6 *Victoria*

An estimated 1000–3000 feral horses occur in Victoria (Dyring 1990). The population is thought to be increasing (Department of Conservation and Environment Policy issued 3/88). Between 1200 and 1400 horses are estimated to occur in the Cobberas–Tingaringy Unit of the Alpine National Park. Small numbers are reported from the Errinundra National Park, and cattlemen estimate that there are about 300 in Bogong National Park. Feral horses are uncommon in the Wonnongatta–Moroka National Park. About 40 occur in the Gutturmurgh Creek region within the Snowy River–Byadbo Wilderness area. Feral horses have also been seen in the Nunniong region, south-west of the Cobberras.

About 200 are estimated to occupy the Barmah State Forest near Echuca (Management Plan for Barmah State Forest 1990).

3. Biology

Section summary

Australian feral horses are adaptable and hardy, inhabiting country ranging from semi-arid plains and rocky ranges to tropical grasslands and swamps, temperate ranges, subalpine mountains and small offshore islands. They have been most intensively studied in semi-arid central Australia. These studies provide most of our knowledge about Australia's feral horses. Research on feral horses has also been conducted in the subalpine mountains of Victoria and New South Wales, and another study has commenced in the wet-dry tropics of the Northern Territory.

Feral horses usually form small social units called harem groups and bachelor groups. Harem groups usually contain a dominant stallion, one to three mares and their offspring. They favour areas near permanent water, while bachelor groups will range more widely. Feral horses in central Australia have home ranges of about 70 km² to which they are strongly attached.

Bestdes human control, the primary cause of death in feral horses is associated with drought, mainly through starvation, lack of water and consumption of usually avoided toxic plants. Old horses, juveniles and mares with young are the most vulnerable during dry times. Feral horse populations can increase by 20% each year when conditions are good.

3.1 Wild horses of the world

There are no truly wild (that is, never domesticated) horse populations remaining. Examples of wild horse ancestors are Przewalski's and Tarpan horses. Przewalski's horses are kept in captivity but are presumed extinct in their native range of central northern Asia (Berger 1986). The Tarpan horses of Poland were finally hunted to extinction in the mid-nineteenth century, although horses with Tarpan-like qualities were later bred in an attempt to recreate a similar herd (Harbury 1984). Horses were first domesticated 2500 to 5000 years ago, and today domestic horses are widely distributed throughout the world. Free-roaming but managed herds of horses exist in reserves in England and southern France (Berger 1986). Most of what is known about wild horses comes from studies of these English and French free-roaming populations or feral horses in North America.

3.2 Special adaptations of the horse

Most feral horses are very wary and difficult to approach although some, especially young bachelors, can be inquisitive. In a few instances, feral horses have become used to traffic or people, but most rarely have contact with humans and remain extremely cautious and easily frightened.

Horses are highly adapted for fast, free movement across open grassy areas. The long bones of the legs provide leverage for locomotion, and the short bones of the joints absorb concussion (Evans et al. 1977). Flight from perceived danger is their main form of defence.

They possess both monocular and binocular vision, enabling a wide view of their surrounds (Evans et al. 1977). Although both distant and very close objects are poorly seen, any movement is readily detected. Their hearing is well developed. Their sense of smell helps them locate food, which is directed into the mouth by the pliable upper lip and then cut by the front incisors. These are angled forward, enabling horses to graze close to the ground (Evans et al. 1977).

[1] *Ruminant—any animal of the artiodactyl sub-order or division* Ruminantia, *which comprises the various cloven-hoofed and cud-chewing animals.*

Horses are non-ruminant[1] herbivores. Roughage is broken down by microbial fermentation in the caecum and large colon (Wagoner 1977). Unlike cattle, horses do not need to spend time ruminating, allowing them more time to be selective during grazing. Feral horses can walk up to 50 km from water to feed (Berman and Jarman 1988). Their mobility, teeth and digestive system make them well suited to utilising the sparsely distributed and unpredictable food and water of arid Australia.

'Horses are well adapted to the highly variable Australian environment.'

3.3 Overseas research

During the last 20 years there has been a proliferation of studies on the ecology of wild, free-ranging and feral members of the horse family. Significant research has been conducted in Africa, North America, Asia and Europe. Initially zebras (Klingel 1965, 1969) received attention, followed by free-ranging but managed ponies in Britain (Tyler 1972). During the 1970s and early 1980s, feral horses and donkeys in North America were studied by several researchers (Feist 1971; Welsh 1973; Moehlman 1974; Rubenstein 1981; Miller 1983; Berger 1986). Duncan (1980) investigated the Camargue horses in France and Kaseda et al. (1984) studied free-ranging horses in Japan. Recent comprehensive accounts are to be found in books by Waring (1983) and Berger (1986).

3.4 Australian research

McKnight (1976) conducted an Australia-wide questionnaire survey, initiated in 1966 and followed up in 1971, researching general aspects of Australian feral livestock including horses. The CCNT studied feral horses in central Australia between 1984 and 1990. Research included:

- aerial surveys in the Alice Springs and Gulf districts to determine distribution and abundance;
- the ecology of feral horses and their interaction with cattle;
- the environmental impact of feral horses;
- the economic aspects of managing feral horses;
- the home ranges[2] and movement of feral horses; and
- a refinement of harvesting techniques.

3.4.1 Habitat

Horses can occupy a range of habitats although they are best adapted to open grassy plains. In Australia, feral horses inhabit country ranging from semi-desert plains and rocky ranges to tropical grasslands and swamps, temperate ranges, subalpine mountains, and small offshore islands.

Feral horses are commonly found in areas of low pastoral value away from the more intensively managed areas, although they usually select the 'sweetest' country on which to graze, a common complaint from pastoralists. Feral horses prefer grassy flats, but often retreat to hill country to escape drought or mustering activities (Berman and Jarman 1987). Hill country is the hardest sort of area in which to catch or cull them.

Dyring (1990) found that horses avoided the forests in Kosciusko National Park (New South Wales), preferring to graze the grasslands and heaths throughout the year. However, in the heat of the day in summer, they use forests for shade and relief from horseflies (Tabanidae).

[2] *Home range — the area over which an animal normally roams.*

Feral horses in Coffin Bay National Park (South Australia) frequent degraded she-oak (*Allocasuarina verticillata*) and melaleuca (*Melaleuca lanceolata*) low open woodland, and appear to graze spinifex and sword sedges (*Lepidosperma gladiatum*) (G. Saunders, DELM, pers. comm. 1991).

3.4.2 Diet

Horses eat mainly grasses, but they will eat emergent and sub-emergent plants in swampy areas. They also eat roots, bark, buds and fruits (Waring 1983). The study by Berman and Jarman (1987) is the only publication on feral horse diets in Australia. Conducted in the Alice Springs district, the study found that horses mainly feed on short grasses, preferably oat grasses or bottlewashers (*Enneapogon* spp.). They are selective grazers, capable of walking long distances to locate the most palatable feed (Berman and Jarman 1988), which means that they can obtain more grasses and higher quality grasses than cattle can, and that they browse shrubs less than cattle do. Horses spend more time grazing than do ruminants such as cattle.

'Horses are selective grazers, capable of walking long distances to locate the best feed.'

In central Australia, feral horses graze near drinking water if feed is plentiful (Berman and Jarman 1987), although as feed is depleted they are forced to forage further from water to areas that are less intensively grazed by other herbivores (Berman and Jarman 1987; Dobbie and Berman 1990). They drink probably once a day in summer, and every second day in winter, and in central Australia spend most of their time grazing more than 3 kilometres from permanent water.

3.4.3 Social organisation

Feral horses tend to form small social units, either in a harem, which consists of a dominant stallion, his mares and their offspring, or in a bachelor group, a group of from one to three males comprising mainly two to four year olds who have been forced out of their harem groups (McKnight 1976; Berman and Jarman 1987). In central Australia harem groups often comprise five to seven individuals (Berman and Jarman 1987). In south-eastern Australia, Dyring (1990) stated that typical group size was one to four individuals. Hoffmann (1983), during observations of horse groups in central Australia, reported a large proportion of multiple male harem groups although later studies (Berman and Jarman 1987) found these to be uncommon. Bachelors usually occur either alone or in groups of from two or three males (Berman and Jarman 1987). Young females experiencing first oestrus[1] are usually ignored by the dominant stallion and tend to leave their groups (Berger 1986). Keiper (1986) reports instances of dispersing fillies remaining unattached for up to a year before forming a harem with a bachelor male or joining an existing harem.

Small social groups tend to come together and form large herds of 100 or more horses at watering points in the following conditions:

- when palatable feed is abundant. However, the horses soon disperse into smaller groups when feed is scarcer and they are forced to travel further from water to graze; and
- during drought, when many horses use the few remaining watering points (Berman and Jarman 1987).

Harem stallions, mares and foals require reliable resources and generally favour areas surrounding permanent

[1] *Oestrus—a period of the oestrous cycle, usually lasting one to two days, during which ovulation occurs, and the mare is receptive to males.*

waterholes. Bachelor groups are more mobile and more readily occupy areas where water is less reliable, needing to maintain only their own condition for growth. They probably return to more predictable areas for food and water when they are old enough to acquire mares, or in periods of drought (Dobbie and Berman 1990). Horses relying solely on temporary waters are more prone to perish during drought.

3.4.4 *Group stability*

Harems tend to be stable breeding units, whereas bachelor groups are more unstable with frequent changes.

When food supplies are low the size of social units decreases, mainly because bachelors steal mares from large harems (Berman 1991), and because both the foaling rate and the foal survival rate are low. Sub-adult animals probably are forced to leave their harem groups earlier than usual (Berman and Jarman 1987). Stevens (1990) reported that harem groups become unstable when food supply is low.

3.4.5 *Home range*

In central Australia, food and water resources are shared by many feral horse social groups (Dobbie and Berman 1990). Interaction between them is common, particularly while watering. Dominant males maintain a group without defending a territory. Vast home range boundaries make it impossible for them to successfully patrol and exclude intruders. Most acts of aggression between stallions are displays such as prancing, neck-arching, head-tossing and pawing, and a variety of vocalisations (Berger 1986). Only about 10% of aggressive encounters are fights.

'Permanent waterholes are an important focus for control operations.'

Permanent waterholes tend to attract larger groups of horses and a high proportion of harem or breeding groups, highlighting the importance of permanent waterholes as foci for control operations in arid areas.

Mitchell et al. (1982) roughly estimated that feral horses in Queensland occupied a maximum home range of 100 km^2. Using radiotelemetry in central Australian range country, Dobbie and Berman (1990) reported home ranges of approximately 70 km^2 (range 52–88 km^2). This is similar to ranges of feral horses in the North American deserts, but much larger than in the wetter areas of the world. There has been no study of feral horse home ranges in other parts of Australia.

Bachelor males tend to occupy the largest living areas, whereas harem groups occupy smaller, more stable living areas (Dobbie and Berman 1990; Berger 1986). Bachelors appear to avoid domineering harem males except during the breeding season when the older bachelors attempt to gain females.

Studies in central Australia indicate that feral horses have a strong attachment to their home range and resist being forced out of it by helicopter (Dobbie and Berman 1990). This affinity of horses for their home range implies that intensive control activities such as mustering or helicopter shooting, over a limited area are usually more effective than extensive programs that leave more animals behind which are more difficult to remove in subsequent operations.

Feral horses near areas mustered by helicopter are not greatly disturbed. They remain within their home ranges (Dobbie and Berman 1990) and can be mustered in later programs.

3.4.6 *Breeding*

Horses breed during spring and summer (Wagoner 1977). Mares have a regular oestrous cycle which averages 21 days

and an oestrus or receptive period of between four and a half and nine days. The mean gestation period is 336 days, with mares returning to heat within nine to 14 days of giving birth (Hungerford 1990). The twinning rate is very low (Evans et al. 1977). Foaling is concentrated over spring and summer (Dobbie and Berman 1990). On average, puberty in females is attained at 12 to 24 months (Hungerford 1990).

'Populations can increase by 20% a year under good conditions.'

Feral horse populations can increase by 20% a year when resources are not limiting (Eberhardt et al. 1982). Most mares in good condition breed successfully but very few mares in poor condition foal (Berman and Jarman 1987). Although mares are capable of foaling every year, pregnancy stress usually results in their raising one foal every two years, the intervening year allowing them to recover sufficient body condition to support another pregnancy (Wagoner 1977).

Feral horses in Victoria have developed several defects attributed to inbreeding, including cow-hocks, knock-knees and hammer-heads. Such horses are regarded as hardy and agile but as lacking stamina.

3.4.7 Mortality factors

'Mortality in feral horses is due mainly to factors associated with drought and human control operations.'

The main causes of death are associated with drought (through starvation, thirst and poisonous plants), and internal parasites in foals. Pregnant or lactating mares, young horses under two years old and very old horses are the first to die in drought. Bushfires in Victoria are also known to have caused dramatic localised reductions in feral horse numbers (Dyring 1990).

Up to 80% of mares in good condition, approximately 24% of the population, are pregnant at any one time (Berman 1991). Survival of each age class depends on seasonal conditions. An average of 20% of the population, mostly juveniles and sub-adults, dies each year.

Dingoes are potential predators of young foals but, although not studied, probably have little or no effect on recruitment (Campbell 1989).

Research in the United States suggests that males have a higher death rate than females, possibly associated with male aggression and the energy costs and stresses involved in obtaining and maintaining harems (Berger 1986).

In some areas poisonous plants limit horse populations. Horses generally avoid these plants unless other feed is scarce, so plant poisonings are more common during dry times and in overgrazed or burnt areas. Kimberley horse disease or 'walkabout' is usually fatal, affecting primarily horses that eat rattlepods (*Crotalaria crispata* and *C. retusa*) (Payne, n.d.). Kimberley horse disease is prevalent in the Victoria River district and the Kimberley district of Western Australia.

Birdsville disease results from prolonged feeding on Birdsville indigo (*Indigofera linnaei*) and occurs in the Northern Territory, western Queensland and northern South Australia. Fatalities are not as high as for Kimberley horse disease, and recovery of mild cases is common (Hungerford 1990). Toxicity varies with season and locality. The plant is toxic in central Australia but is reported to be harmless on the Barkly Tableland (Hungerford 1990). Meat from badly affected horses can be toxic to pets. For this reason, horse meat from central Australia cannot be used in pet meat. Darling pea (*Swainsona* spp.) is also toxic

to horses and the possible cause of some poisonings in central Australia (Berman and Jarman 1987).

Apart from toxicity, there are a few diseases that cause poor health but are not considered to contribute significantly to feral horse mortality (Berman 1991). Horses frequenting wetland areas are liable to carry heavy worm burdens that cause 'ill-thrift'. Pollitt (1990) revealed that feral horses occupying wetland areas of Moreton Island carried heavy worm burdens (strongyles), but little is known about parasite loads in other areas. Swamp cancer (cutaneous habronemiasis) is an ulceration of the skin as a result of infestation by *Habronema* larvae (Hungerford 1990). It affects horses in northern Australia, particularly during the wet season. Horses in tropical Australia are liable to tick burdens. Those in sandy country often suffer from elongated hooves, whereas horses in rocky country tend to maintain well-trimmed feet in good condition, which may influence longevity.

PART TWO

IMPACT AND USE

4. Economic Impact of Feral Horses

Section summary

Feral horses are both a pest and a resource. The economic damage they cause to pastoralism is not well quantified, but studies of diet and habitat, and the experience of pastoralists, show that it is probably significant, especially during and after drought.

In central Australia horses and cattle eat a similar range of plant species and use basically the same habitat, so potential for competition is high. However, horses are more selective feeders than cattle and their mobility allows them to use hill country and areas more distant from water than cattle. As conditions dry off, horses range further from water and enter hilly country seeking the best quality forage, while cattle cope by eating a broad range of lower quality feed on flat land. As drought proceeds cattle also move further from water, often encountering country already grazed down by horses.

Feral horses can negate the attempts of pastoralists who destock during drought to conserve remaining feed and protect the land resource from overgrazing. They also take and foul water, interrupt stock watering, damage fences and troughs and disrupt cattle during musters. Studies are needed to quantify the relationship between horse density and damage to pastoralism.

Horses are also a valuable resource, providing a variety of products including meat for human consumption, pet meat, pharmaceutical products and hair for musical instruments, brushes and automobile upholstery. Feral horses sell for about $100 each at the station gate in the Alice Springs region. The price varies from $80 to $150 depending on size and condition.

Feral horses processed for human consumption have an estimated annual export value of between $4 million and $6 million. Commercial sale of mustered or field-shot horses can help offset management costs, but the extent of this practice is still limited by legislative restriction and animal welfare concerns about capture methods, transport and slaughter. Both these areas need to be addressed if the commercial use of horses is to continue as an integral part of feral horse management.

4.1 Introduction

Feral horses are a resource used by capture and sale and, in limited instances, for tourism. They can also be a major pest to pastoralists by reducing productivity or increasing production costs of cattle enterprises through competition for forage, especially during drought. In this section the economic damage caused by feral horses is assessed, as well as their use as a commercial resource.

'During drought, feral horses can foil attempts by pastoralists to conserve remaining feed and to protect the land.'

4.2 Economic disadvantages

The hidden cost of feral horses is their contribution to long-term environmental degradation (Section 5). They cause economic damage mainly to pastoral grazing lands by:

- competing with cattle for feed and water;
- damaging fences;
- damaging water troughs and pipes;
- interrupting stock watering;
- disturbing cattle musters;
- mating with domestic mares; and
- being a potential exotic equine disease reservoir.

Berman and Jarman (1987) indicate that feral horses in central Australia reduce cattle industry productivity. In a survey of pastoralists in central Australia, the two most important problems stated for feral horses were damage to fences (45% of respondents) and competition with cattle for feed (39%) (Bowman 1987b).

4.2.1 Competition between feral horses and cattle

Although there is potential for feral horses and cattle to compete for food (Berman (1991) under extensive rangeland conditions, it is very difficult to prove that competition occurs, let alone quantify and assign a cost to it.

Feral horses are thought to compete with cattle by eating forage that would otherwise be available to domestic stock. Horses and cattle eat a similar range of plants (Berman and Jarman 1987). However, as horses are more selective grazers than cattle, there is often a geographical separation of the two species. Although not quantified, from diet and habitat studies it is believed that competition is significant and most pronounced in dry seasons. Horses remove much of the forage needed by cattle to endure droughts (Berman and Jarman 1987), and horses and cattle respond in different ways to drought conditions. As conditions dry off, horses walk long distances from water and enter hill country seeking better quality forage, while cattle cope by eating a broad range of lower quality feed. With prevailing dry conditions and dwindling food supplies, cattle begin to range further from water in search of food, only to encounter areas already grazed by horses (Berman and Jarman 1987). In addition, in arid areas during dry times, when ephemeral watering points are depleted and more horses are forced to water at bores or at the remaining permanent waterholes, competition for limited feed in these high-use areas is heightened (Campbell 1989).

The impact of horses on cattle is probably greatest on flat, uniform country, and least in country that contains a variety of landforms including hills. There is in the latter a greater geographical separation of horses and cattle due to habitat preference (Berman and Jarman 1987).

Horses on low quality (high fibre) feed require larger amounts of food than cattle to obtain the same nutrients (Berman and Jarman 1987). However, as horses usually select a higher quality diet, this probably helps them maintain similar daily intakes (Berman and Jarman 1987). Horses spend more time grazing because they do not ruminate (chew the cud). Based on diet and habitat overlap studies in central Australia, 100 feral horses remove forage that could support 45 to 128 cattle, varying according to time since rain, landform and vegetation types. Broadly speaking, a horse is equivalent to one beast (Berman and Jarman 1987), which implies that cattle productivity could be increased simply by removing feral horses and replacing them with an equal number of cattle. This would be appropriate only where the number of feral horses to be removed was considered as part of the total grazing pressure. For example, a station may be capable of sustaining 4000 large herbivores without long-term damage to the rangeland, yet if it already has 1000 feral horses, then only 3000 cattle should be carried. If 4000 cattle are run as well as the 1000 horses then overgrazing is to be expected. In such a case, the removal of feral horses benefits cattle productivity through reduced competition for feed.

4.2.2 Competition for water

Horses require about 25 litres (5.5 gallons) of water each day and nearly double that during hot weather (Model Code of Practice for the Welfare of Animals: *Destruction or Capture, Handling and Marketing of Feral Livestock*

Animals 1989). Cattle drink more than horses but horses waste more by rolling in waterholes or dams and saturating their coats, manes and tails. As natural waters dry up, feral horses are more likely to use bores and wells, thereby increasing pumping costs (Campbell 1989), an impact that is most severe during drought.

4.2.3 Damage to watering points

Drinking horses are very cautious, and if they jump in fright or aggression they can damage troughs, pipes and tanks (McKnight 1976; Campbell 1989).

4.2.4 Fence damage

A common complaint is stock-fence damage (McKnight 1976; Letts et al. 1979; Bowman 1987b; Campbell 1989). Typical damage includes broken or sagging wires, and damaged star pickets and spacers (Berman and Jarman 1987).

Fence damage commonly results when horses are unaware of a fence and run into it, are frightened into a fence, a social group accidentally separated by a fence attempts to regroup or stallions on opposite sides of a fence confront one another (Berman and Jarman 1987).

Pastoralists in central Australia estimated that repairs to fences damaged by feral horses cost approximately $800–1000 a property each year (1985–86 prices) (Bowman 1987b). Berman and Jarman (1987) also recorded significant fence damage, which caused livestock losses because of problems such as the loss or mixing up of paddocked stock, which in turn interferes with management and disease control programs (Letts et al. 1979; Campbell 1989).

4.2.5 Interrupting stock watering

Feral horses disrupt other stock watering by dominating and drinking first. This is particularly disruptive when animals take a long time to water. The impact on production is not known.

4.2.6 Disturbance of stock musters

The presence of feral horses can unsettle stock being mustered, and cause a mob to split or run, making mustering more difficult. Some pastoralists consider them to have a bad influence on general stock management by making cattle more 'wild' (Bowman 1987b).

4.2.7 Mating with domestic mares

Feral horses can interfere with station horse-breeding programs when mares escape to feral herds or where feral stallions sire foals. Nevertheless, some station managers regard feral herds as a valuable source of work animals (Campbell 1989).

4.2.8 Exotic disease

Significant feral horse populations do not occur close to major populations of domestic horses, which are the most likely source of diseases for feral horse herds. Therefore, feral horse herds are a potential but low risk reservoir of exotic diseases should these diseases ever enter Australia. Although Australia is a net importer of horses (Pilkington and Wilson, in press), the annual export trade in live horses (approximately $30 million) and horse meat (approximately $20 million) is significant and has the potential to grow. Most live horse exports are to Asia (Pilkington and Wilson, in press). Australia has an edge in this trade because of its relative freedom from major horse diseases, a status it is keen to protect. Of course, exotic diseases are also a major threat to the domestic horse industry, which is large, with approximately 40 000 full-time jobs in the racing industry alone (Pilkington and Wilson, in press).

The exotic diseases of horses which are of most concern to the Australian Quarantine and Inspection Service (AQIS) and the Australian Horse Industry are African horse sickness, equine influenza and contagious equine metritis, although

several others are of concern including Borna disease, equine viral encephalomyelitis, dourine, epizootic lymphangitis, equine piroplasmosis, glanders, surra and vesicular stomatitis. Of these, equine influenza represents the most serious economic threat (Clement et al. 1990).

AQIS has a strict quarantine policy for horse imports aimed at preventing the entry of exotic horse diseases into Australia. New Zealand has relatively free access to Australia. Horses from Europe must go through Ireland, France or the United Kingdom, countries for which the quarantine procedures and disease status of horses are well known. Under the Australian Veterinary Emergency Plan (AUSVETPLAN), national contingency plans for the control of major exotic animal diseases have been approved by the Agriculture and Resource Management Council of Australia and New Zealand. AUSVETPLAN provides a series of operational national disease strategies and operational procedure manuals for the eradication of specific diseases. AUSVETPLAN strategies are being prepared for African horse sickness and equine influenza.

4.3 Commercial uses of feral horses

Major commercial uses of feral horses include meat for human consumption, pet meat, by-products (hide, hair, meatmeal, heart, spleen), a source of horses for work or recreation, and potential tourism value.

Both domestic and feral horses are used for meat production in Australia, either exported for human consumption or as pet meat. Only the Northern Territory permits the sale of horse meat for human consumption within Australia. Captured feral horses sell for an average of $100 a head (Alice Springs). Prices may vary from $80 for a light condition horse, to $120 for a medium size horse, and $150 for a large horse (R. Bryan, CCNT, pers. comm. 1991).

Making use of feral horses during their control offers a means of offsetting control costs, although their capture and transport are important animal welfare concerns (Section 6.3). Animal welfare groups fear commercial utilisation will perpetuate feral horse suffering. They believe that continuation of the industry will encourage managers to increase their feral horse herds for later utilisation. In central Australia, where significant financial returns have been received during control operations, pastoralists continue to pursue their objective to eliminate feral horses. Commercial utilisation of feral horses as part of control operations has been instrumental in reducing the central Australian feral horse population. However, there is no doubt that feral horses can suffer during their capture and transport for slaughter. Management practices must be modified to reduce this (Section 6.3).

4.3.1 Pet meat

Horse meat as a fresh or frozen product is used in Australia for pet food, wholesaling for around $A1.10–2.00 a kilogram. None is used in canneries. Horse pet meat is also exported from Australia, mostly to Japan. Recent exports peaked in 1988 with at least 600 tonnes (worth $A800 000) to Japan, but have since declined, apparently because of objections to dyed meat. The *Export Control Act 1982*, administered and enforced by AQIS, requires all pet meat exported from Australia to be stained with Brilliant Blue dye to reduce the risk of meat substitution. This possibly gives a market advantage to other countries which do not require meat to be dyed (Ramsay, in press; Section 7.6.5).

Horses killed for pet meat are slaughtered either in the field or at licensed knackeries. Where field slaughtering for pet meat is permitted,

contractors shoot feral horses and other game, storing the meat in portable chillers before taking it to a point of sale. The slaughter of feral horses can provide direct income for pastoral properties, contract musterers, transporters, independent pet-meaters, meat industry processors and exporters. Horses from central Australia are not permitted to be used as pet meat because of the risk of Birdsville disease (*Indigofera* or indospicine poisoning) (Section 3.4.7).

The Queensland *Meat Industries Act 1965* prohibits the field slaughter of horses for pet meat in Queensland, primarily to protect the beef industry from possible meat substitution, and to protect the resources already invested in existing horse knackeries. Field slaughtering of horses for pet meat is permitted in the Northern Territory (where Birdsville disease is absent) and in Western Australia with no apparent problems. Some meat slaughtered in the Northern Territory is reportedly sold in Queensland (B. Ramsay, Department of Primary Industries and Energy (DPIE), pers. comm. 1991).

Approximately 2000 feral horses were slaughtered in the Northern Territory in 1989 for pet meat (Northern Territory Department of Primary Industries and Fisheries). Figures are not known for Western Australia. Ramsay reports an average meat yield of 110 kilograms a horse and an approximate return of $A95 a horse to shooters.

Horse pet meat knackeries exist in Queensland, New South Wales, Victoria, Western Australia and South Australia. Many domestic horses are slaughtered at knackeries for pet meat, although some feral horses are used, particularly in Queensland. Approximately 10 000 horses (both domestic and feral) are thought to be slaughtered each year in Australia for pet meat (Ramsay, in press). Apart from meat, saleable by-products include horse hides, hair, meat and bone meal.

4.3.2 Meat for human consumption

'Feral horses have an estimated annual value of between $4 and 6 million as export meat for human consumption.'

Approximately 463 000 tonnes of horse meat (from more than one million horses) were used worldwide for human consumption in 1988 (Ramsay, in press). Major consumers are France, Japan, Belgium, Luxembourg, the Netherlands and Italy. Major exporters of horse meat are the United States, Argentina and Canada. Australia exports annually about 8000 tonnes of feral and domestic horse meat ($A13–18 million), representing only 6% of the international trade. The relative proportion of feral and domestic horses in this trade is not accurately known, but feral horses are estimated to be approximately 30% of the trade or between $4 and 6 million (Senate Select Committee on Animal Welfare (SSCAW) 1991a). Most horse meat exports from Australia, 55-75% annually, go to Japan where the meat is generally used as manufacturing meat (smoked meats, sausages, and meat balls) as opposed to prime cuts (Ramsay, in press).

There are two main export abattoirs in Australia, at Peterborough in South Australia and Caboolture in Queensland. A third abattoir at Tennant Creek (Northern Territory) processes horses infrequently. Between 40 000 and 60 000 horses (domestic and feral) were killed annually at export abattoirs between 1987 and 1990 (Ramsay, in press). Ramsay states that meat processors could use many more feral horses if they were available. Synnot (1984) reported a boneless meat yield from feral horses of 125–175 kilograms an animal. The lean meat characteristic of feral horses and the absence of veterinary residues give the Australian horse meat a market advantage over other countries.

However, marbled meat is presently favoured by the European market that seeks prime meat cuts and offers better prices than the Japanese manufacturing meat market.

Humans are not at risk from indospicine poisoning through eating horse meat which comes from licensed horse meat abattoirs. Few feral horses are now obtained from areas where Birdsville disease (*Indigofera* poisoning) occurs, and any horses that have been feeding on the plant are likely to be in poor condition and not fit for travel and slaughter for human consumption.

As an added precaution, feral horse processors require endorsement on Travelling Stock Permits stating that Birdsville horse disease has not been observed on the properties of origin for the previous three months.

4.3.3 Hides

Feral horses are rarely hunted for their skins alone, although during the preparation of this document, cases of hide-hunting in the late 1980s were reported, with hides selling for around $20 each. Very few hides are taken from field slaughtered horses because the hides are often damaged during field-dressing or quartering. Most market hides are from animals killed at abattoirs, and most are exported to Japan for processing, one product being the inner soles of fashion shoes. Horse-hide exports returned $A1.6 million dollars in the 1989–90 financial year, averaging $A2.40 a kilogram (Ramsay, in press).

4.3.4 Hair

Small quantities of horse hair are exported from one company in New South Wales to regular buyers in the United States of America, New Zealand and Belgium/Luxembourg (Ramsay, in press). Only 1.2 tonnes ($A35 000) were exported in 1989–90 (Australian Bureau of Statistics). Australia also imports small shipments of horse hair (3 tonnes, $A25 104, from China in 1989–90) for domestic use or for processing and export. Tail hair is used mainly for producing industrial brushes. Good-quality tail hair is also used in bows for the violin (white hair) and bass (black hair). Mane hair is used mostly in automobile upholstery. Ramsay (in press) reports that many pet meat processors do not sell horse hair because they are unaware of the market.

4.3.5 Hearts and spleens

Pharmaceutical compounds can be extracted from the hearts and spleens of horses. Cytochrome C, an enzyme, is obtained from hearts and used for biochemical analysis. The Netherlands was the largest buyer of horse hearts and spleens in 1991, prices averaging $A1.50–2.00 a kilogram for hearts and $A2.50–3.50 a kilogram for spleens (Ramsay, in press).

4.3.6 Work or recreation horses

Captured feral horses can be broken in and used as replacement stock horses. Only the better types of horse are suitable and demand is low (Letts et al. 1979). Some Timor ponies on Croker Island (Northern Territory) have been purchased from the Aboriginal owners for use as children's ponies in the Darwin region.

4.3.7 Tourism potential

'Feral horses are of limited but potential interest to tourists.'

Feral horses are of limited but potential interest to tourists (Letts et al. 1979; Squires 1981), but the potential is considered to be small. Some Australians believe that feral horses should be retained in wild populations because they represent a symbol of Australia's pioneering heritage. On the other hand,

others, including the Australian Conservation Foundation, believe horses are a threat to the Australian environment and should be controlled (SSCAW 1991a). The proportion of the Australian population supporting each viewpoint is unknown.

A Board of Inquiry held in 1978 into feral animals in the Northern Territory recommended that Timor ponies should be displayed to the public in a suitable reserve close to Darwin (Letts et al. 1979), but no action was taken. The Board also stated that Timor ponies offered the genetic potential to develop a small horse suited to Northern Territory conditions.

Some stations bred horses for the Indian remount trade before the Second World War (Section 6.7). These horses, along with horses bred in many other parts of Australia, were known as Walers. The Waler Society of Australia wishes to preserve the genetic material contained in central Australian feral horses because some of them originated from Waler stock. It is debatable whether feral horses still possess characteristics of the famous Waler but they may have genetic material worth preserving. Reserves may be set aside for this purpose.

4.4 Complementary interactions between feral horses and other animals

Under arid conditions, feral horses open soakages by pawing in sandy creekbeds. This can be advantageous to other animals by making water available to wildlife and enabling cattle to use pasture not normally available to them.

5. Environmental Impact

Section summary

The environmental impact of feral horses has been studied only in central Australia and the southern highlands. Although the damage caused by horses was investigated in both areas, it was difficult to quantify. In central Australia, other factors such as seasonal conditions, changes in Aboriginal burning patterns and grazing damage from cattle and wild herbivores such as kangaroos and rabbits, have a major and probably greater influence on the natural environment. All factors, not just feral horses, need to be considered in deciding how best to protect the land from unsustainable damage.

What has been observed and recorded, however, indicates that feral horses can cause serious environmental damage. Correlative evidence from a study by Berman and Jarman (1988) indicates that feral horses in central Australia help denude large areas of rangeland and in so doing force kangaroos from their favoured habitat, foul waterholes with their carcasses and accelerate gully erosion.

During drought, feral horses and other grazers are believed to threaten native fauna refuge habitat. It has been suggested that it is essential to protect these sites so that native species can recolonise other areas after drought. This proposition needs to be investigated.

In central Australia, changes in vegetation, water quality and rabbit activity are being monitored before and after removal of horses from Finke Gorge National Park west of Alice Springs (Northern Territory). This study will provide important information on horse damage and the consequences of controlling their density.

Dyring (1990) found that areas in the southern highlands which were frequented by horses had fewer native plants. Weeds were more common along horse tracks than in areas not used by horses, and grazing by feral horses along stream banks and trampling at crossings caused bank erosion and stream siltation.

There is much anecdotal and qualitative information to indicate the level of damage caused by feral horses. However, until the relationship between feral horse damage and horse density can be more accurately quantified, reducing density should be the basis of feral horse management.

5.1 Introduction

The environmental impact of feral horses may be defined as any change to the environment caused by them.

In the United States, most studies of horses focus on their ecology and behaviour rather than on environmental impact, although Krysl et al. (1984) highlighted the need to re-evaluate feral horse management because of deteriorating rangelands there, noticeably around watering points.

In New Zealand, grazing and trampling by the Kaimanawa feral horse herd in the central North Island reportedly caused severe degradation of forest–grassland margins and two other grassland communities (Rogers 1989). Continued uncontrolled grazing by feral horses is expected to lead to the elimination of hard tussock grassland from some areas, and to favour the spread of weeds.

In Australia, only two studies have investigated the environmental impact of feral horses, one in the Alice Springs district (Berman and Jarman 1988) and one in the southern highlands of Victoria and New South Wales (Dyring 1990). No quantified information is available for other parts of Australia, making it difficult to determine effects in areas such as northern Australia.

Findings from central Australia, however, may provide an insight into the environmental impact of feral horses in semi-arid Western Australia, northern South Australia and western Queensland, which also receive low and irregular rainfall.

5.2 Environmental impact in central Australia

Changes to the environment may be either short-term or long-term. Short-term changes attributed to feral horses (Berman and Jarman 1988; Berman 1991) include:

- horse tracks (hooves disturb the soil), horse pads (paths created by repeated travel along certain routes), dung and urine scalds;
- plants damaged by trampling, the removal of grass and baring of ground through grazing and shrubs damaged by browsing;
- water supplies depleted, waterholes fouled and soaks dug in sandy creekbeds;
- collapse of wildlife burrows; and
- visual and auditory changes to the Australian bush (horses being present and the sounds of whinnying and hoof-beats).

'Feral horses are one of several factors that cause significant damage to Australia's arid rangelands.'

The environmental impact of feral horses is difficult to quantify because of the influence of other factors such as season, weather conditions, cattle, kangaroos, rabbits, foxes and changes in Aboriginal burning practices. All factors, not just damage caused by feral horses, must be considered by landholders, and appropriately managed in order to protect the rangeland for the long term. However, it is difficult to separate feral horse damage from co-existing factors, particularly under extensive rangeland conditions. The relationship between feral horse density and the degree of damage caused by them is not known, and the level of density below which impact is negligible has not been determined.

Although most short-term changes to the environment (for example, dung) can be quantified, others (for example, removal of grass) are difficult to distinguish from the effects of other introduced herbivores, particularly cattle.

Long-term changes to the soil, vegetation and wildlife are potentially more serious, and perhaps irreversible, and therefore should be prevented. Examples of potential long-term feral horse impact (based on Berman and Jarman 1988; Berman 1991) include:

- acceleration of erosion by removal of vegetation and disturbance of soil;
- changes in pasture species composition as a result of selective grazing or differential responses by different plant species to grazing;
- restriction of the distribution of native fauna through the removal of food and shelter;
- reduction in the frequency or intensity of grassfires as a result of the removal of ground fuel, with resultant increases in shrub density; and
- seed dispersal of native and introduced species, either in dung or in manes and tails (Campbell 1989).

In central Australia, Berman and Jarman (1988) studied the impact of feral horses and cattle on the environment. They concluded that feral horses help to denude large areas, force macropods from these areas, foul waterholes with their carcasses and contribute to accelerated gully erosion. Their impact extends further from water than that of cattle because they are more mobile and can cross hills that are normally barriers to cattle. These conclusions were based on correlative

evidence from counts of animal signs and the assessment of soil and plant characteristics in over 3000 15-metre radius sample areas. During drought, feral horses can walk 50 km from water in order to reach feed (Berman and Jarman 1988). Managers have more financial incentive to remove cattle before they starve during drought, than they have to remove feral horses. Areas remote from the impact of cattle-grazing may serve as refuge areas for native plants and animals, yet the intrusion of feral horses threatens these important conservation areas.

Morton (1990) suggested that in arid Australia, grazing stock and unmanaged introduced herbivores, such as the rabbit and feral horse, have been major factors in the disappearance of medium-sized native mammals. He postulates that in drought native mammals rely on pockets of suitable habitat for survival. These are mainly drainage lines that are wetter and more nutrient-rich. Morton believes that these are the same areas most under threat from non-native herbivores during drought. Although the relative impact of feral horses has not been quantified for these refuge areas, it is likely that they suffer considerable pressure, especially during drought.

Databases such as the Environmental Resources Information Network, when fully developed, can assist in targeting critical areas to study concerning the overlap between feral horse distribution and rare and endangered native plants and animals. The CCNT is currently assessing feral horse impact in one such area, Finke Gorge National Park, Northern Territory (Section 5.5).

5.3 Environmental impact in south-eastern Australia

Research by Dyring (1990) suggests that feral horses in subalpine and montane areas of Victoria and New South Wales compact soil and alter vegetation by trampling. Dry soil is most susceptible to compaction, wet soil more prone to structural damage.

Areas frequented by horses had fewer plant species and less individual plants. Introduced plants were more common along horse-tracks and other areas disturbed by horses than in areas where there is little disturbance.

Grazing and trampling appear to contribute also to the breakdown of stream banks. Feral horses searching for food along stream banks reduce the abundance of *Sphagnum* moss in favour of drier, grassy vegetation with potential to increase runoff and therefore accelerate erosion. Peaty soils at stream crossings and drinking points are generally churned up by hooves, leading to possible breakdown of the banks and siltation.

Wharton and Dempster (1981) observed that the low numbers of feral horses in Victoria seem to have little impact upon wildlife but, because horses prefer better quality grasslands, there may be competition between feral horses and grey kangaroos.

5.4 Possible impact in northern Australia

The environmental impact of feral horses in northern Australia has not been studied, but some projections are presented. They may contribute to accelerated erosion, accentuated by heavy rainstorms at the end of the dry season when groundcover is at its lowest. Visits in 1991 to horse-occupied areas in the Kimberley (Western Australia) and the Gulf (Queensland) revealed apparently very low groundcover and substantial erosion, particularly along creek lines. Whether this damage was caused by feral horses or other hoofed animals is not known. A further complication is fire, bushfire being common throughout much of northern Australia during the dry season. Feral horses in the Kimberley and

Cape York appear to favour recently burnt areas, grazing the emerging green pick. Perhaps horses suppress the re-establishment of plant cover on recently burnt ground, by dislodging soil particles with their hooves, thus contributing to increased runoff and erosion. Removal of vegetation by feral horses may also reduce the occurrence or intensity of dry-season bushfires, the consequences of which are not known but could include disruption of the balance between pastures and shrubs.

Feral horses damage the tree bark by chewing and rubbing, particularly paperbark trees near watering places (B. Walsh, CCNT, pers comm. 1991). Trampling damages the moist soil that fringes swamps where horses tend to congregate, and horse activity breaks down banks around waterholes.

With the removal of unmanaged cattle during the Brucellosis and Tuberculosis Eradication Campaign (BTEC) in the last few years, there are now areas with feral horses but few cattle. In these areas, which include Aboriginal lands in the Kimberley and northern Gulf properties, the removal of cattle will result in increased feed which will in turn lead to higher feral horse populations.

5.5 Environmental implications of removal

A long-term monitoring project commenced in 1991 in Finke Gorge National Park, west of Alice Springs (Northern Territory) to assess the environmental implications of removing feral horses from the Park (Low et al. 1991). Changes in vegetation, water quality and rabbit activity are being monitored to help determine the value of controlling the feral horse herd. Potential park management problems following horse removal include increased rabbit activity and increased fire hazard along the river system if the introduced couch and buffel grasses are no longer grazed by horses.

Recent culling of feral horses on Moreton Island has greatly reduced the island's horse population. Subjective assessment by ranger staff following control indicates the recovery of vegetation on the dunes and an increase in bird numbers and nestings in wetland areas.

PART THREE

ATTITUDES

3

6. Attitudes of Interest Groups

Section summary

This section examines the attitudes of community groups which have a major interest in feral horses, particularly animal welfare, Aboriginal and horse protection groups. The previous sections on economic and environmental impact dealt with the concerns of pastoralists and conservationists.

Most, although not all, groups accept that feral horses need to be managed. The principal issues are the degree of management needed, the techniques used and their application. There has been considerable criticism of the treatment of feral horses during control operations, focused mainly on shooting from helicopter and, more recently, on mustering and long-distance transport.

Animal welfare groups promote the use of widescale fertility control and more recently eradication to minimise the potential suffering of feral horses. However, eradication is rarely achievable, except in rare situations such as where re-invasion from other areas is not possible, and widescale fertility control is not possible with current technology. Eradication is favoured by many pastoralists and conservationists, but groups such as the Waler Horse Society of Australia are strongly opposed to it. Animal welfare groups do not support commercial use of feral horses, fearing that it will encourage land managers to keep some feral horses for future utilisation and thus perpetuate the associated suffering.

Horse management techniques need to be applied in accordance with best practice, using skilled staff and appropriate equipment so that feral horse suffering is minimised. We conclude that commercial use of horses is an integral part of feral horse management, at least for now. Without it, horses would not be managed in many areas, and would therefore suffer cruelly in drought through thirst, starvation and consumption of toxic plants. The Subcommittee on Animal Welfare (SCAW) of the Standing Committee on Agriculture and Resource Management (SCARM) is preparing a code of practice for the transport of horses. All relevant interest groups should be consulted during its preparation. Once accepted, States and Territories should ensure that commercial operators adhere to the code. This could be done by requiring operators to be registered, with adherence to the code being a condition of registration.

Many feral horses occur on Aboriginal lands, but there is no single Aboriginal attitude toward them. The differing Aboriginal and white pastoralist attitudes to feral horses are a potential source of conflict. During negotiations to plan and implement district feral horse control programs, the damage that horses cause needs to be explained to all land managers so that they can make informed decisions. Aboriginal representation should be an integral part of a government advisory service, especially where Aboriginal groups are involved.

The Waler Horse Society of Australia wants to protect feral horses which its members believe are descendants of horses exported from Australia for the army remount trade. The extent to which Walers occur among feral horses is disputed. Feral horses may possess characteristics worthy of preservation but if they are to be kept they must be managed to ensure there is no suffering during handling or drought, and no significant environmental or economic damage.

6.1 Public interest

Public interest in Australia's feral horses was low until the 1980s. Before this, there

were only occasional public complaints from animal welfare groups on the transport of captured horses (McKnight 1976).

There have been many articles on feral horses in a broad range of both local and nationally distributed newspapers and magazines (Wurst 1987). The treatment of feral horses has also received widespread overseas media attention, usually focusing on a condemnation of horse-shooting from helicopters. Criticism of control methods used to be the only side of the argument presented in the media, but that is now balanced by articles which emphasise the damage that horses cause and the need for control.

Australia is a highly urban society and most Australians rarely come into contact with feral horses. The media's influence on public opinion is powerful, as shown when public concern expressed through the media over feral horse management in the United States led to the protection of feral horses by law there in 1971.

6.2 Specific interest groups

Differing community viewpoints exist on the management of feral horses. These include removing all horses, using horses, protecting horses (Berman and Jarman 1987), and refraining from horse management (Nugent 1988). Conservationists, including the Australian Conservation Foundation, favour humane culling of feral horses because of the damage they are believed to cause to native flora and fauna (SSCAW 1991a). Pastoralists generally regard feral horses as pests because they compete with cattle for resources and reduce pastoral productivity (McKnight 1976; Section 4.2). Central Australian Aboriginal communities tend to consider feral horses as belonging to the country. Generally, they do not view them as pests but often use them for profit, so eradication is not favoured (Nugent 1988, SSCAW 1991a). A further view opposes both the shooting and long-distance transport of horses, and favours non-lethal control methods (Section 6.3). Some welfare lobby factions, and those advocating the retention of Waler-type horses, may favour the lawful protection of feral horses.

Scientific research has a role in providing information on the damage caused by feral horses so that differing groups can debate the management of the horses with greater awareness and understanding of the damage they cause and the likely consequences of other alternative management action.

6.3 Animal welfare concerns

Animal welfare groups aim to protect animals from cruelty and improper exploitation, encourage the considerate treatment of animals and denounce practices perceived as causing animals unnecessary stress. Several prominent animal welfare groups have an interest in feral horse management operations in Australia. These include the Royal Society for the Prevention of Cruelty to Animals (RSPCA), Australian and New Zealand Federation of Animal Societies (ANZFAS) and the Franz Weber Foundation.

'Animal welfare considerations need to be an integral part of any feral horse control program.'

Consideration of animal welfare issues should be an integral part of any culling or harvesting program. Well planned and coordinated programs using trained operators are likely to be more humane than the current and often *ad hoc* programs.

The SSCAW conducted an inquiry into the culling of large feral animals in the Northern Territory. It included consideration of the views of RSPCA, ANZFAS and other animal welfare groups, most of which advocate the eradication of feral animals, although they are

concerned about current control methods (SSCAW 1991a). SSCAW concluded that eradication should be the aim of control programs. However, this is rarely achievable except locally (Section 9.3.2).

The RSPCA supports the destruction of feral animals provided that such practices are humanely implemented, part of a coordinated national approach and adequately funded to enable the use of good equipment and well trained operators. ANZFAS believes the current approach to feral animal control in Australia is *ad hoc*, opportunistic and based on methods that give only short-term reduction of feral horse density (SSCAW 1991a). Many control methods are expensive, ineffective and often cause animal suffering. ANZFAS accepts that from time to time feral animal populations, including feral horses, may cause agricultural or environmental damage (Hansard, 1990). Where this occurs, ANZFAS accepts, albeit reluctantly, that lethal control methods such as helicopter shooting may be necessary. They would prefer that the aim of control is eradication using, where practical, methods such as fertility control (Hansard 1990). But eradication is rarely possible (Section 9.3.2), while fertility control is currently not practical for widespread feral horse control (Section 8.5.2).

ANZFAS is strongly opposed to the commercial use of feral horses, particularly the transport of feral horses (Hansard 1990).

6.3.1 Shooting

The RSPCA regards shooting as a necessary control technique, but is opposed to the shooting of animals from a moving platform, believing it to be inaccurate and the cause of suffering to animals. The SSCAW recognises, however, that shooting from a helicopter is often the only practical method of culling in rugged, inaccessible terrain. It has been condoned as the most humane method of culling in rugged localities, provided that suitable firearms and ammunition are used, and that all wounded animals are followed up quickly and killed. The SSCAW was satisfied that the Northern Territory Government conducted adequate training and testing of personnel involved in the shooting of large feral animals from helicopter.

The SSCAW further recommended that only those persons approved by government authorities should shoot from helicopters, although both government officers and private individuals would be eligible for approval. This would ensure both operator safety and the welfare of the animals. The SSCAW also recommended that Commonwealth, State and Territory governments introduce an accreditation or licensing system for all people involved in helicopter shooting programs. The authors support both recommendations. Prior approval by the appropriate government authority should be mandatory before any helicopter shooting program, the shoot should be monitored and results reported.

6.3.2 Commercial use

The RSPCA denounces the commercialisation of feral animals, fearing that it could lead to an increase in the number of pest animals. The SSCAW expressed concern about mustering and long-distance transport of feral horses, and recommended that the use of horses in the export horse meat industry should be reviewed (SSCAW 1991a). The Committee also recommended that all State and Territory governments prohibit the transport of horses in double-deck vehicles (SSCAW 1991b). In August 1992, at a conference on the long distance haulage of feral horses, Greer (Department of Primary Industries, (DPI), pers. comm. 1991) presented preliminary evidence that double-deck transport of horses may not be more stressful than single-deck transport. It may be that horses feel more secure in double-decked

transporters because the vehicles are more stable, and horses may feel more secure in the enclosed bottom deck. However, this is conjecture and requires further investigation. The Bureau of Rural Resources' publication *Welfare of horses being transported* (Pilkington and Wilson 1990) contains suggestions for improving the welfare of feral horses in transit.

The promotion of more effective feral horse control in some areas of Australia relies on an ability to generate revenue from the sale of captured horses. A continuing trade in horsemeat means that transported horses must arrive in good condition and without significant losses from bruising, maiming or death. If transport costs rise markedly as a result of animal welfare concerns, there will be little incentive to muster and the damage caused by feral horses will increase. In the long term more horses will be placed at risk of slow death because of drought and poisonous plants. The relevant *Model Codes of Practice* should provide sound guidelines for the transport of horses including stock selection, yard design, food and water requirements, loading and loading density, in transit inspections and rest stops. Failure to follow approved codes of practice can be used to define acts of cruelty under relevant State and Territory animal welfare legislation. Codes of practice can be used as a basis for accreditation of helicopter shooters, musterers and transport operators. Adherence to the prescribed code of practice could be made a condition of accreditation. Failure to abide by the code would result in deregistration.

6.3.3 Other techniques

Because of concerns over transport, SSCAW strongly supports the development of new techniques for control (SSCAW 1991a). Most animal welfare groups prefer non-lethal culling methods and support the development of fertility control (SSCAW 1991a).

However, Hone (1992) shows that reductions in the fertility of a population may not result in a population reduction because of compensatory changes such as increased survivorship and lowered breeding age. Species with a low birthrate, such as horses, are less likely to exhibit compensatory mechanisms, although this needs to be studied. More work is needed to determine whether fertility control is possible, although Bomford (1990) suggests that several difficulties must be overcome before it could be successful (Section 8.5.2).

The RSPCA identified other areas for research to refine or develop techniques for feral animal control. These include more efficient destruction with shooting or poisons, behavioural methods of attracting animals to one location by biochemical or physiological means, and genetic manipulation to modify the ability of pest animals to survive or the incorporation of lethal genes into suitable viruses (SSCAW 1991a). The SSCAW also recommended that the Commonwealth government establish research priorities in non-lethal, long-term feral animal control (SSCAW 1991a). The authors see little opportunity to develop new, non-lethal techniques for feral horse control.

6.3.4 Welfare concerns

Feral horses may suffer through drought if they are not controlled. The degree of suffering can be minimised by improving the efficiency of existing techniques, developing improved techniques and by ensuring that populations are reduced to low density so that the need for ongoing control is minimised.

6.4 Aboriginal perceptions of feral horses

Aboriginal people are important landholders in some areas where feral horses occur, so their involvement in the process of developing and implementing pest management strategies is essential. It

is also necessary to develop an understanding of Aboriginal attitudes towards feral animals. Representatives of the Central Land Council, Northern Territory, stressed the importance of consulting Aboriginal people on feral animal control (SSCAW 1991a). They also emphasised that there is no single Aboriginal community point of view toward feral animal management.

'There is no single Aboriginal community attitude to feral horse management.'

Published material on the matter is sparse, and the following points are based on information gathered by Nugent (1988) from ten Aboriginal communities in the western Alice Springs district (Western MacDonnell Ranges and south-eastern Tanami Desert). The information does not necessarily apply to other parts of Australia.

Although aware that horses are introduced stock, Aboriginal people in central Australia view feral horses as now 'belonging to the country' (Nugent 1988). Aboriginal people in the Northern Territory have had contact with introduced animals for several generations, and do not consider their presence unusual. Indeed, the presence of feral animals is sometimes viewed as advantageous, being an indicator of healthy country.

Introduced animals are not perceived as a cause of widespread land damage and, although some communities associate them with overgrazing, the consequences are of little concern. Localised disturbances such as other animals being robbed of grass and the fouling of water during dry times are recognised (Nugent 1988).

Despite an attitude of acceptance toward feral stock, the traditional concept of responsibility for country includes feral animal management (Nugent 1988). Aboriginal people regard introduced animals as 'a source of food, income and employment' provided sufficient resources are available for their capture (SSCAW 1991a, Nugent 1988). The greatest incentive for control is income derived from the sale of captured animals.

Trapping and mustering are common methods, while the practice of shooting and leaving carcasses to rot is strongly opposed and seen as wasteful. Aboriginal people associated with cattle station work are more inclined to advocate feral horse control, although they also see horses as a source of riding animals. Some Aboriginal people prefer to see horses left undisturbed, others favour selling some but retaining enough to permit intermittent harvesting for income. Most communities surveyed expressed the desire to conduct muster operations independently without outside (white) contractors (Nugent 1988). Aboriginal people generally are reluctant to favour eradicating a resource (SSCAW 1991a).

Differing Aboriginal and white pastoralist perceptions of feral horses are a potential source of conflict. In negotiations for district control programs, the harmful impact of horses needs to be explained to all land managers, including traditional Aboriginal owners, so that they can make informed decisions. Trained Aboriginal representatives could be an integral and effective part of a government advisory service (Section 11.2).

6.5 Commercial harvesters

Feral horses were identified as a small but significant commercial resource worth between $4 and $6 million annually (Section 4.3). Some landholders, most notably some Aboriginal groups, and commercial operators who utilise feral horses, see a greater potential for harvesting feral horses (Section 6.4). If feral horses are allowed to build up to higher densities in some areas, so that they can periodically be harvested, it will

be necessary to reduce grazing pressure from other sources, namely domestic stock and other wild herbivores such as kangaroos and rabbits, so that there is not unsustainable damage to the rangeland. Whether this management option is economically and environmentally sustainable has not been assessed.

There is likely to be major opposition to sustained commercial harvesting of feral horses because entrenching the industry will be seen by animal welfare groups as perpetuating inhumane practices, and by pastoralists as encouraging a pest. This is an area of potential major conflict. When developing land management goals for an area and considering the role pest animals such as feral horses play in it, all interest groups need to meet to discuss issues and develop mutually compatible outcomes.

6.6 Brumbies

'Brumby'[4] is an Australian term used to describe the 'wild horse'. Its origin is uncertain, although there are three possible explanations. One concerns James Brumby (Australian Encyclopaedia 1983), a soldier and horse-breeder who released his horses into the New South Wales bush in 1804 when he departed for Tasmania (Austin 1986). On subsequent sightings, presumably the horses were referred to as 'Brumby's horses' or simply 'Brumby's'. Another suggestion is that brumby may be a corruption of 'baroomby', a Queensland Aboriginal term for wild, while the third is that it derives from 'Baramba', the name of a creek and station in Queensland (Australian Encyclopaedia 1983). The word 'brumby' is used also to describe a bush-bred mount or a horse of poor breeding (Ramson 1988), but for the purposes of this document, the term refers solely to feral horses.

6.7 Walers

The term 'Waler' originated in India in 1846 to describe horses imported from New South Wales (Yarwood 1989), and was later used to describe all Australian horses abroad. Yarwood describes the Waler as 'typically three parts Thoroughbred ... with the origin of the fourth element depending on its intended field of service'. It was not a breed but a 'type' or style of horse developed for a range of purposes.

'Australia exported nearly half a million Walers.'

The British Indian Army remount trade began in 1834 and continued until the eve of World War II. Australia exported almost half a million Walers (355 000 to India) between 1861 and 1931. During this period they were bred and exported from every Australian State or colony (Yarwood 1989). Victoria, Queensland and New South Wales were the major exporters. Walers are remembered for their role in the charge of the Australian Light Horsemen at Beersheba in 1917.

The Australian Stock Horse Society was formed in 1971 to maintain horses with essentially the same style as Walers. Many horses kept by society members are no doubt descended from Waler stock. Most Australian feral horses are not Walers, although some true-to-type Walers may exist. Even in areas where feral horses are descendants of Waler types, the strict selection applied by stockmen for Waler production and its hybrid vigour have been absent for perhaps 50 years. Breeders wishing to raise Walers may have more success using pure breeds, as opposed to feral horses, and recreating the conditions under which they were first developed.

[4] *The term 'brumby' was used in print in 1880 in the Australasian, which referred to 'brumbies' in Queensland (Ramson 1988). A.B. (Banjo) Paterson did not use the term, but his famous poem 'The man from Snowy River' in* The Bulletin *in 1890 highlighted the running of brumbies by men on horseback and secured the place of 'wild bush horses' in Australian folklore.*

The Waler Horse Society of Australia wants areas to be set aside for feral horses, to preserve the different types, not only Waler types but Coffin Bay ponies, Timor ponies and Snowy Mountain brumbies. Feral horses may possess characteristics worth preserving, but if they are to be kept they must be managed to ensure there is no suffering during handling or drought, and no environmental or economic damage.

PART FOUR

TECHNIQUES AND CURRENT MANAGEMENT

4

7. Current Management

Section summary

The extent to which feral horses are controlled is influenced by the degree and form of damage they cause, their abundance, landholder perception of the problems they cause, public opinion and the potential for their commercial utilisation.

Capture by mustering or trapping for sale as meat, and shooting either for pet meat or leaving the horses as waste, are the main control methods. Other methods such as herd relocation and lethal injection are used rarely.

The level of control attained varies from nil to local eradication. Local eradication is possible only where the terrain makes control relatively easy, or where encroaching settlement has forced horses away. Pastoralists often tolerate low feral horse numbers. Where they are uncontrolled, it is usually because they are considered too difficult or too costly to remove. This may not necessarily be the case. Control tends to be least where financial incentives are low or where public opposition to control operations is high. Minimal control of horses is common.

Typically, control is undertaken only when feral horse numbers are perceived as too high. Significant economic and environmental impact may occur long before that. Follow-up control is often not undertaken until the horse population returns to a high level. Feral horse damage needs to be better quantified so that land managers can make more informed decisions on feral horse management.

7.1 Introduction

This chapter presents an overview of current feral horse management in each Australian State and Territory. The major landholder groups affected by feral horses and factors which limit effective management are discussed. Critical assessment of current management practices can highlight inadequacies and indicate improvements.

7.2 Landholders involved

'Landholders often have different attitudes toward feral horses and aim for different levels of control.'

The three main landholder groups affected by major feral horse concentrations are pastoralists, conservation authorities and outback Aboriginal communities. Pastoralists generally regard feral horses as pests and favour their control. Aboriginal people tend to accept their presence unless financial incentives for their removal offer benefits to the community. National parks and conservation authorities aim to reduce the damage they cause to conservation areas. As a result of differing concerns and resources, these three landholder groups often aim for different levels of feral horse control. This is a potential source of conflict. Improved extension services are an important means of encouraging better coordinated and effective widespread control of feral horse damage (Section 11).

State and Territory governments, including forestry agencies, are responsible for managing feral horses on government controlled land within their jurisdictions, although many exercise little control. Most forestry authorities do not regard current feral horse densities in State forests as a problem, and therefore conduct no control.

7.3 Legal responsibilities

Primary responsibility for both feral animal control and the prevention of cruelty to animals lies with State and Territory governments (SSCAW 1991a).

Individual landholders are responsible for feral animal management on their land.

The Commonwealth Government is concerned primarily with international aspects of feral horse management, including animal export and import, livestock within export slaughter facilities, and exotic disease preparedness. It is required to control pests on Commonwealth-acquired land such as Department of Defence and other Commonwealth-owned land, although few of Australia's feral horses occupy these areas. The Australian Nature Conservation Agency is responsible for pest animal control in relevant parks, including Kakadu and Uluru National Parks.

7.4 Current control techniques

The effectiveness of techniques for managing feral horse damage depends on factors such as the degree and form of damage, the number of horses to be controlled, the area of land affected, seasonal conditions, topography and operator experience.

'Management of feral horse damage relies almost exclusively on controlling feral horse density.'

Management of feral horse damage relies almost exclusively on controlling feral horse density. It may involve harvesting horses for commercial gain or killing horses for no return. The two main harvesting methods are trapping at water points and helicopter mustering. Trapping is usually undertaken at bores or dams. Musters are done using helicopters, motorbikes, and stock horses, either separately or in combination. Captured horses are sold for slaughter or domestication. Shooting is carried out both from the ground and helicopters, and shot horses may be used for pet meat or left as waste.

Whether managers decide to control feral horses or to establish a horse sanctuary (i.e. regardless of the end-use of horses), they may require at least some of the following control techniques. The list includes options not in current use and some not fully developed.

- **Trapping** yards at water points, using attractants, with automated mechanical traps, and lure mares.
- **Mustering** with lure mares, helicopter, coachers[3], motorbikes or on horseback.
- **Fencing** to exclude horses from sensitive areas or fencing off water points to drive horses to trap sites.
- **Shooting** from the air or from the ground.
- **Herd relocation.**
- **Immobilisation and lethal injection.**
- **Fertility control.**

Commercial use of feral horses may be an integral part of some techniques. Uses include field slaughter for pet meat, licensed knackeries for pet meat or human consumption and dingo baits.

Each technique is described in Section 8.

7.5 Overview of management in each State and Territory

An overview of current management practices in the States and Territories is presented in this section and summarised in Table 3.

[3] *A colloquial term describing the use of stockhorses released amongst feral horses to quiet them and help mustering.*

State/Territory	Region	Methods used
Northern Territory	Northern	Ground shooting (common) Aerial shooting (common) Helicopter mustering (uncommon) Trapping at water (uncommon) Field pet-meating (sporadic)
	Southern	Trapping at water (common) Helicopter mustering (common) Coacher horses and bikes (uncommon) Aerial shooting (common) Ground shooting (uncommon)
Queensland	Northern	Ground shooting (common) Aerial shooting (uncommon) Helicopter mustering (uncommon) Trapping at water (uncommon)
	South-west	Ground shooting (common) Trapping at water (common) Mustering with bikes (uncommon)
	South-east	Ground shooting (common) Aerial shooting (uncommon)
Western Australia	Kimberleys	Ground shooting (common) Aerial shooting (uncommon) Field pet-meating (uncommon)
	Pilbara	Ground shooting (common) Field pet-meating (common) Aerial shooting (uncommon)
	Goldfields	Ground shooting (common) Field pet-meating (uncommon)
	Southern	Ground shooting (uncommon)
South Australia	Northern	Ground shooting (common) Mustering with bikes (common) Aerial shooting (uncommon) Trapping at water (uncommon)
	Southern	Herd relocation (uncommon)
Victoria	North-east	Mustering on horseback (uncommon)
	Barmah	Lure mares (uncommon)
New South Wales	North-west	Ground shooting (uncommon)

Table 3: Methods currently used for the control of feral horses.

Note: Each method is classified as either common (used by most landholders), uncommon (used by very few landholders) or sporadic (happens periodically). Information was obtained from interviews by one of the authors (W. Dobbie) with a variety of government agencies and landholders involved in feral horse manage ment. Tasmania and the Australian Capital Territory have no feral horses.

7.5.1 Northern Territory

The CCNT has the delegated responsibility for managing feral animals in the Northern Territory (SSCAW 1991a). Horses are not a declared pest, although they can be declared as pests and their control enforced under three Acts: *Territory Parks and Wildlife Conservation Act 1988, Stock Diseases Act 1956–89,* and the *Soil Conservation and Land Utilisation Act 1985* (SSCAW 1991a). In addition, the *Northern Territory Pastoral Land Act 1992* establishes the Pastoral Board which can require pastoralists to control feral animals deemed to be causing land degradation (G. Davis, CCNT, pers. comm. 1991). Although the Northern Territory Government has legislative power to require feral horse control, the usual practice is to advise pastoralists. Forcing their cooperation with legislative sanctions is a last resort.

Feral horse management is more common in the southern Northern Territory than the north. There are markets for the sale of captured horses at Peterborough in South Australia, Tennant Creek in the Northern Territory and Caboolture in Queensland. Ongoing scientific research on feral horses in the Alice Springs district has helped landholders in the southern region to become aware of feral horse damage and what can be done about it.

A questionnaire of 38 stations in the southern Northern Territory indicated that trapping at water was the most common method (Bowman 1987b). Of the stations that mustered feral horses, 64% used trapping at water and 22% used helicopter mustering. Three other trapping/mustering combinations were used, namely trapping with motorbikes (6%), helicopter, motorbikes and coacher horses (3%) and helicopter and motorbikes (3%). The number of horses caught per operation ranged from eight to 393 horses, although it was usually fewer than 50. Sixty-eight per cent of pastoralists in the Alice Springs district had attempted to muster feral horses since 1984, while 90% had mustered horses at some previous stage.

Forty per cent of southern pastoralists surveyed reported that they also used shooting to control feral horses. Shooting generally occurred on stations with low feral horse numbers, and was probably used because of the ease of shooting rather than its effectiveness. These stations also tended to use ground shooting, whereas on stations with high numbers, helicopter shooting or harvesting was more likely. Leases with high concentrations tend to have rugged range country in which ground shooting is ineffective.

Local Aboriginal people are interested in commercially harvesting feral horses in the Hermannsburg area west of Alice Springs. Funding has been sought by the community to help purchase equipment.

In Watarrka and Finke Gorge National Parks, exclusion fencing is used in conjunction with other methods to inhibit re-invasion by horses of controlled areas.

Pet-meaters are allowed to operate north of Tennant Creek but are prohibited from operating in the southern Northern Territory because of Birdsville disease.

There is very little commercial harvesting of feral horses in the northern Northern Territory where the main form of control is shooting from the ground, although some shooters supply horse meat to local crocodile farms (B. Walsh, CCNT, pers. comm. 1991).

Feral horses from the northern cattle tick infested regions have to be presented free of ticks before transport across the cattle tick line to protected (Barkly Tableland) or clean (southern region) districts is approved. This may require one or more dippings or sprayings (C. Sorrenson, DPIF, pers. comm. 1991).

Australia's only feral horse sanctuary opened in 1988 at Bonrook station, Pine

Creek, approximately 200 kilometres south of Darwin. It is intended to carry up to 1200 horses (Schulz 1990).

7.5.2 *Queensland*

Feral horses are declared noxious in Queensland under the Land Protection Act 1985–90. The Rural Lands Protection Branch is responsible for vertebrate pests control, but has not been involved in feral horse control, giving priority to feral pigs and wild dogs (G. Telford, D of L, pers. comm. 1991).

There is little feral horse management throughout Queensland. Shooting is the most common method and reportedly has been successful on many of the smaller leases in northern Queensland. The BTEC led to increased pastoral lease fencing that improved control of both cattle and feral horses. Few feral horses were shot during BTEC operations because time and funding were limited, although small numbers were occasionally shot at landholder request during paddock inspections. Some stations in the Gulf of Carpentaria have had some success mustering with helicopters. The horses are mustered into portable or fixed yards with wing fences. In south-west Queensland trapping is more common and several stations trapped large numbers during the dry times of the 1980s, when many other feral horses died of starvation and thirst.

Along the top of the Gulf, several stations were completely destocked of cattle under BTEC. The remaining feral horses are free of competition with stock for feed and are abundant. Their numbers are likely to increase further.

It is illegal in Queensland to shoot feral horses for pet meat in the field. All horses destined for pet meat must pass through licensed knackeries (Section 4.3). The relevant section of the Meat Industries Act 1965 was inserted to reduce the chances of meat substitution (R. Arthur, DPI, pers. comm. 1991). Pastoralists with feral horse problems favour changing the Act to permit field slaughter similar to that in Western Australia and the northern Northern Territory. They believe this would provide a financial incentive to control feral horses in remote districts.

The prohibition of field slaughter means that all feral horses used for meat must be caught and transported. Most are slaughtered at meatworks in Caboolture near Brisbane, although horses from the Gulf country are also sent to abattoirs at Peterborough (South Australia) and Tennant Creek (Northern Territory). Horses slaughtered in Queensland are rejected by the meatworks unless accompanied by a declaration stating that they originate from an area free of Birdsville indigo.

Horses north of the tick line need to be dipped twice within a few days before being trucked south. Typically one dip is at the point of capture and the second is at a Department of Primary Industries inspection yard (P. Jones, DPI, pers. comm. 1991).

7.5.3 *Western Australia*

Feral horses are not declared pests and therefore not controlled by the Agriculture Protection Board of Western Australia (APB). Annual donkey shoots are conducted by the APB in the Kimberley and Pilbara where donkeys are common and a declared pest, but horses are not shot.

There is little feral horse management in Western Australia. They are locally abundant only in the Kimberley, but apparantly their numbers are restricted elsewhere by the widespread occurrence of toxic plants (*Crotalaria* spp.) which cause Kimberley horse disease. Some station managers shoot feral horses opportunistically from the ground, and a few horses are captured and used as replacement stockhorses, especially in the Kimberley.

Until recently, pet-meaters operated out of Kununurra. Pet-meat shooters also operate occasionally in the Pilbara and Goldfields districts. Field slaughtering of horses for pet meat is permitted in Western Australia. Transport of live horses to abattoir is regarded as uneconomic in most of Western Australia because of distance. The closest export abattoirs are Peterborough and, when operating, Tennant Creek. Horses trucked sough from Kimberley district must undergo government tick inspection at Broome.

There is little feral horse control in the east Pilbara district apart from opportunistic ground shooting to waste, and occasional field slaughtering for pet meat. In 1991, 900 feral horses were removed by pet-meaters from one station south of Newman.

Approximately 1700 feral horses were removed from the Lake Carnegie area in the north-eastern goldfields region by a pet-meat shooter in late 1987 (A. J. Stevens, APB, pers. comm. 1991). This reduced the population to an estimated 800, from which it has not since recovered, probably because of subsequent extremely dry seasons. As a result, follow-up control has been minimal, and has been restricted to some pet-meating of feral horses, along with harvesting of camels and kangaroos.

7.5.4 South Australia

Feral horses are not a declared pest in South Australia and are not regarded as a serious pest (K. Heinrich, Animal and Plant Control Commission (APCC), pers. comm. 1991). The *Animal and Plant Control Act 1986* does not differentiate between feral and domestic horses. The APCC may require specific landholders to take action if horses are deemed to be causing land degradation through overstocking (J. Burley, APCC, pers. comm. 1991).

There is little feral horse management in South Australia. Ground shooting is the main form of control in the north, where the major concentrations of feral horses occur. Helicopter shooting was used to reduce feral horse numbers during BTEC operations in South Australia in the early 1980s. Horses were removed because they blocked cattle tracks around some waters, which inhibited effective destocking, because it was difficult to determine whether all cattle had been removed or not (A. Gibson, APCC, pers. comm. 1991).

Most mustering is by motorbike (A. Gibson, APCC, pers. comm. 1991) and captured horses are generally sent to Peterborough for slaughter. Helicopter mustering is apparently uneconomic due to the low density of feral horses in the northern pastoral zone. Trapping is uncommon (A. Gibson, APCC, pers. comm. 1991).

Aboriginal people are commercially harvesting feral horses from the Pitjantjatjara Aboriginal lands in the north-west (G. Snowdon, Anangu Pitjantjatjara Council, pers. comm. 1991).

Feral horses in Coffin Bay National Park are not presently managed (G. Saunders, DELM, pers. comm. 1991). The Coffin Bay Pony Preservation Society wants to relocate the horse herd by the end of 1993 to a more acceptable area where conservation values are not compromised. Government approval was obtained but the herd has not been relocated.

7.5.5 New South Wales

National Parks and Wildlife Service policy is to remove feral horses from reserves. However, there is virtually no feral horse control in New South Wales, apart from infrequent ground shooting in northern areas.

Brumby running or mustering on horseback is not a licensed activity in Kosciusko National Park but provision exists in the Plan of Management for its use to control feral horses (Dyring 1990).

7.5.6 *Victoria*

The policy of the Department of Conservation and Natural Resources (DCNR) is to control introduced animals in national parks to conserve native plants and animals and to protect the environment. Feral horses predominantly occur within or close to national parks. The Director of National Parks and Wildlife can issue permits to approved brumby runners.

Licensed brumby running clubs operate in Victoria and occasionally muster feral horses on horseback in national parks. Dogs are often used to help run them into winged yards. Only one rifle can be carried and this is used solely for destroying seriously injured horses. Captured horses are used as stockhorses or sold through local saleyards for pet meat or for use as ponies. Mustering on horseback is not an effective population control method. Only few horses are usually caught, although it is considered to be low-level control at no public cost (B. Walters, DCNR, pers. comm. 1992). Foals and yearlings are preferred for domestic use. Up to 200 feral horses each year are removed from the Cobberas–Tingaringy Unit (Proposed management plan, Alpine National Park 1989). The future of brumby running in that unit may be limited as much of the Park is a proposed wilderness area where hoses and dogs will not be permitted (B. Walters, DCNR, pers. comm. 1992).

Shooting is not used for feral horse control in Victoria, although it may be considered as a last resort to stop severe environmental damage in national parks. The public would be consulted through relevant organisations before shooting was attempted (D. Miller, DCNR, pers. comm. 1991).

7.5.7 *Australian Capital Territory*

There are no feral horses in the Australian Capital Territory (Dyring 1990). A small population was destroyed in Namadgi National Park in May 1987 in accordance with the publicly endorsed management plan. Changes in environmental impacts following eradication are being monitored by the ACT Parks and Conservation Service. Re-invasion by feral horses from neighbouring Kosciusko National Park (new South Wales) is possible but considered unlikely (K. Williams, ACT Parks and Conservation Service, pers. comm. 1991).

7.5.8 *Tasmania*

G. Gregory (DPIF, pers. comm. 1991) reports that there are no feral horses in Tasmania.

7.6 Factors influencing effective management of feral horses

Animal welfare concerns, lack of information, control costs, inadequate advisory services and legislative restrictions all influence the effective management of the damage caused by feral horses.

7.6.1 *Animal welfare concerns*

None of the options identified in these guidelines for controlling feral horses offers freedom from suffering. The development of more humane methods and the improvement of existing methods would minimise suffering. Such practices could include a halt to shooting feral horses from helicopter, and restricting mustering and transport to operators who are appropriately qualified and experienced. Greater knowledge of the stress caused to feral horses during control operations would help government agencies to ensure that methods are modified to improve their welfare. Further work is needed, along the lines of Greer (1989), to quantify feral horse suffering and determine the most humane practices.

7.6.2 *Lack of information*

'There is little awareness among some interest groups and the general community about the damage caused by feral horses.'

There is insufficient information about feral horse distribution, density and impact. It is important to measure the damage feral horses cause to production and conservation values. Although the authors conclude that available information shows that feral horses are a serious pest, animal welfare groups may be more supportive of control operations if more detailed scientific information on damage can be collected. Ideally, the relationship between density and impact should be determined to establish the appropriate level for cost-effective control, although this is likely to be a difficult and expensive process.

7.6.3 *Poor extension*

There is little awareness amongst some groups with an interest in feral horses, and the community in general, about the damage feral horses cause, the research and development that has been undertaken into feral horse management techniques, the restrictions on control operations due to the remoteness of areas where feral horses occur, and the difficulty of applying control techniques. Consequently, some groups may propose or encourage inappropriate management methods. The relevant interest groups need to be more aware of the damage feral horses cause and what can and should be done to manage them.

7.6.4 *Costs*

There are substantial costs associated with feral horse management. Costs include research, provision of advisory services, equipment, fuel and wages for control operations. The primary beneficiaries, principally pastoralists and government land managers, must provide the bulk of funds.

7.6.5 *Difficulties in capturing and marketing feral horses*

'A system of accreditation for musterers and transport operators can help reduce suffering of feral horses.'

The following problems influence the success of capturing and marketing feral horses:

- careful planning by experienced operators is needed to prevent feral horses suffering. Ensuring that only experienced operators conduct control operations presents difficulties. Government officers cannot supervise all musters. A system of accreditation for musterers and transport operators may be necessary;
- feral horses are most difficult to control in rough terrain with natural watering points. This country precludes effective mustering from the ground and inhibits running and directing horses from the air;
- aerial musters are costly and operator experience influences the degree of success. Pilot competence and yard location and design are important factors;
- feral horses that become accustomed to helicopters tend to resist being turned and so become unmusterable (R. Bryan, CCNT, pers. comm. 1991). Planning and effective implementation of musters is essential, otherwise repeated unsuccessful operations may inhibit future success;
- if alternative watering points are available, trapping may be ineffective except during drought when most watering points dry up. The topography near natural waterholes is

often too rough to erect portable yards, so these waters can become refuges for horses that avoid being trapped;

- captured horses need to be transported from the place of capture. In rough country, road access is restricted, limiting sites where live-catching of feral horses is practical; and
- there is little financial incentive to catch and sell feral horses on properties that are remote from horse abattoirs more than 1500 kilometres away, or those that are inaccessible to road trains.

Landholder involvement Landholders are primarily responsible for the control of feral horses on their land. The method and degree of control reflect individual attitudes.

Shooting may be the only control option available to some land managers. However, many pastoralists believe that feral horses are too difficult to catch and that returns from their sale are too low throughout Australia's extensive pastoral districts. Pastoralists are reluctant to try again when previous mustering attempts have failed, so harvesting is commonly rejected, with shooting seen as the only available method. Futhermore, many also will not use aerial shooting because of cost, and either undertake no control, or attempt an ineffective ground-shooting campaign.

Predictably, those landholders who are most motivated to control feral horses are those who have horses causing the most damage, or those who are located closer to horse abattoirs. The financial incentive from the sale of feral horses is an important factor in management decisions. A greater awareness by landholders of the financial rewards of harvesting and the production and conservation benefits of feral horse control would encourage more widespread and effective control (Sections 11.2 and 11.3), although some landholders will not undertake feral horse control without substantial government assistance. Absence of control is the most likely option on land controlled by the land holders under current government policy, as it is on much Aboriginal land, unless it generates an income.

Attempts to muster feral horses are often unsuccessful, which may reflect a lack of understanding by pastoralists of how to handle horses, or a lack of planning or time available for horse management. Cattle are worth two to three times as much as feral horses and therefore cattle producers give a low priority to horse control, which is generally left until the end of the cattle season in October or November. At that time there is little surface water and high temperatures, and the start of the northern Australian wet season is imminent.

Government involvement Current government advisory services on feral horse management are inadequate. The CCNT is the only authority actively involved in the feral horse control. Two field officers and one scientist in the Alice Springs district deal with feral horses as part of their duties. The relevant authorities in other States generally have no involvement in feral horse control, priority being given to controlling other pest animals. There is also reluctance for governments to become involved in feral horse control because of feared repercussions from animal welfare groups. As a result, feral horses tend to be neglected, and the relevant government vertebrate pest control authorities have little expertise about their management. The requirement for feral horse management needs to be assessed for each State and Territory. Training of selected regional officers in feral horse management, especially for Western Australia and Queensland, would assist.

'Permitting field slaughtering of feral horses for pet meat in Queensland could provide more incentive for control.'

Legislative restrictions The Queensland *Meat Industries Act 1965* prohibits field slaughtering of feral horses for pet meat. The aim of the legislation is to prevent meat substitution by requiring all horses to be slaughtered at licensed meatworks. Kangaroos may be slaughtered in Queensland and meat from horses field slaughtered in the Northern Territory is sold in Queensland (Ramsay, DPIE, pers. comm. 1991). Changes to legislation allowing field slaughtering in Queensland could provide incentive for effective control and increased utilisation of feral horses in remote districts. It is important, however, to restrict pet-meating to areas free of Birdsville disease or to develop a cheap and reliable technique for detecting Birdsville indigo toxin (indospicine) in the meat. The consequences of permitting field slaughter of horses in Queensland warrant investigation (Section 12.10).

Horse meat exported from Australia as pet food must be stained with blue dye under the *Export Control Act 1982*. Australia and the United Kingdom are the only countries with this requirement, which was enacted in Australia to reduce the risk of meat substitution. Australian pet meat exports to Japan are declining and competing exporters are gaining market preference (Ramsay, in press). Horse pet meat exports totalled more than $800 000 in 1988. Although removing the requirement for staining pet meat may increase market share, it is unlikely that the State and Territory authorities will agree. Past discussions within the Animal Health Committee of SCARM have dismissed this proposition.

8. Methods of Control

Section summary

No single method is likely to offer effective control of feral horse damage. Combinations of methods may be effective, and the method or combination will depend upon local conditions.

Feral horses can be caught by trapping in yards at water points or by using feed or lure mares as an enticement. They can be mustered by helicopter, motorbike, or on horseback, with or without coacher horses. Trapping may cause less stress than mustering, although skilful musterers using coacher horses, a helicopter, motorbikes and horseback riders cause very little stress to mustered horses.

Captured feral horses can be sold as riding horses, relocated to reserves or humanely destroyed on the spot. The best financial returns can be obtained by transporting captured horses to abattoirs where they are slaughtered for human consumption. Careless operators can cause much suffering to horses during long-distance transport. Operators must be accredited and required to abide by a relevant code of practice, otherwise there is a risk that this most valuable control option will be banned.

Shooting from a helicopter is the only practical method of quick, large-scale and humane culling in inaccessible locations. Wounded animals can be followed-up quickly and killed more readily than by ground shooters. Shooting must be done by trained shooters abiding by the guidelines (Appendix A, R4 and R5). Shooting is costly and usually provides no immediate income. Large-scale shooting of feral horses is liable to be opposed by the public, both in Australia and internationally.

Non-lethal control options such as fertility control, feral horse reserves and tourist herds are not practicable in most cases. Usually, horses must be captured, or darted, handled and transported. Consequently, they are subjected to considerable stress and suffering. There is no suitable, long-acting anti-fertility drug or delivery system for such a drug. As a result, fertility control is not yet a viable technique for managing feral horse damage.

8.1 Introduction

This chapter describes techniques for reducing the damage caused by feral horses. No single method is likely to offer effective control, but a combination of methods may be successful. The applicability of each method or combination of methods depends on the specific circumstances. Managers must decide on the most appropriate course of action.

'No single method is likely to offer effective control.'

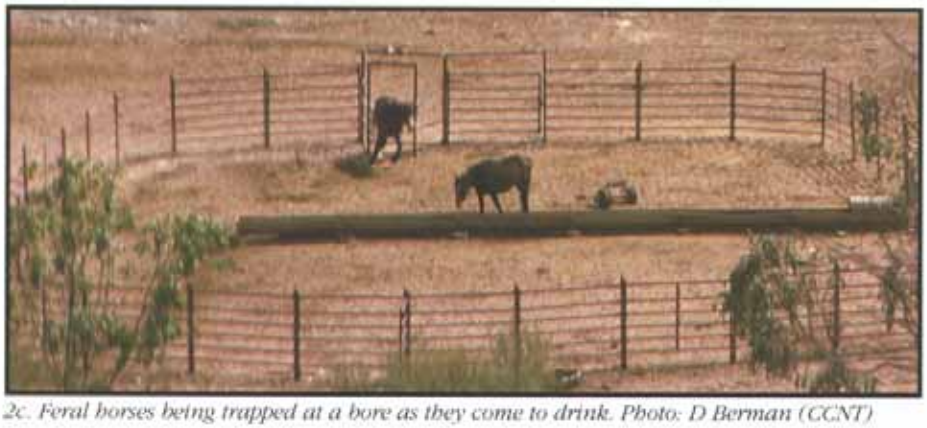
Management options and objectives (local eradication, reduction to and maintenance at very low densities, maintenance at high densities, and the uses of tourist herds and sanctuaries) are discussed in Section 9.3. Because of difficulties in quantifying impact, control (at least for the immediate future), is based on managing horse density.

It should be noted that the feral horse densities used for selecting control options are derived from central Australian case studies, as are the data on the costs and benefits of control.

Various control methods and their advantages and disadvantages are presented. Figure 2 shows some important feral horse control options that work well in central Australia. Technical details of trapping, mustering and shooting are presented in Appendix A.

2a. Feral horses mustered by hélicopter into portable yards. Photo: D Berman (CCNT)

2b. Feral horses denied access to a waterhole by an electric fence. Photo: D Berman (CCNT)



2c. Feral horses being trapped at a bore as they come to drink. Photo: D Berman (CCNT)

Figure 2: Some important feral horse control options that work well in central Australia.

8.2 Capture

Captured horses may be sold for domestication or slaughter, relocated to reserves or humanely destroyed at the point of capture. In all options except the latter, captured horses must be transported, usually long distances by road. If they are badly handled there is potential for horses to suffer considerably during and after capture. They can be driven to exhaustion, injured in the yard or on the truck, and may become dehydrated if not provided sufficient opportunity to drink. This suffering can be minimised with little extra cost to operators by following correct procedures. These include slowly pushing horses during musters, using quiet and patient handling in the yard, providing food and water, not transporting pregnant animals or those in poor condition, separating different age and size classes and not overloading trucks. SCARM is preparing a code of practice on transporting horses which will incorporate these and other procedures to minimise suffering.

'A code of practice on transport of horses is being prepared.'

There is little demand for feral horses for domestication. There is only one feral horse reserve in Australia and opportunity for herd relocation is rare. Most captured feral horses are killed for meat or other products. Horses can be slaughtered for human consumption at Peterborough and Caboolture abattoirs in South Australia and Queensland respectively (Section 4.3). For pet meat, there are licensed horse knackeries in Queensland, New South Wales, Victoria, Western Australia and South Australia (Ramsay, in press). Processors use mainly unwanted domestic stock, although some feral horses are used, particularly in Queensland. Feral horses destined for knackeries or abattoirs are caught mainly by trapping or mustering and transported to processing plants by road or rail.

8.2.1 Trapping at water points

Feral horses can be trapped as they come to drink by permanent or portable yards erected around a watering point. A one way bayonet (or spear) gate is common, or landholders can wait in hiding to close gates as horses enter the yards. In the drier regions most permanent yards built at bores or dams are primarily to trap cattle.

Trapping at water points

Advantages	Disadvantages
• Money from the sale of captured horses can fund further control • Relatively cheap • Minimal stress to animals compared with mustering • Yards may be left attended if bayonet entrances are used	• Restricted to dry times when there are few places for horses to drink • Disrupted by untimely rainfall • Trapping can take several days • Horses may be injured by fighting or running into fences if impatiently handled

Trapping costs are minimal apart from yard erection or portable yard purchase. With existing yards, trapping costs may be covered by five or ten horses.

Motorbikes are sometimes used with trapping to run approaching horses into yards, but their use is usually unnecessary and of dubious benefit.

8.2.2 *Trapping using feed attractant*

Trapping using feed attractant	
Advantage	**Disadvantage**
• Trap-yard location is independent of water	• Yard feed usually does not attract feral horses

Hay or other palatable forage is often used to catch cattle in portable yards, but it is not practical for large-scale feral horse control, largely because horses may not recognise hay as feed. In extensive pastoral districts, feed alone in yards does not lure feral horses (R. Bryan, CCNT, pers. comm. 1991). Even during drought when natural forage is sparse, water is the prime reason horses visit the yards.

8.2.3 *Automated traps*

Automated traps	
Advantages	**Disadvantage**
• Yards do not have to be continuously guarded • The number of animals trapped can be monitored remotely	• More costly than conventional trap-yards and probably no more effective

Automatically closing mechanical gates have been used to trap cattle and feral horses. One type uses feed to attract animals to enter a wide turnstile gate that is automatically triggered to revolve, pushing the animals into the yard proper. The mechanism is elaborate and expensive compared to conventional or bayonet entrances, and feed is an ineffective attractant to horses.

8.2.4 *Helicopter mustering*

Helicopters are used to cover large areas and variable terrain to muster feral horses into winged yards that are either permanent or portable. Portable yard design depends on personal preference, and most established yards are designed for cattle rather than horses. As many as four helicopters can be used at one time. The area covered also varies widely, from 100 km^2 up to 1000 km^2 in pastoral Australia. Small Robinson helicopters are popular for mustering because of their manoeuvrability. Hire costs are about $260 an hour, including fuel. Ultralight aircraft are relatively cheap to hire (approximately $90 an hour) and could be used with helicopters for mustering (B. Walsh, CCNT, pers. comm. 1991), but they are less manoeuvrable than helicopters, so their effectiveness for mustering feral horses is questionable (Appendix A, R3).

Helicopter mustering	
Advantages	**Disadvantages**
• Money from the sale of captured horses can fund control • Rainfall has less influence on success than it does with trapping • Horses can be driven out of country inaccessible by vehicle • Enables mustering over a wide area • Quick: one day to complete muster, two extra days to erect and dismantle portable yard	• Expensive if horses are not sold • Useful only where the horse numbers are high • Horses that escape learn to avoid helicopters • More stressful on horses than trapping • Risk of helicopter accident • Inexperienced pilots may push horses too fast or too far causing exhaustion, injury or separation of foals from mares

Helicopter mustering is likely to be economic only when horse density is more than 0.3 horses a square kilometre (i.e. about 90 horses within a mustering area of 300 km^2). However, factors such as topography, operator experience and distance from market affect the efficiency and costs of mustering. Generally, about 40 to 50 horses need to be caught to cover the cost of a helicopter mustering operation.

8.2.5 Mustering with helicopter, horses and motorbikes

A helicopter is sometimes used to bring feral horses out of rough terrain onto flatter, more open country where riders wait on motorbikes. Meanwhile, a group of stock horses, referred to as coacher horses or trainers, is walked out to a suitable flat area. The motorbikes are used to run the feral horses towards the coacher mob until the feral and coacher horses are 'boxed' together. The coacher horses have a calming influence on the feral horses, which become easier to control. The whole mob is walked to yards where the coachers are drafted off.

Helicopters are unnecessary where the terrain can be covered adequately on motorbike. Other combinations with coacher horses include helicopters and motorbikes, or motorbikes alone.

Mustering with helicopter, coacher horses and motorbikes	
Advantages	**Disadvantages**
• Money from the sale of captured horses can fund further control • Suitable for flat, open country when trapping is not possible • Cheaper than helicopter mustering alone • Coachers calm mob, which results in less injury, exhaustion or separation of foals from mares	• Requires skilled motorbike riders • High injury risk to riders • Only small areas can be mustered. Large areas need repeated treatment • Opposition from animal welfare groups to transport and slaughter

8.2.6 Mustering on horseback and brumby running

Mustering on horseback and brumby running	
Advantages	**Disadvantages**
• Money from the sale of captured horses can fund further control • Low financial risk • Mounted riders can traverse rough terrain	• Few riders with necessary skills • Takes few animals • Running of feral horses in fragile and broken country can damage the environment and feral horses may be injured or foals separated from mares

Skilled horse riders are used to pursue and direct feral horses into winged yards. Horseback musters are uncommon, because there are few capable riders and capture success is low. Roping feral horses from horseback is called brumby running and occurs mainly in the southern highlands of New South Wales and Victoria.

8.2.7 Lure mares

Lure mares	
Advantage	**Disadvantages**
• Low-cost method	• Useful only for small areas • Few animals can be taken

Tame mares can be used to lure feral stallions that then are more easily captured or shot (proposed Barmah Management Plan 1990). Lure mares attract horses only from the immediate area, and large-scale control is not possible, but the method can supplement other techniques. Costs are small but the method is useful only for intensive treatment of small areas when the feral horse population is low.

8.3 Manipulating distribution

8.3.1 Fencing-off watering points

Specific watering points such as dams can be fenced to prevent feral horse damage to high-use areas. Strategic fencing can also be used to improve trapping success by limiting watering points and forcing horses to drink where they can be trapped. If there is only one other watering place, it should not be fenced or horses will perish.

Solar-powered electric fences have been used in the Alice Springs district to fence off natural waterholes in difficult terrain. Electric fences are light, relatively cheap and quick to construct (Appendix A, R2).

Fencing-off watering points	
Advantages	**Disadvantages**
• Increases trapping success • Trapping is possible in areas that have many water points • Can assist cattle management • Useful to manage feral horse damage on country surrounding the water • Most wildlife can cross horse and cattle fences	• Fences need to be inspected regularly • Impractical where domestic stock need access to the water to be fenced • Feral horses at risk from lack of water if there are few alternative watering points

8.3.2 Exclusion fencing

Exclusion fencing	
Advantages	**Disadvantages**
• Provides long-term results • Can have other benefits such as improved cattle management	• Conventional fencing is difficult in rugged terrain • Costly — approximately $800 a km (Territory Pastoral Services) • Fences usually require regular inspection • Risk that a new fence may prevent horses from watering

'Strategic fencing can improve trapping success.'

Strategically placed fences can direct feral horses into areas where they are more easily controlled, and exclude horses from valued resources. For example, by using exclusion fencing in combination with other methods, it is possible to reduce horse density in an easily treated area. Animals in other areas where they are difficult to control, such as hill country, are then allowed to enter the more easily treated area. Alternatively, preparing newly fenced areas for cattle often encourages pastoralists to remove the feral horses first. Standard post-and-wire stock fences are generally used.

'Shooting from helicopters is the only practical method for quick, large-scale and humane culling of large animal pests in inaccessible areas.'

8.4 Shooting

8.4.1 Helicopter shooting

Helicopter shooting	
Advantages	**Disadvantages**
• Quickly reduces feral horse numbers in areas where they cannot be mustered or trapped • No yards or trucks are necessary • Wounded animals can be followed-up quickly and killed	• Costly, and shot horses cannot be marketed • Must use trained shooters • There is both national and international concern with large-scale shooting, especially from animal welfare groups • Inexperienced shooters may wound horses

Shooting from helicopters is the only practical method for quick, large-scale and humane culling of large animals in inaccessible locations (SSCAW 1991a). Shooters can get close to the target animal, and any wounded animals can be followed-up quickly and killed. (Appendix A, R4)

Helicopter shooting costs about $10 a horse based on the average cost of reducing feral horse density from one horse a square kilometre to 0.3 horses a square kilometre. At densities lower than 0.3 horses a square kilometre, the cost may be more than $70 a horse.

Shooting from helicopters should be conducted by experienced government shooters or certified private individuals adhering to strict operational guidelines (SSCAW 1991a; Appendix A, R4).

8.4.2 Ground shooting

Feral horses are commonly shot from the ground. The stallion is generally shot first, which confuses the remaining horses, slows their retreat and increases the chances of taking them. Ground shooting is often used alone, although it is sometimes used to remove horses that cannot be mustered or trapped. Ground shooting is usually opportunistic, but where used concertedly and with other methods, it can lead to local eradication (Section 9.3.2).

Ground shooting is generally effective only on fairly flat and readily accessible

Ground shooting	
Advantages	**Disadvantages**
• Relatively cheap • Yards or traps are not necessary • Can be combined with pet-meating where this is permitted • Can supplement harvesting and mustering	• Difficult to pursue wounded animals in rough country • Shooting can disperse remaining animals before they can be shot • Not suitable for large-scale control or in rugged country

country. It is impractical when water is abundant, and in rugged country. It is not suitable for large-scale control. Wounded animals are often difficult to pursue, especially in rough country. Occasional ground shooting may teach horses to avoid certain areas, making overall control difficult.

Ground shooting effectiveness can be improved by stationing shooters at working points.

Droughts are an opportune time to remove horses which cannot be mustered by ground shooting. Shooting during drought also reduces the number of horses that would otherwise die slowly of hunger or thirst (Appendix A, R5).

8.4.3 Pet-meat shooters

Pet-meat shooters	
Advantages	**Disadvantages**
• Feral horses are not shot to waste • Conducted by professional pet-meat shooters at little or no cost to the landholder • Professional shooters are usually proficient and cause little suffering to horses. Legislation requiring accreditation and registration of operators could be used to control practices and quality of shooters	• Pet-meat shooters prefer areas of highest feral horse density, and where access is easy • Pet-meaters do not aim to control feral horse damage • Only larger animals are removed • Restricted to accessible country • Operations are restricted by the availability of shooters which is often unpredictable, making it difficult to incorporate shooters into a management program

Field slaughtering of feral horses for pet meat is currently permitted only in Western Australia and northern Northern Territory. Pastoralists generally encourage pet-meat shooters, who require landholder permission to operate. Horses are shot using large-calibre (.308/7.62mm) rifles and are usually hunted along with other animals such as camels, buffalo, donkeys and kangaroos. Shot horses are either boned on the spot or quartered and boned at processing plants. Field-shot meat is placed in portable chillers and transported to processing plants for packing and sale.

Approximately 8000 feral horses were shot in the Northern Territory for pet meat in 1984 (Bowman 1987a), but only about 1900 were shot in 1989. Field slaughter of feral horses for pet meat was prohibited south of Tenant Creek in 1984 following the deaths of dogs in Alice Springs from eating horsemeat affected by Birdsville disease. The number of horses shot in Western Australia is unknown.

'Smart bounties' could encourage the shooting of feral horses for pet meat in areas where it is currently unprofitable as a result of low horse density or high transport costs. Smart bounties are payments for a specified outcome, specified area and limited time. For example, pastoralists may subsidise pet-meat shooters or commercial harvesters so that it is profitable for the commercial operators to harvest on the pastoralist's property. The potential for this system to aid pest animal management needs further investigation.

8.4.4 Darting and lethal injection

Darting and lethal injection	
Advantage	**Disadvantages**
• Seen as more humane than most other lethal techniques	• Very costly • Labour intensive • Requires veterinary supervision • Horses must be approached closely for effective darting • Dart delivery of drugs can cause injury

Darting can be used to cull a small population discreetly, provided the horses are easy to locate and approach. It is useful where conventional firearms cannot be used because of the threat to the public. A low-charge dart containing tranquilliser is injected intramuscularly to immobilise approachable horses, which are then killed quickly with a lethal intravenous injection of barbiturate such as Valabarb (Pollitt 1990). It is unsuitable for broadscale control.

8.5 Non-lethal options

8.5.1 Herd relocation

Feral horses may be captured, transported and released in another area where they can more readily be managed. This removes them from a problem area without the need for culling. However, it is expensive. Horses have to be amenable to live capture, and suitable areas for relocation where they will not cause unacceptable damage need to be available. Some feral horses at Bonrook Sanctuary in northern Northern Territory were obtained this way. Similarly, feral horses in Coffin Bay National Park (South Australia) may be relocated outside the park on nearby grazing land where they can be more easily managed (G. Saunders, DELM, pers. comm. 1991). Herd relocation has very limited use. It is unsuitable for wide-scale control. The relocated herd must still be managed to control damage. Horse sanctuaries are one form of herd relocation. Here, the intention is to maintain the feral horse population, and this affords long-term horse welfare provided subsequent management is adequate.

Herd Relocation	
Advantages	**Disadvantages**
• Enables retention of particular feral horse herd, for example, Coffin Bay horses • Favoured by groups opposed to lethal control • Has a limited tourism potential	• Expensive to capture and maintain animals • Relocated population still needs to be managed • Limited application • Suitable relocation sites must be available • Horses may suffer during capture and transport

8.5.2 *Fertility control*

Fertility control	
Advantage	**Disadvantages**
• Potentially humane, non-lethal method of stabilising the feral horse population	• Not practicable for large-scale control where horses are widely dispersed and difficult to approach • No long-acting or permanent drug is presently available. Annual treatment needed • Currently no effective means for delivering a suitable drug • Horses are long lived. Would give no immediate reduction in feral horse damage • Dart-delivery of drugs can cause injury and destabilise feral horse social structure

'Non-lethal control options such as fertility control, feral horse reserves and tourist herds are not practicable for wide-scale control.'

Some animal welfare groups favour fertility control as a humane means of stabilising feral horse populations. It is appealing, but currently there is no technique for wide-scale, cost effective administration of contraceptives to feral horse populations (Berman and Dobbie 1990). It also cannot provide immediate relief from feral horse damage. Horses are long-lived, and any benefits limiting population growth through fertility control would not be achieved for several years (Bomford 1990). Hone (1992) also shows theoretically that biological compensatory mechanisms may reduce the effectiveness of fertility control.

Bomford (1990) estimated that it would cost $20 a horse a year to treat with anti-fertility agents 1000 horses within a fenced area. The costs would be considerably higher for a widely dispersed wild population. In contrast, the cost of reducing the population by conventional shooting was estimated to be between $5 and $13 a head, with no recurring cost and the frequency of follow-up shoots dependent on the growth rate.

Provided current problems can be overcome, fertility control may be useful for stabilising a feral horse population which has first been reduced by some other form of control. Garrott (1991) suggested that horse removal operations would still be needed in conjunction with a fertility control program in order to stabilise a feral horse population with an annual growth rate of 15% or more. Thus fertility control would not necessarily replace conventional control methods. Kirkpatrick et al. (1990) reduced the birthrate in a small number of partially tame and approachable feral horses on a small island off the US coast. Zoos around the world use fertility control to prevent overcrowding in pens.

It is concluded that chemical sterilisation of Australia's feral horses is not now feasible, because of the large number of horses to be treated and the difficulties in administering a suitable

drug, if it were available, to the widely distributed feral horse population that often occurs in inaccessible country (Appendix A, R8).

Some groups have suggested that the reproductive capacity of feral herds could be reduced by sterilising dominant males through capture and castration. It is unlikely to be successful. Dominant stallions retain their harems for only about three years, generally being replaced by a bachelor male (Berger 1986). Displaying oestrus mares that are not fertilised by the dominant male are likely to be mounted by subordinate males within the same group, or by outsiders. Young females exhibiting first oestrus are often ignored by the dominant stallion but mounted by subordinate males before leaving the harem group. Bomford (1990) concluded that the use of sterilised males was unlikely to limit population size effectively.

8.5.3 Feral horse reserves

Feral horse reserves	
Advantages	**Disadvantages**
• Useful to protect special herds • Enable visitors to view feral horses closely • Useful to test applicability of fertility control techniques	• Expensive • Ongoing management is necessary • Limited applicability

The use of feral horse reserves is really a management option rather than a control technique. A wild horse sanctuary opened at Bonrook Station, about 200 kilometres south of Darwin, in 1988 (Schulz 1990). It is Australia's only feral horse reserve. Bonrook is managed by the Franz Weber Foundation, an international animal welfare organisation, and funded largely by donations from Europe (Schulz 1989). The Northern Territory Government approved the sanctuary on condition that all boundaries were securely fenced and other feral stock removed. A brumby can be sponsored for $100 a year or a Waler for $1000 a year, in return for a photo and reports on the horse's condition. About 200 horses are held within internal fencing on the lease. Until boundary fencing is completed, an unknown number of other horses use country on and adjoining Bonrook. It is planned to carry up to 1200 horses on the 600 km^2 property (Schulz 1990). In order to stabilise the horse population on the lease, development of a birth-control program has been proposed, where 80% of the herd is darted with a contraceptive automatically each year during the dry season when horses enter a water trap-yard to drink (Schulz 1990). The success of this program will be a useful gauge of the wider applicability of fertility control for feral horses.

A wild horse reserve ensures the local protection of a feral herd and enables visitors to closely observe feral horses. However, given the close management, it is debatable whether the horses can be considered to be feral.

Horse reserves are a limited management option and are not suitable for widespread control.

8.5.4 Tourist herds

Tourist herds	
Advantage	**Disadvantages**
• Utilises the feral horse population	• Costly • Ongoing management is necessary • Limited applicability

The maintenance of herds for tourism is also a management option rather than a control technique. Maintenance of feral horse herds has been proposed for several national parks to satisfy tourist expectations. The establishment of 'camera herds' of Timor ponies, banteng (South-East Asian wild oxen), buffalo, and possibly deer is seen as a potential source of income for some Aboriginal groups (Gurig National Park Plan of Management 1987). The establishment of camera herds on Cobourg Peninsular was first proposed by Letts et al. (1979). The Timor ponies in that area are presently left undisturbed (E. Baird, pers. comm.)

The retention or removal of about 25 feral horses in Coffin Bay National Park is being investigated.

8.5.5 Adoption schemes

There is no feral horse adoption scheme in Australia. The United States introduced 'Adopt a mustang' and 'Adopt a burro' programs in an attempt to dispose of surplus feral horses and donkeys following their lawful protection in 1971. The demand for adoption was inadequate to cover all surplus stock, resulting in many feral horses remaining in feedlots at taxpayer expense (Arnold 1986). They are not a suitable management option for Australia as the demand would be even lower than for the United States, and Australia has several times more feral horses.

Adoption schemes	
Advantage	**Disadvantages**
• Non-lethal means of disposing of some unwanted horses	• Expensive • Low demand for adoption • Suffering can occur during capture and transport

PART FIVE

STRATEGIC FERAL HORSE MANAGEMENT

9. Managing Damage

Section summary

Managers must first assess the relative impact of feral horses compared to other factors affecting production and environmental outcomes. Once the decision to address feral horse damage is taken, the next steps in controlling damage are to define the problems associated with feral horses, measure the severity of their impact and determine their distribution and density. The aim of the program must be stated, for example: reduction to 0.1 horses a square kilometre, and a strategy developed. The methods of control, and the places and times to use them, must be determined.

The most cost-effective operations with the least financial risk, such as trapping on flats, are conducted first so that they can provide funds for more risky or expensive operations such as helicopter mustering in hills or shooting.

During the control program the manager must continually assess the success of each step with a more thorough assessment at the end of the program. The number of horses remaining after the process should be compared with the number before the program began. This performance monitoring provides incentive to continue or allows modification of the strategy if necessary.

In areas where there is a market for feral horses, a properly planned strategy should enable control of feral horse damage at negligible costs to the landholder. In some areas, landholders may wish to harvest feral horses in a suitable way. Here the overall damage caused by feral horses and other grazers must be managed to protect the rangeland. Potential conflict with other land managers and interest groups, notably animal welfare organisations, will need to be addressed by landholders contemplating managing feral horses for sustained harvest.

9.1 Introduction

Effective management of feral horse damage requires thorough preparation to develop a long-term plan that can be incorporated into a landholder's yearly program. No single method is likely to provide effective damage control; a combination of methods will probably be needed. This section describes the process for planning and implementing control, using a theoretical example from central Australia.

9.2 Assessing impact

'Managers must first assess the relative impact of feral horses compared to other factors.'

A manager should first determine the severity of feral horse damage (Sections 4, 5, and 10.2) and compare it to other factors influencing the desired production or conservation outcome. Factors such as other pests (e.g. rabbits or kangaroos), the quality of livestock and the distribution of water points may have as great or greater an impact on production. Where practical, these other factors must be assessed, and where necessary addressed along with feral horse damage, preferably as part of a whole property plan. Whole property planning emphasises the integrated approach to land management, an approach endorsed as part of the Ecologically Sustainable Development process and also under Landcare and the National Drought Policy. Most States and Territories have developed, or are developing, relevant legislation to encour-

'Whole property planning emphasises an integrated approach to land management.'

age whole system land management. Examples are the South Australian *Pastoral Land Management Act 1989* and the Northern Territory *Pastoral Land Act 1992*. Property plans are negotiated cooperatively between relevant government agencies and landholders.

Feral horse damage to the environment and to cattle production is extremely difficult to quantify, making it difficult to determine the level of control needed.

Ideally, large-scale and long-term intervention experiments are required to quantify damage. Here, feral horse density is varied and responses in desired production and rangeland variables are monitored. The studies need to be large-scale in order to smooth out the influence of factors such as the patchiness of the land and local rainfall variations, which can have profound influences on a small scale. Studies need to be long-term because a series of dry years may prevent the results of reducing feral horse damage becoming evident until climatic conditions are favourable again. However, large-scale experiments with non-treatment control areas are very expensive. In the absence of this information, most managers in feral horse areas accept from observational and other evidence that feral horse damage is significant, especially in the rangelands during and coming out of drought (Sections 4 and 5). Under these circumstances, the best assessment a manager can make is to assume that the level of damage is directly related to feral horse density, and that reducing impact therefore involves reducing their numbers. Inexpensive and effective methods of measuring the severity of feral horse impact are needed. It is advisable to determine the distribution and density of feral horses while assessing their impact (Section 10.3). This information is essential for planning the control strategy and monitoring success.

9.3 Objectives

In most cases, landholders see feral horses as a pest and their primary objective for feral horse control is to remove or reduce the damage to production and the natural environment. Landholders must decide how to control their feral horses, based on the type and level of impact they perceive on their operations and property. Alternatively, some landholders see feral horses as a harvestable resource.

9.3.1 Management options

Depending on the type and degree of impact perceived, a manager may aim to:

- *locally eradicate* horses;
- *reduce* feral horse density to a level where damage is acceptable;
- *maintain* feral horses at relatively high densities;
- *manage a protected herd* (for example, Bonrook Station);
- *do nothing*.

Except for the 'do nothing' option, management of feral horse damage will usually require manipulation of the feral horse population.

9.3.2 Levels of control

Three broad control objectives exist.

'While appealing, eradication is rarely achievable.'

Local eradication Eradication is appealing because it offers freedom from damage and ongoing control costs and, once achieved, freedom from any animal cruelty associated with control techniques. However, eradication is rarely achievable. Braysher (1993) outlines criteria that must be met in order to achieve eradication. The primary criterion (*) which must be

met for eradication is that the rate of population increase is negative at all densities. Whether this can be met for a feral horse population can be determined by the five subsidiary criteria.

- *Feral horses must be killed at a rate faster than replacement rate at all densities. This is difficult to achieve because as horse density declines it becomes progressively more difficult and expensive to locate and remove the last few animals.
- Immigration must be zero. This is possible for offshore islands where completely effective barriers can be erected and maintained, or where there are controllable margins such as well-maintained horse-proof fences.
- All individuals in the population must be at risk from the control technique(s) used. If animals become trap-shy or shy of humans, then some individuals may be no longer at risk.
- Feral horses must be able to be monitored at very low densities. If this is not possible, survivors may not be detected.
- The social-political environment must be suitable. For example, if certain groups object strongly to the eradication of feral horses, they can directly thwart or politically influence the program.
- Discounted cost-benefit analysis favours eradication over control. Discount rates are used to estimate the value of future benefits against the costs of actions in current dollars. This criterion is difficult to meet because of the high initial cost of eradication and because benefits accrue over a long period. For example, at a discount rate of 8%, it is unlikely that eradication will be cost-effective. Eradication has a large initial outlay but, if it can be achieved, there are no ongoing costs. For cost-effective eradication, each situation should be assessed to determine whether eradication costs outweigh discounted benefits for the rate selected. However, eradication has been achieved without cost-benefit analysis mainly for the protection of conservation values to which it is difficult to assign a monetary value.

Eradication of pest animals has been achieved only on relatively small islands and for the aquatic rodents, coypu and muskrat, in England, when populations were low and of limited distribution. Even so, it cost approximately $A10 million to eradicate coypu, equivalent to $1000 per animal removed (Gosling 1989).

Where local feral horse eradication is possible, it may best be left as a long-term objective. After an initial reduction in the population to low levels, a manager may wait for a drought or other suitable conditions to achieve local eradication.

High level of control Where damage is great but eradication is not possible or desirable, sustained high level control is necessary to reduce the frequency of repeat application of control methods and the associated suffering. A high level of control will also reduce the likelihood of horses suffering during drought.

Much of the pastoral zone where feral horses occur has highly variable climatic conditions. Extended droughts are common, and at these times feral horses have their greatest environmental impact while competing closely with domestic stock and other herbivores for remaining feed (Sections 4 and 5). During drought, land managers reduce or relocate stock to save their core herd and to protect the land. Outside drought, feral horses may not have a significant economic impact and the need for destocking diminishes. Restricting feral horse control only to drought periods is usually impracticable because of competition with other tasks such as reducing cattle density and because of the lack of financial and other

resources, competition with other drought-affected land managers for musterers and road transport, and the poor price for feral horses as a result of a sudden oversupply. It is therefore recommended that land managers aim to reduce horse density to the level the land can sustain during drought.

'Managers should aim to reduce feral horse density to the level the land can sustain during drought.'

This density has not been determined accurately for central Australia, but observations (Berman 1991) indicate that the feral horse impact is likely to be acceptable at densities of 0.1 horses a square kilometre or less. Additional studies are needed to verify this (Section 12.6). One or more of the techniques detailed in Section 8 can be used to reduce feral horse density to 0.1 horses a square kilometre. Incorporating commercial harvesting enables full cost recovery and may even return a profit (Table 4, Section 9.4.2). In the absence of reliable, quantifiable data, a similar density is recommended for other areas of the arid and semi-arid pastoral lands. At 0.1 horses a square kilometre, horse density will take seven good years to return to 0.3 horses a square kilometre (Berman 1991).

Management area	Method	Cost ($)	Horses removed	Horse remaining	Gross income from sale of horses ($)	Profit/loss ($)
1	Trapping	2000	500	Nil	50 000	+48 000
2	Trapping	2000	500	Nil	50 000	+48 000
3	Trapping	3000	100		10 000	+7000
	Helicopter mustering	2000	130		13 000	+11 000
	Shooting	400	40	30	-400	-400
4	Trapping	3000	50		5000	2000
	Helicopter mustering	3000	100		10 000	7000
	Shooting	800	80	70	800	800
5	Helicopter mustering	8000		200	20 000	+12 000
	Shooting	1000	100	100	-1000	-1000
	TOTAL	**25 200**	**1800**	**200**	**155 800**	**132 800**

Table 4: Estimated costs of controlling the damage caused by 2000 feral horses using a combination of trapping, helicopter mustering and shooting from a helicopter.

Note: The figures used are based on costs and prices for feral horse control in central Australia. Prices and costs may differ elsewhere.

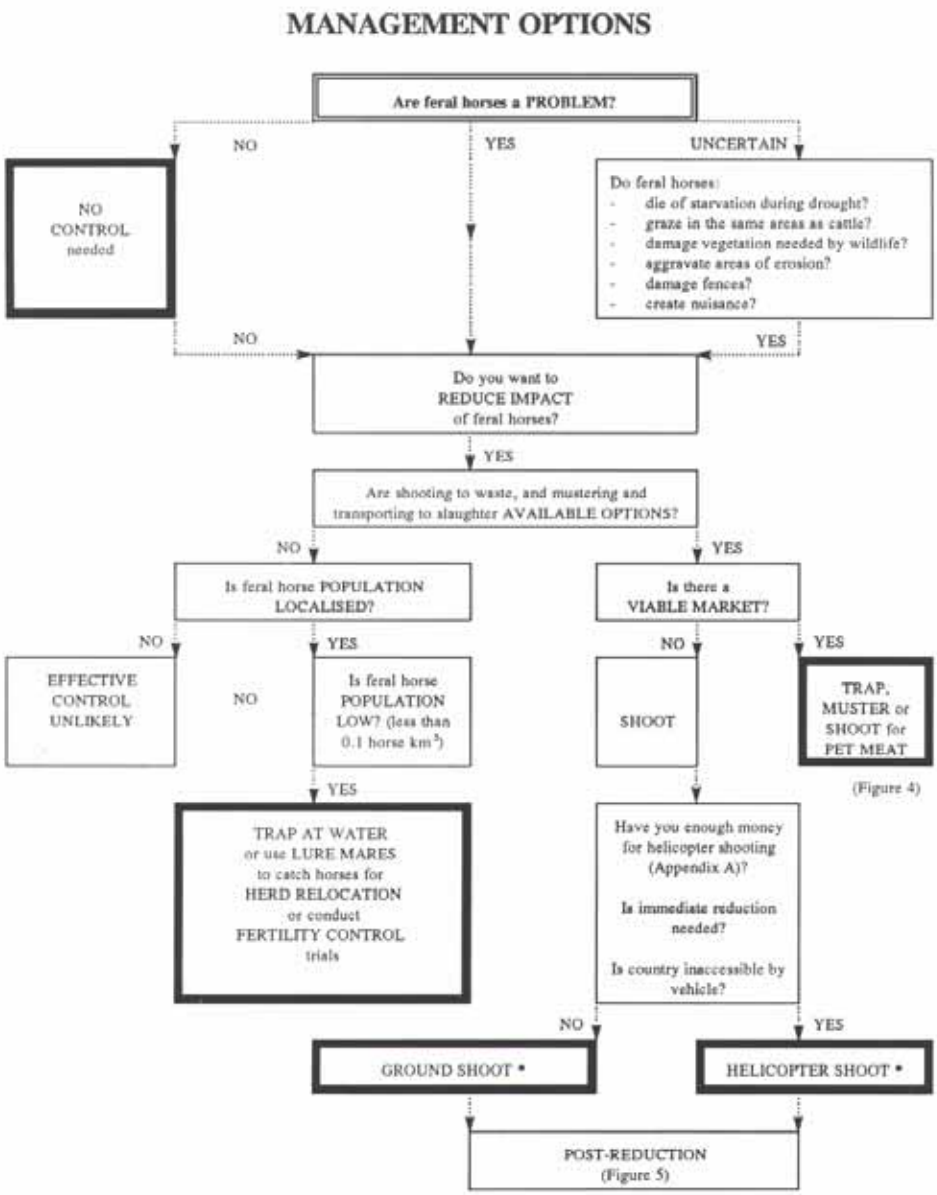


Figure 3: Management options. Flow diagram to assist in the selection of the most appropriate method(s) for feral horse control. Harvesting options are presented in Figure 4. Control options (Section 8) are highlighted.

** Shooting must be done only by qualified, competent shooters, Appendix A, R4.*

Maintaining the desired density requires removal of approximately 30% of the population each year. Control should concentrate on the harem group which contains the breeding females. Adult females comprise 30% of the total population and on average produce one young every second year (Berman 1991). Landholders should take advantage of the concentration of feral horses around water during droughts to maintain the desired density.

Low level of control Where it is uneconomic to use commercial harvesting to achieve the desired horse density, a manager may consider using

HARVESTING OPTIONS

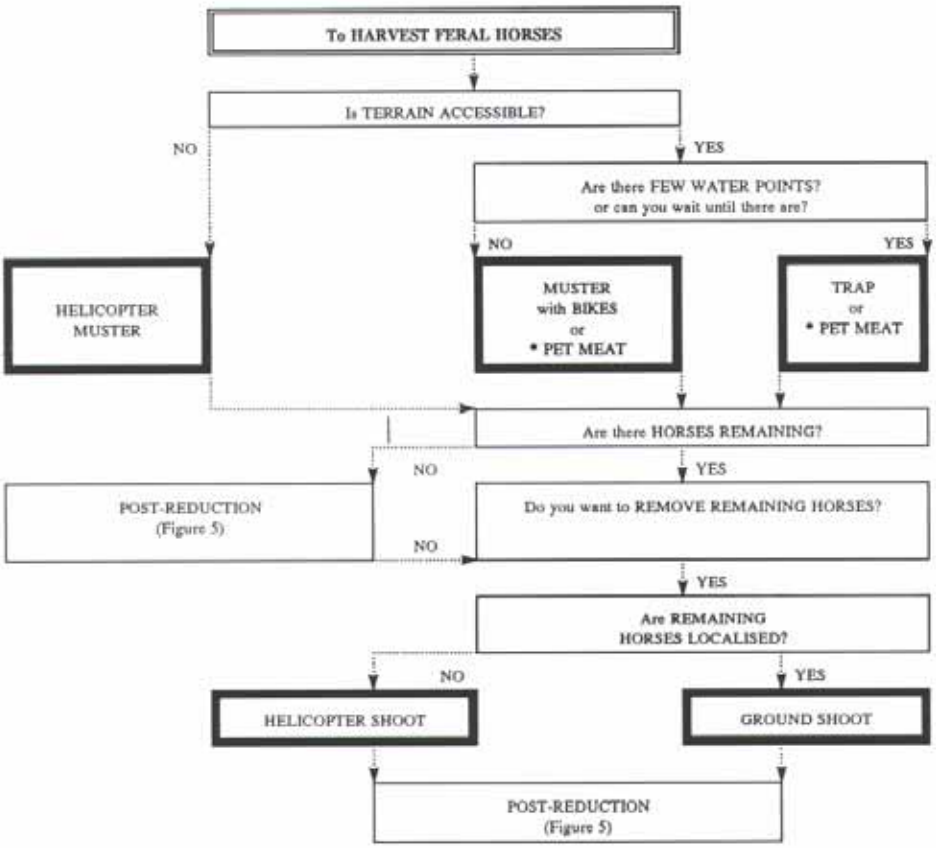


Figure 4: Harvesting options. Flow diagram to assist in the selection of harvesting techniques for feral horse control. Control options (described in Section 8) are highlighted by thick outline.

** Check that State or Territory legislation does not prohibit field-slaughtering of horses for pet meat.*

smart bounties to foster harvesting (Section 8.4.3). However, unless control action is undertaken, the pastoralist can expect that tolerating higher densities will be at the cost of running less stock, especially during droughts. One way of implementing this approach would be in the maintenance of a tourist herd or horse sanctuary. The density of feral horses that a property can support is not known, but long-term maintenance of the population requires annual removal of excess animals or the use of fertility control, provided a successful process can be developed and implemented.

Some landholders may wish to manage feral horses as a harvestable resource (Section 6.5). Groups likely to be most interested in this are the commercial industry based on feral horses, and Aboriginal people. If this option is adopted, the likely grazing damage caused by higher feral horse densities must be balanced by reducing the damage caused by domestic stock and other wild herbivores. Those choosing this option

POST-REDUCTION OPTIONS

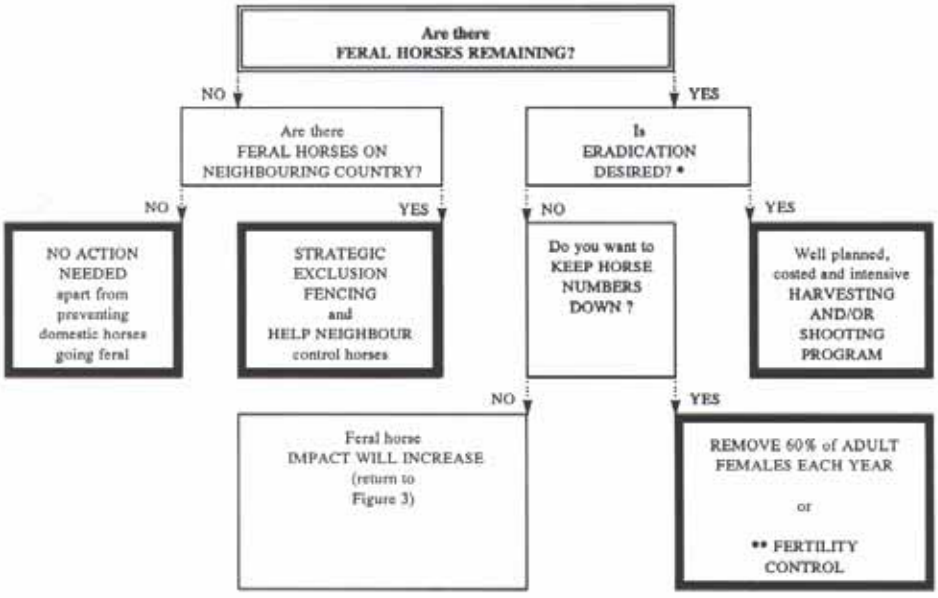


Figure 5: Post-reduction options. Flow diagram to assist in the selection of post-reduction options, following successful reduction of feral horses to a low density. Control methods are highlighted by thick outline.

** To achieve local eradication, a manager must assess whether the necessary criteria can be met (Section 9.4.2) and whether there are suitable climate conditions such as drought.*

*** Fertility control presently is applicable only on small, localised and intensively managed populations.*

5

must also take account of the relative instability of this small industry and the likely influence that animal welfare organisations may have on its long-term viability (Sections 6.3 and 6.5).

9.4 Strategy

After impact has been assessed, density and distribution determined and a control objective chosen, a strategy to achieve that objective can be developed.

9.4.1 Selection of methods

'Best techniques for feral horse control are trapping at water points, helicopter mustering and aerial and ground shooting.'

Control techniques with the widest practical application across Australia and greatest potential for effective control of feral horses are:

- trapping at water points;
- helicopter mustering;
- aerial shooting; and
- ground shooting.

Techniques for trapping feral horses at water, fencing to improve trapping success, and helicopter mustering and shooting have been refined in the course of controlling feral horses in central Australia (Appendix A and Section 8).

Where herd retention or relocation is adopted, trapping, mustering or shooting may be needed to maintain a stable population. Fertility control may be a suitable control option in these situations, provided that the necessary drugs and delivery mechanisms can be developed.

9.4.2 Selecting management options

The three flow diagrams (Figures 3, 4 and 5) help lead managers through the process of choosing the most suitable method for controlling feral horse damage. They are only a guide, but may offer options not normally considered.

Figure 3 contains the first steps that a manager must take before addressing a feral horse problem, and for deciding which management options are most suitable for a particular purpose. Figure 4 contains the steps involved in choosing the most appropriate techniques for control. Figure 5 contains options for managers who wish to maintain feral horses at a low density following initial control.

Management strategies Effective feral horse control relies not only on the selection and application of appropriate techniques but also on the formulation of an overall management strategy. Five broad approaches to feral horse control in central Australia and the likely consequences of each are presented below (Table 5).

Management areas Dividing a property into workable 'management areas' and applying the techniques most suitable to each area enables effort to be concentrated and monitoring of the program to be improved, resulting in more effective control.

The appropriate size of a management area varies according to factors such as seasonal weather conditions, terrain and the size and concentration of the feral horse population in question. Management areas of 300 to 400 km^2 may be most appropriate for semi-arid lands where pastoral stations are large and permanent waterholes sparsely distributed. In northern Australia, where surface water is more common, smaller management areas may be more suitable.

Treating one management area and then moving to the next one in successive two-year periods is likely to be the most effective form of control (Figure 6).

Permanent water points are the foci of distinct feral horse 'management areas' in

much of pastoral Australia. They are generally sparsely distributed throughout semi-arid Australia and are centres of horse dependency during droughts. Management areas in tropical Australia may be less well defined but, again, preferred watering points and feeding locations where horses tend to congregate towards the end of the dry season can be identified and targeted.

9.5 Monitoring and evaluation

9.5.1 Performance criteria

Managers must be able to determine how closely they have met the objective(s) of their control operations. Most landholders do this by visually assessing the number of horses and their impact before and after control. More quantitative techniques

Action	Possible result
• Do nothing.	• Problem remains, may worsen and will be costly in the long term: — loss of cattle production — soil, pasture and wildlife adversely affected — horses will die of starvation, or toxic plants, or thirst during drought.
• Control implemented when numbers are obviously too high, i.e. when the ground is bare and horses die of starvation.	• Provides only periodic relief from impact. Environmental and economic damage continue.
• Shoot as many feral horses as possible.	• Quickly relieves problem, but is costly and will need to be repeated periodically as population builds up again.
• One-off trapping or mustering as many as possible. Shoot what is possible of the remainder.	• Harvesting and sale of horses pays for shooting, but it is difficult to shoot every horse. Horse numbers and damage will increase without follow up control.
• Regular trapping and mustering. Shoot unmusterable horses.	• Harvesting and sale of horses pays for shooting, but again it is very difficult to shoot every horse. A long-term management program is needed to minimise the damage. Requires a long-term commitment. Can pay for itself.

Table 5: Approaches to feral horse control in central Australia, and likely consequences

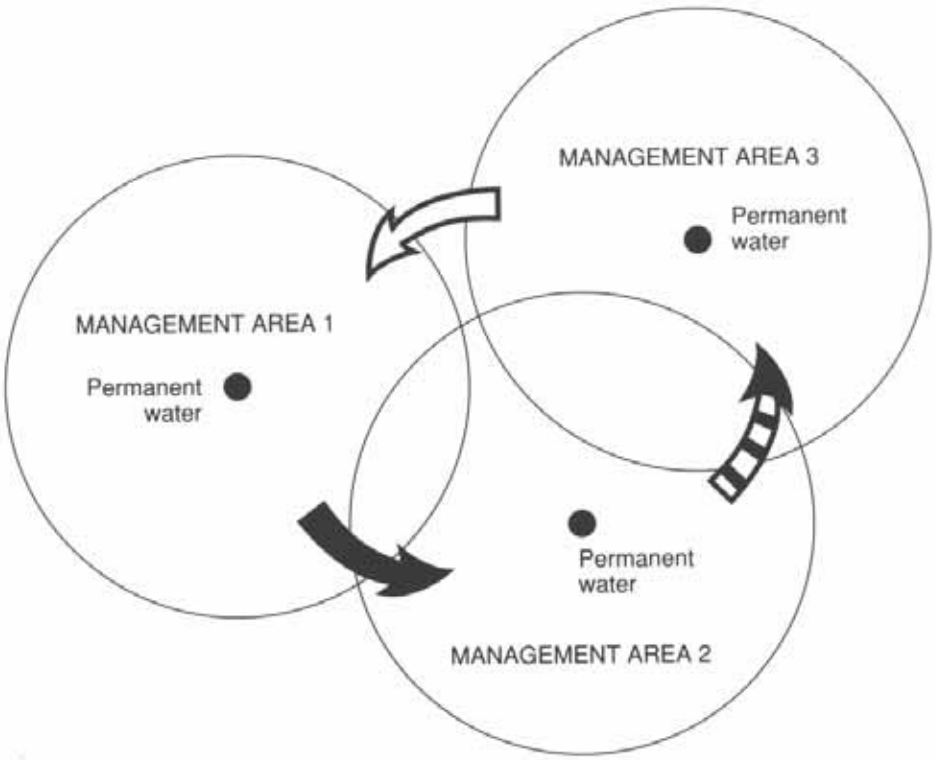


Figure 6: Sequential use of land management units to help manage feral horse damage. Control operations should centre on the areas of most importance for feral horses, moving from one 'management area' to the next in succession. Where surface water is abundant, as in northern Australia, preferred grazing areas may be the centre of management areas instead of the permanent water points in more arid country.

for assessing impact and monitoring the success of control are given in Section 10.

The areas where feral horses occur are subject to environmental extremes, which may mask the benefits of control, at least in non-drought periods. Accurate, scientifically designed monitoring by qualified officers can be very expensive and may take several years, a process which is usually beyond the resources of pastoralists. It is more appropriate for government and/or research agencies to quantify the benefits of feral horse control which pastoralists can then use to guide their management.

In the short term, a manager should determine the extent to which the desired feral horse density is reached instead of attempting to quantify a change in the level of damage. Inexpensive methods for estimating feral horse density that can be integrated into a manager's routine work pattern are needed (Section 10).

9.5.2 Criteria for failure

Failure to meet performance objectives by a specified time is generally indicated by the continued presence of large numbers of horses or their sign, although the use of monitoring techniques (Section 10) helps quantify success.

Major control operations may fail for reasons such as the following:

Helicopter mustering Costs vary considerably in central Australia but 40 or 50 horses need to be caught to recoup costs. If many horses escape being yarded, a repeat muster may be warranted, although factors such as yard location and operator experience should be reviewed.

Trapping Costs for trapping are small. Only five or ten horses need to be caught to make trapping worthwhile. A lower catch probably indicates that the horses are watering elsewhere.

Shooting It is difficult to determine what proportion of the horse population remains after each shoot and therefore difficult to estimate the number of follow-up shoots needed. Horse activity persisting at important places such as waterholes should be assessed. The decline in the number of horses shot in an hour is a reasonable reflection of the decline in density. As the population declines, time needed to locate and kill a horse increases to the stage where it becomes too expensive, although it is difficult to stipulate accurately this point because it depends on the resources available and landholder perceptions. Local eradication may be possible in places such as national parks, but at great cost, whereas shooting horses on a cattle station may become non-viable when fewer than 50 are shot per hour. Recently, only two feral horses were seen and shot in a Northern Territory national park at a cost of $215 a head. In contrast, 277 horses an hour were shot in a 20-kilometre wide buffer zone surrounding the same park, at a cost of about $1.50 a head (R. Bryan, CCNT, pers. comm. 1991).

9.5.3 *Case studies*

A comparison of feral horse management practices on two adjoining cattle stations in central Australia enables a comparison of the costs and benefits of two different approaches. Both leases had a large problem with feral horses, control being most difficult in the large expanse of rugged hill country. Many horses were dying of starvation or toxic plants during drought.

Case 1 One manager chose to shoot 2000 horses from a helicopter. The cost was estimated to be $20 000 ($10 a head), which included helicopter hire, fuel, ammunition and wages. Highly trained and experienced government shooters were employed. It brought immediate relief from the impact of feral horses, although not all feral horses were removed and a remnant population remained. The number of these animals increased, and further shooting was conducted several years after the initial shooting program (costs were not available for the later shoots). Intensive shooting and drought combined to reduce the feral horse population to about 10% of its former size about six years after the first shoot.

Case 2 The manager of the adjoining lease chose to harvest his horses over a six-year period; feral horse impact continued during this time. About 3300 feral horses were caught (2000 trapped and 1300 helicopter-mustered), grossing an income of around $330 000 ($100 a head average price), giving sufficient funds for further control. Both trapping and helicopter mustering were profitable, particularly as trapping costs were small. The feral horse population was reduced to about 10% of its former size, without shooting, over the six years.

Over a similar time span, both stations reduced the impact of feral horses by lowering their horse populations by 90%. Case 1, which solely employed shooting, obtained some immediate relief from feral horse damage, whereas Case 2 had ongoing impact in some areas of the lease for six years after commencing control.

Control in Case 1 probably cost over $20 000, whereas Case 2 probably netted more than $250 000 during control. This income provided Case 2 with funds for appropriate follow-up control and measures for improving feral horse and station management facilities such as permanent trap-yards, more watering points and fencing. The overall outcome in Case 2, which made use of feral horses, was better than that in Case 1.

On both stations the chance of horses suffering during drought is now much reduced. The density is too low for further capture and sale, so regular follow-up shooting by trained marksmen will be necessary to keep the numbers down. Local eradication was not achieved on either station, but the manager of Case 2 learnt much about his feral horses during six years of mustering and trapping. The knowledge gained, plus the funds from the sale of horses, should allow long-term, efficient and humane control.

The benefits of commercial utilisation of feral horses extend beyond the landholder, to helicopter pilots, truck drivers, meat workers and waterside workers. Furthermore, if the meat is exported, then overseas buyers essentially are paying for the solution to Australia's feral horse problem.

9.6 An example of a control strategy

A hypothetical model is used to illustrate how a manager might attempt to control feral horses on a large inland cattle station, typical of a situation where most Australian feral horses occur.

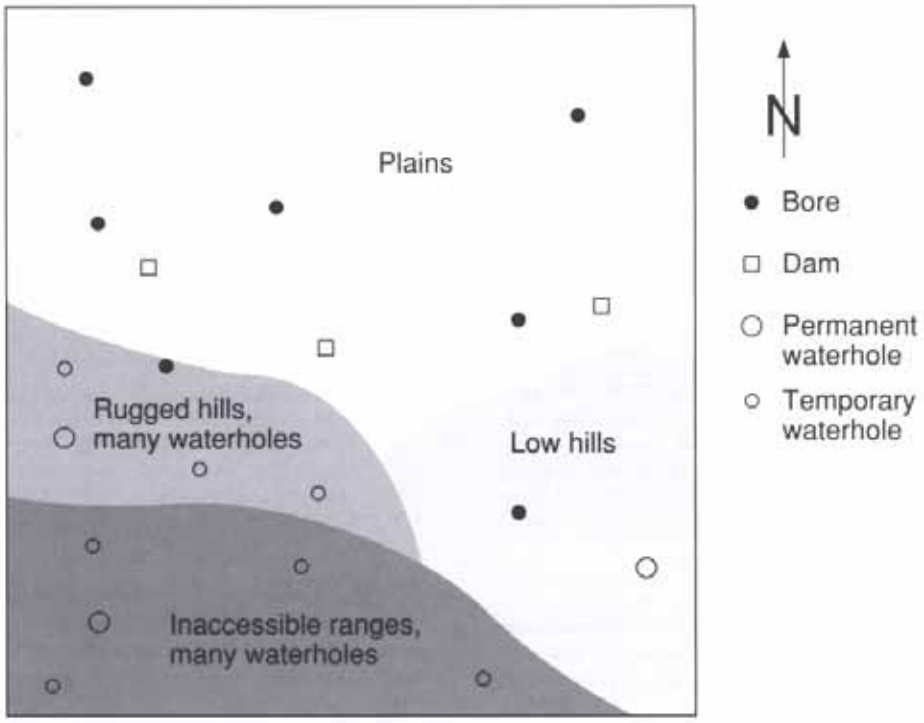


Figure 7: Diagrammatic representation of a property showing the different types of country.

9.6.1 *The property*

In the model, the inland station has two main types of country, plains in the north and hills in the south. There are low hills with few natural waterholes in the south-east, rugged hills with many waterholes in the south-west, and rough and inaccessible range country with many waterholes along the southern boundary (Figure 7). The station is approximately 2000 km^2 and carries about 6000 cattle.

9.6.2 *The problem*

Feral horses on the station are perceived to be reducing cattle productivity and damaging the land. They threaten the manager's aim to maximise profit in a way that is consistent with long-term sustainable use of the land.

9.6.3 *Determining an overall strategy*

1. The manager first determines the distribution and density of feral horses on the property. Aerial inspections, bore runs and past mustering experience indicate that there are about three times as many cattle as horses on the property, therefore about 2000 feral horses are distributed on both hill and flat country.
2. The manager then determines the objective of feral horse control. Although unable to quantify the extent of damage, the manager assumes that the level of damage is directly related to horse density and wants to remove all horses if practicable, or at least reduce the population by 90%.
3. Next, the manager determines the most suitable control options (Figure 3). One method of control or a combination of methods might be needed to achieve effective overall control.
4. Finally, the manager devises the strategy and implements control.

The property is divided into five management areas of about 300–400 km^2 each. The manager decides to catch and sell horses to offset the control costs, and to concentrate on one management area for one or two years, depending on the success rate, before moving to the next management area. Effective control of feral horse damage requires a long-term plan and on-going maintenance action.

Trapping Trapping is the most cost-efficient method of harvesting horses and is the first method tried. The manager decides to trap in the flat country first because costs are low and the chance of success is high. Trapping at established yards involves a small outlay; the flat country has fewer natural waterholes than the hill country, so most horses water at bores for much of the year and the sale of captured horses could help pay for control operations in more difficult areas of the lease.

The manager temporarily fences other dams or waterholes to force the horses to drink where they can be trapped, then attempts trapping in the accessible hill country where there are bores. Important waterholes are fenced to help move feral horses onto the bores that are to be trapped.

Mustering The manager uses helicopters to muster areas that are difficult to trap because of terrain or season. Mustering is usually the second choice after trapping because it involves greater financial outlay. However, it is a valuable method of control and can be both effective and profitable. It is essential to have experienced pilots and ground crew. Income from mustering can be used to pay for follow-up shooting of unmusterable horses.

Shooting The manager uses helicopter shooting to remove feral horses that cannot be captured. Sales from

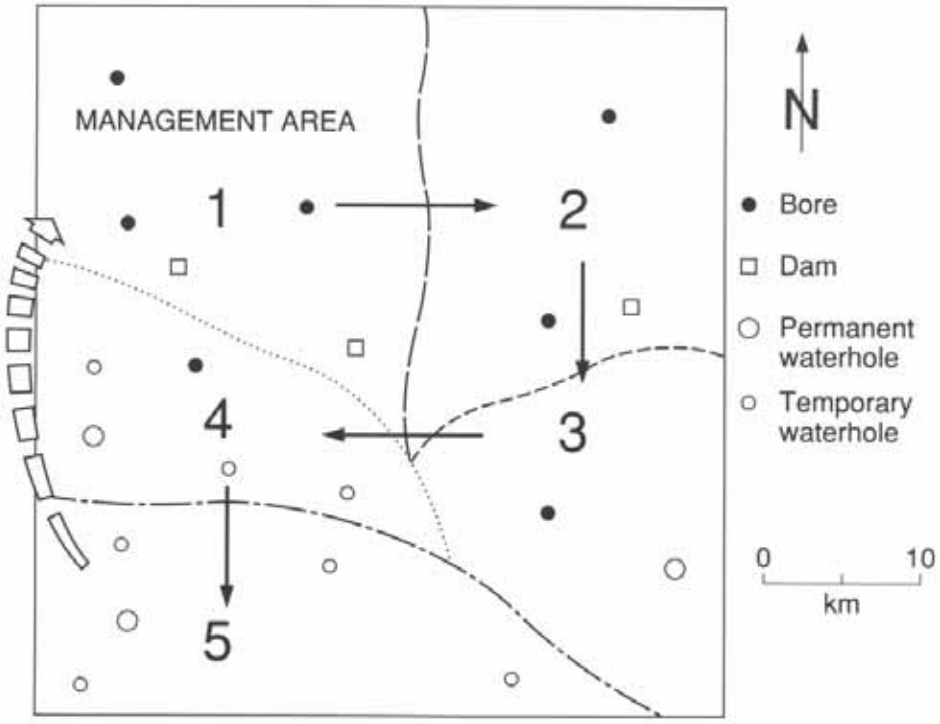


Figure 8: An example of the sequential application of control efforts. Each management area is 400 km² or less.

captured horses can pay for the shooting, which must be done by qualified, competent shooters abiding by the CCNT procedure (Appendix A, R4).

5. When the control program is complete, the manager determines the distribution and density of remaining feral horses on the property to assess the success of control and help plan future action.

9.6.4 *Implementing the control program*

1. The manager traps feral horses at bores in one area of the flat country (Figure 8 Management Area 4) when seasonal conditions permit. Any dams or major waterholes that horses are using are temporarily fenced off. Most horses should be forced to the bores where they can be trapped. The size of the remaining horse population in this management area is then estimated.
2. The manager moves to another area of the flat country (Management Area 2) and traps this area in the same manner. Following trapping, the size of its horse population is estimated.
3. The manager moves to the low hilly country (Management Area 3), and attempts trapping at the bore or main waterhole if they are accessible. The waterhole is fenced to improve trapping success at the bore. If many horses remain after trapping, the manager uses helicopters to muster, then shoots any unmusterable horses. The size of the remaining horse population in this management area is estimated.

4. The manager moves to the rough hill country that contains a lot of natural waterholes (Management Area 4). Trapping is done at bores if the rugged terrain prevents trapping at, or access to, the natural watering points. Only the most important waterholes are fenced off to force horses to use the bores. If many horses remain after trapping, the manager uses helicopters to muster, concentrating on the major waterholes in the area. Unmusterable horses are shot, and the size of the remaining horse population in this management area is estimated.
5. The manager moves to the inaccessible range country that contains many waterholes (Management Area 5) and chooses a suitable yard site that trucks can reach and where portable yards can be erected. Mustering is done by helicopter and unmusterable horses are shot. The manager estimates the size of the horse population in this management area.
6. The manager estimates the overall density of the horse population on the property and compares it with the density before control was carried out.
7. Following initial action to remove most horses, ongoing low level action is necessary to remove most adult females each year, amounting to about 30% of the total remaining horse population. The manager concentrates control on harem groups, which contain the breeding mares, and takes advantage of future droughts to ground shoot feral horses at watering points to further reduce the population.
8. The manager returns to the various management areas if feral horses start to reinvade or naturally increase, and repeats control operations.

The cycle is continued, moving from one management area to the next. A long-term plan should keep feral horse numbers down so that they are not a problem and, at the same time, should cover costs (Table 4).

9.6.5 *The outcome*

'Helicopter mustering costs about $30 a head.'

Table 4 shows the cost of controlling 2000 feral horses on the cattle station modelled.

- The feral horse population was reduced to 90% of its former size, reducing feral horse damage to cattle production and environment damage.
- Before the control program commenced there were 6000 cattle and 2000 horses on the property (8000 stock units). Assuming one horse is equivalent to one steer (i.e. 1 stock unit) and that the maximum stocking rate for the station was 8000 stock units, the manager may increase cattle numbers by 2000 to 8000. Alternatively, an increase of 1000 cattle would leave 1000 stock units of pasture for using as a drought reserve or to increase the productivity of the herd. Studies are needed to clarify the relationship between feral horse density and the cost to pastoral production.
- It may take five years or more to achieve this extent of control, partly waiting for suitable seasonal conditions and partly fitting it in with other work. During this time production losses from feral horse impact continue, whereas shooting could reduce impact immediately.
- The cost a head of trapping increased in the hill country where waterholes needed fencing. Trapping costs averaged about $9 a head.
- The cost a head of helicopter mustering increased in the more rugged country. Mustering costs averaged about $30 a head.
- Shooting was conducted from a helicopter at an average cost of about

$10 a head (Table 6 in Appendix A). Shooting became less efficient in the more rugged country.

- Gross income was equal to $100 a head average price after freight, yard fees and agents' commission (Wurst 1987).
- This example assumes that all horses caught were adult or near-adult and therefore saleable. It does not account for foals.
- Control was profitable (about $130 000), producing funds that can be put into continuing control. After reduction, density was about 0.1 horses a square kilometre or a total of 200. The cost of shooting horses at this density is estimated to be $35 a head (Table 6). Therefore, the cost of stopping the population increase would be $2100 a year, made up of the cost of shooting 60 horses (30% of the remaining 200 and any offspring), 60 × $35 = $2100.
- Given the costs of ongoing yearly control and the undesirable animal welfare implications, the manager may investigate the possibility of local eradication of feral horses by fencing and intensive action using the profits from sale of captured horses. To achieve this the necessary criteria must be met (Section 9.3.2).
- Subjective population estimates are nearly always underestimates. Since the assessment of the performance of control operations and the planning of future control are based heavily on estimated horse numbers, managers should consider using scientific aerial surveys to estimate population sizes before and after carrying out their management program.

10. Monitoring Control Programs

Section summary

Ideally, land managers should monitor changes in the degree of damage resulting from feral horses and through manipulation of their density. However, this is difficult and can be very expensive for the arid and semi-arid parts of Australia where feral horses are most common. Factors such as seasonal conditions and changed pastoral management can confound interpretation of results. In addition, reliable and practical indicators of rangeland conditions are not readily available.

Nevertheless, managers should monitor changes in production which result from feral horse management, and use simple techniques such as regular photography of fixed photo-points to assess pasture. For national parks, changes in fauna abundance and vegetation composition should be assessed.

Generally, however, managers will continue to assess the effectiveness of feral horse management by monitoring the change in feral horse density.

Inexpensive, reliable and simple means of quantifying feral horse density in an area before and after control are needed. Methods must be acceptable to most landholders or they will not be used. Transect counts of horse dung offer promise. In addition, scientifically designed aerial surveys could be made more attractive to individual landholders if government agencies could show their accuracy and if survey teams, either government or private, were more readily available.

Large-scale management experiments offer hope for better quantification of the relationship between feral horse density and the costs and benefits of control. There are several issues however, that need to be addressed with these experiments. One is the availability of reliable indications of rangeland health.

10.1 Introduction

The effectiveness of a control program should be monitored as part of all management plans. Program outcome is evaluated against the stated objectives (Section 9). A manager should quantify damage or be able to determine when horses are no longer causing unacceptable damage. Damage is difficult to quantify, but attempts to do so should be made both before and after any control program.

This section outlines some methods for monitoring damage. Most require considerable time and scientific expertise. Help can be sought from government agencies through regional officers. Ideally, government research organisations will quantify the relationship between feral horse density and production and/or environmental damage. Land managers can then use feral horse density, which is more easily measured, in order to assess damage for their region.

In the absence of quantified impact, landholders usually express objectives for feral horse control in terms of the proportion of the population to be removed or the density desired after control. This requires methods for assessing feral horse density before and after control.

Techniques for estimating feral horse density and damage are briefly outlined below. Their application today is probably limited to areas such as national parks where there are sufficient resources and expertise.

10.2 Local monitoring (damage)

The major driving force behind changes in pasture, wildlife and cattle production in the rangelands is rainfall. Rain-induced changes tend to confound attempts to monitor feral horse damage.

Cattle production may be best monitored by recording branding percentages before and after feral horse control. Mortality rates, weight gains or visual estimation of body condition may also be measured. At the very least, managers can record the number of calves branded before and after horse control, although a more accurate assessment is to record the proportion of calves to cows once a year for several years before and after feral horse control. Alternatively, a manager may set up a property management experiment by reducing feral horse density to different levels in different paddocks and monitoring cattle production in each paddock. Again, monitoring should be conducted for several years before starting horse control, to identify other cattle production factors specific to different parts of the property. Most managers would require scientific advice to design such experiments and interpret the results. Such a study could be set up with government assistance by local Landcare or other community groups. It should be scientifically designed, large-scale and, if possible, replicated.

Wildlife abundance can be monitored along property roads and fencelines using line-transect methods or by counts of dung or tracks. Small mammals and reptiles are best sampled using Elliott and pit traps. Considerable scientific expertise is needed for transect and site selection, species identification and data analysis.

Vegetation monitoring to detect rangeland degradation is conducted by the range management sections of government agencies. Methods may vary with the State and Territory but usually require good botanical knowledge. The interpretation of results is often based on complex statistical analysis.

Photographing vegetation at fixed points and estimating the percentage cover or the proportion of desirable and undesirable species for each season are methods suitable for most managers.

Soil erosion can be assessed by measuring the proportion of area affected by actively eroding gullies. This can be estimated by walking across a paddock counting the number of times footsteps fall on actively eroding areas and on uneroded areas. However, even the most experienced operator has difficulty measuring the extent of erosion and monitoring changes, let alone attributing the changes in erosion to changes in feral horse density.

10.3 Local monitoring (density)

Feral horse abundance can be measured in three ways: as the total number of animals in a population, as the number of animals per unit area (absolute density) and as the density of one population relative to that of another (relative density) (Caughley 1977). Population size and absolute estimate of abundance are difficult to obtain and often inaccurate. Indices of relative density are usually sufficient, although they apply only to comparative studies between similar areas and over time.

Aerial inspection (as distinct from scientific aerial survey) is the most common means of assessing the effectiveness of control operations. This requires recording how many feral horses are removed and then, by aerial inspection, gauging how many remain. Observing the change in horse activity at watering points can also assist. These methods are subjective and therefore prone to error, but are quick, easy and

readily acceptable to most landholders. Experienced observers can learn a lot from aerial inspections, sufficient to determine the next appropriate form of action. Means of making these qualitative inspections more quantitative need to be developed.

Scientifically designed aerial surveys are generally considered too expensive for use by individual landholders, although they are advisable for areas such as national parks where funding and expertise allow. They are perhaps the most objective way to estimate feral horse densities on large properties (more than 1500 km^2), although managers will need to be convinced about the benefits of spending $2000 to $10 000 on a survey before they will consider it. Costs vary according to the distance the aircraft must travel to the property, the size of the property, and the intensity of the survey. A high-winged aircraft with a radar altimeter is usually used. Experienced observers are required, the survey must be properly designed, and the data analysed and interpreted by a suitably experienced scientist. The value and applicability of various aerial survey techniques are discussed by Pollock and Kendall (1987).

Dung counts can be used as an index of relative density. They provide a more reliable indication of animal density than either visual or track counts (Seber 1982). Changes in dung counts can be used to determine changes in animal density. In areas where decomposition of dung varies considerably, for example in the wet and dry conditions of northern Australia, the influence of variable decomposition rate on dung counts will need to be assessed.

Estimates of horse population density can be calculated if defecation rates and horse social group composition are known. Defecation rate can be determined using the following formula (Dyring 1990):

$$\text{Mean daily defecation rate} = \frac{(M \times 6)+(S \times 20)+(F \times 8)}{N}$$

where M = mean number of mares per group, S = mean number of stallions per group, F = mean number of foals per group, and N = total mean group size.

The density of units of dung can be calculated using the following formula from Overton and Davis (1969):

$$t = \frac{1}{na_1} \sum y$$

where t = dung count index, $\sum y$ = sum of groups of dung in all plots, n, each with an area of a^1. Dividing t by the defecation rate gives the number of 'horse days' utilisation.

The density of horses per day is then derived by dividing the defecation rate by the number of days in the sampling period.

The applicability of the dung count method needs to be tested and may need to be modified for different regions, but it is a potentially useful tool if properly described in regional extension manuals.

Mark-release-recapture methods can be used to estimate population size although these are labour-intensive and have several limitations (Caughley 1977). Natural markings and characteristics of horses may be useful to identify individual animals and assess the percentage they represent of the total population before and after control.

10.4 Regional surveillance

Relevant government agencies can readily assess the intensity and obtain an indication of the relative effectiveness of various control methods by recording the costs and methods used and number of horses taken for various regions. This information would also be useful to indicate trends in feral horse density on a local, regional and State scale. Information

collected would be an integral component of any State or Territory pest management information system aimed at cost-effective management at local, regional and national levels (Fordham 1991).

Scientific aerial surveys can provide population estimates over extensive areas. Repeat surveys, about every four years, of major areas of suitable horse habitat would help to indicate the regional effectiveness of control operations. This would require government financial assistance. Populations of other large animals such as donkeys, cattle and camels could also be monitored.

Landholder questionnaire surveys by regional government field officers could provide regional indices of the degree of feral horse control undertaken and provide a landholder perspective on the degree of feral horse damage. These surveys could also incorporate information about other feral animals. Formal questionnaires tend to be unpopular with landholders, and the information obtained is subjective, which makes strict comparisons over time or between different regions difficult. A nationally consistent questionnaire is desirable if such surveys are to be used.

Local or regional fluctuations in cattle production may be more indicative of changed seasonal conditions and management practices than the effectiveness of feral horse control. Similarly, it is difficult to attribute changes in wildlife abundance, pasture composition or soil erosion solely to the effectiveness of feral horse control.

10.5 Large-scale management experiments

Walters and Holling (1990) advocate the use of scientifically designed, broadscale experiments in which hypotheses are field-tested. This requires cooperation between scientists and land managers. For example, ten properties may be randomly assigned varying feral horse densities that must be maintained for a certain period while cattle production and the costs of feral horse control are monitored. In this way the most cost-effective feral horse density can be determined. Long-term experiments such as this may be necessary to adequately test management options. Before such studies are carried out several issues need to be addressed:

- persuading a manager to maintain a high feral horse density while economic damage and land degradation occur. Some compensation from government, or subsidies from other landholders may be necessary;
- the most practical ways of assessing the effectiveness of feral horse control are subjective and therefore prone to substantial error. Reliable indicators of rangeland condition and other benefits of control need to be determined;
- the studies need to be very large to cover the range of several horse populations and pastoral properties. Coordination on this scale may be difficult and expensive;
- each station has a different history of feral horse and cattle densities and management practices, which may make it difficult to find suitable areas for replicated treatments; and
- in arid areas there is tremendous spatial and temporal variation in the amount and timing of rainfall and resulting pasture growth. Therefore studies need to be long-term.

'Reliable indicators of the health of Australia's pastoral lands are needed.'

Much can be learnt simply from recording actual management practices without manipulating them (Case studies in Section 9). Basic information on the strategy used, its success, and its costs and benefits can be obtained.

Comparisons can be drawn between managers who employ different strategies, and could provide some insight into the possible outcomes of different approaches. Field officers and willing landholders could compile relevant information, if necessary on an anonymous basis, so that the information can be used to help guide others. Problems can occur with this approach because different treatments are not randomly chosen. This can potentially lead to bias in the results. For instance, a manager who has successfully reduced feral horse density to the lowest levels in the district is most likely to be the one who has best managed his cattle in the past. Therefore, high cattle production may result from good past and present cattle management and not from low horse density, so care must be taken when interpreting results.

11. Implementing Management

Section summary

The techniques and strategies for effective control of feral horse damage exist, but most government land management agencies, private land managers and the public in general have little knowledge and understanding of feral horse impact and how to manage it effectively. A better awareness and understanding in interest groups is essential for more effective feral horse management. Community-based groups provide effective mechanisms for distributing information and providing advice, training and other assistance. Development of a management-orientated videotape and nomination of a publicity officer in feral horse management are two important elements of any such program.

At government agency level, officers should have appropriate expertise and experience in feral horse management. However, specialist training on feral horse management must be seen as only one part of a broader vertebrate pest control training package, which encompasses a whole-system approach to resource management.

11.1 Introduction

Techniques and strategies exist for the effective control of feral horse damage, but are not widely used. Reasons include lack of awareness by landholders of appropriate control methods, their cost-effectiveness or how best to carry them out, disillusionment as a result of past unsuccessful control attempts using poor techniques, and the influence of objections by animal welfare groups to conventional control methods.

This section outlines mechanisms and the role of government and other interest groups that help to instigate and maintain effective control of feral horse damage.

11.2 Role of government

Relevant State and Territory governments should be able to provide landholders with practical advice on the best way to deal with a feral horse problem, but currently few land management agencies across Australia have the relevant knowledge and experience. Appropriately trained and experienced regional officers are needed to facilitate feral horse management in the areas where feral horses are most common and cause significant damage. Selected Aboriginal

'Specialist training in feral horse management should be part of a broader, whole-system approach to land management.'

participants should be encouraged to train to coordinate and facilitate feral horse control on Aboriginal land. The CCNT has expertise in feral horse management and could conduct the necessary training on a cost-recovery basis. However, it is important that specialist training in feral horse management be seen as part of a broader vertebrate pest management training package which encompasses a whole-system approach to land management. Relevant State and Territory pest management agencies are responsible for the more general training.

This document provides the basic information for a suitable training program on feral horse management. Courses of one to two weeks would be sufficient and should cover topics such as feral horse ecology, animal welfare issues, techniques and management strategies, the economics of control, shooter training and extension methods. Ideally, the courses would include participation in one or more control operations.

Trained officers are better qualified to give landholders and others advice and information. An appropriate training course for about ten participants may cost about $15 000, including airfares, accommodation and a field trip.

11.3 Landholders and managers

Responsibility for feral horse control lies with the landholder, who needs to be informed about both the need for control and the methods available. Face-to-face contact between locally respected and informed government field officers and landholders is an effective way of taking information to the managers, although it is rarely practised.

'Extension encompasses developing awareness, which leads to understanding, shared objectives and appropriate action.'

Targeted extension/education is needed to demonstrate the most appropriate control strategies to individual landholders and to show both landholders and the public the consequences of ineffective feral horse control. Extension encompasses several steps, including first developing awareness, which leads to understanding, shared objectives and appropriate action. Extension involves gathering the necessary information, packaging it, then marketing it.

Other techniques include slide talks to cattlemen's associations and groups such as Landcare and park rangers, management-oriented videotapes, booklets, and field days. A management-based videotape with footage of control operations may be a more effective extension tool than reading matter, although it may also be more expensive. Extension programs need to stress the importance of integrating feral horse and other pest animal management into a land manager's normal schedules and not treating it as an ad hoc addition.

Landcare and similar community-based groups provide an effective way of bringing relevant land managers and interest groups together to discuss the needs of the various groups and develop a joint approach to managing feral horses and other pests, plus other relevant land management issues. Efficiencies of scale are possible through a coordinated approach in areas such as helicopter hire, musterers, transport and other resources. Community groups also enable government to target extension and other limited resources more effectively.

'Failure to involve all relevant players can result in ineffective control.'

Failure to involve all relevant players in the planning and implementation of feral horse and other pest animal management can result in ineffective control.

11.4 Register of musterers, pilots and shooters

The knowledge and expertise of musterers, helicopter pilots and shooters, and transporters associated with feral horse control, varies considerably. Inexperienced or incompetent operators using poor equipment are less successful than experienced operators. They often let many horses escape, making later control more difficult. Unacceptable suffering is often common with these operators. To overcome this, it is recommended that relevant State or Territory agencies register and accredit contract musterers, helicopter pilots, shooters and transporters of feral horses.

Only accredited operators should be used for aerial shooting or commercial muster and transport of feral horses. Operators should be assessed on their past records, skills and access to suitable equipment. Aerial shooters should follow

the Northern Territory's Procedures and Guidelines for Shooting Feral Animals and transporters abide by the latest codes of practice for mustering and transporting feral horses. Operators should be deregistered if they breach these conditions.

Provision should be made for interested landholders without experience in feral horse management to serve as trainees by helping experienced operators during musters. This has been done in central Australia where Aboriginal people have attended local musters to learn how best to conduct subsequent musters on their land.

11.5 Public

During the past decade, there has been a significant increase in the prominence given in the various forms of media to feral horses and their control. This is usually concentrated on the more sensational aspects of feral horse control, especially helicopter shooting. A balanced presentation is needed so that the public and relevant interest groups can make informed decisions about feral horse damage and appropriate ways of dealing with it. Relevant extension material needs to be developed in cooperation with animal welfare and other relevant interest groups such as pastoralists, conservationists and Aboriginal communities. A coordinator or public relations officer should be appointed to oversee the program to increase community awareness of the feral horse management issue. There is scope for this officer to include information about the need for managing other animal pests as part of the program.

'Extension material needs to be developed in cooperation with animal welfare and other interest groups such as pastoralists, conservationists and Aboriginal communities.'

11.6 Portable abattoirs

Portable abattoirs to process horsemeat in the field for human consumption have considerable potential to encourage feral horse control in Queensland, the Northern Territory, Western Australia and South Australia by creating locally accessible markets. Horses must still be captured, but trucking distances would be reduced to the distance to the nearest portable abbatoir. Major requirements for the operation of portable abattoirs are adequate water supply and suitable areas for the disposal of offal.

A South Australian operator has proposed developing a mobile abattoir and testing it for processing feral goats. Progress is slow but, if successful, the operation could be adapted to process horses (Ramsay, DPIE, pers. comm. 1992). There is an abandoned mobile abattoir in the Top End of the Northern Territory (B. Walsh, CCNT, pers. comm. 1991). The venture failed because some pastoralists opposed the tracks it created and the damage caused by apparently indiscriminate operators. Nevertheless, the value of mobile abattoirs should be investigated as part of the package of factors needed for the viability of commercial use as a control mechanism.

11.7 Legislation for control

Some pastoralists conduct extensive free-range stockhorse breeding programs. In some cases it is difficult to distinguish between these horses and feral horses, so the effectiveness of coordinated feral horse control programs can be compromised. Horses that can be branded as young animals and mustered annually are managed animals like other livestock, and not feral. Those that are not branded should be classed as feral, not owned, and should be subject to control. To overcome the difficulty of distinguishing feral horses from others, it is suggested that relevant States and Territories investigate the practicalities of enacting legislation which requires landholders to

brand all horses over 12 months old. It should be noted that some pastoralists who conduct extensive stockhorse breeding programs may oppose such legislation. Consultation with relevant interest groups will be necessary to identify any possible problems and to gain acceptance before such legislation is developed and implemented.

PART SIX

FACTORS LIMITING MANAGEMENT

6

12. Factors Limiting Management

12.1 Introduction

This chapter identifies the additional information and other changes needed to improve management of feral horse impact.

The use of an asterisk (*) denotes that the deficiencies concerned should be addressed as a package. They relate to the viability of the commercial use of feral horses which is an essential component of the strategy. They have been consolidated in the recommendations and have the highest priority for investigation. Other studies have also been given a higher or lower priority in the Recommendations. When recommendations from other species guidelines are identified, priorities may need to be re-assessed.

The following have been identified as suggested areas for further investigation.

12.2 Regional distribution and abundance of feral horses

Deficiency

The density of feral horses throughout Australia in general is poorly known. Data from aerial surveys are out of date (Northern Territory), not analysed (Western Australia) or non-existent. A nationwide questionnaire/interview survey was conducted by McKnight in 1966-1971 (Section 3.4). Wilson et al. (1992) produced distribution maps of the major vertebrate pests, including feral horses, based largely on subjective information.

Developments required

Strategic, regional aerial surveys should be conducted at least every five years in areas where feral horses are or have been a problem. The data on feral horse distribution and abundance should be used as a basis for planning control including determining priority areas for action. The possibility of combining surveying for other animals (for example, donkeys, kangaroos) should be investigated. Alternatively, regional field officers using a nationally consistent questionnaire could obtain subjective information from managers, at lower cost.

Consequences

Improved State and Territory land planning and targeting feral horse management would result, with an increasing capacity to integrate feral horse control with management requirements for other pest species.

12.3 On-property distribution and abundance

'Most managers have no accurate estimate of feral horse distribution and abundance on their properties.'

Deficiency

Most property managers have no accurate estimate of feral horse distribution and abundance on their property.

Developments required

Scientifically designed aerial surveys may be made more attractive to individual landholders if government agencies demonstrate their accuracy, if survey teams (government or private consultants) are more readily available, and if they can be shown to be cost-effective.

Modified dung count, line-transect or mark-recapture methods are needed that are suitable for managers to integrate with normal management practices. Modified techniques must be tested in different

regions, but are potentially valuable tools if properly described in regional extension manuals.

Consequences

This sort of technique would allow the assessment of likely feral horse impact and planning of control programs. It also enables accurate assessment for potential commercial harvesters. Follow-up surveys can help assess program success.

12.4 Ecology

Deficiency

Nothing is published on the diet, habitat use, social organisation, reproduction, mortality, movement and home range of feral horses in northern Australia and temperate eastern Australia.

Consequences

Without basic ecological information, the effective assessment of likely feral horse impact in these areas is not possible.

Developments required

Dyring (1990) indicated avenues for further research in subalpine New South Wales and Victoria. For management planning, information is needed on the population and movement of feral horses over the whole region, plus long-term monitoring of environmental variables. Factors which need further investigation include feral horse distribution, abundance, social behaviour, movement patterns and habitat use, impact on native vegetation and role of feral horses in weed transmission.

12.5 Environmental damage

Deficiency

The environmental damage of feral horses in both northern Australia and temperate eastern Australia is not known.

Consequences

It is important to assess damage in order to determine the need for control and to determine the extent of control needed (i.e. the level to which the horse population on individual properties should be reduced in order to minimise impact).

Developments required

Feral horse impact in northern Australia and temperate eastern Australia, including the relationship between feral horse density and impact, should be determined. The studies should include an assessment of the non-target impact of feral horses (for example, observations indicate that couch and buffel grass may become a problem following the removal of feral horses from Finke Gorge National Park).

12.6 Cost-benefit analyses

'Costs and benefits of control options need to be better quantified and equated with feral horse density.'

Deficiency

The costs and benefits of control options have not been adequately quantified and equated with feral horse density.

Consequences

In order for land managers to determine how to maximise the benefit-cost ratio for feral horse management, they need to know the relationship between the costs and benefits of feral horse management and feral horse density. This relationship would be valuable for extension purposes and in planning property management. Such analyses would be a precursor to the development of a computer-based decision support system for managing feral horses.

Developments required

The relationship between feral horse density and the costs and benefits of control should be determined. This is likely to be difficult and expensive. As a preliminary study, available information on the costs and production benefits of previous feral horse control programs should be collated and evaluated. A broadscale, scientifically designed management experiment may also help to quantify control costs and benefits.

12.7 Animal welfare concerns

Deficiency

'Means for improving the humaneness of feral horse mustering and transport need to be determined and implemented.'

*(a) Mustering and transport of feral horses to slaughter for commercial use is a major animal welfare concern. Means for improving the humaneness of feral horse mustering and transport to slaughter need to be determined and implemented.

(b) The potential for fertility control to manage feral horses in Australia.

Consequences

(a) The capture and long-distance transport of feral horses, particularly in double-deck transports, are high-priority animal welfare concerns. The issue is complex and of major concern to the pastoral industry, conservation agencies and animal welfare groups. On the one hand, animal welfare groups are legitimately upset about the suffering that mustering and transport can cause to feral horses. On the other hand pastoralists and other land managers are unlikely to control feral horses effectively without the financial incentives provided by the commercial use of feral horses, especially in more remote areas where double-deck transport can make commercial use viable. Less control will also expose more feral horses to suffering during droughts.

(b) Induced fertility control is favoured by animal welfare groups as a means of limiting the population growth of feral horses. In North America there has been recent research into fertility control, but its application is not currently feasible for Australian conditions where feral horse numbers are high and their domain extensive. With further developments it may have merit in specialised areas where horses cannot be removed but numbers have been reduced to low levels by conventional means.

Developments required

*(a) Independent assessment is needed to examine such factors as the condition and stress levels of captured and transported horses. Sedatives in horse drinking water before transport could also be considered, along with the use of hessian to enclose trailers. Modification of double-deck transports to make them suitable for feral horses may be possible. The Senate Select Committee on Animal Welfare (SSCAW) made several recommendations concerning the transportation of livestock which have been referred for consideration to the Subcommittee on Animal Welfare (SCAW) of the Standing Committee on Agriculture and Resource Management. SCAW should assess available information, establish a code of practice for the transport of feral and other horses

Points marked thus (*) should be addressed as part of a coordinated package.

and determine areas requiring further investigation.

The report of Pilkington and Wilson (1990) provides important information on this matter. Only registered and accredited musterers and transporters that abide by the established code should be permitted to muster and transport feral horses commercially.

(b) The Franz Weber Foundation proposes to develop and trial a viable means of fertility control in the herd at its horse sanctuary near Pine Creek (Northern Territory) in an effort to slow population growth and avoid potential overstocking. This study should be monitored to assess its potential wider use for horse control in specialised areas.

12.8 Extension

Deficiency

Current mechanisms for developing awareness and understanding amongst land managers of the damage caused by feral horses and the need for appropriate management are minimal.

Consequences

Information derived from research is not reaching those who need it. Landholders receive little or no advice on feral horse control from government bodies.

Developments required

(a) Training schools should be established to train relevant government field officers in feral horse management. This would improve the extension services provided by vertebrate pest control agencies throughout Australia.

(b) A management-oriented videotape for landholders, outlining strategic feral horse management and showing control exercises in operation, would be a valuable extension tool.

(c) A register of contract musterers and experienced pilots should be prepared and maintained by regional vertebrate pest control agencies, and distributed to landholders.

(d) A coordinator/public relations officer should be appointed and trained with the task of increasing community awareness of the problems posed by feral horses and other animal pests and the need for control.

(e) The development of a computer-based 'expert' system on feral horses would be a valuable management tool to help landholders select the most suitable options for reducing feral horse impact.

12.9 Resources for feral horse control

Deficiency

There is a lack of coordinated action and resources to take advantage of drought to control feral horses.

Consequences

Opportunities for reducing feral horse populations during drought are often missed.

Developments required

During and coming out of a drought are the times when feral horses cause most damage to pastoralism and the environment, and when they suffer most. They are also the most opportune times to undertake control or to reduce feral horse density even further while they are restricted to limited feeding and watering points. The National Drought Policy (Drought Policy Review Task Force 1990) recognised this and recommended that

'Opportunities for reducing feral horse populations during drought are often missed.'

governments initiate joint programs to control feral animals that are most susceptible during these times. However, action by pastoralists is often prevented by lack of resources. Systems for identifying and coordinating action, to control feral horses during drought, need to be developed. Provision of government resources to relevant landholders could be considered.

12.10 Legislation

Deficiency

*(a) It is illegal to field slaughter feral horses in Queensland for pet meat.

(b) Legislation is needed that enables feral horses to be distinguished from horses managed for stock or other purposes, so that unmanaged horses can be controlled.

Consequences

(a) There is less financial incentive for commercial harvesters to assist landholders to control feral horses in Queensland.

(b) Effective feral horse control is inhibited.

Developments required

*(a) The Queensland *Meat Industries Act 1965* appears inconsistent with Northern Territory and Western Australian legislation. It is illegal to field slaughter horses for pet meat in Queensland, primarily to protect the beef industry from meat substitution, but also to protect resources invested in existing horse knackeries (Section 4.3.2). Field slaughtering of horses for pet meat is permitted in the Northern Territory (where Birdsville disease is absent) and in Western Australia with no apparent problems. Legal field slaughter in Queensland would encourage feral horse control in areas where control is presently minimal or absent. Changes to the legislation warrant investigation because of the benefits they could offer feral horse control, but such changes are discouraged until the full ramifications (meat substitution, impact on knackeries, Birdsville disease) receive careful consideration.

(b) State and Territory governments should examine the practicalities of enacting (if not already in existence) legislation which requires landholders to brand all horses over 12 months old. Unbranded stock would be classed as feral, not owned, and subject to control by government agencies. If stock can be regularly mustered then both their numbers and impact can be managed (Section 11.7).

12.11 Market research

Deficiency

The market potential for by-products from horses slaughtered in remote locations has not been fully explored.

Consequences

Feral horse control in remote districts is often perceived as too costly. A reliable market for horse by-products would help offset the control costs.

'A reliable market for horse by-products would help offset control costs.'

Developments required

*Alternative marketing options, such as the use of offal from field pet-meating, as

food for crocodile farms and the production of meat meal, should be investigated.

12.12 Recommendations

The recommendations are listed in priority order within two categories, very high and high. The resources needed to address each recommendation vary considerably and may influence the order in which they are addressed.

Very High (1 – 6)

(1) **Commercial utilisation of feral horses.** This is an essential element of most programs to control horse impact, without which many land managers would not undertake control. Several aspects of commercial use need to be investigated as a package to ensure the viability of this component of the management strategy. These include the following:

Legislation

— review *Meat Industries Act 1965* (Queensland) that prohibits the field slaughtering of horses for pet meat. Changes to the Act to allow field slaughter would give pet-meat shooters an incentive to remove feral horses in that State (Section 7.6.5).

Animal welfare

— **long-distance transport of feral horses.** Submissions to the SSCAW and comments on a draft of these guidelines expressed serious concern about the welfare of feral horses captured and transported to slaughter, and recommended that double-deck transport of horses be prohibited in all States and Territories. There is good reason for these concerns. Nevertheless, we believe that commercial use of feral horses (including transport by double-decked vehicles in accordance with agreed codes of practice) is essential for effective feral horse control, both to protect production and conservation values and to reduce the number of feral horses that suffer in drought. The SCAW is examining the recommendations of SSCAW and developing a code of practice for the land transport of feral and other horses. Pilkington and Wilson (1990) provide valuable background to SCAW's deliberations. We strongly support this assessment and the establishment and enforcement of an effective code of practice to minimise the suffering of feral horses during transport (Section 6.5).

Markets

— **stable markets,** both local and international, are essential to the viability of the commercial feral horse industry. The potential of the market and the most suitable form of product for each market needs to be determined for meat for both human consumption and pet meat;

— **'smart bounties'** should be considered, to encourage commercial operators where feral horse density is too low to enable profitable operations without an additional head price. Smart bounties should apply only to specified areas for a specified duration, as determined by regional vertebrate pest control officers (Section 8.4).

Abattoirs

— the **establishment of portable abattoirs** to process meat for human consumption should receive Commonwealth, State and Territory government support. Portable horse abattoirs would avoid the need for horses to be transported long distances, and provide a financial incentive for their control in remote districts (Section 11.6)

Register and accreditation of contract musterers, pilots and transporters.

— The relevant State or Territory vertebrate pest agency should **register and accredit contract musterers, helicopter pilots and shooters, and transporters of feral horses**. Only accredited operators should be used for aerial shooting or commercial muster and transport of feral horses. Operators should be assessed on their past record, skills and access to suitable equipment. Aerial shooters should follow the Northern Territory *Procedures and guidelines for shooting feral animals* and transporters abide by the latest codes of practice for the mustering and transport of feral horses. Operators should be deregistered if they breach these conditions. Use of experienced operators increases the success rate of musters and improves the welfare of horses (Section 11.4).

(2) **Threshold level of control.** Although there is good evidence that feral horses cause serious damage to pastoralism and the environment, quantification of the relationship between feral horse density and the costs and benefits of control would enable managers to assess more accurately the level of control needed (Sections 4 and 5). The threshold density to which it is most cost-effective to reduce feral horse numbers needs to be determined. This is likely to be a difficult and expensive exercise. As a preliminary to a major study it is recommended that the following be undertaken:

- available information from the CCNT and relevant pastoralists on the costs and production benefits of previous feral horse control programs should be collated and evaluated;
- a large-scale, management-based experiment to determine the benefits and costs of controlling feral horses to the recommended density of 0.1 horses a square kilometre should be undertaken in central Australia.

(3) **Strategic, regional aerial surveys.** Feral horse density across Australia is poorly known. More accurate information on the distribution and density of feral horses and other large, wild herbivores is needed to provide base data from which to plan and gauge the effectiveness of control action. Surveys should be undertaken in areas where feral horses are considered to be a problem, using consistent methods for States and Territories (Section 12.2).

(4) **Determining feral horse density.** Simple, low-cost and rapid methods for assessing local feral horse density are needed to determine the effectiveness of feral horse management. The methods must be suitable for use by most landholders. Potential areas for investigation are a simplified aerial survey technique, or dung counts (Section 12.3).

(5) **Training schools and regional workshops** should be established to train relevant State and Territory field officers in the strategic management of feral horse impact. This would improve the extension services provided by vertebrate pest control agencies throughout Australia, and help landholders plan feral horse control programs. The CCNT has the necessary expertise and experience and should consider undertaking this task on a cost-recovery basis (Section 11.2). This specialist training needs to be seen as part of a broader vertebrate pest management training package which encompasses a whole-system approach to land management.

(6) **Biology of feral horses in the wet/dry tropics and the southern highlands.** Information on biology and impact is essential to determine the necessary extent of feral horse management in these areas (Section 5).

High

(1) A **management-oriented video-tape** that outlines strategic feral horse management and shows control exercises in operation would be a valuable extension tool for landholders (Section 11.3).

(2) **Feasibility of fertility control** of feral horses is to be tested by the Franz Weber Foundation at its horse sanctuary in the Northern Territory. This study should be monitored to assess its potential wider use for horse control in specialised areas (Section 8.5).

(3) **Legislation requiring branding of all stock horses more than 12 months old** should be considered by each State and Territory. Any unbranded horses can then be classed as feral and subject to control. If horses can be mustered regularly and young animals branded, the implication is that both their numbers and impact could be regulated. Such legislation may be an appropriate backdrop to a more cooperative approach to control through improved extension services (Section 11.7).

(4) **The environmental implications of removing feral horses** need to be examined to identify potential management problems (for example, the spread of buffel grass) (Section 12.5).

(5) **A coordinator and/or public relations officer** should be appointed and trained to increase community awareness of the problems posed by feral horses and the need for control. Increased awareness and understanding can help reduce the conflict between the various interest groups involved in feral horse management (Section 12.8).

12.13 Implementation

The Vertebrate Pests Committee (VPC) is responsible for overseeing the adoption of the guidelines and addressing the information gaps. The extent to which resources are directed to implementing the feral horse guidelines and addressing the identified recommendations will depend on the relative priority assigned by the VPC, based on an overall assessment of the guidelines for subsequent species. The VPC will also oversee regular reviews and updates of the guidelines.

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APPENDIX A

Ready References

The following is a detailed description of techniques for trapping, mustering, shooting, handling and transporting feral horses. A section is also included on fertility control. 'Ready References' are designed for government extension officers and for the preparation of regional extension manuals.

Ready References are based mainly on the extension manual *Control of brumbies in central Australia* by W. Dobbie and D. Berman (1992), Conservation Commission of the Northern Territory and the Northern Territory Department of Primary Industry and Fisheries.

R.1 TRAPPING

Trapping is a cost-effective method of catching brumbies. Costs are much lower than for helicopter mustering. A survey of central Australian pastoralists in 1986 indicated that average cost per head for catching feral horses was $8 by trapping and $27 by helicopter mustering (Bowman 1987b). Trapping also causes less stress to animals than other methods of catching and is most effective during dry conditions when there are few waterholes. It can be made more effective at other times by fencing off waterholes to reduce the number of alternative watering points.

Basic design of portable trap-yards

Figure 9 illustrates the main features of a trap-yard suitable for trapping feral horses.

The size of the yard depends on the number of horses you expect to catch. Where no established yard exists, a minimum of 50 portable panels is recommended. This holds about 150 horses. Regular trucking of captured horses throughout the operation empties the yards, allowing further horses to be trapped.

Traps should be located where most of the horses drink, unless this is not practicable, such as where the country is too rough to allow the erection of portable yards, or road access is difficult. In these situations, and where surface water is not abundant, feral horses can be forced to drink where a yard can be built by fencing-off the most important waterholes.

Acclimatising horses and duration of trapping

The effectiveness of trapping can be increased by allowing a short time for horses to become accustomed to portable trap-yards. This is done by allowing most horses to find and freely enter and leave the entrance gate or bayonets. An acclimatisation period of at least a week is advisable unless rain is expected, which can make trapping ineffective by dispersing horses. A settling-in period is not necessary where an established stockyard is used to trap horses, if those horses have regularly used the yard to obtain water.

Under central Australian conditions, often the greatest number of horses are caught on the third day of trapping. Trapping should continue for perhaps five days or more, until few horses are being caught. Horses should be trucked-off as soon as a truck load has been captured. Sufficient food and water must be provided.

Entrances and exits

Either a gate or bayonet entrance may be used. A standard gate entrance is easy for horses to locate and more horses will probably enter the yards than through a newly positioned bayonet entrance. However, the gate needs to be closed

manually behind each group of horses entering, which requires the yards to be continually monitored. Bayonet gates free labour and allow more than one yard to be trapped at one time.

Entrance to portable yards

The gate or bayonet entrance of portable yards should be directly opposite the water trough to encourage horses to enter and drink. If pads or stock trails do not already exist, it may help to shovel a 'pad' which leads through the bayonet, to help horses locate the entrance.

An exit bayonet can help catch more feral horses. Horses get used to entering through the bayonet during the training period, enabling more horses to be caught when the bayonets are set.

Established yards

Often conditions suitable for trapping last no longer than a week, giving no time to move and set up portable yards. Established yards speed preparation for trapping and reduce the risk of trapping being disrupted by rain. If cattle yards at a bore already exist, care should be taken to ensure they are secure for horses. Portable panels inside the yards can be used to reinforce low or weak sections.

Trapped cattle and wildlife

Commonly in pastoral country, cattle are trapped as well as horses. The yards should be checked morning and afternoon to release trapped cattle if they are not needed. Although this can be a nuisance, it should not inhibit the trapping of horses.

Wildlife such as kangaroos and dingoes which enter trap-yards can escape under the bayonet or through the rails of the yard.

R.2 FENCING ALTERNATIVE WATERS

Trapping is usually restricted to dry times when few alternative watering points are available. However, fencing alternative waters can increase the time suitable for trapping and help move horses from watering holes where traps cannot be built. Fencing-off waterholes can significantly increase the success of trapping.

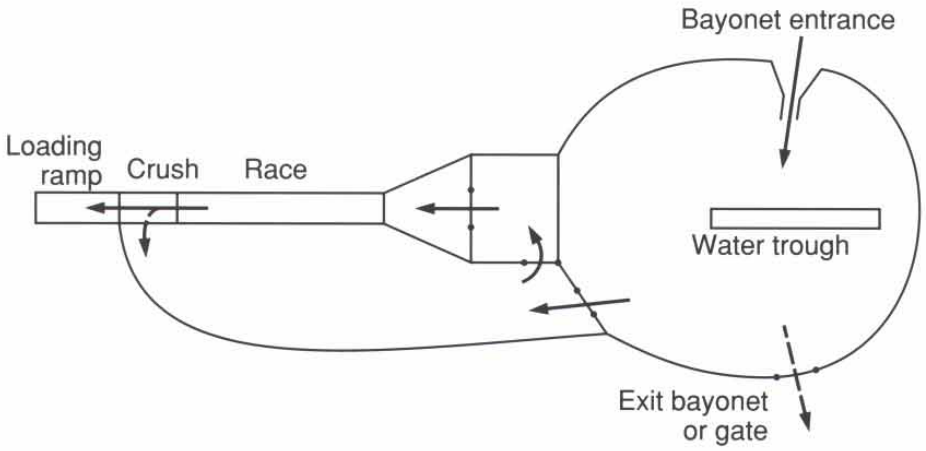

Figure 9: Main features of a portable trap-yard suitable for trapping and loading feral horses.

Only the most important waterholes need to be fenced to trap most of the horses. Choosing which waterholes to fence is based on their permanence and how important they are to the horse population.

Various forms of fencing can be used, including conventional stock fences, hessian fences and electric fences. Electric fences may be unfamiliar to some landholders, so details of their construction are presented below.

Electric fences

Effectiveness

Electric fences are lightweight, relatively cheap and quick to construct, and can be effective against feral horses. They have been used successfully in the Alice Springs district to prevent feral horses watering at particular waterholes. Animals touching the fence receive a short, sharp shock, which is not harmful but tends to deter stock from breaking the fence. Most horses do not contact the fence but eventually walk to another watering point (Dobbie and Berman 1990). Electric fences are used in a national park west of Alice Springs, and have been used on a cattle station in the east MacDonnell Ranges to increase trapping success.

Fence visibility

The fence must be highly visible to make approaching horses aware of its presence. Coloured flagging tape tied to the fence wires makes the fence visible during the day, and attaching a few small lights which flash with each pulse helps make horses aware of the fence at night.

Fences can be damaged if the horses know no other watering point, or if the fence is first breached by cattle, allowing horses to enter. The horses then crash through the fence to get out. Once broken, the entire fence is easily destroyed.

Careful monitoring is needed to ensure that feral horses can find other watering places. If they continue to congregate at the fenced watering point, they should be shot to prevent undue suffering. Cattle which hang near the fenced waterhole should be walked to the nearest bore. Kangaroos and dingoes can go under the fence to reach water.

Power supply

The electrical energiser sending electrical pulses along the positive wires of the fence can be powered by a 12-volt car battery for about two months. A mini-energiser for small fences is powered by 6 'D' torch batteries. A solar panel can be used to maintain the battery charge for long-term fences.

Fence design

Conditions in low rainfall areas are generally too dry for the soil to offer effective earthing and maximum shock. A series of positive and negative wires, a 'fence return earthing system', is recommended to maximise the voltage. In areas where soil moisture content is high, all fence wires should be positive.

Fences may be of two or three wires depending on the amount of stock pressure and the terrain. In dry conditions where a fence return earthing system is used, a two-strand fence contains a top live (+ve) wire and a bottom earth (-ve) wire. A three-strand fence contains top and bottom live wires (+ve) and a middle earth wire (-ve).

Earthing is important. Without a good earthing system the fence will not work effectively. A good earth can be made by running a plain galvanised wire off the fence 'earth' wire and staking it in the waterhole.

Fencing permanent waterholes

Initially, permanent waterholes should have a small unfenced portion of water, to prevent horses or cattle perishing and to reduce the likelihood of damage to the fence by thirsty stock. Long-term fences around permanent, heavily used waterholes may assist the management of not only feral horses but also cattle. A solar panel should be used to maintain the battery charge in long-term fences.

Equipment and advice

Stock and station agents supply fencing equipment and advice. Local landholders who already use electric fences can also be valuable sources of information.

Trees serve as good strainers, although steel posts can be used both as strainers and throughout the fence when trees are absent.

Costs — construction time and maintenance

A 10-watt solar panel costs around $310, a large energiser $250, and a mini-energiser about $100. Material costs for electric fences are estimated to range from $300 (50 m × 50 m temporary fence with mini energiser and no solar panel) up to about $1100 (300 m × 50 m permanent fence with large energiser and 10-watt solar panel). Not many horses have to be moved and trapped to pay for the fence; 11 horses can provide $1100. Solar panels, energisers and batteries used on temporary fences are easily removed and repositioned at other locations, considerably reducing costs after the initial outlay.

Two people can erect an electric fence around a small waterhole or cleared dam in a few hours. A large fence in awkward terrain may take more than a day.

Long-term fences around waterholes are prone to flood damage. Maintenance may be necessary also during droughts when stock pressure increases. Any break in the fence must be fixed quickly during dry times or the fence will be completely destroyed by horses that get in through the breach and then smash their way out. Cattle are more likely than horses to push through the fence, making the first breach. During dry times, the fence should be checked at least once a week.

R.3 HELICOPTER MUSTERING

Musters should centre on the watering points or grazing areas which are of most importance to feral horses. In central Australia, these are often permanent waterholes and springs. The extent of horse tracks and dung and the number of horses seen in the area give an indication of horse activity. Important waters are usually avoided by horses in good seasons and used heavily when it is dry.

Timing

Helicopter musters should not be conducted between September and January, when mares have young foals at foot or are heavily pregnant, nor when horses are in poor condition.

Yard site

A suitable yard site needs to be flat to enable the erection of portable yards, and have sufficient space for trucks to turn.

Design of portable mustering yards

Many designs of muster yards are available, depending on personal preference. Figure 10 illustrates a basic yard effective for mustering horses.

Siting of yards

Yards should be set up on big pads (stock trails) to encourage horses to run along the pads which, ideally, should lead through the main entrance. They should be unobtrusive to approaching horses, being not easily visible until the horses

are close. Low spots should be avoided as horses prefer to run uphill. The approach to the yards should be flat or slightly uphill.

Avoid having trees near the entrance of the yards as these can restrict manoeuvring by helicopters at this crucial point.

Entrances and fences

A wide entrance gate of about 6 m allows horses to enter the yards freely.

The yard entrance can be a pressure point. It is important to run six to ten portable panels either side of the main gate to commence the wing fences and strengthen this area.

An 'open' feel to the yard entrance reduces the risk of horses baulking near the main gate. Hessian should not be hung at the entrance but started three or more panels out from the main gate.

Long wing fences assist the helicopters to funnel horses towards the yards. Wings are merely a visual barrier. They should not be at a sharp angle to incoming horses, but should 'funnel' horses towards the yards. Hessian is usually run out from the yards for about 100 m and tied to a top strained wire along a line of star pickets. Further extension of the wing fences should continue till they reach natural barriers such as the side of a range or hill. To deflect approaching horses, one wing fence often needs to be longer than the other, and a length of 1 km is commonly used. Ribbon wings are cheaper than hessian and can be run out simply by tying the line to trees. Ribbon wings are made by tying flagging tape to twine. They can be rolled up and re-used many times. However, the ribbons tend to tangle in the wind so it is desirable to leave ribbon wings up for the shortest possible time. Other types of wing extension include flag bunting, which does not tangle and is much quicker than ribbon wings to put up and take down.

Packing tape has been used on one station in Queensland, with two strands tightly run in a line from tree to tree. The taut tape whistles in the breeze and is reported to be effective in keeping horses off the wings.

Radio contact

Radio contact between pilots and ground crew is useful.

Mustering areas

Intensive mustering of a defined management area of approximately 400 km^2 around a permanent watering point may offer the most effective way of catching most of the horses. Few horses would have to be pushed outside their home range, and any follow-up shooting could be kept to a minimum. This strategy involves moving from one 'management area' to the next and may require more yard sites than mustering larger areas (Section 9).

When mustering very large areas, many horses are pushed out of their home range areas, which they resist leaving. Also, the greater the distance horses are pushed, the more chance they have to escape. Those which get away are harder to catch next time. Horses lost by helicopters become more cunning and difficult to yard and may lead other horses away from the yard site. However, mustering extensive areas is important if truck access is restricted by rough terrain, or if there are few suitable yard sites.

R.4 HELICOPTER SHOOTING

If feral horses cannot be caught or no viable market exists for captured horses, shooting either from helicopters or the ground is the only method for reducing their number quickly. Herd relocation is unworkable if the horses cannot be caught. Fertility control is currently impractical on a broad scale and does not reduce damage in the short term. It is

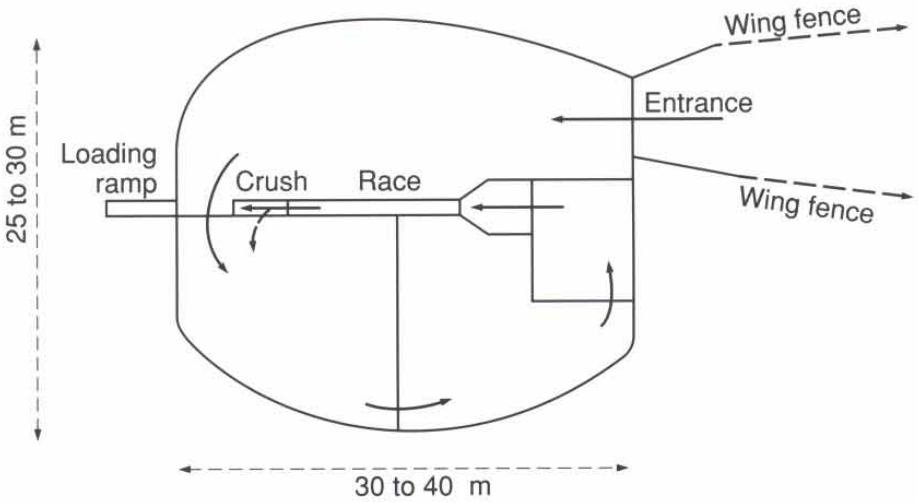

Figure 10: Basic design of a portable yard for mustering brumbies.

important to note, however, that unless local eradication can be obtained, which it usually cannot, ongoing control by shooting, trapping or a combination of these methods is necessary.

Animal welfare concerns

Shooting from helicopters is the quickest and most humane method of large-scale culling. Helicopters enable the shooter to get close to the target. Any wounded animals can be quickly followed-up and killed. The Australian Veterinary Association (1988) accepts the need to cull feral horses in Australia and that strictly controlled helicopter shooting is the most humane technique for large-scale culling. The SSCAW shares this view (SSCAW 1991a). The advantage of helicopter shooting over ground shooting is that helicopters can follow horses over most terrain, making it difficult to lose a wounded animal. In addition, helicopters enable quick, large-scale control over large areas of inaccessible country.

All shooting from helicopters should be conducted by experienced, certified personnel adhering to established guidelines for the use of firearms and ammunition. The importance of ensuring a quick kill, using additional shots if necessary, should be emphasised.

The following points, taken from the 1988 report of the Northern Territory Feral Animal Committee Sub-group, outline the recommended procedure for shooting feral horses from helicopters.

- It is illegal under the Air Navigation Regulations to carry firearms in an aircraft or to fly below 150 m. Exemptions to these regulations must be sought from the Commonwealth Department of Transport and Communications for helicopter shooting.
- Shooting from helicopters is hazardous, with a high potential for serious accidents. Personnel must be competent and well trained.
- All shooters must receive:
  - helicopter and flying safety training;
  - training in firearm safety and maintenance, and in shooting,

both on the ground and in the air; and

— testing and accreditation by an independent agency for marksmanship, both stationary and mobile.

- shooters must be schooled in the procedures for minimising animal suffering. In particular, they must abide by the following:
  - do not shoot at an animal unless you are confident of killing it cleanly;
  - use only heart or chest shots. The horse brain is a relatively small, mobile target well protected by bone. Heart-lung shots, with appropriate weapons and ammunition, result in a quick kill;
  - inadvertently wounded animals must be followed-up and killed before any further groups are targeted and shot;
  - suitable firearms should be used for shooting feral horses on the ground or from helicopter. These include weapons such as the Springfield M14 and MIA, LIAI SLR, Heckler and Koch M91 in .308 (7.62 mm) calibre. For helicopter shooting spot-on/aim point sights or 2 quality telescopic sights are useful. Similar or high-powered telescopic sights are preferable for ground shooting. Projectiles suitable for killing feral horses are 150—170 grain silver tip or soft nose;
  - two weapons should be carried by the shooter at all times; and
  - refresher and retraining courses should be held regularly.

To ensure shooters abide by these procedures, the authors recommend that only registered and accredited shooters should be used, and that adherence to specified procedures and codes of practice be a condition of registration and accreditation (Sections 6.3.2 and 12.7).

Costs

Helicopter shooting costs approximately $10 a head to remove 70% of the horse population if the starting density is higher than 0.3 horses a square kilometre (Table 6). This includes helicopter hire and fuel, ammunition and shooters' wages. Removing the last 20–30% of a population becomes increasingly difficult and the costs increase sharply. This is consistent with figures for closely monitored donkey shoots in the Victoria River District of the Northern Territory (Choquenot 1988).

Approximate density (horses/km^2)	Estimated cost per horse ($)
above 0.3	10
0.3 — 0.15	20
0.15 — 0.05	35
below 0.05	70

Table 6: Estimated costs of shooting feral horses from helicopter (adapted from Wurst 1987)

A spotter plane, often that of the pastoralist, can increase markedly the efficiency of a shooting operation by directing the helicopter and shooter from one mob of feral horses to the next. This keeps the shooter in constant work and no time is lost searching for animals.

Spotter planes are unnecessary where the density of feral horses is high, above 0.3 horses a square kilometre, as spotting saves no time in locating horses.

R.5 GROUND SHOOTING

Shooting from the ground is usually impractical when surface water is abundant, horses are dispersed, the country is rugged, and where large-scale control is needed. Wounded animals cannot be pursued rapidly in rough

country and suffer unnecessarily. Occasional shooting from the ground may only teach horses to avoid certain areas, and have little impact upon the overall population. Ground shooting can be advantageous during drought when horses congregate at long-lasting waterholes, providing an opportunity to remove horses not previously caught. This can supplement earlier harvesting efforts and enables effective overall control.

Guidelines for ground shooting

The following guidelines are taken from the 1988 report of the Northern Territory Feral Animal Committee Sub-group and outline the correct procedure for shooting feral horses from the ground:

- personnel must be qualified in the use of firearms. Qualifications should include a practical test of marksmanship;
- firearms and ammunition used must be suitable for the species and the distance over which they will be shot (R.4);
- if possible, use telescopic sights. Aim to destroy the brain or heart/great vessels of the target animal. Shooting at other parts of the body is unacceptable;
- check to ensure that the animal is dead; and
- immediately use all possible action to locate and destroy any wounded animal.

R.6 HANDLING CAPTURED HORSES

Feral horses need to be handled quietly and cautiously to reduce the risk of injury and the risk of horses escaping. The *Model Code of Practice for the Welfare of Animals - Feral Livestock Animals* issued by the SCAW should be followed. SCAW is preparing a code for the transport of horses, including feral horses. Once prepared, it should be the basis for handling horses during transport.

Stockperson outside the yards

A person standing outside the yards can help to slow horses being run through a gateway, reducing the risk of horses attempting to jump out of the yards. An outside person can also relieve pressure points where horses bunch up, which is important in portable yards. Most contract musterers use portable yards because established yards are uncommon in country occupied by feral horses.

Personal safety

For personal safety the motto is 'eyes in the back of your head' when working brumbies in a yard. Beware of horses kicking.

Drafting

Drafting is necessary to separate young and poor condition horses from the rest of the herd. This reduces the risk of light stock being injured on the truck. The herd should be drafted into stallions, mares in advanced pregnancy, mares with foals at foot, and horses greatly differing in size, and transported separately. Stallions should be drafted off from a maternal herd if the horses are to remain in the yard for more than two days. This reduces the incidence of horses fighting while in the yard.

Young foals, horses in poor condition and heavily pregnant mares should not be transported, but humanely destroyed.

Hessian in the yards

Hessian hung above normal yard height can be used to deter horses from pressuring or jumping vulnerable parts of the yard such as the main gate. A length

of hessian held between two people in the yards can sometimes help move difficult horses through a gateway.

Food and water for yarded horses

Yarded horses require access to water. The *Model Code of Practice for the Welfare of Animals — Road Transport of Livestock* states that horses require 25 litres (5.5 gallons) of water a day, although double this amount may be needed in very hot weather (above 40°C).

Supplementation with electrolytes is desirable for horses mustered in hot weather. Mixtures of electrolytes are available from stock and station agents and are administered by placing the required amount in the water trough. Electrolytes are not necessary for horses caught by trapping.

Yarded horses require 6 kg a day of good quality hay. Hay may be trampled and wasted unless placed along the inside edge of the yard panels.

Hosing down horses with water refreshes recently mustered horses. It is essential in hot weather but is an advantage in most weather conditions as it has a quietening effect.

Cattle prodders or flappers

Flappers or electric cattle prods can be used to encourage horses to move along the race. Flappers are recommended because horses are more sensitive to prodders than are cattle. Prodders should be used judiciously.

R.7 PROPERTY ACCESS FOR TRUCKS

Vehicle access

Existing tracks may need grading and their gullies filled to enable trucks to reach yarded horses.

When portable yards are used, new tracks graded to reach the best location may be needed. Overhanging branches along the track should be lopped if they restrict truck access or have the potential to injure or frighten horses during transport.

Where tracks are too rough for road trains, body trucks or semi-trailers can ferry out horses to trailers parked on better sections of track. Horses can then be jumped across to the waiting vans.

Loading

Feral horses normally can be loaded in reasonable time and without incident when handled correctly. They become harder to load if they are disturbed. Some operators prefer to draft horses into age and condition classes before loading, as it speeds up the process because horses move faster through the race if not interrupted by drafting as they are loaded. On the other hand, other operators prefer to draft during loading, which has the advantage that less handling is needed. Different lines of horses can be taken off through the crush while the line to be loaded continues up the loading race on to the truck. Horses do not usually load well at night.

Recommended loading densities during road transport range from 0.9 m^2 a head, for ages 12-18 months, to 1.2 m^2 a head for adults. The authors endorse these recommendations.

Branding

Horses must be branded for proof of ownership. A hair brand is sufficient. Horses can be side-branded in the race or branded on the rump after they have been loaded.

Sale

Horses may be sold at point of capture, from which they are generally loaded and transported to meatworks. Otherwise, they are trucked to a government trucking yard where buyers may inspect stock.

Yard fees are payable to cover feed and holding costs.

Horses are stock, and under State and Territory law a correctly completed waybill is needed for transport.

R.8 FERTILITY CONTROL

Introduction

The aim of fertility control is to reduce the birthrate and thus slow population growth. Most animal welfare groups propose the use of fertility control for feral horses, regarding it more humane than the conventional methods of control now used.

Contraceptives work on horses but administering the drug into 'wild' horses is very difficult, time-consuming and costly. The cost is generally prohibitive.

There are also concerns about the effectiveness of fertility control (Section 8.5.2).

Proposed administration of contraceptives

The most common means proposed for contraceptive administration is by dart, either from a helicopter or from the ground. Horses would need to be re-treated each year. Other means, such as oral administration, are not species-specific.

Problems with fertility control

There are several problems which prevent the adoption of fertility control for horses. These include:

- lack of a suitable single-dose drug;
- the large number of horses which would have to be treated;
- the wide distribution of feral horses, often in inaccessible country;
- a reduced birthrate will not decrease the number of horses in the short-term, so feral horse damage will not be decreased, because horses are long-lived animals;
- the large number of natural waterholes, which makes it difficult to concentrate darting;
- the difficulty of closely approaching wild horses, making darting very difficult; and
- the very high costs in purchase and broadscale administration of drugs.

Several developments are needed before fertility control is a viable option. These include:

- a relatively inexpensive drug which causes long-term or permanent infertility;
- a way of selectively delivering the drug automatically and cheaply only to feral horses and not cattle or wildlife; and
- a way of identifying treated horses.

Fertility control may be useful to help stabilise small populations of horses in localised, controlled areas such as parks or reserves. Its use would be limited in inaccessible country. Its main potential is as a post-reduction technique in specialised areas to stabilise a horse population which is first reduced by more conventional methods.

THE FOLLOWING IS A LIST OF MEMBER ORGANISATIONS OF THE VERTEBRATE PESTS COMMITTEE AND CONTACTS FOR MORE INFORMATION ON PEST ANIMALS

Executive Officer
Wildlife Division
Conservation Commission of the Northern Territory
PO Box 496
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The Director
Agricultural Production & Natural Resources Branch
Bureau of Resource Sciences
GPO Box E11
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PARKES ACT 2600

Chief
Animal & Plant Control Commission
GPO Box 1671
ADELAIDE SA 5001

Unit Manager
Vertebrate Pests Land & Catchment Protection Branch
Department of Conservation & Natural Resources
250 Victoria Parade
MELBOURNE VIC 3000

Chief
Division of Wildlife & Ecology
CSIRO
PO Box 84
LYNEHAM ACT 2602

Executive Director
Rural Lands Protection Board
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NORTH QUAY QLD 4002

Manager
Agricultural Production
NSW Agriculture
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ORANGE NSW 2800

Manager
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ACT Parks & Conservation Service
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Chief Executive Officer
Agriculture Protection Board
Baron-Hay Court
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Director
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Australian Nature Conservation Agency
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CANBERRA CITY ACT 2601

Senior Research Officer
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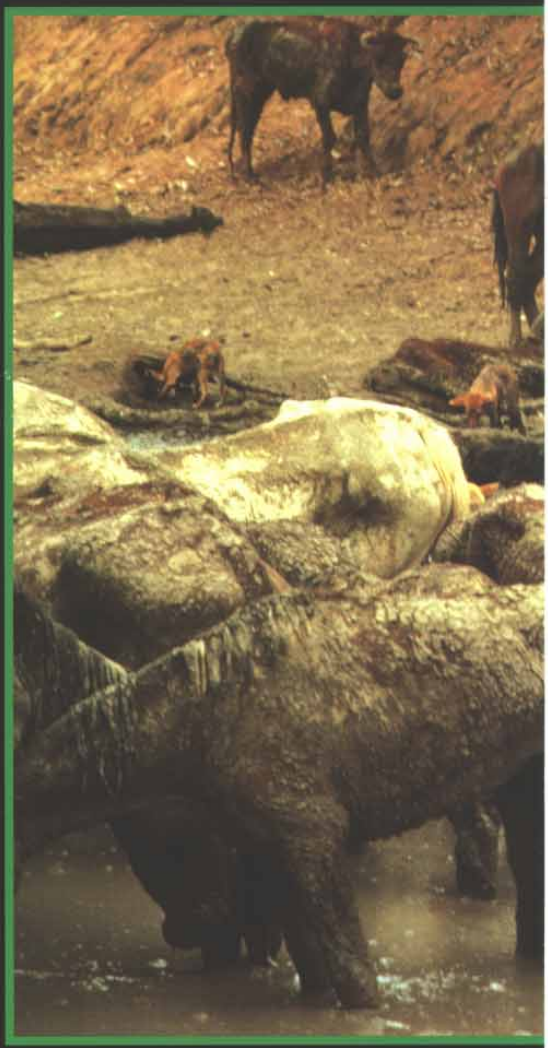
Riccarton
CHRISTCHURCH NEW ZEALAND

Australia has an estimated 300 000 feral horses, mainly in central and northern Australia. Feral horses are a complex management problem because they are widespread, often occur in relatively inaccessible country, are a major economic and environmental pest, and are both a commercial resource and an animal welfare concern.

This book contains a comprehensive review of the history of feral horses in Australia, their biology, the damage they cause, and past and current management. The attitudes of animal welfare and other interest groups are examined. The authors recommend management techniques and strategies for control, illustrated by a case study. Areas for further research are identified.

The book is an essential reference and management guide for policy makers, land managers and other interested in feral horses.



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