FERAL ANIMAL AND WILD STOCK CONTROL STRATEGY FOR LANDS MANAGED BY THE DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

KIMBERLEY REGION

Western Australia Department of Conservation and Land Management (2005)

Contents

Acknowledgements

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Cover Page Photos (top to bottom):
Cattle – (Photo: Karlene Hindmarsh)
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Cane Toad – (Photo: Chris Done)
Cat in cage trap – Purnululu National Park (Photo: Allan Thomson)
Pacific Rat in Elliot trap – Adele Island Nature Reserve (Photo: Kirsten Pearce)
Mouse – Browse Island Nature Reserve (Photo: Kirsten Pearce)

Cattle – Drysdale River National Park
Photo: Allan Thomson

BACKGROUND

Populations of feral animals in the Kimberley region have been altering native vegetation assemblages and ecosystem functions, and destroying valuable foraging and shelter habitat of native fauna since the arrival of Europeans in Australia. Cats and rodents may have been introduced from shipwrecks prior to the European colonisation of the land. Exotic fauna including, cats, cattle, donkeys, camels, pigs; rodents and cane toads, have all adapted to conditions in northern Australia and now exist largely unchecked by natural predators and most other population constraints.

In this strategy the term 'feral animals' encompasses those species that do not occur naturally in Australia and are having a negative impact on biodiversity. Within the context of this document the term 'wild stock' is limited to cattle of this animals special standing in a legal context and references to feral animals shall implicitly include wild stock. It is acknowledged that species that are considered native to Australia, such as dingoes or silver gulls, may also be regarded as pests when they become established in large numbers outside of their natural range in a response to human induced change.

The promotion of biodiversity conservation is a key role of the Department of Conservation and Land Management across the State. Where ecosystems are altered by the behaviour of feral animals; the vigour and biodiversity of these carefully balanced ecosystems may be irretrievably modified. The destruction of soil profiles, water turbidity, weed dispersal, soil erosion and compaction; selective grazing, wallowing and predatory behaviour are all impacts attributable to feral animal behaviour. These impacts must be managed to protect the biodiversity values that characterise the State.

The remoteness and topography of the Kimberley region significantly increases costs and logistical problems associated with control efforts. Long term financial and personnel commitment with defined strategies and combined efforts with neighbours, stakeholders and other government departments will be essential to ensuring the success of future control and eradication programs.

This strategy refers to lands in the Kimberley region that are vested in the Conservation Commission of Western Australia, are held by the Executive Director or are covered by management agreements (See map 1).

The principles and components of this strategy can also be applied to proposed conservation estate (Eg. Long standing reservation proposals and those defined in the 2015 pastoral lease renewal process) and areas covered under other conventions (Eg. Wetlands of International Importance) where a problem is identified or could be avoided by early intervention.

The preparation of this document has highlighted the absence of feral fauna data on significant areas of conservation estate. Reserves not managed by on-site or local staff are particularly conspicuous in their lack of distribution and abundance of data.

The content of this strategy is intended to facilitate the development of reserve based feral fauna control plans. The requirement for details specific to reserves will be met in these plans. CALM district officers and rangers are encouraged to request regional assistance and liaison in all feral animal planning and control.

GUIDING DOCUMENTATION

CALM's Key Objective

'To protect, conserve and where necessary and possible, restore Western Australia's natural biodiversity'

- **Department of Conservation and Land Management Act 1984**
  Section 33 (1) (d) – *to be responsible for the conservation and protection of flora and fauna throughout the State...*

  Section 56 (1) - (1) *A controlling body shall, in the preparation of proposed management plans for any land, have the objective of achieving or promoting the purpose for which the land is vested in it, or for which the care, control and management of the land are placed with it....*

- **Draft Kimberley Region Management Plan (2001)**
  '..prepare a control program for weeds, feral animals and other pest species on a priority basis which incorporates exiting and potential impact, locations and availability of resources, and a monitoring component within the control program'.

- **The Department of CALM's Strategic Planning and Forward Estimates Process:**

  Each year the Corporate Executive agrees on priority areas for action under six identified key result areas (KRA's). Whilst a commitment to the KRA's remains constant from one year to the next the priorities may change. For example the list below is inclusive of the priorities for 2005-2006. This document will be updated on an annual basis to reflect this.

  Nature Conservation Output

  KRA 1

  NC 1C - Expand biological surveys...including the Kimberly and Kimberley Islands ahead of the arrival of the cane toad.

  KRA 2

  NC 2A - Expand and enhance invasive species control programs on all conservation reserves under Departmental management as a major focus of our conservation management ethic and proposed good neighbour policy.

NC 2B - Management of the conservation reserve system with the primary goal of maintaining and recovering biodiversity.

NC 2D - Management of 12 Wetlands of International Importance in WA.

KRA 3

NC 3M - Develop and implement Cane Toad monitoring and management programme.

Special emphasis for 2005/6

Increase emphasis on core management of parks and reserves including control of threatening processes (feral animals, weeds etc.)

- **Agriculture and Related Resources Protection (ARRP) Act 1976**

Section 39 - Department to control declared plants and animals

A Government department shall control declared plants and declared animals on and in relation to public land under its control.

This is subject to the Agricultural Protection Board Act 1950, which overrides the ARRP Act. This '*allows CALM, in carrying out its responsibilities unde the ARRP Act, to reserve the right to decide priorities and the level of control in accordance with availability of funds.*' (CALM, Good Neighbour Policy)

- **Good Neighbour policy (Internal Draft)**

Section 4 - Control of Introduced Pest Animals

4.5.5 *CALM would like to see the pest animal control program eventually expanded to include Donkeys, horses and camels to address the ecological pest problems on UCL and CALM – managed lands.*

4.6.2 *The priorities and programs for wild dog control on CALM managed lands and UCL are developed in collaboration with DAWA, shires and landowners....*

4.6.4 *Whilst dingoes are considered vermin in pastoral areas, they are an important component of the natural ecosystem...*

Section 5 – Straying Stock on CALM-managed lands

5.2 – Pastoral Zone

5.2.1 *It may be appropriate to develop a written agreement to formalize the management of straying stock in the unfenced sections of boundaries between acquired pastoral properties and adjoining leases and reserves. Such agreements may cover monitoring and mustering arrangements, sale of mustered stock and losing of waters close to the lese boundary.*

5.2.2 *Where mustering of stock is approved on CALM-managed lands, neighbours bear the cost of mustering and arrange return of branded stock to respective owners. Fifty per cent of returns from sale of 'cleanskins' is paid to CALM. Agreement to muster is conditional on acceptance that stock remaining on CALM-managed lands may be killed as part of feral animal control.*

- **Related Acts and Regulations**:

  Conservation and Land Management Regulations 2002 (Regulation: 3, 15, 19, 20).
  Local Governement (Miscellaneous Provisions) Act 1960 (Section: 458(1), 458(2), 459, 460, 462-79, 481, 483, 484).
  Dividing Fences Act 1961.

- **1080**

  Circular 5/97 Use of Registered 1080 Products by CALM Personnel.

- **Firearms**

  Draft departmental (CALM) firearms occupational safety and health guide – corporate firearms license.
  Firearms regulations 1974.
  Firearms Act 1973.

OPERATIONAL OBJECTIVES

- Consistent with region-wide priorities and with Departmental objectives and.regulations, undertake feral animal control on CALM managed land in the Kimberley region.

- Continue to monitor and document the status, impact, distribution and management of feral fauna across CALM managed land in the Kimberley Region. In doing so a consistent approach that can be implemented regionally will be adopted.

- Enhance the conservation and restoration of ecological values in the Kimberley region by removing feral fauna.

- Enlist indigenous, community and stakeholder support and participation in feral fauna management planning and control.

- Foster working relations with the Department of Agriculture Western Australian (DAWA) to facilitate a joint approach to feral fauna control.

- Develop reserve-based feral fauna management plans that are strategic, ecologically sound and promote an integrated management approach. From initial implementation at strategically nominated sites, successful models will be extrapolated across the region.

- Establish a long-term feral fauna control budget plan.

Mus domesticus (Browse Island Nature Reserve, 2005)
Photo: Kirsten Pearce

KEY OUTCOMES

This strategy is stage one of a long-term commitment to feral fauna control. Its primary objective is to improve the co-ordination and planning of feral animal control on conservation estate.

This document:

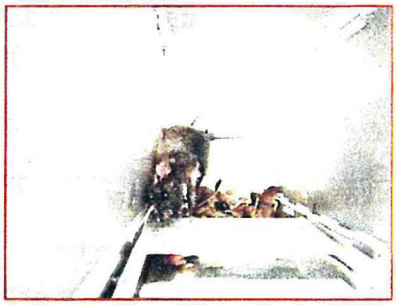
- Encourages a consistent approach to feral fauna control, with comparable outcomes.

- Highlights a deficiency of feral fauna data.

- Based on current information, prioritizes locations across the Kimberley for feral faunal control.

- Guides the development of reserve-based feral fauna control programs.

- Establishes criteria for monitoring, evaluation and resource allocation.



Rattus exulans (Adele Island, 2005)
Photo: Kirsten Pearce

REGIONAL REQUIREMENTS

- Survey and document the status of feral fauna on CALM-managed lands.
- Secure long term funding commitment for feral fauna control to foster a sense of regional commitment and to ensure a sustained approach to feral fauna control.
- 1080 training of CALM Officers to facilitate feral pig and cat control programs. Identify all training requirements in staff development and work programs.
- Firearm training to facilitate feral, cattle, donkey, came, pig and cat control programs. The Department acknowledges the need for an internal program to train officers to shoot from a 'moving platform' (aerial shooting). This is being considered for development.
- Foster relations with pastoral lessees and traditional owners. Encourage co-management of control programs that operate across tenures.
- Establish relations with DAWA or external contractors to undertake aerial shooting programs and mustering.
- Foster relations with DAWA and other informed agencies to facilitate successful control programs and to keep informed of research innovations.
- Establish community liaison programs to inform and educate people about the impact of feral animals.
- Establish a region-wide protocol for the handling of straying stock.
- Develop work programs that focus on the allocation of tasks in the late dry season when many feral fauna species are congregated around water sources.
- Develop a regionally consistent and comparable approach to survey, documentation and monitoring methods.
- Develop a model to facilitate the exchange of information between CALM officers; including promoting onsite jointly operative control, monitoring and evaluation sessions.
- Ensure that all threat abatement programs are coordinated and acknowledge possible linkages between various threatening processes.
- Develop a long term monitoring program.

ENVIRONMENTAL IMPACTS OF FERAL FAUNA NORTHERN AUSTRALIA

Despite their long history in Australia, in many instances the impact of feral animals on specific flora and fauna species remains unclear. A list of the environmental impact of feral animals found in the Kimberley region can be found in Appendix 3.

HOOFED SPECIES

Hoofed species (including pigs, cattle, donkeys and horses) damage soil biocrusts which are organically rich surface layers that protects the soil and contributes to soil productivity and biodiversity. This layer also helps to diminish erosion thus protecting soil structure. It is acknowledged that there has been substantial damage to the surface layers of the soils of the Kimberley at a landscape level (McKenzie and May, 2002). Hoofed species can cause significant soil erosion and also soil compaction. Soil compaction prevents seedling recruitment of native flora and reduces soil water uptake. Trampling behaviour destroys native flora and fauna habitat (McLeod, 2004).

Cattle, donkeys and horses all require a regular replenishment of water. As a direct consequence, particularly in the dry season, water holes, or areas in the vicinity of these water sources, are severely impacted upon (DEH, 2004). This is often seen in with a high degree of disturbed ground at water sites, erosion, intensive over grazing and a reduction of native flora diversity (and often an increase in weed density and diversity).

Cattle, donkeys and horses are all vectors of weeds. Seeds may be spread on their hair or in their droppings.

Cattle, donkeys and horses compete with native herbivores for food. Intensive grazing patterns and selective grazing (of the most protein rich and palatable species) prevents the natural opportunities for seedling recruitment, causing a reduction in floristic diversity and thus reducing the availability of palatable vegetation for native fauna. Granivores, which are specialist feeders, may also be disadvantaged by this reduction of floral diversity. Areas impacted on by grazing activity are often recolonized by exotic flora species, such as *Cenchrus ciliaris*.

CATTLE (*Bos indicus and Bos tarus*)

(See Hoofed Species)

PIGS *(Sus scrofa)*

Feral pigs are known to directly threaten a number of native fauna and flora species (McLeod, 2004). Particularly along riparian zones their feeding, trampling and wallowing behaviour can destroy native fauna habitat and food resources, cause erosion, increase water turbidity, cause nutrient enrichment of low nutrient waters, encourage water colonization and spread diseases (DAWA, 1992; Freegard, 2004). There is not considered to be a positive correlation between feral pig damage and

population size (CALM, 2005) in that a small number of these animals can cause a significant amount of damage. Of concern is the estimation of the pig densities in the Kimberley being greater than anywhere else in the State and affecting a large land area (See Appendix 4).

DONKEYS *(Equus asinus)*

(See Hoofed Species)

HORSES (*Equus callabus*)

(See Hoofed Species)

CANE TOAD *(Bufo marinus)*

Cane toads were introduced to northern Australia in 1935 to control the Scarab beetle on sugar cane crops. Unsuccessful in their purpose, they have rapidly been making their way across northern Australia. Without the development of effective controls they are predicted to arrive in Western Australia within the next two to five years.

The predatory behaviour of cane toads in conjunction with the effect of their toxins on would-be predators is causing an impact on the native fauna of northern Australia, however the extent of that impact is not well known. The level of competition with native animals for habitat is also poorly understood.

Research to date confirms the dramatic, deleterious impact of cane toads on northern quoll (*Dasyurus halucattus*) populations which predate upon the cane toad (Freeland, 2004; McLeod, 2004). Little research has been undertaken to confirm the impact of cane toads on invertebrate species, a group of animals that are known to be the primary diet of the toad.

It remains unclear what the long-term impact of the cane toad will be. Observations suggest that some native species, such as freshwater crocodiles and the black kite are capable of learning how to safely predate cane toads (Freeland, 2004). This does not suggest, however, that a complacent attitude is going to be adopted toward cane toads.

Cane toads represent a broad scale environmental threat and a social nuisance. Inadequate monitoring and data are hindering the development of native species recovery actions.

CAT (*Felis catus)*

Feral cats are listed as a threatening process in Schedule 3 of the Endangered Species Protection Act 1992 (DEH, 2004)

Given the absence of rabbits in the northwest, the diet of the feral cat is limited to native species including, birds, insects, reptiles and small mammals (McLeod, 2004; Dickman, 1996). Feral cats display a distinct preference for live prey, and target with

greatest success species which forage on the ground, or live in colonies (Dickman,1996). Species most vulnerable to feral cat predation are in a weight range under approximately 220g (Dickman, 1996). As they are capable of obtaining their water requirements from prey species, feral cats range into a broad array of habitats. Feral cats also compete with native species for food and habitat (Dickman, 1996)

Conclusive data confirming the impact of feral cats on native species in northern Australia is inadequate. The decline in native species in the north west is commonly attributed to grazing, fire and feral fauna predation. Separating specific 'cause and effect' is a time and cost consuming process.

HOUSE MOUSE *(Mus domesticus)*,

The house mouse competes with native rodents for food (Moro, 2000) and may also predate avifauna eggs and chicks. Again the impacts of this species in the broader environment are largely unknown in northern Australia.

PACIFIC/POLYNESIAN RATS *(Rattus exulans)*

The Pacific rat is believed to threaten ground nesting island avifauna. Pacific rats have also been recorded as having an impact on island skink populations (Towns, 1996). Pacific rats predate upon incubating birds, chicks and eggs (Atkinson, 1985; Keplar, 1967). Moves are currently underway to have the impact of rodents on island fauna listed as a key threatening process under the Environmental Protection and Biodiversity Conservation Act (EPBC) Act 1999. This listing may open up funding opportunities to tackle problems on at least one 'Kimberley' island (Adele Island Nature Reserve). Further understanding of processes and methods of control at a broadscale level are required before undertaking work on the mainland.

WILD DOG (*Canis familiaris familiaris*, and hybrid, *Canis familiaris familiaris* + *dingo)*

The dingo (Canis familiaris dingo) is not here included in the definition of 'wild dog' and is considered as a native species.

Wild dogs predate upon native fauna and domestic stock. Baiting is primarily undertaken on pastoral leases to protect stock. Under the principles of the Good Neighbour Policy, CALM will bait for wild dogs not only to protect native fauna, but also to protect the interests of neighbours. This will be addressed on a case-by-case basis.

CAMELS *(Camelus dromedaries)*

The full impact of camels on biodiversity is not well documented. Their disregard for fences, is however, commonly acknowledged. They also trample native flora, and fauna habitat (McLeod, 2004). In addition to consumption of grasses, camels will graze, often destructively, on trees up to 3.5m. During dry periods, they also compete with native animals for water resources, consuming up to 200 litres in three minutes (DEH, 2004). They have also caused damage to infrastructure whilst seeking water

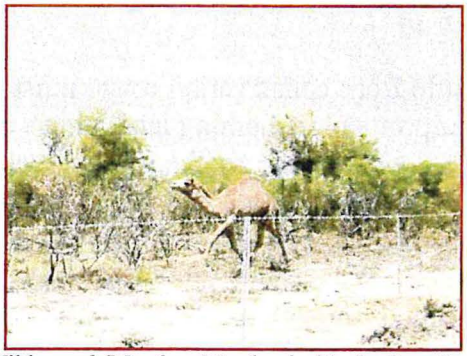
during harsh periods. In the Kimberley region the destruction of important desert wetland environments, and impacts on termite mounds, has been recorded (G Graham pers com). Their padded feet have been thought to be less destructive on the soil profile in particular in sandy country. Their feeding behaviour is very destructive. Their browsing habits are highly selective, with the trees or shrubs 'selected' being almost entirely stripped and with upper branches broken to facilitate access to upper foliage (D.Wurst, pers. comm.). Populations appear to be moving into new habitat having exceeded their carrying capacity in desert regions (D. Wurst, pers. Comm.).

EUROPEAN RED FOX *Vulpes vulpes*

Predation by the European red fox on native mammals, reptiles and ground nesting birds is considered to have contributed to the decline of a number of species in the natural environment (DEH, 2004). The fox is only seasonally recorded in the southern Kimberley. In particular they have been regularly recorded in the Eighty Mile Beach area and, whilst there might be concerns about their impact on turtles and migratory waders, more work in documenting this is required. Little is known about their distribution into the deserts but they have been recorded from the Dampier Peninsula, where Bilby (*Macrotis lagotis*) populations are known to exist. On balance, given our limited knowledge of the impacts of the fox in the Kimberley, control work on this species is unlikely to be treated as a priority. There may be opportunities, however, to build on the work undertaken in the south of the State under the Western Shield program.

OTHERS

Other feral animal species have been recorded in the Kimberley region. This includes exotic invertebrates such as the Singapore Ant (*Monomorium destructor)* and the Mystery Snail (*Pomoceae bridgesii).* The status of such exotic species is unknown on CALM estate. Equally little is known of exotic marine species and further work is required to assess their status also.



Wild camel (Mandora Marsh – inside the fenceline)
Photo: Tanya Compton

RECOMMENDED CONTROL METHODS

In the wet/dry climate of the northwest, as a generalisation, it is wise to take advantage of the harsh late dry season conditions in developing feral fauna control programs. At this time of the year water sources are severely depleted. Populations, including, cane toads, donkeys, camels, cattle and pigs will congregate at the scant water sources, providing an opportune window for control. Reduced food resources are also characteristic of the late dry season. Baiting programs may also be more effective at this time during which feral fauna are more inclined to accept foreign foods.

Opportunities exist where fencing will be effective when undertaken in a strategic manner and particularly when combined with other control methods. Land systems with natural barriers may require minimal infrastructure to prevent entry to roaming cattle, donkeys, horses and camels.

Carefully planning is required when developing fencing options. Constraints that need to be considered include rugged landscapes, remote and vast locations, limited financial resources, seasonal flooding, water inundated soils, seasonal and permanent water courses, and fire events. Long term maintenance demands and staff availability must be taken into consideration, including the adoption of a find it and fix it mentality amongst staff.

The user of 1080 products must have a letter of authority as provided by CALM or DAWA following the completion of a 1080 Authorization Course. All handling protocol is per current training instructions.

Control operations, which promote co-operation with traditional owners and neighbouring land owners and stakeholders is should be adopted as a matter of standard practice..

CATTLE

Programs to remove cattle from conservation estate must be developed in line with a regional good neighbour protocol. Adjoining landholders must be offered an option to remove their cattle from CALM estate and be given a realistic time frame in which to comply. Subsequent to a period of no action, CALM officers may remove the straying cattle. The CALM 'Good Neighbour Policy' is still in development stages, however the pertinent guidelines may be noted on page five of this strategy. It is a recommendation of this strategy that a north west protocol is developed for removal of cattle from CALM managed lands.

Where the terrain is rugged and inaccessible for vehicles, cattle may be removed with an aerial shooting program. Alternatively cattle may be mustered (by lease holders or contractors) aerially or on the ground. It is the Department's approach in the region that, following any mustering programs, remaining cattle are shot to minimise the rate

of build up of a new population. Aerial shooting for cattle is most effectively undertaken on a land-system-by-land-system basis to take advantage of natural barriers and to prevent the immediate re-establishment of populations (Goddard, pers comm.).

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DONKEYS

Donkey control is undertaken by the Department of Agriculture Western Australia (DAWA). Since 1994 the DAWA has been fitting radio transmitter collars to (Judas) donkeys. This program relies on the social behaviour of the donkey, with the collared donkey leading aerial trackers and shooters to even the smallest mob of donkeys. CALM currently pays for this work to be undertaken by DAWA and it is intended that this program will be expanded.

FERAL PIGS

Traditionally the preferred method for controlling feral pigs has been shooting. Recent research has indicated that shooting achieves the eradication of approximately 30% of the population. The remainder disperse into the environment (Twigg,. pers comm.). It is considered that shooting as a single control method in the Kimberley will not be effective.

Baiting programs which include a pre-feeding period of approximately 5 days prior to baiting procedures have indicated an excellent rate of control (Twigg, 2004). At locations where access is restricted by topographical features, or is cost prohibitive, shooting may still be used as a control method (Everett, pers comm). In suitable conditions, trapping may still be employed as a control method (also with a pre feeding period).

CANE TOADS

Whilst not currently found in the region this toad is within a few kilometres of water catchments leading to Western Australia from the Northern Territory. Major initiatives are underway in the implementation of a number of approaches to prevent, or at least delay the introduction of cane toads into the State. Activities undertaken include;

- The monitoring of the location and rate of spread of the cane toad in the Northern Territory in the vicinity of the Victoria River.
- Documentation of suitable refugia for the cane toad during the dry season.
- Trialling of fencing and trapping techniques.
- Documentation of important habitats.
- Improved quarantine at the State border.
- Biodiversity monitoring programs.
- Public education and the development of community participation in control programs.

Research is being undertaken on cane toad gene manipulation to prevent metamorphosis. If this is successful, release of a product is a minimum of 10 years away (CSIRO, 2004). The Queensland government is also funding investigations into the development of a suitable toad 'bait'.

RODENTS

Rodent control is conducted using ground baits. Use of baits (typically containing active ingredients such as Brodifacoum, Warfarin or Bromadiolon) poses a risk to non-target species. The native fauna present at specific sites will determine bait program methodology, which may require a creative planning approach. Aerial baiting of islands for rodent infestations has proven success, however is limited to sites where bird activity does not pose an unacceptable risk to the aerial team. The Department of Conservation (DOC) in New Zealand, which has recognized rodent baiting expertise, has previously rendered assistance to CALM rodent eradication programs (Burbidge, 2001).

FERAL CATS

A new bait is currently being developed by CALM (Algar, pers. comm.) and is expected to be released by the end of 2005. Baiting operations are made complex by the large home range of the feral cat and their low densities. They are also extremely cautious and very reluctant to take carrion (McLeod, 2004). Trapping and baiting methodology is under constant review to overcome these obstacles. The use of visual attractants is also being investigated. T

CAMELS

Shooting is the method currently employed for feral camel control on CALM managed land in the Kimberley region.

WILD DOGS

Wild dogs are typically baited with 1080 meat baits. In 2004 a new salami style bait, 'Pro Bait Plus', was tested against the traditional dried meat bait. Results were not conclusive; however preliminary results suggested that the dogs showed no preference. The Pro Bait Plus baits were found to last better in the natural environment (Thomson, 2004).

Photo: Karlene Hindmarsh

FERAL FAUNA OF SIGNIFICANCE ON CONSERVATION ESTATE

These species (in approximate order of significance) are currently considered to pose the most significant threat to the environmental values of the Kimberley region. This priority listing is only an indication. Individual site assessment may reveal some variation of priorities based on the unique conditions found at each site.

1.Cattle
2. Pig
3. Donkey
4. Cat
5. Polynesian Rat
6. Cane Toad (Listed as a immediately identifiable potential threat)

ESTABLISHING PRIORITIES FOR ACTION

There is very little data available to quantifiably justify the prioritization of feral fauna on CALM managed land in the Kimberley region based on population density or scope. As part of on-going work the status and distribution of feral animals will continue to be documented to assist in the allocation of resources.

Most assessments and records of feral fauna occurrence are based on opportunistic observations (see Appendix 2). Given the vast areas in question; costs, logistics and time full-scale feral fauna surveys are difficult to achieve in any detail, however, it is intended that an program will be undertaken over time for each of the CALM managed reserves.

Feral fauna management should adhere to the following principles (in order of priority):

1. Prevent the introduction of feral species at regional, state or nation wide borders.
2. Identify and eradicate new, island or outlying populations.
3. Control, contain or eradicate existing populations.

The nomination of sites for control, containment or eradication of feral fauna should take into consideration:

- Environmental and social values and impacts
- Indigenous and other stakeholder support
- Potential for re-population of control site
- Practicality of control (resource based)
- Practicality of control measures
- Environmental impact assessment (EIA)

Environmental and social values and impacts

The severity of environmental degradation being caused by feral fauna behaviour should be considered in the development of control priorities. Feral fauna can reduce the aesthetic or recreational appeal of a site by their presence or by the environmental degradation they cause. Feral fauna may also pose a risk to road users.

Determining sites of high environmental and cultural values will help to direct prioritization measures. Sites of cultural value may include sites such as initiation sites or sites that provide valuable food resources. Sites of high environmental value may include threatened ecological communities, rare flora and fauna locations, or sites of high biodiversity.

Indigenous and other stakeholder support

Stakeholder, neighbour, and traditional owner relations which are existing or may be readily established will be crucial in the successful establishment of successful 'across tenure' planning and control. Consideration should be given to multi-agency and multi-'industry' participation and long term planning.

Potential for re-population of control site

Removal of feral species from an open land system must be done so in the knowledge that the area might be continuously re-populated. Securing ongoing financial and staffing commitment must be reflected in any control plans.

Fencing may be determined to be a realistic means to control the re-population of sites by cattle, horses or donkeys. Regular maintenance must be programmed to ensure the effectiveness of this strategy.

Practicality of control measures

Plans should be constructed with a long term focus and at a scale appropriate to the availability of financial and human resources. Feral animal control requires ongoing financial and personnel commitment. Where extensive resources are not available to undertake broad scale programs, it may be more effective to target strategically selected, less affected areas or outlying (island) populations. In addition to the crucial outcome of preventing the establishment of new or outlying populations, these operations, where strategically selected, may be managed successfully within the limits of available resources.

Logistical planning must take into consideration the, seasonality of site access, officer capability (training background), topographic limitations, availability of contractors, adequacy of resources for follow-up measures, site repopulation and visitor risk assessment.

Environmental Impact Assessment

The impact of control operations (if any) must be measured against the benefit of the anticipated outcome. See below 'Environmental Impact Assessment'

FERAL FAUNA PRIORITIZED ON CALM MANAGED LAND IN THE KIMBERLEY REGION

This table lists those species considered to pose the greatest risk to reserve values (based on current knowledge).

LOCATION	SPECIES
North Kimberley	
Prince Regent Nature Reserve	Cattle
Drysdale River National Park	Cattle and donkeys
Mitchell IBRA sub region	Feral cattle, cats (potentially pigs)
East Kimberley	
Parry Lagoons Nature Reserve	Cattle
Ord River Nature Reserve	Cattle
Purnululu National Park	Cattle and cats
Point Spring Nature Reserve	Cattle and cats
Mirima National Park	Cats and wild dogs
West Kimberley	
Geikie Gorge National and Conservation park .	Pigs
Brooking Gorge Conservation Park	Cattle
King Leopold Range Conservation Park	Pigs and cattle
Island Reserves	
Adele Island	Pacific/Polynesian Rats

Cane Toad (*Bufos marinus)*
Photo: Chris Done

ENVIRONMENTAL IMPACT ASSESSMENT

All actions undertaken for feral fauna control must remain mindful of their impact on the natural environment. Impacts of concern include:

- Native animal by-catch in baiting and trapping programs. Unlike elsewhere in southern Australia plants containing fluroacetates are not widespread in the Kimberley. Because of the lack of exposure to such poisons there is concern that the level of resistance of native animal species to the 1080 poison is not as great as found in southern native animal species.
- Mustering of cattle often requires pushing through roads to allow trucks to access muster points. The potential for the introduction of new weed species, and the creation of 'disturbed' weed habitat, must be given due consideration in the planning process. Tracks will also facilitate the movement of feral fauna throughout the landscape.
- The removal of grazing herbivores also removes 'fuel load regulators'. Fire planning must be carried out in conjunction with feral fauna control planning.
- Encouraging the public to remove and kill cane toads poses a threat to morphologically similar native frogs, such as *Cyclorana australis.*
- Removal of wild dogs may cause an increase in feral cat populations as the predator-prey hierarchy is changed.

MONITORING AND EVALUATION

As with all operations where we are dealing with long term outcomes, monitoring and evaluation of our activities is essential.

It is considered by DAWA staff that results of aerial surveys to determine the density of feral cattle and donkey populations in the east Kimberley did not accurately portray on – ground conditions. The nature of the landscape proved to be a significant obstacle in the acquirement of accurate density and scope data (D. Goddard, pers comm). Aerial surveys will be used by CALM to determine presence/absence across the landscape and to try to establish population trends along a series of transects.

Any aerial shooting undertaken requires comprehensive documentation that records the location for each species. A progressive decline in numbers taken will be indicative of control success. Ongoing monitoring and control measures will be essential to prevent the re-establishment of feral fauna populations.

Evaluation of baiting (1080) programs (such as those undertaken for wild dogs or feral pigs) are often difficult to quantify as the animals may move some distance away from the baiting station to die.

Similarly for control programs, monitoring is most successfully undertaken in the late dry season when most animals are less dispersed throughout the landscape, and will congregate at water sources.

Monitoring of feral fauna requires persistence and ingenuity to overcome the numerous obstacles to obtaining accurate and indicative data. However it is relevant that monitoring programs, as an initial target, should seek to determine trends in the environment and should focus on baseline parameters

Documentation

Documentation at each stage of planning, implementing, and monitoring is essential. It facilitates accountable priority setting and resource allocation and provides a valuable history of feral animal control across the region.

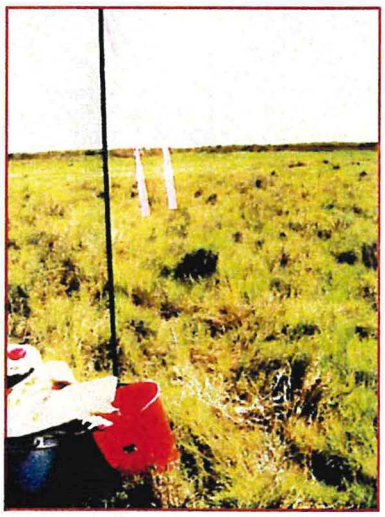
Comprehensive documented results, which can justify a particular control approach are more likely to attract funding. Equally, documentation of successful outcomes will guide other officers in their planning and control operations.

Documentation must be:

- Comprenhensive,
- Available to all staff,
- In a user-friendly format, and,
- Archived in a retrievable manner

Evaluation

The evaluation process requires consideration of approaches that did, or did not, work. Understanding the reason behind success or failure places operators in an improved position in the development of future plans. All operational planning demands continual reassessment and plan modification as know-how develops and new initiatives and techniques are revealed.



RESOURCE ALLOCATION

Distribution of finances must satisfy three elements:

i. Long term financial commitment to feral animal control and containment at prioritized locations
ii. Long term financial commitment to the repeat process of site survey, treatment monitoring and site evaluation
iii. Immediate 'non specific' funding to target new feral animal incursions which can be eradicated

TASK	COORDINATOR	RESOURCES	COSTS	COMPLETION DATE
Document the status and distribution of feral animal species across CALM managed lands.	RNCO	• Vehicles, aircraft • GIS mapping	$35,000 per year	June 2006
Develop and implement feral fauna plans for priority estate (including across tenure control).	RIC's	• Vehicles • Aircraft • 1080 and firearm trained staff and/or contractors.	By priority reserve	December 2005 for plan. Implementation on-going with annual reviews.
Liaise with neighbours to facilitate 'across tenure' control.	All staff	vehicle	$5000	Initiate by June 2006
Liaise with DAWA on issues of feral fauna control and research. Co – ordinate control approach and implementation where applicable.	RLNC, RNCO	• Vehicle	$10 000	Ongoing
Monitoring, evaluation and review	RLNC, RNCO, RIC's,	• GPS • Camera • Binoculars • Vehicle • Aircraft • GIS contractor	$20 000	On going
CALM Officer Training	RLNC, DM	• Flights to Perth • T/A	$15000	June 2008
Wet season mobilization for priority reserves	RIC's, RNCO	• Quad bikes • Fuel drops • Aircraft • 1080 and/or firearm trained staff or contractors.	By reserve	On going
Emergency funding for new incursions.	RLNC	• Vehicle • Aircraft • GIS contractor	$15 000	

INDIVIDUAL CONSERVATION ESTATE GUIDELINES

PLANNING

Developing a feral animal control plan will ensure you target the right species at the most appropriate time using the most effective and up to date methods. Plans also allow you to set objectives which are measurable, achievable and justifiable, and create an operational environment which supports logical monitoring and follow-up treatments. Plans are also invaluable for supporting funding applications (especially for long term planning) and developing work programs.

The guidelines, below, will help to develop a logical plan for each area of CALM managed estate and assist in guiding existing and future priorities. The reserved based plan is intended to be a brief document, which calls on the unique experiences and knowledge of park based CALM officers. It is also intended that this document will assist future CALM officers in gaining a rapid appreciation of on – ground issues and control measures.

Using these guidelines it is intended that 'stand alone' plans will be developed for CALM managed reserves that will assist in regional resource allocations. The plans will be endorsed by program leaders and the regional manager.

OUTLINE OF FERAL ANIMAL CONTROL PLAN FOR INDIVIDUAL ESTATE

Background:

- Estate name
- Size (ha)
- Landscape features
- High Value sites
- Vegetation
- Past and current use
- Sites of Cultural Significance
- Stakeholders (existing relations)
- Access

Feral Fauna Profile (In table format)

Feral fauna on Site

Feral animal Status (In table Format)

Species	Location	Impact	Past control	Notes

Strategic Priorities for Action (In table Format)

Priority (high/low/moderate)	Objective	Strategy	Action	Responsibility

Species by Species Priorities for Action (In table Format)

Priority (high/moderate/low)	Species	location	Objective	Actions	Notes

Environmental Impact Assessment

- Potential impact of control work.

Monitoring and Evaluation

- Locations where monitoring has not been undertaken
- Past and current monitoring activities
- Cost approximations for the short and long term.
- Time frames
- Standard/uniform documentation style
- Record keeping custodianship

Resource Requirements

Resource nomination must be considered with realistic consideration of CALM officer availability and work programs design.

Consider:

- Staff availability
- Budget for short and long term
- Training requirements
- Materials, equipment, vehicle costs and maintenance
- Safety procedures – personnel protective equipment and first aid
- Aerial photos
- GIS expertise
- Public education
- Documentation
- Monitoring
- Wet season mobilization (for priority sites)

Signed off by

- Regional Manger
- Regional Leader Nature Conservation
- District Manager

CASE STUDY

To be developed by during 2005.

REFERENCES

- Atkinson, A.E (1985) *The spread of commensal species of Rattus to oceanic islands and their effects on island avifaunas* in: ICBP Technical publications No.3, Department of Science and Industrial Research, New Zealand.

- Biodiversity Group, Environment Australia, (1999) *Threat Abatement Plan for Predation by Feral Cats – National Feral Animal Control Program,* Commonwealth of Australia, Canberra

- Burbidge, A (unpublished) *Montebello Renewal – Black Rat Eradication, 2001.* Department of Conservation and Land Management.

- CALM – Intranet, *Western Australian Consolidated Acts, Conservation and Land Mangement Act 1984*
  URL: http://www.austlii.edu.au/au/legis/wa/consol_act/calma1984290/
  Accessed – February 2005

- CALM – Intranet, *Western Australian Consolidated Acts, Agriculture and Related Resources Protection Act 1976*
  URL: http://www.austlii.edu.au/au/legis/wa/consol_act/aarrpa1976458/
  Accessed – February 2005

- CALM – Nature Base, *About Us*
  URL: http://www.calm.wa.gov.au/about_calm.html
  Accessed – February 2005.

- CALM (unpublished) *Strategic Planning and Forward Estimates Process 2004/5.*

- CALM (2001), *Draft Kimberley Regional Management Plan*

- CALM Feral Pig Information Exchange Day (Unpublished), Perth, March 15th, 2005.

- CALM (Unpublished) *Good Neighbour Policy 2004 (Internal Draft)*

- *CALM Intranet,* Firearms regulations 1974
  URL: http://www.austlii.edu.au/au/legis/wa/consol_reg/fr1974211/
  Accessed – January 2005

- CALM Intranet, *Draft departmental firearms occupational safety and health guide – corporate firearms license.*
  URL: http://calmweb.calm.wa.gov.au/drb/csd/hrb/risk/guidelines/firearms.doc
  Accessed – January 2005

- CALM Intranet, *Western Australian Consolidated Acts, Firearms Act 1973*
  URL: http://www.austlii.edu.au/au/legis/wa/consol_act/fa1973102/
  Accessed – January 2005

- CALM Intranet, *Use of Registered 1080 Products by CALM Personnel*
  URL: http://calmweb.calm.wa.gov.au/drb/edo/mab/circ.htm
  Accessed January 2005

- CSIRO, *Cane Toad Research*
  URL: http://www.csiro.au/index.asp?type=faq&id=CaneToadControl
  Accessed: February 2005.

- Department of Agriculture Western Australia (DAWA), (unpublished) Memo: Preliminary evaluation of a new bait for wild dog control, September 2004.

- Department of Environment and Heritage (DEH) (2004), *Invasive Species in Australia* pamphlet series, Canberra
  The feral pig
  The feral horse and feral donkey
  The feral cat
  The feral camel
  The cane toad
  European Red fox

- Dickman, C.R., (1996) *Overview of the Impacts of Feral Cats on Australian Native Fauna – Invasive Species Program,* Australian Nature Conservancy Agency, Canberra.

- Freegard, C., (2004), Draft *Feral Pig Management Strategy for Departmental Managed Land.* Department of Conservation and Land Management.

- Freeland, B – (HLA – Envriosciences Pty Ltd) (2004) *An assessment of the Introduced Cane Toad's (Bufo marinus lineaus) impacts on native Australian fauna, with particular reference to the Eastern Kimberley Region* (reference incomplete)

- Keplar, C., *Polynnesian Rat predation on nesting Laysar albatrosses and other pacific seabirds,* in: Auk, Volume 84, July 1967 pp.426-430.

- McCleod,R., (2004) *Counting the Cost: Impact of Invasive Animals in Australia 2004.* Cooperative Research Centre for Pest Animal Control. Canberra.

- McKenzie, N.L., May, J.E. (Eds) (2003) *A biodiversity Audit of Western Australia's Biogeographical Subregions in 2002,* Department of Conservation and Land Management, Western Australia.

- Moro, D., *Evaluation and cost benefits of controlling house mice (Mus domesticus) on islands; an example from Thenvenard Isl. WA.* In: Biological Conservation, Vol. 99, 2001 pp.355-364

- Norman, F.I., *The Murine Rodents Rattus rattus, exulans and norvegicus as avian predators,* (reference incomplete)

- Rickman, L *Feral Pig.* In Australian Culture: Introduced Species
  URL: http://cstl-cla.semo.edu/zeller/feral_pig.htm
  Accessed – February 2005.

- Towns, D.R., (1996) *Changes in habitat use by lizards on a New Zealand Island following removal of the introduced pacific rat – Rattus exulans,* In: Pacific Conservation Biology, Vol 2, pp. 286-92.

- Twigg, L., Lowe, T., Martin, G., (unpublished) Everett, M., *How do we bait those damn pigs?* Summary of baiting trials undertaken at Gogo Station in 2004.

- Whittaker, M, *Croak and Dagger* in: The Australian Magazine, May 8-9, 1999.

- Personal Communications.

    - Department of Conservation and Land Management
    - Allan Thomson – East Kimberley District Nature Conservation Officer

    - Natural Resource Management
    - Troy Sinclair – Coastal and Marine Facilitator, Kimberley Region

    - Department of Agriculture Wester Australia
    - Derek Goddard – East Kimberley Biosecurity Officer
    - Mick Everett – West Kimberley Biosecurity Officer

    - Kimberley College of Tafe, Broome
    - Beau Bibby – Lecturer: Lands Parks and Wildlife Management.

    - Nothern Territory Parks and Wildlife
    - David Wurst – Parks Ranger

APPENDIX 1 - FERAL ANIMALS OBSERVED ON CALM RESERVES IN THE KIMBERLY REGION.

Introduced Feral Fauna Species	Geikie Gorge NP & CP	Brooking Gorge CP	Devonian Reef CP	Purnululu NP & CR	King Leopold Ranges CP	Tunnel Creek NP	Windjana Gorge NP	Ord River NR	Parry Lagoons NR	Mirima NP	Camp Creek CP	Lawley River CP	Laterite CP
Bos tarus and indicus										erradicated			
Bufo marinus													
Bubalus bubalis				erradicated							one sighting		
Camelus dromedaries				erradicated									
Canis familiaris familiaris													
Equus asinus				erradicated					erradicated	erradicated			
Equus caballus									erradicated				
Felis catus													
Mus domesticus													
Rattus exulans													
Sus scrofa													

This list is based on observations by CALM officers. It is not a definitive assessment. At the remote, less frequently visited locations, it is likely that feral animals in addition to those noted here, do occur

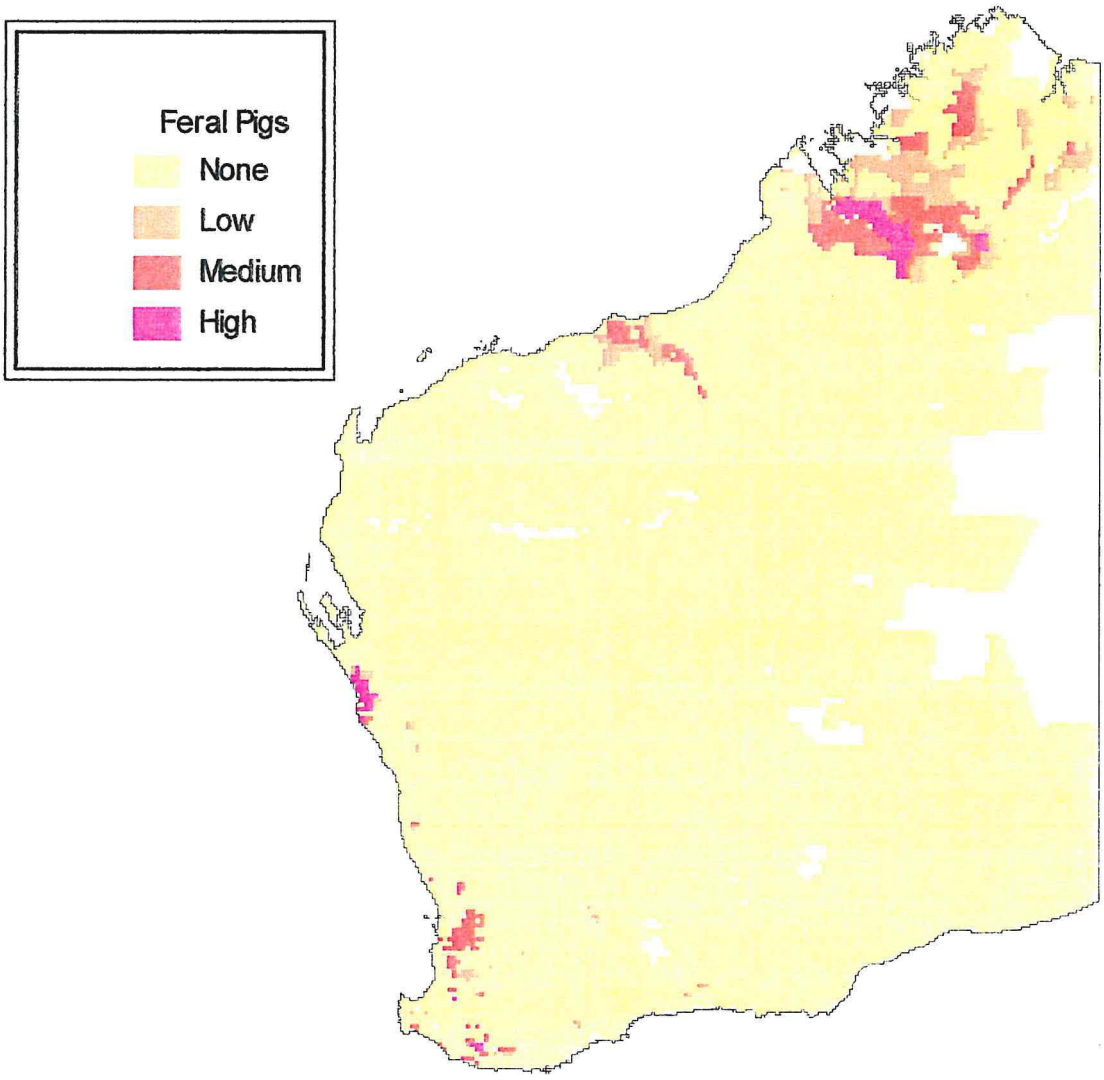
Information supplied by:

CALM Officers: John Abbot, Lindsay Brown, Lindsay Baker, Renae Dingo, Rod O'Donnell, Brad Rushforth, Allan Thomson,

Mitchell River NP	Prince Regent NR	Drysdale River NP	Point Springs NR	Dragon Tree Soak NR	Wolf Creek Crater Meteorite Reserve	Coulomb Point NR	Browse Island NR	Adele Island NR	Lacepede Islands NR	Swan Island NR	Rowley Shoals MP	Scott Reef NR	Pelican Island NR
			erradicated										

APPENDIX 2 - THE ENVIRONMENTAL IMPACT OF FERAL ANIMALS IN NOTHERN AUSTRALIA		
Introduced Feral Fauna Species	**Declared Status***	**Environmental Impact**
Bos tarus and indicus	exempt	damage to soil profile, erosion, selective grazing, trampling of vegetation, encourage fire encroachment into rainforests, trampling of native fauna habitat,
		spread of weed species, competes with native herbivores for food and water.
Bufo marinus	A1, A2, A3	predation of native species, habitat competition, toxic to some native predators, resource competition
Camelus dromedaries	A4, A5, A6	drains waterholes, damages fences, selective grazing,
*Canis familiaris familiaris (feral)***	(in wild) A5	predation of native species, resource competition.
Equus asinus (feral)	A4, A5, A6	damage to soil profile, erosion, selective grazing, wallowing, trampling of native fauna habitat, compete with native herbivores for food.
Equus caballus	A5 (in wild)	damage to soil profile, erosion, selective grazing, wallowing, trampling of native fauna habitat, compete with native herbivores for food.
Felis catus	exempt	predtation of native species, resource competition, possible disease vector.
Mus domesticus		predates eggs of native avi fauna, compete with native fauna for food and habitat.
Rattus exulans		Predate the eggs and chicks of native avifauna. Impact most severe among island populations. Competes with native fauna, including lizards.
Sus scrofa	A4, A5, A6	disease and weed vector, wallowing, damage to soil profile, erosion, trampling of native fauna habitat, possible disease vector.
* DAWA - www.agric.wa.gov.au		
** Canis familiaris familiaris + dingo hybrid = A5		
A1 Entry Prohibited		
A2 To be eradicated in the wild		
A3 Keeping prohibited		
A4 Entry subject to DAWA permits and/or conditions		
A5 Numbers will be reduced/controlled		
A6 Keeping subject to DAWA permits and/or conditions		
A7 A management programme for each species outlines the area conditions under which controls may be applied.		
Programmes are for the whole of the state or as indicated for each species.		

APPENDIX 3
Feral Pig distribution in Western Australia



Courtesy of Andrew Woolnough
(Vertebrate Pest Research Section)
Department of Agriculture Western Australia