

The prospects for the camel in Australia

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Introduction

The aim of this paper is to report on the current situation and future prospects for feral camels in Australia. The paper is divided into three parts. In the first, we address recent research findings concerning the growth of the feral camel population, and recognition of the significant damage the animals are causing to natural, cultural and physical environments. Given that an increasing feral camel population has, and will, lead to increasing impacts, in the second part of the paper we consider how this situation can be addressed. In presenting current options for the management of feral camels and their impacts we take into account varying cultural attitudes to the presence, control and commercial use of the animals. In the third part, we draw on a systems approach to explore possible alternate futures for feral camels in Australia within the context of different management scenarios. In doing so, we consider ethical questions concerning the right balance between control and commercial activity. Firstly, however, we briefly discuss the introduction of the camel to Australia and the release of the animal into the wild once it was no longer required for use as a beast of burden.

The introduction of camels to Australia

Prior to European colonisation Australia possessed no native domestic species suitable for the transportation of goods and people, and while settlers in the coastal regions introduced horses and donkeys for this purpose, the animals proved unsuitable for use in the arid and semi-arid rangelands that comprise three-quarters of Australia's land mass (Stafford Smith *et al.* 2007). The camel, by contrast, is able to work in dry conditions and, with the assistance of Muslim cameleers,¹ was used extensively in the exploration and development of Australia's arid interior.

Camelus dromedarius, commonly known as the one-humped dromedary camel, was first introduced to Australia in 1840 from the Canary Islands. While only one camel survived the journey by ship on that occasion, from 1860 onwards increasing numbers of camels were successfully transported to Australia from British India and neighbouring regions, including Baluchistan, Afghanistan, Rajasthan, and the area now known as West Pakistan (McNight 1969). So strong was the demand for camels between 1880 and 1907 that an estimated 20,000 camels were imported for use as freight and draught animals during that period (McNight 1969). By the 1920s, however, the expansion of railroads and the increasing use of motor vehicles led to the replacement of camels as the dominant mode of transport of the European settler society.² As a result many camels were released to range free in the bush away from European habitation, where many people came to regard them as pests and labelled them as feral.

Recognition that feral camels are a problem

Over the ensuing years, the number of camels in Australia increased exponentially and they began to have significant impacts on fragile ecosystems and on Aboriginal cultural sites, isolated communities and the pastoral enterprises of desert Australia. However, for the best part of 75 years, the significant damage that feral camels

¹ Commonly referred to in Australia as 'Afghans' (see Jones and Kenny 2007).

² In some parts of central Australia Aboriginal people used camels as a mode of transport until the early 1970s (see Vaarzon-Morel 2008).

caused was largely out of sight and out of mind for most Australians because it occurred in sparsely populated areas a long way from the coast.

In 2001 serious concerns started to be raised over the number of feral camels in Australia and the negative impacts they might be having, following a broad-scale aerial survey of feral camels in the Northern Territory which suggested that there could be as many as 300,000 feral camels in Australia and that the population was doubling about every eight years (Edwards *et al.* 2004). Four years later, in 2005, the first national workshop on feral camels was held in Alice Springs. The workshop brought together for the first time a small but representative group of stakeholders with an interest in the management of feral camels (including government land management agencies, relevant non-government organisations, land managers and researchers). It recommended the development of an integrated national approach to the management of feral camels.³ Shortly thereafter, the Desert Knowledge Cooperative Research Centre (DKCRC) obtained funding to conduct research on feral camels. Specifically, the researchers investigated the distribution, abundance and population dynamics of feral camels, evaluated stakeholder perceptions of feral camels, assessed the impacts of feral camels and reviewed the options available for managing these impacts. A report containing the results of the work was released in 2008.⁴

The research found that feral camels occurred over an area 3.3 million square kilometres in size across Western Australia, South Australia, the Northern Territory and Queensland (Saalfeld and Edwards 2010). Significantly, most of the area in which they were found is remote from major townships and transportation infrastructure (Saalfeld *et al.* 2008). The overall population was estimated to be 953,000 camels (Saalfeld and Edwards 2010) and modelling confirmed that the number of camels was doubling about every nine years (Pople and McLeod 2010). Although the density of camels varied throughout the feral camel range, in some places it was estimated at more than one camel per square kilometre (Saalfeld and Edwards 2010). The majority of camels (43%) were found to be on Aboriginal land⁵, followed by Crown land (25%), pastoral land (22%), and conservation land (10%) (Saalfeld and Edwards 2010).

Feral camels were found to cause significant negative impacts to the Aboriginal cultural landscape, the environment and the economy. It was estimated that, annually, they cost more than \$10 million in direct economic impacts such as infrastructure damage, competition with livestock and management costs (Edwards *et al.* 2010). This was some order of magnitude higher than earlier damage estimates of \$0.2 million (McLeod 2004). Costs to the natural environment and to the cultural values of Aboriginal people were found to be significant but could not be quantified in dollar terms (Edwards *et al.* 2010). Examples of such camel impacts include damage to vegetation through camel feeding behaviour and trampling, the suppression of recruitment in some plant species, damage to wetlands including Aboriginal sacred

³ This involved collaboration and the promotion of attitudinal changes, the identification and protection of key assets currently or likely to be affected by feral camels, the clarification of environmentally 'acceptable' camel population levels across a range of situations, and clarification of how and where the commercial use of camels could contribute to the management of feral camels.

⁴ *Managing the impacts of feral camels in Australia: a new way of doing business* (Edwards *et al.* 2008).

⁵ The term 'Aboriginal land' used in this paper refers to those areas of land in the Northern Territory, South Australia and Western Australia, which have been granted under Statutes that provide for the grant of land to be held on behalf of traditional owners of that land, as well as other grants of freehold or leasehold to bodies representing the Aboriginal owners.

waterholes through fouling, trampling and sedimentation, competition with native animals for food, water and shelter, the destruction of bushfood resources and a reduction in Aboriginal people's use of their traditional lands. Overall, these costs were found to dwarf the positive economic benefits that camels currently provide (Edwards *et al.* 2010).⁶ Additionally, feral camels are an important emitter of greenhouse gases (Drucker *et al.* 2010).

The research addressed the perceptions of Aboriginal landholders, pastoralists and conservation land managers in respect of feral camels. It found that there was a general appreciation among Aboriginal landholders that camels damage natural and cultural resources and affect their customary use of their traditional lands (Vaarzon-Morel 2008, 2010; see also Central Land Council 2010a). Yet, while acknowledging that camels needed to be controlled, most Aborigines also viewed feral camels as a potential resource that could provide livelihood opportunities (Vaarzon-Morel 2010). Although the culling of camels was supported by some Aboriginal people in areas of high camel density, in general most did not support culling, which they regarded as wasteful (Vaarzon-Morel 2010; cf. Central Land council 2010b). Pastoralists and conservation land managers recognised the impacts that camels are having on the natural environment and on pastoral production and accepted that efforts were needed to manage these impacts (Zeng and Edwards 2010). Both latter groups favoured commercial harvesting to manage the impacts of camels but, unlike Aborigines, they also favoured culling (Zeng and Edwards 2010).

As a result of the research, the DKCRC report recommended a national approach to managing the impacts of feral camels. It defined four management zones with management prescriptions for each zone (Edwards *et al.* 2008) and a long-term target density of one camel per ten square kilometres in order to mitigate broad-scale negative impacts (Edwards *et al.* 2008). In the next section we consider current options for managing the impacts of feral camels in Australia. We then consider possible scenarios that could influence the future prospects for camels in Australia.

Managing feral camels in Australia

In order to reduce the impact of feral camels, either camels need to be excluded from vulnerable assets or camel numbers need to be reduced. While a variety of physical barriers have been used to exclude feral camels from places, fencing has been the most common form of physical barrier.⁷ However, because camel-proof fences are expensive to build and maintain, they are mostly used for the protection of highly valuable assets (Saalfeld and Zeng 2008). Moreover, they afford little protection in times of drought when hundreds or thousands of camels might invade an area looking for water as happened in 2006/07 at the remote Aboriginal community of Docker River⁸.

Currently, the methods available to reduce feral camel numbers are culling and wild harvesting for purposes such as the production of meat for pet and human consumption and the establishment of small domestic herds, or for live export (Figure 1). Being a long-lived species with a low reproductive rate, camels are an unsuitable candidate for fertility control (Lapidge *et al.* 2010). Research has also shown that there are likely to be considerable impediments to the use of chemical or

⁶ At the time, positive economic impacts were estimated to be approximately \$0.6 million per annum, that is, less than 17% of the estimated cost attributed to negative impacts.

⁷ Structures which allow camels to drink but not fall into the water have also been used to protect waterholes and rockholes (Saalfeld and Zeng 2008).

⁸ See Central Land Council 2010b.

biological control agents for managing the impacts of feral camels in Australia (Lapidge *et al.* 2010).⁹

What then is the position regarding wild harvesting of feral camels? Although a fledgling camel industry has been operating in Australia for about 20 years, the number of feral camels extracted for commercial purposes each year has remained relatively small. In 2007, for example, fewer than 6000 camels were harvested commercially, mainly for pet meat (Zeng and McGregor 2008). In most preceding years the number was well below this level. There are no accurate figures on the number of domesticated camels held behind wire in Australia; however, the number is believed to be fewer than 10,000, which is far below the number of beef cattle (25.4 million) and sheep (85.7 million) (2007 figures: Nossal *et al.* 2008). The failure of productivity growth in the camel industry in Australia has been attributed to a combination of factors. These factors include: the reliance on a free-ranging feral population; a lack of critical infrastructure, and established markets; the high cost of removing feral camels from remote areas; a weak supply chain; and the fact that not all feral camels are of commercial quality (Zeng and McGregor 2008).

The methods for reducing the impacts of feral camels outlined so far are inadequate to the task, which leads us to consider culling. The two approaches to culling feral camels are aerial or ground culling. Aerial culling involves accredited personnel shooting camels from a helicopter under clearly defined standard operating procedures. It is considered to be the most cost-effective and humane way of reducing the density of feral camels over the large expanses that need to be managed in Australia (Saalfeld and Zeng 2008). Ground culling, by contrast, has application only in particular situations and is not cost-effective over large areas (Saalfeld and Zeng 2008). Individual landholders often use this method to manage feral camels on their properties and in commercial pet meat operations.

The DKCRC research was the catalyst for the current Australian Feral Camel Management Project and the recent development of the National Feral Camel Action Plan, which was endorsed by the Australian, state and territory governments.¹⁰ The two are coupled, with the management project aiming to protect key environmental assets within the Australian rangelands through the removal of camels, while the action plan provides guidance on managing feral camels and their impacts now and into the future.

The Australian Feral Camel Management Project is a four-year initiative funded through the Australian Government's Caring for Our Country Program (\$19 million) with contributing funding from state and territory governments. Begun in 2009, it aims to reduce the impacts of feral camels around key environmental assets by reducing the density of feral camels. A variety of management approaches are being used to reduce the density of camels, including aerial culling and the wild harvesting of camels for pet meat and, where the meat is intended for human consumption, for abattoir slaughter.

The action plan aims to deliver four key outcomes: (1) the development of an understanding of the need for and support for the management of feral camels and their impacts; (2) a reduction in the negative impacts of the current overabundance of feral camels through immediate population reduction; (3) the adoption of a platform for the long-term management of feral camel impacts; (4) the development of

⁹ These impediments include the lack of a suitable delivery mechanism for chemical agents and a lack of species specificity in known biological agents (Lapidge *et al.* 2010).

¹⁰ <http://www.environment.gov.au/biodiversity/invasive/ferals/camels/pubs/draft-feralcamel-actionplan.pdf>

partnerships and social capacities that will facilitate the long-term management of feral camel impacts. Although the action plan does not deal explicitly with the development of a camel industry, it does recognise that the commercial harvesting of feral camels is a legitimate activity which can contribute to the reduction of camel impacts. However, the action plan does not condone the establishment of a camel industry based solely on the sustainable harvesting of wild camels.

Future prospects for feral camels in Australia

Looking to the future, what are the prospects for the camel in Australia? We are faced with a situation where there is a large and increasing population of feral camels that is causing significant damage over large parts of its current range. We now explore possible alternate futures for the feral camel in Australia within the context of different management scenarios. We identify potential drivers for, and critical issues affecting, each management scenario (Figure 1) and assess whether it is actually feasible.

Scenario 1: No management

The first scenario is that of ‘no management’. While some animal rights groups might initially support this scenario, there are no other strong drivers for it. Under this scenario, the feral camel population would grow until it reached carrying capacity; this would be followed by a cycle of decline and growth according to seasonal conditions and whether limiting resources like water are available. As the population grew, so too would the damage caused by camels, creating large impacts on the environment, including the localised extinction of preferred tree species such as the desert quandong and faunal species such as dingoes and red kangaroos, which rely on water. Camels would initially move into new territory and die in their thousands during drought (as occurs in red kangaroos),¹¹ leading to animal welfare and human health issues. On the basis that the population appears to be growing at, or close to, its maximum rate, Pople and McLeod (2010) concluded that it may take many years for equilibrium to be reached between the feral camel population and the environment. The events that unfolded in central Australia in the summer of 2006/07 in the region around Docker River (Edwards *et al.* 2008¹³) provide an insight into the future under this management scenario. Clearly, the ‘no management’ scenario is not viable, particularly given that there are strong drivers to reduce the impacts of camels and this option will not deliver this outcome. Moreover, animal welfare concerns would eventually result in a push for intervention to reduce the feral camel numbers.

Scenario 2: Eradication of the feral camel population

The second scenario involves the eradication of the feral camel population. There are no identifiable drivers for this management scenario, which if realised would mean a gradual improvement in the quality of affected assets as the density of feral camels declined until no feral camels remained. It would also mean that there would be no camel industry unless it was based on farmed camels (see Scenario 6). This scenario is not viable because community attitudes and the increasing marginal costs of control would work against an eradication approach. The overriding factor, however,

¹¹ See Bayliss 1987.

¹³ Edwards *et al.* (2008) describe a situation where there was a mass incursion of feral camels onto remote Aboriginal settlements and pastoral properties in response to localised rainfall events following several years of below average rainfall.

is that it would not be possible to eradicate a widespread established species like the feral camel in Australia using available control methods (Lapidge *et al.* 2010).¹⁴

Scenario 3: Manage feral camels to reduce impacts

The third scenario is to manage feral camels to reduce their impacts. There are strong drivers for the third scenario, which include the current attitudes of federal, state and territory governments, the attitudes of many interest groups and key stakeholders (including environmental groups, the pastoral industry, most Aboriginal traditional landholders, and the Australian Camel Industry Association¹⁵), and the likelihood of increasing damage to key assets if feral camel population growth goes unchecked. This is the current management scenario that is being pursued under the National Feral Camel Action Plan and the Australian Feral Camel Management Project. Under this scenario, there would be ongoing management to maintain the density of camels at one camel per ten square kilometres at regional scales, with the impacts of camels being reduced to acceptable levels across their range. In the medium and longer term, management initiatives would be driven by landholders who would have the capacity to implement effective and coordinated management using a variety of approaches.

This is a viable management option as it has an existing management framework (Edwards *et al.* 2008), widespread landholder support, government support through the National Feral Camel Action Plan, and a large scale management program that is already in place to reduce the camel population and its impacts. However, the success of this approach depends on two factors. The first is the will and commitment of governments to provide enough support to address the current overabundance of feral camels.¹⁶ The second factor is the maintenance of enduring efforts in managing the impacts of feral camels. Key ingredients for long-term success are the development of partnerships and social capacities that will facilitate the long-term management of feral camel impacts¹⁷ and an increase in the consumption of camel products that will lead to increased markets.

Scenario 4: Sustained yield harvesting of feral camels and Scenario 5: Opportunistic harvesting as the sole management action

As both the fourth and fifth scenarios share some characteristics, we discuss them together. Scenario 4 involves the harvesting of feral camels for a sustained yield, while the fifth scenario concerns the opportunistic harvesting of feral camels as the sole management action. Drivers for both these scenarios include the attitudes of some segments of the camel industry and possibly those of the hunting fraternity, as well as individuals who see the wild harvesting of feral camels as a major economic opportunity for Aboriginal people. However, currently the economic driver for these two approaches is weak because markets are poorly developed and the camel industry is small.

Under Scenario 4 the feral camel population would be harvested at the same rate as it seeks to increase. With a population that is increasing at its maximum rate (as camels currently are), the more the population is allowed to increase before harvesting, the larger will be the sustained yield (Caughley and Sinclair 1994) and the cheaper it will

¹⁴ While there is some possibility for the improvement of feral camel management outcomes through the development of novel approaches involving fertility control and pesticides (Lapidge *et al.* 2010), the development of these will take time and they are unlikely to improve the prospects for eradication (see earlier section on 'Managing feral camels in Australia').

¹⁵ Lauren Brisbane (2010, pers. comm.).

¹⁶ Outcome 2 of the action plan.

¹⁷ Outcome 4 of the action plan.

be to extract animals from remote areas. There are both negative and positive aspects to this scenario. It is likely that feral camel densities would remain at levels above those required to mitigate damage effectively and, because of market needs, harvesting efforts may become biased towards the extraction of young animals and males, leaving the females of reproductive age to maintain population growth potential. The positive side is the potential establishment of livelihoods for Aboriginal people living in remote communities.

Scenario 5 involves ongoing management through opportunistic wild harvesting to remove camels when market demand and prices are good. This model is currently used to ‘manage’ the impacts of feral goats over much of the Australian sheep rangelands (Forsyth *et al.* 2009). In most other respects, the future under this management scenario is similar to that under Scenario 4. In both scenarios, however, if the harvesting effort were insufficient to halt population growth, a cycle of population growth/decline would ensue, as we outlined earlier in Scenario 1. The nature of the cycle would depend on how the number of camels harvested varied with density (Caughley 1987).

Neither management scenario is viable because neither would lead to the reduction of camel impacts, for which there are strong drivers (see Scenario 3), nor does the National Feral Camel Action Plan support them. In addition, there is a critical lack of markets for harvested camels. While a market pull could be developed, it would depend on getting the costs of supply down to a comparable level to that of beef production. Other critical issues affecting growth in the camel industry would also need to be addressed, including a lack of critical infrastructure, extensively established industry, a weak supply chain, and the fact that not all feral camels are of commercial quality (Zeng and McGregor 2008). It is also likely that once viable farmed operations are established (see Scenario 6), feral camel harvesting would be reduced or would stop, leading to an increasing population. An intensive breeding program behind fences would mean that farmed animals would have stronger genetics, focused on market characteristics, than would feral stock.

It is also worth noting that the pet meat market can easily be saturated (Zeng and McGregor 2008) and recent contamination¹⁸ issues with camel pet meat (Fitzgerald *et al.* 2011) will limit the market.

Scenario 6. Taking camels into a husbanded or farmed situation

The final management scenario involves taking camels into a husbanded or farmed situation. Drivers for this management scenario include the attitude of the Australian Camel Industry Association and that of individuals who see camel farming as a major economic opportunity for Aboriginal (and other) people. As with Scenarios 4 and 5, currently the economic driver for this approach is weak, as markets are poorly developed, the relevant infrastructure required is not present and the camel industry is small.

Under this management scenario, feral camels would either be farmed alone or and co-grazed with cattle. Additionally, feral camels would be wild harvested and held for a short-term before being sold. Initially, there would be a heavy reliance on wild camels to provide foundation stock. However, this would decline with time as the size of the farmed population increased. Under this scenario some pastoral properties

¹⁸ FitzGerald *et al.* found that toxin residues from *Indigofera* spp. were responsible for the severe liver disease that resulted in the death of three dogs. The dogs had consumed meat from camels that had grazed on *Indigofera*, a native plant that grows in parts of Australia.

would increase their profitability under co-grazing (Phillips *et al.* 2001), there would be less woody weeds and fewer undesirable plant species (Zeng and McGregor 2008), and employment opportunities would increase for Aboriginal people living in remote communities. Damage caused by camels would initially decline with the heavy demand for animals to establish domestic herds but would then increase to unacceptable levels as this demand declined and the number of feral camels again increased.

This management scenario is supported under the National Feral Camel Action Plan as the model on which the future development of the camel industry in Australia should be based. It represents the best chance of addressing two critical issues for the industry, those of weaknesses in the supply chain and the comparatively high cost of production. However, this management scenario is not a viable scenario on its own. There are strong drivers to reduce the impacts of feral camels (see Scenario 3) and this option will not effectively deliver this outcome. Moreover, as we discussed for Scenarios 4 and 5, critical issues affecting growth in the camel industry would also need to be addressed, including the lack of markets and infrastructure, and the costs of supply. Additionally, a critical issue of relevance under this management scenario is that in some jurisdictions there are legislative impediments to keeping camels as stock (Carey *et al.* 2008).

Conclusion

The management of feral camels over Australia's remote landscape is a complex matter, involving multifarious and interconnected biodiversity, economic, social and ethical issues such as those addressed in this paper. It is clear that high and increasing camel numbers are resulting in increasing impacts upon fragile natural and physical environments. In turn, the damage wrought by the changing and shifting feral camel population as it expands and impinges on human settlements, as well as on conservation, pastoral and Aboriginal cultural landscapes, has resulted in recent and ongoing attempts to manage the situation.¹⁹ Current approaches to management include culling and the wild harvesting of feral camels for meat for pet and human consumption as well as the exclusion of the animals from key assets. This prompts us to ponder the question 'What are the future prospects for feral camels in Australia?' The reality is that feral camels are here to stay in Australia. There is no intention to eradicate them, nor would it be feasible to do so. However, due to their impacts they require management. While there are a number of options available to land managers and governments for the management of the animals, no single option would be likely to fully address the problems posed by such a significant feral population as currently exists. In the end a number of options are likely to be used. Those with the most potential appear to be management to reduce impacts (Scenario 3) in tandem with farming operations (Scenario 6). Major drivers which will determine the success or otherwise of these options are government and community support through continued funding and the development of consumptive markets with efficient supply chain infrastructures.

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¹⁹ This has occurred in large part through the recent Australian Feral Camel Management Project and the National Feral Camel Action Plan.

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