The Impact of Cattle Activity on the Northern Territory *Acacia peuce* Waddy-wood population.

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Introduction

With northerly migration of Simpson Desert dunefields and the consequent expansion of unsuitable habitat from the south (Crocker & Wood, 1947) *Acacia peuce* Waddy-wood has retracted to three disjunct populations on the fringes of the Simpson Desert. Two populations in the east, 300 kms apart, occur at Boulia and Birdsville in Queensland. The third, and smallest, population is 400 kms west in the Mac Clarke (*Acacia peuce*) Conservation Reserve (MCCR; Fig.1) 230 kms south-east of Alice Springs in the Northern Territory (NT).

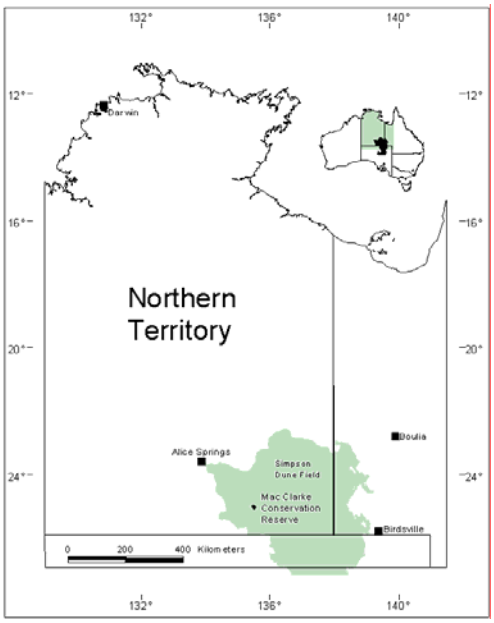

Fig.1 Distribution of *A. peuce* in Australia.

A. peuce is usually an erect tree able to reach heights of up to 18 metres. It is slow growing and is estimated to live 500 years or longer (Chuk, 1982; Schabort, 2000). Foliage can be variable, pale yellow flowers are solitary and often inconspicuous, and, pods are large and flattened. Bark is grey-brown and fibrous, timber is very dense with dark red heart-wood.

Fig. 2 Day-old emergent

The NT *A. peuce* population is classified as endangered (restricted distribution, population reduction) in terms of the principal IUCN criteria (IUCN, 2001) whereas the national status for all three populations is vulnerable. A decline in *A. peuce* would likely result in significant losses in biodiversity, it is a keystone

species in the local ecosystem. The nitrogen-fixing ability of *Acacia* trees improves soil quality for many other plants, over 70 plant species have been collected from the area (Chuk, 1982). The shade of *A. peuce* is essential for water and energy conservation of several animal and plant species, the tree also provides food and shelter for many desert animals. Letter-winged kites *Elanus scriptus* roost, nest and breed in the trees, the endangered plains rat *Pseudomys australis* plagues here during good seasons.

Fig.3 Young *A. peuce* seedling.

As a relict of former climatic regimes and a more contiguous distribution, conditions conducive to germination (Fig.2) and seedling establishment (Figs.3 & 4) occur infrequently in present times (Bowland, *In prep.*). The distribution of the NT *A. peuce* population is significantly fragmented (Bowland & Clifford, 2002). Cattle are attracted to fragments by shade (Fig.5) and closely associated watering points (Bowland & Clifford 2002).

Fig.4 Ten month-old seedling showing the remains of a cotyledon and bipinnate leaves at the base with flat phyllodes higher up.

The aim of this study was to identify and, in some cases, quantify the impact on *A. peuce* by cattle activity.

Study Area

MCCR covers an area of 3041 ha, it was set aside from the surrounding cattle station, Andado, in 1977. In 1985 only 475 ha of the proclaimed park were

Fig.5 Cattle attracted to *A. peuce* shade in a barren landscape.

fenced from large herbivores (camels, donkeys, horses, cattle), offering protection to less than 50% of the NT *A. peuce* population (Bowland and Clifford, 2002). Parks and Wildlife rangers visit MCCR four to five times a year to carry out routine maintenance and to collect monitoring data on *A. peuce* and other wildlife.

Fig.6 New soft, growth attractive to cattle.

Rainfall is low (188.3 mm per annum) and variable, with 54% falling from December to March (Bowland *In prep.*). Water courses, usually dry, drain storm water run-off from surrounding high areas through MCCR. Seasonal temperatures are extreme. Summers are hot , with night temperatures in winter reaching zero and below. Humidity is low and evaporation high. Strong south-easterly winds prevail year round.

The herbaceous layer is substantial and diverse, 70 plant species have been collected from the area (Chuk, 1982). *A. peuce* grows on the numerous small alluvial claypans known as 'stony downs' or 'gibber' country. Soils that support *A. peuce* are a combination of clays, which become expansive when wet, with high levels of salinity below 50 cms and a high proportion of gypsum in the subsoil (Deveson, 1980). The substrate is fragile and highly erodible as shown by soil loss initiated by cattle and vehicle activity (Chuk, 1982). Cattle pads traverse the area as the animals move between grazing areas, shade and water.

Fig.7 Browsing of new growth by cattle creating a hedge effect and impeding tree development.

Methods

Dispersed fragments of the population were inspected to identify and list any impact cattle activity had on *A. peuce* trees. Observations suggested that cattle activity was stunting the development of young trees. Evidence for stunting was derived from height/diameter ratios where stunted plants will exhibit below average ratios. Saplings inside and outside the fenced area were measured for comparison. Regeneration plots, permanently set up in 1979 as a consequence of the 1978/81 germination event (Chuk, 1982), were used to test this observation. Heights and diameters (at 1/5th of tree height) of saplings were measured in plots A, B, C, E, F, and G, inside the fenced area, and plot N, outside the fenced area. Differences in current mean heights and in height to diameter ratios between recruits on either side of the fenced area were compared (T-tests).

Fig.8 Development of *A. peuce* stunted as a consequence of cattle activity.

Results

Most of the observed impact on *A. peuce* by cattle is physical damage (Table 1). Generally, *A. peuce* is of little importance to cattle as a food source, however they do crop new shoots whilst these are still soft and palatable [Fig.6] thus creating a hedge effect (Fig.7) and stunting the growth of smaller

Fig.9 Consequences of cattle activity include removal of herb layer, soil loss, root exposure, concentration of dung, and bark damage.

trees (Fig.8). Large trees experience bark damage (Fig.9), they are used as rubbing posts while smaller trees can be extensively broken by bullocks (Fig.11) using them as sparring partners.

Fig. 10 Severe lateral root exposure from soil loss initiated by cattle trampling.

Germination is a rare event (Bowland *In prep.*), emergent trees (Figs.2 and 3) are usually concentrated within 30m of large mature trees. Seedlings (Fig.4) are at risk of being browsed or trampled when cattle congregate at the base of trees in search of shade. Apart from this and the concentration of droppings and urine (Fig.9), the herb layer is completely removed (Fig.9) while lateral roots are exposed (Figs.9 and 10) through soil loss initiated by excessive trampling.

The mean height of recruits outside the fenced area (x=0.48m) was significantly lower ($p<0.01$, $t=3.97$,$df=128$) than that of recruits inside the fenced area (x=0.83m). The mean height/diameter ratio for saplings inside the fenced area (x=29.2) was significantly higher ($p<0.001$, $t=4.69$,$df=126$) than that of saplings outside the fenced area (x=20.2).

Fig.11 Physical damage by cattle to an *A. peuce* sapling.

Discussion and Recommendations

A. peuce is long-lived, 500 hundred years and longer, and very slow growing (diameter increases about 1.0938 mm per year), individuals take between 70 and 100 years to reach maturity. Germination events, linked to high rainfall periods, are rare. Mature trees are frequently killed or severely damaged by lightning strikes (Fig.12) and wind-fell.

The NT *A. peuce* population is severely fragmented with fragments spread on- and off-Park over area of about 300 km^2 (Bowland and Clifford 2002). It is generally recognised that in many woody vegetation communities, the smaller the fragment the higher the risk of extinction.

Table 1. Summary of the impact of cattle activity on various stages of *A. peuce* life cycle.

Impact	**Germination and emergents**	**Seedlings**	**Saplings**	**Intermediate Trees**	**Mature Trees**
Direct::					
Trampling	3	3	3		
Browsing	3	3	3	3	
Rutting			3	3	
Rubbing				3	3
Root exposure			3	3	3
Indirect:					
Herb layer removed	3	3			
Soil loss	3	3	3	3	3
Seed bank exposure	3				
Concentration of waste products	3	3	3	3	3

From the evidence collected and analysed in this study it is quite clear that cattle activity is a severe hindrance in the natural life cycle of *A. peuce* . Bearing in mind the long road to maturity and replacement of individuals, it would, in terms of the long term conservation of the species, be wise to manage the impact of cattle on the NT *A. peuce* population more closely. All unprotected fragments are subject to the impacts of cattle activity as shown and are destined to die off as persistence and regeneration is unlikely with cattle present.

It is recommended that the entire population be appropriately managed and not only the fragments within the declared boundaries of MCCR. The prime action would be to set up mechanisms to minimise or eliminate the impact of cattle on *A. peuce*. The outcome of a management program should be the exclusion of cattle from *A. peuce* habitat except under controlled circumstances where grazing is used in fire risk management to reduce the fuel load.

Management options include the construction and maintenance of appropriate fencing of both MCCR (along declared boundaries) and off-Park sub-populations, the provision of alternative water points (Bowland and Clifford 2002), and the provision of other sources of shade for cattle.

Fig.11 Mature tree recently struck by lightning.

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