# The Question of Camels, Weapons against weeds or Liability for Landholders

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## Abstract

The paper outlines the challenges and successes of a project run by Desert Channels Queensland (DCQ) and funded by the Desert Channels Foundation which has focused on the role of camels in controlling prickly acacia (*Vachellia nilotica*), a weed of national significance, while also helping to recover degraded areas of the Mitchell Grass Bioregion. Grazing patterns have been monitored using electronic tags, while pasture species diversity was monitored to determine changes in plant species, density, and ground cover.

While camels are much maligned as a pest, the project has started to identify clear trends which offer opportunities to landholders tackling a weed covering 21 million hectares in the DCQ region, but also points to critical management learnings, particularly as preferential feed resources become scarcer. As the regional camel herd increases there is a need to be on the front foot in managing this species to ensure it is a valuable weapon in weed control and a benefit to the recovery of the rangelands and not a liability for landholders.

Through the trial, camels have shown a clear preference for prickly acacia flowers and seedpods over the perennial native Mitchell Grass. As more landholders seek to manage cattle and camels in combination these preferences can be exploited and aid in recovery of degraded areas and potentially form the foundations for new income streams.

**Keywords:** Camels, Prickly Acacia, Mitchell Grass Downs, Rangelands Recovery

## Introduction

The prevalence of prickly acacia (*Vachellia nilotica*), a weed of national significance in the Mitchell Grass Downs (MGD) bioregion, has generated an interest in the potential for camels to be used as a management tool to reduce the spread of the weed. Prickly Acacia covers 21 million hectares in variable densities within the Queensland section of the Lake Eyre Basin and can be found in densities higher than 1000 stems/ha. Where extensive infestations occur, control activities can be cost prohibitive for landholders and mean that weed spread occurs more rapidly than control works are able to be undertaken. This has generated the need for a cost-effective means of reducing the spread of the weed while sequential control works occur over multi-year periods.

Camels were identified as a potential means of reducing the spread of prickly acacia due to their preferential browsing of the flowers and seedpods (Dörges and Heucke 2003). Anecdotal evidence suggested that camels preferentially graze prickly acacia flowers and seedpods without spreading viable seed into the environment. However, the prospect of reducing stocking rates of cattle to introduce camels as a management tool for prickly acacia control has proved a barrier to the adoption of camels in the region. Previous studies undertaken in the Northern Territory have suggested that perennial grasses such as Mitchell grass make up only 5% of a camel's diet and the difference in grazing preferences between camels and cattle mean that co-grazing of the two species should be possible without negative impacts on cattle production (Dörges and Heucke 2003; Phillips et *al*. 2001). However, no similar studies have previously been undertaken to determine the impacts of camels in the MGD bioregion in Queensland.

## Methods

This study, which has been running since 2021, provided us the opportunity to observe how the density of prickly acacia affected the camels' grazing habits, land condition, their impact on prickly acacia browsed.

It was undertaken using a small herd of around 17 camels in an 82ha dam paddock near Hughenden (Queensland) of which 42ha was previously submerged dam back water and was initially unvegetated, but with a dam failure was now part of the grazing area. The standard three barb fence excluded cattle from the trial paddock, but they were present in the adjacent 'control' site. The site contained 23,162 mature prickly acacia trees at varying densities.

The physical impacts of the camels on the prickly acacia were monitored at various times between 2021 and 2023.

*Tree and canopy density*

Over the life of the project, 25 ultra-high-resolution (ca 2.5cm/pixel) images were captured using rgb (visible light) commercial drones. Orthomosaic were generated using DroneDeploy.com and rectified/analysed with ESRI's ArcPro software. Each individual prickly acacia tree was manually digitised (classed as prickly acacia, parkinsonia, mimosa bush, dead prickly acacia standing or laying down).

Canopy density of prickly acacia varies significantly with seasons ('fluffy' after the wet, dieback during dry or frost) and canopy changes were estimated using a binary Excess green – excess red index (Meyer and Camargo Neto, 2008), calculation within 3m of a known living tree stem.

*Camel occupancy*

Camels were tagged with ear tags that transferred location information every four hours to track their movement across the area. Data from seven present during the entire trial period were analysed to identify where camels spent the most or none of their time.

*Land condition and grazing impact*

Steel pickets (at 25m intervals) mark a 575m transect through all densities of prickly acacia (see Figure 1). Within each interval, the presence of bark stripping, broken branches, camel scat and camel prints were noted within 5m either side of the transect.

A control transect was established outside the trial paddock for comparison.

Four photo monitoring sites and one DCQ land and biocondition monitoring site were established across the trial paddock to assess changes in groundcover and floral diversity.

Monitoring occurred annually April (end of wet) and October (end of dry season) to show changes in groundcover at critical times. These observations were used in combination with the *Queensland Government Mitchell Grass Biomass Standards* (Future Beef 2013) to estimate pasture biomass and determine a change in pasture biomass over time. The perennial grass extent was mapped and compared over time using the high-resolution drone images.

*Camel Condition*

The condition and health of the camels was assessed on all occasions when site visits occurred. Camel condition assessments were done using a body condition score.

## Results and Discussion

The highest density areas of prickly acacia contained over 1000 mature prickly acacia stems per hectare surrounding the dam and in the centre of the paddock. Densities of prickly acacia lightened to 20 mature stems/ha towards the outer edges of the infestation (Figure 1).

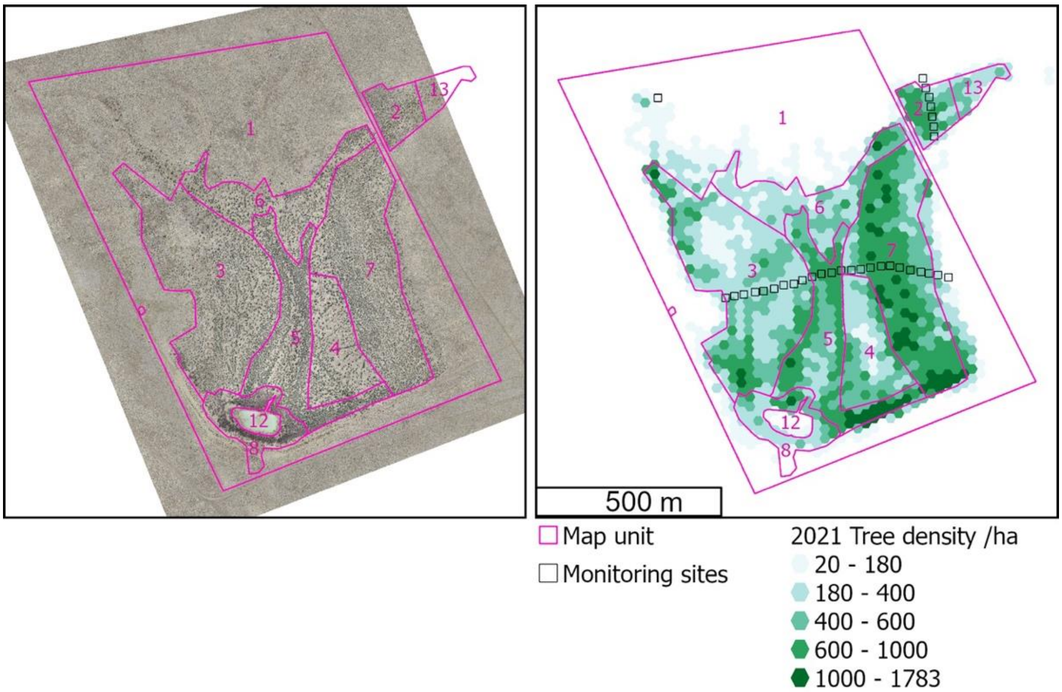


**Figure 1**: Prickly Acacia density distributions*

*Zone 12 is the remaining wet perimeter of the dam. Dense zones 8 and 13 were treated with chemical in 2023.

Tag tracking analysis indicated that camels spent most of their time in lighter density areas (Figure 2) during the day and camped in the southwestern corner during the night. When this data was compared with the prickly acacia density zones it was found that camels avoided zones with higher than 500 prickly acacia stems/ha

During the trial period some GPS tags fell off or ceased communicating with the satellite resulting in incomplete data collection over the time period and were excluded from the analysis. The remaining active seven tags were used as representative results as the camels spend most of their time together in a group. This provided useful information regarding their grazing distribution and matched other observations of camel tracks and scat.

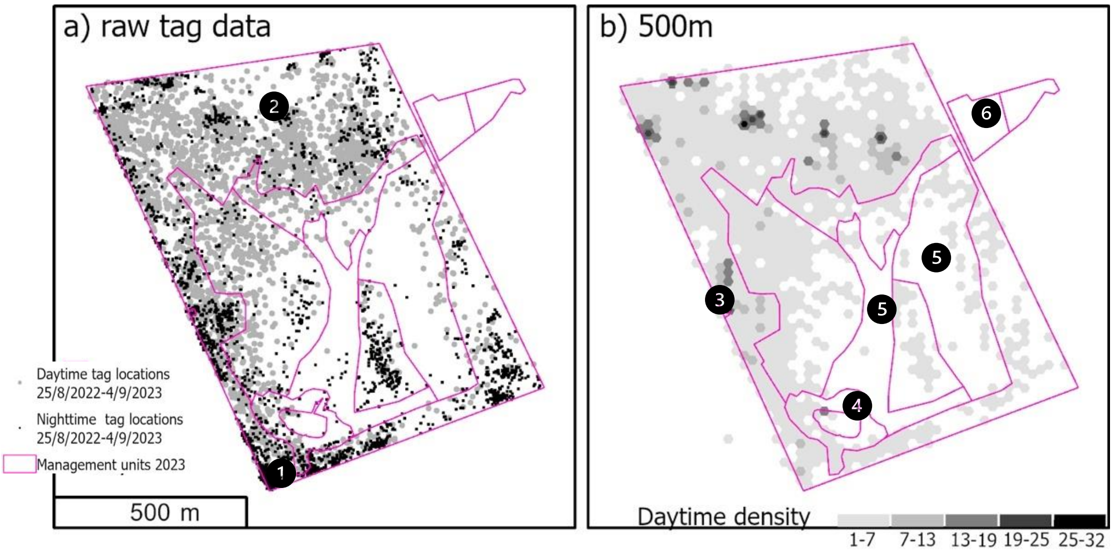


**Figure 2:** Collated four hourly tag locations from seven camels.
Key points of interest: 1 nighttime camp, 2 daytime camp, 3 yards, 4 dam, 5 dense areas, 6 cattle only grazing.

*Land Condition*

There was an improvement in the proportion of perennial grass present over the life of the project, see Figure below. Dry season pasture biomass was estimated (Future Beef 2013) to improve from 1,530kg/ha in 2021, to 2,740kg/ha in 2022 and 3,070kg/ha in August 2023. With the exclusion of cattle it was inferred that these pasture grasses were not preferred by camels and were able to increase in biomass.


**Figure 3:** Photo monitoring shows an increase in Biomass over trial period

Increase in biomass also corresponded to an increase distribution. In July 2021 the area of perennial groundcover (estimated from drone imagery) within the trial site was 21ha, 44ha in 2022 and increased again to 67ha by July 2023. This represents an increase from 26% of the area with perennial groundcover to 82%. Grazing pressure by camels was likely insufficient to suppress the spread of pasture species into previously inundated and bare areas.

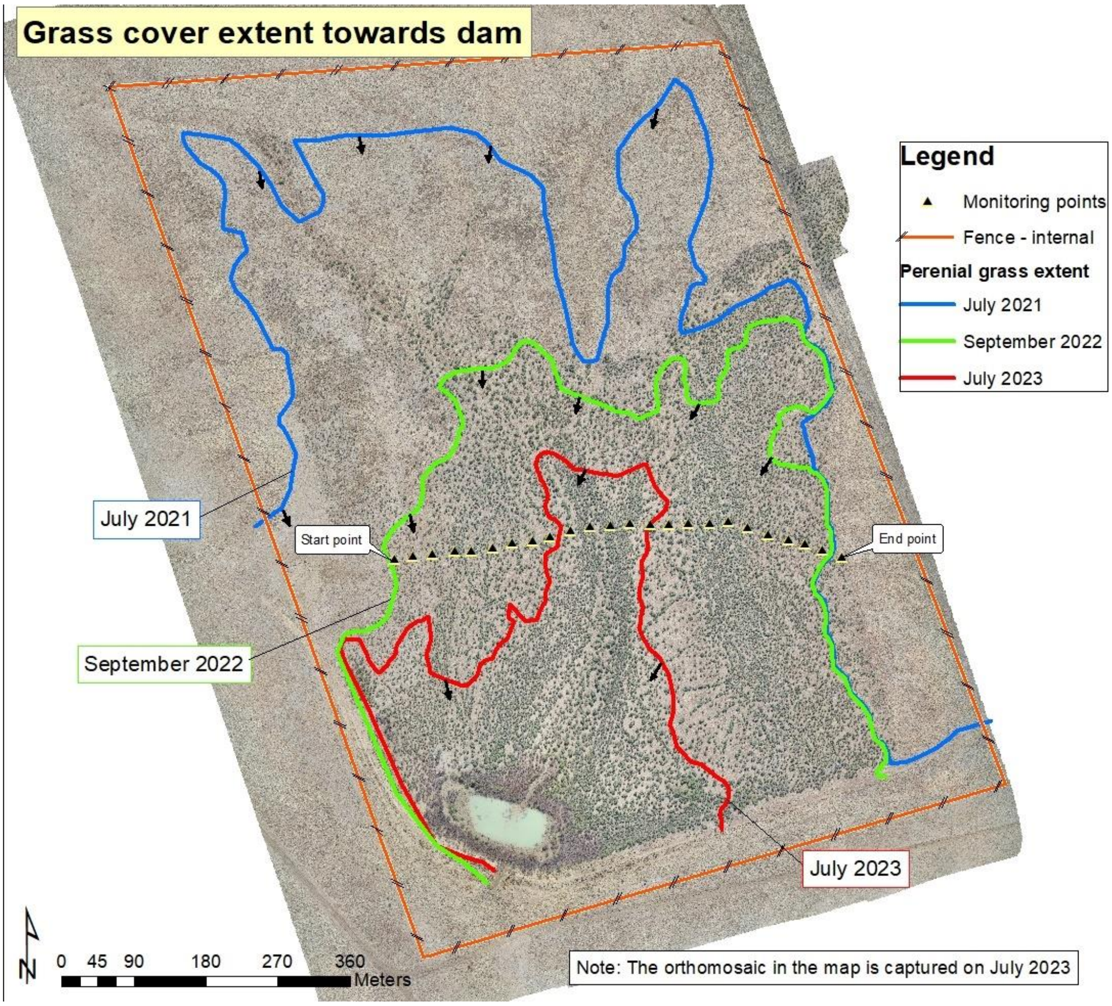


**Figure 4:** Increasing extent of perennial grass

Floral diversity did not vary significantly between treatments, core / margin plots, prickly acacia density class or wet/dry seasons. This is a further indication that grazing by camels was insufficient to impede the spread of additional flora species to previously bare/inundated areas.

Regardless of treatment there were significantly more species observed during summer (Table 1) ie: camel grazing 11.7 (+/- 3) and cattle grazing 13 (+/- 1.7). Summer includes the post wet season response to rainfall in December / January. Spring (includes pre-wet season typical survey period) had the lowest floral diversity.

**Table 1:** Mean species diversity (+/- standard deviation) per treatment and season

| Treatment | Season | # plots | # plant species |
|---|---|---|---|
| **Camel Graze** | Autumn | 23 | 5.9 +/- 1.8 |
| | Spring | 46 | 2.9 +/- 2.1 |
| | Summer | 23 | 11.7 +/- 3 |
| | Winter | 46 | 3.4 +/- 2.1 |
| **Cattle Graze** | Autumn | 6 | 6.3 +/- 0.8 |
| | Spring | 12 | 4.8 +/- 1.3 |
| | Summer | 6 | 13 +/- 1.7 |
| | Winter | 6 | 4 +/- 1.3 |

While there were obvious signs of damage to prickly acacia trees observed in the field, there was insufficient grazing to reduce overall canopy extent, or cause death (of trees), see figure below.

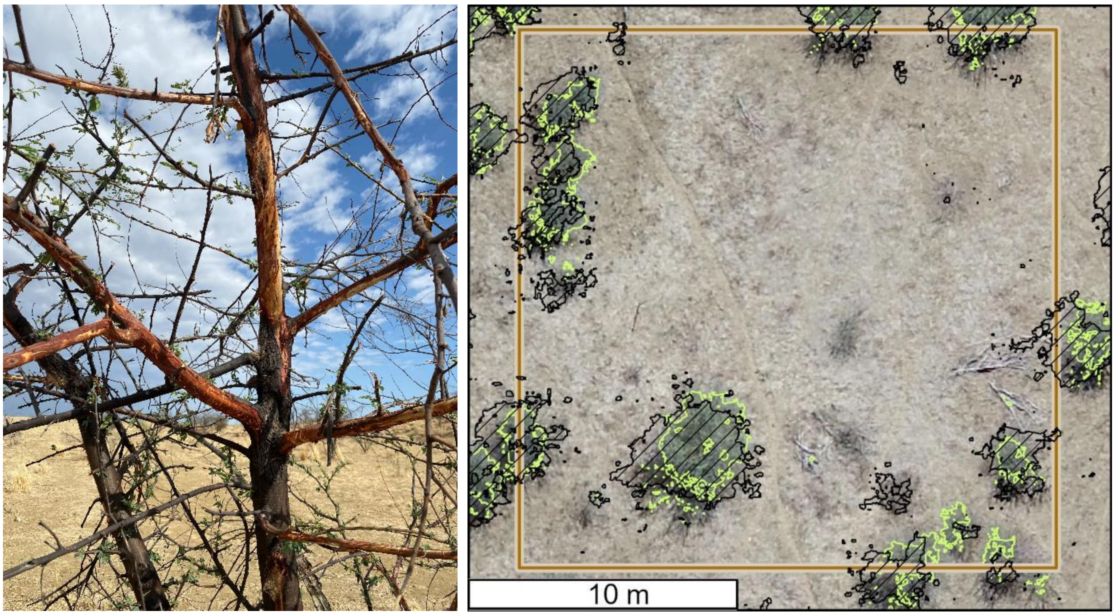


**Figure 5:** Evidence of camel canopy damage on an individual tree (left) and 25m transect location (right image), with a density of 173 stems/ha.

The estimated canopy cover for the sample plot above was 32.8m$^2$ in 2021 (black outline in Figure 5), reduced to 19m$^2$ in 2023 (light green outline in Figure 5). The scale and extent of damage has been difficult to quantify, particularly with the relatively low level, widespread impact we observed in the field. Additional indicators from targeted monitoring trees such as number of flowers and number of seed pods were also highly variable.

Throughout the trial camels maintained their health and body condition above a body score of 3 and this was evidenced by several new calves.

**Figure 4:** Camels in good condition walking through open Mitchell grass (zone 1)

## Conclusion

Results indicate that there is potential for camels to be grazed in combination with cattle without having a negative impact on land condition. Photo monitoring demonstrated an increase in pasture biomass over the life of the project. Mitchell grass quantities improved, likely due to the camels' preferential grazing of forbs and prickly acacia flowers and seedpods (Phillips *et al.* 2001).

The retention and increase of Mitchell grass, one of the preferred pasture grasses for cattle in the region, is an indication that there was no substantial reduction in feed preferred by cattle. The improved extent of perennial grass species also demonstrates that there has been no land condition declines because of grazing by camels.

Preliminary results look promising for the potential of camels to effectively reduce the spread of prickly acacia through their consumption of the flowers and seed pods. However, they don't evenly browse all densities of prickly acacia equally, preferring lower densities and/or easier access. From the results to date where camels were maintained at a stocking rate of approximately 1hd/1300 prickly acacia trees no prickly acacia death has been observed. Importantly, stocking rates of camels should be understood in terms of head/number of prickly acacia rather than number per hectare because of dietary preferences of the camels. Future stages of the study will explore higher stocking rates of camels to browse the prickly acacia more evenly. Increases in camel stocking rates will be carefully monitored to ensure they are accessing higher density areas rather than increasing their proportion of pasture consumed.

As a result of our preliminary observations, it is recommended that if camels are to be introduced as a management tool to control weeds, they should be in combination with chemical control to reduce seed reserves and plant vigour. Particularly in infestations with high (>500 mature stems/ha) densities of prickly acacia.

The lack of negative impacts on land condition and the increase in pasture biomass within the trial site is an indication that there is potential for cattle to graze concurrently with domestic camels without reducing the stocking rates of either species.

The trial will continue for as long as possible to improve our understanding of longer-term seasonal trends.

## Conflicts of Interest

This independent study was funded by the Desert Channels Foundation, contributing the implementation of the NRM plan.

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