

# **Evaluating the effectiveness of an operation to cull feral camels in the Western Little Sandy Desert**

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## **ABSTRACT**

A broad scale aerial survey of the western Little Sandy Desert was undertaken in May 2007 to determine the effectiveness of control measures implemented to reduce the density of large feral herbivores namely camels, horses and donkeys. This report focuses on camels, the primary target of a culling operation in 2006. Of the survey area of some 55,000 km<sup>2</sup> aerial culling was carried out over ~13,965 km<sup>2</sup> of unallocated crown land (UCL) surrounding pastoral leases, which amounted to about 25% of the total survey area. Aerial culling reduced the camel density by ~50% over the cull area, but made no difference to the camel population over the broader survey area; the mean density of camels for the entire survey area was 0.17 km<sup>2</sup> prior to culling in 2005 and it was the same 6 months after culling in 2007. Aerial surveys have demonstrated that camels are not evenly distributed across the landscape. To be cost effective, control strategies need to understand where camels congregate at different times of year and under different seasonal conditions. Determining appropriate spatial and temporal scales of control is critical. Intermittent or one-off small-scale (spatial) culling is costly and is unlikely to have any significant benefit to biodiversity values. However, small scale culling can be very effective if it is frequent.

## INTRODUCTION

Aerial surveys have shown that the feral camel population in Australia is increasing and may now number in excess of 600,000 (Edwards *et al* 2004, Ward *et al* 2005, Lethbridge 2007). The rate of increase is about 10% per year with a doubling of the population every 8 years (Edwards *et al* 2004). This flags a looming environmental problem and suggests that environmental degradation and possible species loss or decline through excessive grazing pressure is very possible. High camel densities can also result in damage to infrastructure such as fences and watering points including rock holes. Work done on the impacts of camel grazing show that when density exceeds about 2 animals per km<sup>2</sup> serious damage to the vegetation can result (Dorges and Heucke 2003). Evidence from aerial surveys (e.g. Ward 2006 and observation this survey) shows that camels are mostly observed as solitary old bulls, in small bachelor herds comprising 3-5 animals or in breeding herds of 15-20 animals with congregations of 50–100 animals in dry conditions. Therefore, in heterogenous desert landscapes and in the absence of control measures, the distribution of camels is uneven, reflecting clumping associated with temporal and spatial habitat productivity and social structure (Ward *et al* 2006). In some of the most productive and biodiversity rich patches of the landscape, camel densities mostly exceed 2 per km<sup>2</sup>, representing a serious threat to the condition of these ecosystems.

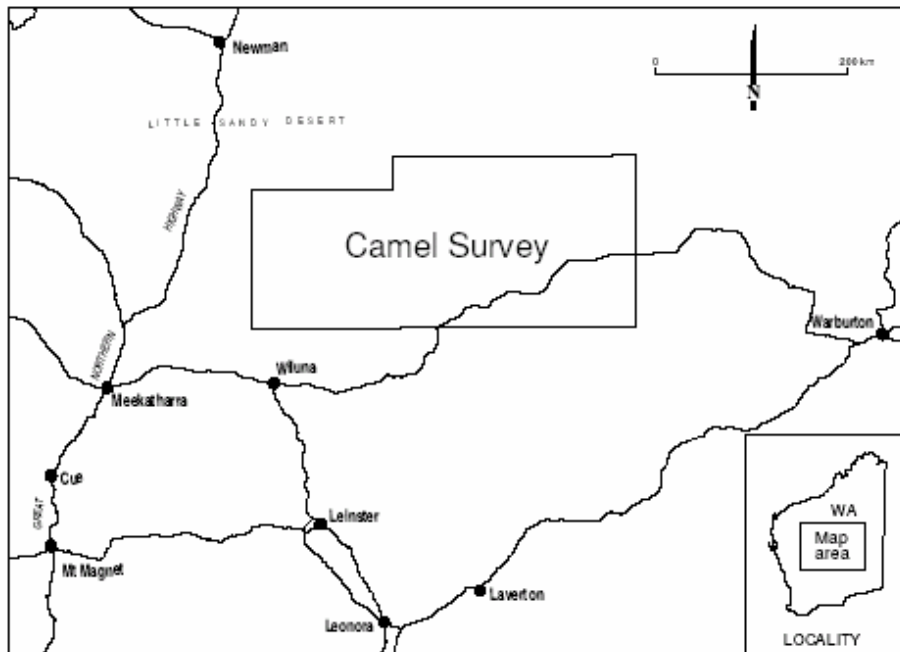
Reducing the density of feral camels (and other introduced herbivores) is necessary to reduce total grazing pressure, especially in areas where camels frequently congregate. Currently, the most cost effective and feasible control strategy is shooting, either by helicopter or on the ground. While there may be limited opportunities for commercial culling operations, such as ground shooting for pet food, remoteness and limited access will mean that most culling will be aerial and to waste.

An aerial culling trial was conducted 26-30 November 2006 in the western Little Sandy Desert region of WA to assess culling effectiveness on the reduction of camel density. To test the effectiveness of the culling operation, pre and post-cull surveys were carried out to determine camel densities. The post-cull aerial survey was conducted 6 months after culling (May 2007). This document reports on the findings of the post-cull survey, discusses the effectiveness of the culling operation, as measured by a change in feral camel density, and makes some observations about the implications of these findings for future camel control programs.

## METHODS

The pre-cull survey area (see Ward *et al* 2005) of some 60,000 km<sup>2</sup> comprised ~36% active pastoral lands and ~64% Unallocated Crown Land (UCL), which included expastoral leases purchased by the government for the conservation system (now gazetted as Conservation parks). The post-cull survey was conducted over the same area except

three of the most northerly survey lines were not re-surveyed, reducing the post-cull survey area to  $\sim 55,000 \text{ km}^2$ . Aerial culling was confined to  $\sim 13,965 \text{ km}^2$  of UCL/proposed Conservation Park, which represented  $\sim 39\%$  of the area of UCL and  $\sim 25\%$  of the total survey area (see Figure 1). Since the pre-cull survey in August 2005, there has been ongoing opportunistic culling of camels on pastoral lands by the leaseholders but this has not been well quantified. Pastoralists within the survey area were most helpful, making airstrips available and providing accommodation and food to the culling crews.



**Figure 1:** Map of survey area

Given the clumped distribution of feral herbivores, the trial used the findings of an earlier aerial survey (Ward *et al* 2005) to determine which areas should be targeted for culling to deliver maximum return (numbers culled, environmental protection) for effort (cost). The timing of the cull (November) was during a dry period when animals tend to form larger herds and congregate around watering points and most productive parts of the landscape. Culling at this time increases the cost effectiveness of the operation. A fixed wing aircraft (Cessna 172) was used as a spotter to detect herds for the helicopter (Robinson R44), which was used as a shooting platform for the culling operation. All animals culled were counted and recorded with 60 specimens used for DNA sampling.

The post- cull survey followed the same procedure and methodology as the pre-cull survey (see Ward *et al.* 2005). A series of east-west oriented line transects were flown with each line being 11.1 km apart ( $6'$  latitude) and 400 km long. Transects commenced at  $120.00^\circ\text{E}$  to  $124.00^\circ\text{E}$  with 14 transect lines extending from  $24^\circ 48' 00''\text{S}$  to  $26^\circ 06' 00''\text{S}$ .

The aerial survey method follows that developed for surveying kangaroos and other wildlife populations (eg Caughley and Grigg 1982, Pople *et al* 1998) and has been adopted and used as a standard method for camel census (Edwards *et al* 2004). A Cessna 210 high wing aircraft fitted with radar altimeter and GPS (Global Positioning System) was used for the survey, which was conducted at a height of 250 ft (76m) and at a ground speed of 100 kts (185 km/hr). Strips 200 m wide on each side of the aircraft were delineated by a cord attached to specially fitted wire struts. The position of the cord was calibrated on the ground for each observer from tables and functions constructed for the purpose (see West Australian Department of Agriculture and food 2005). The marker ropes were checked to confirm accuracy once airborne against two markers set 200m apart on the airstrip.

The flight crew consisted of a pilot and three observers seated in the front right, rear right and rear left positions. The observers were rotated each flight and the tandem right observers counted the same transect independently. Species counted included camels (*Camelus dromedarius*), goats (*Capra hircus*), horses (*Equus caballus*), donkeys (*Equus asinus*), dingo (*Canis lupis dingo*) and cats (*Felis catus*), which were recorded onto data sheets designed for the purpose. Notes on flight path direction, temperature (°C) and visibility were taken at the time of measurement. The protocol for this technique requires counters to count for 97.5 seconds followed by a 7 second gap where data were recorded onto prepared data forms. Each counting period is equivalent to 1 km<sup>2</sup> sampling area. A timer was used so that an audible buzz signalled the end of the count period and was continuous for the 7 seconds gap. The 7 seconds recording time gave a 360m gap between sample cells where no counting was done. For camels, individual numbers and group size was recorded. In the 14 transects a total of 1908 cells were assessed (954 each side).

The double count method was used to analyse the results of the survey (Edwards *et al* 2004, Lethbridge 2007) and to account for perception bias. The correction factors determined from the 2005 survey were utilised to adjust densities. These factors were 1.23 for starboard side counts and 2.45 for port side. Since all but one of the survey crew were the same as those used in the 2005 survey it was deemed appropriate to use these factors.

## RESULTS

A total of 836 camels, 46 donkeys and 534 horses were culled from a portion of the UCL in the 5 day culling operation which cost a total of \$45,650 in aircraft and helicopter time and once other costs were added had a total operational cost of \$79,000. The mean post-cull camel density for the entire survey area was 0.17/km<sup>2</sup> (corrected), which was identical to the 2005 mean pre-cull density. However, the density distribution of camels across the survey area was quite different pre- and post-cull (Table 1). The pastoral area, which made up about one third (36%) of the survey area and which was not formally culled during this operation but had been subjected to opportunistic ground culling, had a post-cull camel density of 0.10/km<sup>2</sup>, which was double the density of the same area

measured by the pre-cull survey in 2005. On the other hand, the UCL, including culled and non-culled areas, had a mean pre-cull density of 0.23/km<sup>2</sup> and a mean post-cull density of 0.19/km<sup>2</sup>, representing a 17% reduction.

Comparing the pre- and post camel density on UCL that was subjected to aerial culling, there has been ~50% reduction in density presumably as a result of culling (Table 1). Based on the number of animals actually culled (836) this suggests that there was a total of ~1,672 camels on 13,965 ha of UCL prior to culling, or 0.12 camels per km<sup>2</sup>, which is only half the density estimated by the 2005 aerial survey. It is likely therefore that the area culled was actually half the area that was programmed to have been culled or that there had been considerable movement of camels out of the area during the period that elapsed between the pre-cull survey and the actual cull.

**Table 1: The mean density of feral camels (per km<sup>2</sup>) pre- and 6 months post-culling. Aerial culling was only conducted on part of the UCL (i.e. UCL Culled), which amounted to ~25% of the total survey area and ~39% of the total area of UCL. There has been some opportunistic ground culling on pastoral lands over the period 2005-2007.**

Land Tenure (% of total survey area)	Pre-cull (2005)	Post-cull (2007)
All lands (100%)	0.17	0.17
Pastoral lands (36%)	0.05	0.10
UCL: Total (64%)	0.23	0.19
UCL: Not culled (39%)	0.23	0.23
UCL: Culled (25%)	0.23	0.12

## DISCUSSION

The post-cull survey returned an overall camel density of 0.17/km<sup>2</sup> (corrected) for the area and gives an estimated camel population for the survey area of 9,860 camels. Most of the camels were observed to be in the eastern end of the survey area, away from the culled zone and where surface water existed in semi permanent pools. The November period was targeted as the best time for culling as this is traditionally the driest time when surface water has dried and few permanent or semi-permanent pools persist. Observations have shown that camels are more likely to be grouped close to water in this period. The survey area was generally dry with most rain falling in the summer months of December and January

The culling operation took place over a proportion of the survey area (25%) at the end of November 2006 and reduced the population of camels over the culled area by 836. While this represents a reduction of about 50% for the culled area, it produced only a reduction of just 8.5 % of the estimated population over the entire 55,000 km<sup>2</sup> survey area. As the camel population has been demonstrated to be increasing at around 10% per year (Edwards *et al* 2004) the culling operation, in the context of the entire survey area, did

not reached the rate of recruitment. It is likely that a net increase in the camel population will result for the survey area this year.

These results highlight two key issues. Firstly, the culling operation only resulted in a 50% reduction in camel density over the area actually designated for culling. This is a poor return on effort and leaves room for considerable improvement. Secondly, the findings illustrate the importance of understanding appropriate spatial scales at which to cull large herbivores such as camels in order to achieve a long term effective reduction in camel density. Clearly, culling 50% of camels over 25% of the survey area will have an ephemeral effect on overall camel density in the region, which equates to an insignificant impact in terms of biodiversity conservation outcomes.

A doubling of the camel density in the pastoral area is most likely due to the dryness of the season at the time of the survey and has influenced the density observed by attracting camels onto permanent water supplies. Rainfall in the month leading up to the survey had been light (4.0mm) although some heavier falls in April would have left water in a few semi permanent pools. Camel distribution has followed that of other observations made when times were dry with camels centered on available water.

## **CONCLUSIONS & MANAGEMENT IMPLICATIONS**

1. Aerial survey has demonstrated that it is an effective and reliable technique for assessing feral camel population before and after culling operations.
2. Culling a proportion (<80%) of feral camels in a small proportion of the landscape results in short term, localized reduction in camel density and is of dubious value. To be effective and lasting, camel culling over relatively small areas must be done regularly (probably annually or biennially), otherwise culling must be undertaken over very large areas. This will require the collaboration and cooperation of all landholders.
3. Culling camels is expensive. A better understanding and knowledge of the seasonal movements and of landscape utilization patterns by camels is needed in order to improve the effectiveness of culling operations and to significantly reduce unit costs. Coupled with this is the need for better vegetation or ecosystem maps that define productive landscape elements. Remote sensing may have an important role to play in mapping vegetation types in the remote arid zone. The more productive parts of the landscape and watering points in the landscape need to be identified and mapped. Using data from aerial survey and radio tracking, and having access to good ecosystem maps, models that predict where camels are likely to be congregating in the landscape can be developed. Aerial culling programs can then focus effort on those parts of the landscape where camel densities are highest. Not only will this provide a high return (camels culled) for

effort, but it also focuses control on parts of the landscape at greatest risk of damage by camels.

4. In addition to control programs, simple but effective monitoring sites need to be established in representative areas so that the impacts of camels on resource condition, and of management responses such as culling, can be properly assessed and evaluated over time.

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