The Feral Goat Industry and Implications for Groundcover
A report prepared for the Western Catchment Management Authority by:

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This report has been prepared as part of the Feral Goat Management in the Western NSW Rangelands project. Any opinions stated herein are those of the author(s) and do not necessarily reflect the policies or opinions of the Western Catchment Management Authority.

*Cover: Feral goats near White Cliffs (Photo: Matilda Ferguson)*
Table of Contents

List of figures .......................................................................................................................... 4
List of tables ............................................................................................................................. 5
Executive summary .................................................................................................................. 6

1 Project overview .................................................................................................................. 7
  1.1 Introduction ..................................................................................................................... 7
  1.2 Methodology .................................................................................................................. 7
  1.3 Terminology ................................................................................................................... 8

2 The feral goat as a product .................................................................................................. 9
  2.1 Introduction ..................................................................................................................... 9
  2.2 Goat meat in a global context ....................................................................................... 9
  2.3 Australia’s place within the international goat meat market ......................................... 9
  2.4 Goat products ............................................................................................................... 10
  2.5 Goat meat characteristics ............................................................................................. 10

3 Physical attributes of the Australian feral goat ................................................................ 11
  3.1 Basic goat physiology .................................................................................................. 11
  3.2 Nutritional information ................................................................................................. 12
  3.3 Reproduction ............................................................................................................... 13
  3.4 Disease considerations ................................................................................................. 13
  3.5 Characteristics of feral vs Boer goats ......................................................................... 14

4 The feral goat harvesting industry in Western NSW ............................................................. 15
  4.1 Overview ....................................................................................................................... 15
  4.2 Drivers of industry ........................................................................................................ 15
  4.3 NSW feral goat industry structure .............................................................................. 17
    4.3.1 On property .......................................................................................................... 17
    4.3.2 Goat dealer operations ......................................................................................... 18
    4.3.3 Goat processor operations ................................................................................. 19
    4.3.4 Live export operations ...................................................................................... 19
  4.4 Inefficiencies in data collection ................................................................................... 20

5 Marketing feral goat meat .................................................................................................. 21
  5.1 Market overview .......................................................................................................... 21
  5.2 The goat meat export market ...................................................................................... 21
    5.2.1 The US market .................................................................................................... 22
    5.2.2 The Taiwanese market ....................................................................................... 23
  5.3 The live export market ................................................................................................. 23
  5.4 The domestic market ................................................................................................... 24
  5.5 Goat meat market potential ......................................................................................... 25
    5.5.1 Potential markets ................................................................................................. 25
      5.5.1.1 The domestic market .................................................................................. 25
      5.5.1.2 Canada ........................................................................................................ 26
      5.5.1.3 Korea ........................................................................................................... 26
      5.5.1.4 Brunei .......................................................................................................... 27
      5.5.1.5 EU 27 .......................................................................................................... 27
List of figures

Figure 2.1: The top ten goat meat exporters globally (MLA 2009)
Figure 2.2: Skin-on goat carcasses at Western Exporters processing plant, Charleville, Queensland.
Figure 3.1: A young male feral goat
Figure 3.2: Dietary preference for animals grazing in the Mulga Lands during a good season when feed type was not limiting (Warman citing Franco 2001)
Figure 3.3: Goats are observed to move quickly through the landscape selecting parts of a wide variety of plants.
Figure 4.1: National feral goat distribution 2006 (Lapidge et al. 2004).
Figure 4.2: Density of feral goats throughout NSW and the ACT during 2004 (DPI NSW 2007)
Figure 4.3: Price/harvest relationship from 1997-2010, derived from figures supplied by MLA 2011
Figure 4.4: The export value of Australian goat meat in thousand A$, derived from MLA 2011 figures
Figure 4.5: Aerial photo of rangeland goats being mustered within a TGP fenced paddock.
Figure 4.6: 2007 Feral goat distribution overlayed with location of goat processors in the eastern states (Lapidge et al. 2004).
Figure 4.7: Yarded feral goats
Figure 5.1: Goat meat exports in value and tonnes from 1990-2010 (MLA 2011).
Figure 5.2: The breakup of destinations for the 25,911 tonnes of goat meat exported from Australia in 2010 (MLA 2011).
Figure 5.3: USA goat meat volume and value 1990-2010 (MLA 2011)
Figure 5.4: Taiwanese goat meat imports in volume and value 1990-2010 (MLA 2011)
Figure 5.5: Total goats exported live from Australia 1990-2010 (MLA 2011)
Figure 5.6: Value of live exports of goats 1990-2010 in A$ (MLA 2011)
Figure 5.7: Destination of live goats exported in 2010 (MLA 2011)
Figure 5.8: Volume of goat meat imported by Canada 1990-2010 (MLA 2011)
Figure 5.9: Live export of goats into Korea 1990-2010
Figure 5.10: Goat meat exported to Korea 1990-2010 (MLA 2011)
Figure 5.11: Number of goats exported live to Brunei 1990-2010 (MLA 2011)
Figure 5.12: The world’s largest goat meat producers based on 2007 figures from United Nations Food and Agriculture Organization (FAO) (MLA 2009).
Figure 5.13: Kiko goats in Tennessee 2010
Figure 5.14: American Spanish Blood does being hand fed for ‘gathering’ purposes, Texas USA 2010.
Figure 5.15: Pakistani goat meat being sold in a Bahraini supermarket October 2010
Figure 5.16: Local goat carcasses in a southern Indian wet market
Figure 5.17: Local goat in the wet market in Bahrain
Figure 5.18: Australian rangeland goat carcasses
Figure 6.1: A degraded TGP fenced goat paddock in May 2009
Figure 6.2: A TGP fenced goat paddock in good order in May 2009
Figure 6.3: Western Catchment Management Authority targets that relate to the feral goat industry in Western NSW (Western CMA)
Figure 6.4: The current situation for the feral goat population of Western NSW.
Figure 8.1: Counting harvested feral goats
List of tables

Table 3.1: A review of dietary studies of goats
Table 6.1: Factors affecting the goat harvesting industry’s effect on groundcover
Table 7.1: The five domains of potential welfare compromise as defined by Mellor and Stafford (2001)
Table 7.2: Key animal welfare issues in the goat harvesting industry as identified by this report, their domains of compromise (based on Mellor & Stafford 2001), and prevention methods within the goat harvesting industry.
Table 7.3: Legislation and codes of practice relating to the harvesting of rangeland goats

List of acronyms

AQIS    Australian Quarantine and Inspection Service
DPI     Department of Primary Industries
DSE     Dry Sheep Equivalent
EU 27   European Union
FAO     Food and Agriculture Organisation
NLIS    National Livestock Identification System
NVD     National Vendor Declaration
PIC     Property Identification Code
TGP     Total Grazing Pressure
US      United States
Executive summary

The feral goat has evolved under the accurate and implacable hand of natural selection to result in an animal of Australian rangeland design. The goat’s ability to make use of a larger proportion of available vegetation than other large herbivores means that it is often the ‘last man standing’ in the ‘bar room brawl’ that is grazing mismanagement.

The market potential for goat meat is extremely strong given both its nutritional advantages over other red meats and its popularity in Muslim and Hindu cultures, amongst others.

It is widely accepted that profitability and seasonal conditions are the major factors affecting the number of feral goats harvested.

This report identifies land degradation caused by harvested underweight goats held within total grazing pressure (TGP) fenced areas at high utilisation rates as possibly the major natural resource threat caused through the goat harvesting industry in Western NSW. Conversely, there is opportunity to capitalise on the goat’s ability to spread its grazing pressure across a large variety of vegetation to improve plant biodiversity and perennial grass density within TGP fenced areas. This relies on grazing pressure management by the land manager. Landholders acquiring natural resource management grants for TGP fencing need to be held accountable for the outcomes of their grazing management.

There is a paucity of data on the goat meat industry in Western NSW. The recommendations made in this report involve extending our knowledge in order to better manage the grazing pressure exerted by the goat industry. Areas needing further research include:

- measuring the actual effect on groundcover caused through the grazing of goats, both feral and managed.
- determining the number of feral goats being harvested in Western NSW.
- determining the number of rangeland goats being managed within TGP fenced areas.
- determining the area of Western NSW fenced for total grazing pressure control.
- determining the actual numbers of managed rangeland and feral goats slaughtered each year.
- assessing the viability of establishing a lot feeding system for underweight goats in Western NSW.
- undertaking an accurate analysis of the comparative Dry Sheep Equivalent (DSE) ratings between rangeland goats and the exotic breeds of sheep which are now common in Western NSW.
1. Project overview

1.1 Introduction

This project is one of five commissioned by the Western Catchment Management Authority (Western CMA) to inform the development of a Feral Goat Management Strategy. This strategy will guide future allocation of incentive funding and effective setting of policies that enable the Western CMA to move closer to its target CT1 - Quality and quantity of vegetation managed to maintain and/or improve designated cover capable of preventing soil erosion.

The other reports produced as part of the Feral Goat Management in the Western NSW Rangelands series include:

- Feral goat population trends in the Western NSW Rangelands
- Review of feral goat regulatory and strategic framework
- Review of feral goat management
- An economic analysis of feral goat control

This project deals with the effects of the feral goat harvest industry on groundcover by investigating the contribution to total grazing pressure exerted by feral goats, goat meat market stability, the effect of feral goats on groundcover and the effectiveness of the harvesting industry in controlling the feral goat population. It is a contentious and timely issue with goat prices reaching an all time high in an abundantly good season that finds the NSW Rangelands, like that of most of eastern Australia, being ‘understocked.’

The extended dry period of the past 10 years is still fresh in the minds of western landholders, many of whom literally kept in business through the harvesting of feral goats when opportunities for profitability through domestic stock were diminished. Now, with the shortage of meat being experienced throughout the world, the feral goat is worth more to landholders than ever before.

The use of a pest as a resource has been the subject of much debate. Are environmental considerations compromised in an attempt to maximise profit from the resource? Does harvesting effectively control the feral goat population? Is total grazing pressure (TGP) fencing in Western NSW improving natural resource management?

To answer these questions we need to understand what drives landholders to harvest feral goats and how effectively the Western NSW Rangelands are harvested. Can feral goats be incorporated in a total grazing pressure calculation, and will the current high prices drive the population below sustainable industry levels?

There is a paucity of data in the goat industry and while I have made every effort to find facts and scientifically proven figures, the lack of these has often left me relying on not just anecdotal evidence, but on my own experience as a landholder in Western NSW, a goat harvester and a Nuffield farming scholar researching the goat meat industry and grazing management across the globe.

1.2 Methodology

To understand the effect of the feral goat harvest industry on groundcover in the Western NSW rangelands, two rounds of research were undertaken.

Primary research consisted of interviews with goat harvesters, producers, depot managers/owners, and processors. Information from these interviews is included in the body of this paper, along with the results of the secondary research which involved an extensive review of relevant literature (see Appendix).
1.3 **Terminology**

There are concerns that the term 'feral' used to describe goats within the industry results in a negative product image, so the term 'rangeland goats' has been widely adopted. Australian feral goats are at times referred to as 'bush goats', and some exporters use the term 'Australian Goats'.

For the purpose of this report, goats are characterised as:

**Feral goat**
Any free-living or 'wild' goat whose movements are not restricted. These animals form the basis of this report.

**Rangeland goat**
Any goat derived from the rangelands and having spent all or most of its life 'behind wire' where its movements were restricted and managed under extensive rangeland pastoral conditions. These animals are important to this report as they are derived from feral herds (sometimes females retained for breeding purposes but usually the smaller, unmarketable portion of a harvested herd). They are often kept for growing out to a marketable weight behind wire provided by TGP management grants from bodies such as the Western CMA. Their impact on groundcover is restricted to the size of the paddock but often the intensity of the groundcover reduction can be great due to movement restrictions and subsequent high grazing pressure.

**Intensively managed or domesticated goat**
Any goat born and raised under intensively managed livestock conditions where husbandry would include management of breeding, health care and individual identification. These animals are predominately derived from non-rangeland conditions. These animals make up a small portion of the industry and do not come under the scope of this report.

**Backgrounding**
For the purposes of this report the term 'backgrounding' refers to the holding of underweight goats in TGP fenced paddocks until they reach a weight suitable for the market.
2. The feral goat as a product

2.1 Introduction

The Australian feral goat Capra hircus began its life as a commercial product in 1952 (Standing Committee on Agriculture 1982) with the establishment of the goat meat export industry. In 1986 Australia overtook New Zealand to become the largest exporter of goat meat (FAO 2011), a position held by significant margins ever since. Feral and rangeland goats comprise over 90% of Australia’s goat industry (Schuster 2006).

2.2 Goat meat in a global context

Goat meat is the most widely consumed red meat across the globe (MLA 2009). It is an important part of the traditions of the Muslim and Hindu faiths and has few, if any, religious taboos. It is an important dietary component of some of the oldest cultures on earth.

China, India and Pakistan are the world’s largest producers and consumers of goat meat but export very little (MLA 2009). Peasant farmers who use the meat and milk in a self-sustaining lifestyle produce much of the world’s goat meat.

2.3 Australia’s place within the international goat meat market

Although the Australian goat meat export industry began in 1952, it was the increased North American presence in the market during the 1990s that encouraged the development of the harvesting industry. Largely catering for the Hispanic population, the bulk of Australia’s goat meat was exported to the US. The Caribbean, Canada and Taiwan also became significant markets.

It is an often-mentioned fact within the industry that although Australia is the world’s largest exporter of goat meat, it supplies less than 0.4% of all the goat meat consumed globally (MLA 2009). Figure 2.1 illustrates Australia’s weighting as the world’s leading goat meat exporter.

![Figure 2.1: The top ten goat meat exporters globally (MLA 2009)](source: FAO latest available 2007)
2.4 Goat products

The fact that goat meat is an important part of some of the oldest cultures on earth enables full use of the entire goat carcass. Traditionally it has been exported frozen skin-on and skin-off as carcasses and six-way cuts. There has been an increase in demand for cubed goat meat branded and packaged in 1 kg bags. Goat leather is of good quality and hides are mostly exported to China for processing. There is a strong market for offal products and heads. Most processors indicate demand is strongest for the six-way cut skin-on product. Figure 2.2 shows skin-on carcasses being prepared for export.

![Figure 2.2: Skin-on goat carcasses at Western Exporters processing plant, Charleville, Queensland.](image)

2.5 Goat meat characteristics

A nutritional analysis of goat meat undertaken by the United States Department of Agriculture (USDA) indicates that goat meat is lower in fat and cholesterol and higher in iron than beef, lamb, pork and chicken (Alabama Cooperative Extension Systems n.d.). These results suggest that goat meat has attributes that would make it an attractive protein alternative for the health conscious consumer. Meat and Livestock Australia (MLA) has commissioned a nutritional analysis of Australian goat meat. The results were not available at the time of compiling this report, however, preliminary findings suggest a similar result to the USDA study.

The meat of mature male goats has a strong and distinctive flavour that is, in general, not acceptable to the Western palate but is highly sought after by Middle Eastern and Hispanic populations among others. Younger male goats and females have a milder flavour and can often be confused with lamb and mutton. This product has traditionally been sold into the Asian market. All goat meat is low in fat so requires slow ‘wet’ cooking to avoid the meat drying out and becoming tough.

Meat quality can be impacted by the stresses experienced by feral goats during harvesting and transport through depletion of glycogen reserves (Schuster 2006).
3. Physical attributes of the Australian feral goat

3.1 Basic goat physiology

The feral goat has evolved under the accurate and implacable hand of natural selection to result in an animal of Australian rangeland design. It is able to use the fibrous browse endemic to the rangelands, travel widely to satisfy nutritional and water requirements, and reproduce abundantly.

The goat's physical suitability to the Australian environment is highlighted by its early history in Australia. According to Marshan (2010, citing Parsonson), of the many livestock deaths onboard the First Fleet, none were goats. They reproduced and fared better than sheep in the early days of the colony, some disappearing into the bush to probably become Australia's first feral goats.

Today, the feral goat found in Australia's rangelands (see Figure 3.1) reflects the mix of meat, fibre and milk goat breeds from which it is derived. These breeds are believed to be Angora, Cashmere, Anglo-Nubian, British Alpine, Saanen and Toggenburg (Jago 1999).

The average weight of a female feral goat is 45 kg and a male 60 kg (Parkes et al. 1996, citing McRae 1984; Mahood, unpublished data; and Harrington 1982). The effect of the now robust harvesting industry on feral goat weight has not been determined. The increase in carcass weight reported by processors (Schuster 1996 and processor survey) is more likely a product of improved harvesting techniques and the removal of underweight goats from the processing system than an actual increase in average goat weight.

Feral goats carry a limited amount of subcutaneous fat (McGregor 2005) making them more suited to hot climates than cold. They have been recorded travelling up to 80 km in a day (South Australian Arid Lands Natural Resource Management Board 2009), although for the most part they tend to stay in their home ranges which are variable in size and usually overlap with other feral goats (Holt & Pickles 1996). Home ranges vary from 139 to 587 km² for males, and are around 190 km² for females (Holt & Pickles 1996 citing King 1992).

It is worth noting that the feral goat population seems to respond to the seasonal variations of Australia's rangelands in much the same manner as the red kangaroo and emu (Pople et al. 1996), travelling large distances and breeding in response to the seasonal variations.

![Figure 3.1: A young male feral goat](image)
3.2 Nutritional information

Goats are described as intermediate, opportunistic feeders (Harrington 1986, Jago 1999, Taylor & Fuhlendorf 2001), with seasonality and availability greatly affecting diet selection (Forsythe & Parkes 2004, Jago 1999). There have been numerous studies conducted to determine the composition of the feral goat’s diet as reviewed in Table 3.1.

Table 3.1: A review of dietary studies of goats

<table>
<thead>
<tr>
<th>Location</th>
<th>Diet summary</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western NSW</td>
<td>High browse intake but select for palatability</td>
<td>Harrington 1979</td>
</tr>
<tr>
<td>Western NSW</td>
<td>Trees and shrubs contributed up to 55% of diet. Maximum of 72% grass in goat diet</td>
<td>Squires 1980</td>
</tr>
<tr>
<td>Western NSW</td>
<td>Preference for browse, particularly Mulga.</td>
<td>Downing 1986</td>
</tr>
<tr>
<td>Western NSW</td>
<td>Up to 50% of their diet from shrubs and trees, once available browse was consumed they reverted to forbs and grasses.</td>
<td>Wilson &amp; Mulham 1980</td>
</tr>
<tr>
<td>Queensland</td>
<td>Preference for legume leaf (34-75% of diet). Seasonal preference for different species. Selectivity decreased as grazing pressure increased</td>
<td>Norton, Kennedy &amp; Hales 1990</td>
</tr>
<tr>
<td>Charleville, Queensland</td>
<td>90% forbs and browse particularly Mulga.</td>
<td>Franco 2001</td>
</tr>
<tr>
<td>Wanaaring, NSW</td>
<td>Broad range of vegetation accepted. Preference for wooded areas, large browse component.</td>
<td>Landsberg &amp; Stol 1996</td>
</tr>
</tbody>
</table>

Squires’ 1980 study used oesophageal fistula collection (stomach bags) on cattle, merino sheep and goats near Cobar on six occasions over a 12-month period and determined that goats ate more trees and shrubs and less grass and chenopod species than cattle and sheep at all times. He also observed that their dexterous prehension ability allowed them to select the most nutritious parts of plants.

Franco’s 2001 study conducted in the Mulga lands near Charleville made use of a season when feed type and quality was not limiting to determine that the diet of feral goats consisted of 90% forbs and browse, and was dramatically different to the other herbivores observed (Figure 3.2).

Diet of Herbivores in Mulga Lands

Figure 3.2: Dietary preference for animals grazing in the Mulga Lands during a good season when feed type was not limiting (Warman citing Franco 2001)

Goats are often observed moving quickly through the pasture, selecting parts of a wide variety of plants (personal observation and harvester survey; Figure 3.3), and grazing trees and shrubs to a height of 1.8 m (South Australian Arid Lands Natural Resource Management Board 2009).
3.3 Reproduction

Female goats are sexually mature at between three and six months of age or at 15 kg (Jago 1999). They have an average of three pregnancies every two years and average 1.59 embryos for each pregnancy (Parkes et al. 1996). A hormonal response to shortening day length causes females to ovulate from February to July (MLA 2006), however, it is probable that rainfall and subsequent increases in available nutrition and female body condition have a greater effect on ovulation than any other cause in seasonal areas (Parkes et al. 1996), resulting in goats breeding all year round. MLA (2006) notes that females can return to oestrus five days after giving birth if adequate nutrition is available.

This reproductive reaction to nutritional variation results in a feral goat population that alters according to seasonal variation. When nutrition is abundant, feral goatherds can increase up to 50% in one year (DEWHA 2008a (citing Mahood 1985, Maas and Choquenot 1995, Parkes et al. 1996, and Fleming 2004)). Jago (1999), using figures cited in Parkes et al. 1996, calculates the rate of feral goat increase at 53% and notes that within two years a feral goat herd of 100 would increase to 234. However, actual population increases are difficult to calculate as most feral goat herds are affected by harvesting and rates of reproduction are variable.

3.4 Disease considerations

Although most feral goats in the semi-arid rangelands of Australia are disease-free, they have been known to carry 22 nematode, two cestode, two trematode, four arthropod and three protozoan parasites. They can also carry a variety of bacteria and viruses such as Coxiella burnetii, which is the cause of Q Fever (Parkes et al. 1996).

Feral goats are included under wild animal management in the 1998 Australian Veterinary Emergency Plan (AUSVETPLAN), which is Australia’s strategy to deal with an exotic disease outbreak. Jago (1999, citing Henzell) noted that feral goats could carry the exotic diseases Foot and Mouth, Bluetongue, Rinderpest, Screw-Worm Fly, Capripox, Rift Valley Fever, Vascular Stomatitis and Scrapie. Feral goats pose a considerable risk in an exotic disease outbreak due to their high mobility and preference for inaccessible country.
3.5 Characteristics of feral vs Boer goats

South African Boer goats were introduced into Australia as a specialist meat goat in the mid-1990s (Schuster 1996). They provide a 'meatier', faster maturing carcass than the typical feral or rangeland goat, however, processors indicate that overall the Boer goat carries too much fat to meet the export market’s requirements and is more suited to the domestic restaurant trade (Schuster 1996).

The introduction of the Boer goat into the pastoral areas of Western NSW has met with variable results. Problems associated with mineral deficiencies, conformation defects and general softness often led to rangeland goat producers procuring few progeny from introduced Boer bucks (Atkinson et al. 2006). Some producers have persisted with cross-breeding programs incorporating rangeland goats and are producing a Boer-type goat more suitable to the rangelands. MLA (2006) cite 200 grams/day growth rate for first cross Boer kids as compared to 100-200 grams/day for rangeland goats. This variation indicates that the potential for producing goats with faster growth rates exists within the feral goatherd.
4. The feral goat harvesting industry in Western NSW

4.1 Overview

The rangelands of Western NSW are home to an undetermined number of feral goats as well as rangeland goats kept for breeding and backgrounding purposes within TGP fenced paddocks. There is no data to differentiate between the harvesting industry and the farmed feral or rangeland goat industry. It is also impossible to separate the goat industry in NSW from Queensland, South Australia and Victoria, with most goat industry figures relating to either the eastern states or Western Australia. As can be seen in Figure 4.1, feral goats are equally unaffected by state boundaries as they are by the plain wire fences that cross the rangelands. Slaughter numbers for each state are unreliable as they are usually an indication of point of slaughter rather than state of origin.

![Figure 4.1: National feral goat distribution 2006 (Lapidge et al. 2004).](image)

4.2 Drivers of industry

The NSW Department of Primary Industries (NSW DPI) conduct regular pest animal surveys that include an assessment of the distribution of feral goats (Figure 4.2). The 2007 survey determined that feral goats have expanded their range slightly to now inhabit 38% of the state. Although it is noted that they are widely distributed in the Western Division, decreases in density were recorded throughout Western NSW that parallel the observations of harvesters interviewed for this project. The report considered the drought and commercial harvesting to be responsible for the decline in density. There was a small increase in density observed in the Lower-Darling region of south-western NSW; this too corresponds with the harvester survey (DPI NSW 2007).
In Western NSW harvesting is conducted by landholders on their own property, with ownership of the transient feral goats being tied to the property they are found on. This constantly shifting ownership of a resource is unusual but often results in priority being given to harvesting the goats before they move off property. In the case of absentee owners or landholders who are unable to harvest the goats for various reasons, contract musters are often engaged to coordinate and facilitate the removal of feral goats off property on a share of profits basis. The 2007 NSW pest survey reported that in 2004, 63% of all feral goat control in the Western Division was from mustering.

Feral goat harvesters surveyed for this report noted that feral goat mob size had decreased from when the goat market was weaker and subsequently there was less harvesting activity.

The commercial harvesting of feral goats is a rare success story for the control of a pest animal. In 2009 Forsyth et al. conducted a detailed study in the Western Australian rangelands and determined that profitability and rainfall had the greatest influence on the number of feral goats harvested (Figure 4.3). It was found that a $1 increase in the price paid per goat was associated with an increase of 3.5 - 5.0% in the number of goats received by the abattoir the following month. An increase in rainfall reduced the number of goats harvested by hindering water trapping and transport on unsealed roads.
In 1992, a paper entitled Feral Goat Commercialisation: the Beginning of the End of Eradication was presented at the 15th Vertebrate Pest Conference in California by Australian Agriculture Protection Advisor, Greg Pickles (Pickles 1992). He argued that commercialisation of the feral goat industry would encourage landholders to view goats as a resource rather than as a pest to be eradicated and that long-term investment in infrastructure was needed to support the industry and would encourage the animal’s preservation rather than elimination. This philosophy is based on the unproven premise that eradication of feral goats was and is possible. While it can be argued that present day feral goat harvesting is more opportunistic than strategic (South Australian Arid Lands Natural Resource Management Board 2009), the financial rewards for effective feral goat harvesting encourage control of what could be an unmanageable pest and enable a profitable alternative to culling. Commercial harvesting will not result in feral goat eradication as the per capita cost of capture increases as goat densities decrease (Pople 1998), although a steadily increasing goat meat price enables profitable control at lower densities. Forsyth et al. (2009) observed that the size of the harvest could be manipulated by altering the economics of the harvest.

A profitable feral goat harvesting industry has a flow-on effect throughout rangeland areas at financial, environmental and social levels. This results in an improved environmental outcome, a more profitable region and flow-on effects in improved social impacts. At a national level, the goat industry makes use of a potentially environmentally damaging pest to earn export dollars.

Figure 4.4: The export value of Australian goat meat in thousand A$, derived from MLA 2011 figures

4.3 NSW feral goat industry structure

4.3.1 On property

Harvesting of feral goats by landholders in Western NSW is conducted by:

- A mustering and/or trapping operation conducted when sufficient feral goat numbers have been observed to suggest that the operation would be economically viable, or
- Ongoing harvesting and release into a TGP fenced paddock until numbers are sufficient for economical transport to slaughter, pasture availability diminishes, or the market price for goat meat is considered satisfactory.

Capture methods usually entail a combination of mustering and water trapping. Goats are selected for slaughter based on weight and sometimes sex. At times female goats are retained for breeding purposes in managed goat operations, but generally goats above 25 kg liveweight are sent to slaughter (this weight cut-off point varies according to market price and pasture availability). If a landholder has a TGP fenced paddock with adequate pasture availability it can be financially rewarding to hold goats until a higher liveweight is realised. Figure 4.5 is an aerial photo of rangeland goats being mustered within a TGP fenced paddock.
In the event of limited pasture availability, or in the case of a TGP fenced paddock not being available, the underweight goats are sold to a goat dealer for backgrounding or re-released as feral goats. The limited market for underweight goats during seasons when pasture availability is restricted can impact negatively on the environment if goat paddocks become overstocked.

Landholders with enough sale goats to fill a semi-trailer or more will usually sell direct to a processor for an over the hooks price. Generally marketing is done through a local goat dealer. Landholders without TGP fencing will often sell small loads to a local goat depot upon capture.

### 4.3.2 Goat dealer operations

The evolution of goat depots in Western NSW has been an organic process aiding the progression of the industry.

Goat dealers assist harvesters by buying small loads and amalgamating them to obtain the economies of scale needed to minimise freight costs. They can also act as an agent, arranging an over the hooks sale to a processor, and assist with the drafting of goats into correct weight ranges. They act as a selling point for underweight goats that are then channelled into the farmed rangeland goat system. Most goat dealers have the capacity to background these small goats themselves and are able to use them for filling supply shortfalls.

Processors are assisted by depots and dealers by reducing the seasonality of supply, drafting goats to meet specifications, increasing supply through the amalgamation of small lots that would otherwise not be feasible to harvest and often providing all weather access to minimise supply disruptions caused by rainfall.

Typically goat depots pay for small loads on a liveweight basis. The goats are then drafted on sex and size, with the underweight goats removed for backgrounding, and the females separated from the males for holding and transport.

Most depots require that the seller of the goats supply a National Vendor Declaration (NVD). This NVD is part of the traceability system (see Section 4.4) and is entered into a national database administered by Ausmeat.

It is possible that a decrease in feral goat density and an increase in the profitability of backgrounding small goats will consolidate the role of the goat depot.
4.3.3 Goat processor operations

The opportunistic nature of the goat harvesting industry carries over into abattoir operations with goats often being used to fill gaps caused by sheep supply shortfalls. An example of this is the entry of JBS Swift into the goat processing industry when lamb supplies were depleted during 2009/2010. JBS Swift currently process up to 10,000 goats weekly depending on supply. (S Chapman 2011, pers. comm., 18 May).

Goat processing plants still cite consistency of supply as being the major factor affecting profitability. They noted an increase in ‘farmed’ rangeland goats improving supply and generally providing a better quality line of goats with less size variation. All plants indicated that supply was heavily affected by road closures during rain periods.

Among other issues, goat processing plants are hindered by labour costs and shortages and foreign exchange rates for a product that relies heavily on the export market. The high costs imposed by the Australian Quarantine and Inspection Service (AQIS) were also mentioned as a limiting factor in processing capacity.

The location of goat processing plants does not correspond with goat populations apart from the Western Exporters plant at Charleville (Figure 4.5). Reasons for this disparity include access to labour and export facilities.

![Figure 4.6: 2007 Feral goat distribution overlayed with location of goat processors in the eastern states (Lapidge et al. 2004).](image)

For product consistency and leanness, processors indicated that they prefer a rangeland carcass rather than a Boer cross. They also noted that while the market preferred a lean product poor goats were not acceptable.

Processors produce a range of products, including skin-on and skin-off carcasses, 6-way cut carcasses, bone-in and bone-out diced goat, offal and other co-products including heads, testicles and penises.

Goat processors in the eastern states sell product largely into the North American market, Taiwan and the Caribbean. KJ Halal Meat, located in Nyngan, caters solely for the domestic butcher market.

4.3.4 Live export operations

Historically, a proportion of goats from Western NSW was exported live by sea to the Middle East. The feral nature of the goats resulted in an unacceptable mortality rate during transport. Live export of goats by sea ceased but the industry was revived in response to strong demand from Malaysia and the availability of affordable airfreight using goats as a backload for imported white goods.
Although live export doesn’t account for a large portion of Western NSW goat production, it is a section of the industry that is growing strongly. Goat depot operations are able to assist the live export industry through amalgamation of animals to meet market specification. P & D Exports, who send on average 1000 goats to Malaysia each fortnight, have developed a quality assurance program with Western NSW goat depot Gates Goats to manage supply and quality issues (P. Elisio 2011, pers. comm., 18 May). Generally, male goats in the 25-40 kg liveweight range are preferred for the Malaysian live export market.

4.4 Inefficiencies in data collection

There is potential to obtain accurate figures on the breakup of feral and managed goats in Western NSW through the National Vendor Declaration (NVD) documentation, however, the system is undermined by inefficiencies and differences of opinion and it is not mandatory in all states.

The current National Livestock Identification System (NLIS) requires that all managed goats must be identified with an NLIS eartag before leaving their property of origin. Harvested feral goats that are sent directly to slaughter are not required to be tagged. The minimal animal husbandry that is characteristic of the rangeland goat industry does not allow opportunity for the tagging of goats within normal management activities. The handling and tagging of goats, particularly large animals, is a difficult and time consuming process that producers are avoiding by identifying all goats sold, whether from behind wire or feral, as feral animals.

The purpose of the NLIS is to enable traceability for food safety and biosecurity purposes. Of the six processors interviewed for this project, five indicated that they were very opposed to NLIS tagging - they felt that the NVD documentation provided more than adequate traceability. The NVD is completed by the seller of the goats and accompanies the goats during transport. More recently, the NVD is completed online. This information is entered into a national database administered by Ausmeat, however not all of the data on the NVD is entered, and importantly, the number of animals is not recorded.

![Figure 4.7: Yarded feral goats](image)
5. Marketing feral goat meat

5.1 Market overview

The market for Australian goat meat has experienced rapid and consistent growth for more than two decades. This growth has been driven by US demand for the meat, increasing affluence in goat meat consuming populations, global population growth and increasing protein demand.

Export market demand for goat meat is also driven to a degree by the demand for mutton, which has been experiencing tight supply and high demand. As goat meat is used in some countries as a mutton substitute, the value of the two products is tied together to some degree (Stokes 2009).

Over 90% of Australian goat meat is exported as a commodity product, usually in frozen carcass or six-way cut form, with very little value-adding. Western Exporters at Charleville has been marketing 1 kg bags of bone-in diced goat meat with success in the US (N Duncan 2011, pers. comm. 11 May).

Australia monopolises the global goat meat market, with high product quality, good market access and industry infrastructure that could enable further expansion in the market.

5.2 The goat meat export market

The Australian goat meat industry is heavily dependent on export with approximately 95% of production being exported (Schuster 2006). This export reliance exposes the industry to risks, including currency fluctuations, increases in costs of export and financial instabilities in the importing countries.

Volumes of exported goat meat have been steadily increasing with only small reductions occurring due to supply restrictions caused by widespread droughts (Stokes 2009). In 2010 the total volume exported was 25,911 tonnes, an increase of 207% since 2000 (MLA 2011).

The value of goat meat exports has increased strongly with the only major (short-lived) decrease in price being caused by the global financial crisis (Figure 5.2). The goat meat value exported during 2010 was A$113 million, an increase of 298% from the 2000 value of A$37 million (MLA 2011).

In order to accommodate the seasonal supply and demand fluctuations that are endemic to the industry, almost all goat meat is exported frozen.

Figure 5.1: Goat meat exports in value and tonnes from 1990-2010 (MLA 2011).
5.2.1 The US market

Despite a faltering economy and shrinking exchange rate, the US has continued to be the strongest market and possibly greatest driver for the Australian goat meat industry, accounting for 58% of goat meat exports during 2010 as indicated in Figure 5.2 (MLA 2011). This has been buoyed in recent years by the entry of meat processors T and R Pastoral as well as JBS Swift into the goat meat market. Their market access in North America has facilitated goat meat product distribution. The strong growth in volume and value of the US market is demonstrated in Figure 5.3.

The strong demand for Australian goat meat in the US comes from the Hispanic, Muslim and African populations. While I was researching Australian goat meat opportunities in the US during 2010, I spoke with consumers in Tennessee who indicated a strong preference for Australian goat meat over any other, including that produced in North America. These consumers particularly liked the flavour of the large male goats which are generally not available from managed goat production systems.

The entry of another supplier into the North American market could reduce our market share but demand continues to grow with the increase in both size and wealth of the goat meat consuming demographic. It is also unlikely that potential competitors could match our food safety standards.

![Figure 5.2: The breakup of destinations for the 25,911 tonnes of goat meat exported from Australia in 2010 (MLA 2011).](image)

![Figure 5.3: USA import of Australian goat meat in volume and value 1990-2010 (MLA 2011).](image)
5.2.2 The Taiwanese market

Taiwan has been consistently importing goat meat from Australia for more than two decades, only being surpassed by the US in 2001. Since then it has remained our second largest export destination in both volume and value. Generally the Taiwanese market prefers a skin-on carcass of smaller size than the US market.

Although a very significant market for Australian goat meat, volumes imported have been quite stagnant (see Figure 5.4) resulting in Taiwan generally not being viewed as a market with extensive growth potential.

![Figure 5.4: Taiwanese import of Australian goat meat in volume and value 1990-2010 (MLA 2011)](image)

5.3 The live export market

In 2010 Australia exported 77,000 head of goats for slaughter and breeding. Collectively they were worth in excess of A$10 million in export dollars (MLA 2011). Rangeland type goats are not among the breeding animals exported.

The total goats exported live from Australia from 1990 to 2010 and the value thereof is shown in Figures 5.5 and 5.6.

![Figure 5.5: Total goats exported live from Australia 1990-2010 (MLA 2011)](image)
The live export market for slaughter provides fresh meat in areas where refrigeration is not commonplace. The demand for live animals as a product is quite distinct from the demand for frozen or chilled meat (Coppin 2009). The use of airfreight to transport goats reduces animal welfare issues associated with lengthy journeys.

Malaysia has emerged as a large importer of Australian goats over the past decade, accounting for 83% of the goats exported live in 2010 as shown in Figure 5.7 (MLA 2011). Malaysia aims to be 35% self sufficient in goat meat supply by 2015 (Stokes 2009), and so have imported Boer types for breeding purposes. The success of their breeding programs is yet to be determined.

Singapore is also a significant importer but it is difficult to differentiate the market data from Malaysia as many of the goats going into Singapore are trucked to Malaysia (Stokes 2009, citing MLA e-newsletter 2009).

The future for the live export trade is tied to animal welfare issues and the cost of freight.

5.4 The domestic market

The market for goat meat within Australia is limited by inconsistent and irregular supply of product to fit market specifications.

There is a paucity of data on the domestic goat meat industry but it is thought that only about 5% of goats slaughtered enter the domestic market and around 90% of this goat meat is sold through ethnic butchers in Melbourne and Sydney (Schuster 2006).
There is some speculation that the lack of a solid domestic goat meat market inhibits growth in the export sector (P Elisio 2011, pers. comm., 18 May). The fact that Australia is home to many people from goat meat eating cultures does seem to suggest that there is room for a domestic goat meat industry. Generally, there is an apparent lack of knowledge about goats, goat meat preparation and health benefits of the meat (Marshan 2010).

Specifications for the domestic market vary according to cultural preferences. Marketing has focused on the food service trade using Boer and Boer cross animals that are similar to lamb in appearance, however, supply shortfalls have restricted market development in this sector. Lack of supply of an animal to suit these specifications can mainly be attributed to the alternative industry of sheep meat production being more profitable.

Demand is strong from Muslim, Chinese and Vietnamese butcher shops for small rangeland goats (D Qureshi 2011, pers. comm. 17 May). This product has a larger supply profile and is more likely to be able to meet demand and supply a consistent product. KJ Halal Meat is capitalising on this by sourcing rangeland goats from Western NSW in the 22-26 kg liveweight range and slaughtering 1000 animals each week at their Nyngan abattoir. Slaughter numbers are restricted by abattoir capacity and labour availability rather than demand for product, which is very strong (M Qureshi 2011, pers. comm. 2 June).

Issues associated with this market centre on pricing. It is difficult to source the animals in good seasons when it is more financially rewarding for producers to hold the goats to a higher weight. It is also less cost-efficient to process a small animal, which increases the costs/kg and subsequent price.

This market for small feral-type goats could provide beneficial outcomes for both the industry and the environment, increasing the scope for removal of small goats from farmed systems during times of poor pasture availability.

### 5.5 Goat meat market potential

It is difficult to find an industry with the growth potential of the goat meat industry. In a world experiencing unprecedented demand for protein it would appear that goat meat can be produced cheaply enough to feed the masses and provide health benefits for the more affluent consumer.

It also plays a part in the religious traditions of the Muslim and Hindu faiths, which comprise some 35% of global population. The migration of people from this religious and cultural background into the typically non-goat meat eating countries of the western world increases demand scope and exposes a larger population to the product.

The world’s two largest consumers of goat meat, China and India, are experiencing significant growth in urbanisation and affluence. The results of these changes are an increasing demand for protein and less ‘backyard’ goat production as population density shifts from rural to urban.

The health benefits of goat meat as opposed to other red meats are not widely known among the health conscious consumers of the western world (Marshan 2010). There has been no data available on the health benefits of Australian goat meat, however MLA have commissioned a study with results yet to be published. The potential to market Australian goat meat as ‘organic’ or ‘natural’ (having not been exposed to husbandry and subsequent chemical application) and living a ‘wild’ and ‘natural’ life is yet to be capitalised on.

Continued growth within the industry could be thwarted by lack of supply, increase in mutton availability and the emergence of a competitor.

#### 5.5.1 Potential markets

Although this report identifies Australian domestic, Canada, Korea, Brunei, and EU 27 as markets with solid potential for Australian goat meat, the potential for industry growth is not limited to these markets. Potential exists within any market that includes a population consisting of people of the Muslim or Hindu faiths, migrated populations from goat meat eating cultures (including but not limited to China, India, Pakistan, Africa, the Middle East, and South East Asia), and populations that include a ‘health conscious’ component seeking to minimise fat and cholesterol consumption.
5.5.1.1 The domestic market

The Australian domestic market appears to ‘tick all the boxes’ for market potential listed above. Local distribution would incur lower market access costs than export and reduced financial risk.

Australia has been a traditional consumer of lamb, which has experienced strong price increases forcing consumers to consider protein alternatives. The Australian consumer survey conducted by Marshan 2010 determined that 31% of the survey population consumed red meat three times or more a week, and lamb was consumed on a weekly basis by 65% of the survey population. Of those surveyed, 35% had tried goat meat with 5% consuming it on a weekly basis. Cultural heritage was cited as strongly influencing goat meat consumption.

While strong potential exists within the sector of the Australian population derived from a goat meat eating culture, there is also potential to expand into the lamb-eating segment by improving product availability and marketing product to suit consumer preferences.

5.5.1.2 Canada

Growth in the sales of Australian goat meat to Canada (as shown in Figure 5.8), have been aided as they have through much of North America by the entry of JBS Swift and T and R Pastoral to Australian goat meat processing. Improved distribution is aiding increasing demand caused by immigration.

![Figure 5.8: Canadian import of Australian goat meat in volume and value 1990-2010 (MLA 2011)](image)

5.5.1.3 Korea

Trade with Korea has been hampered by Korean protocols designed to protect their own agricultural industry. Live export has been sporadic (as indicated in Figure 5.9), but recent increases in volumes of frozen product (Figure 5.10), indicate a potentially strong export destination.

![Figure 5.9: Live export of goats into Korea 1990-2010 MLA 2011](image)
5.5.1.4 Brunei

Brunei has strong similarities to Malaysia which indicate solid potential for the live export trade. As can be seen in Figure 5.11, live export numbers have fluctuated over the past two decades.

5.5.1.5 EU 27

The EU 27 represents a potential destination for a premium goat meat product. Exports into the area have been hampered by quota restrictions that place goat meat in the same quota category as sheep meat. Australia holds only a small share of the quota with the EU sourcing most of their sheep meat from New Zealand. The shortage of Australian sheep meat available for export has enabled a small quantity of Australian goat meat to be exported into the EU 27 since 2006. Although only a small tonnage, the value was over six times greater/tonne than the goat meat exported to the US (MLA 2011).

5.6 Potential competitors

Globally the goat industry lacks commercialism and professionalism. Traditional goat meat eaters would keep a small herd of goats for meat and milk, with a member of the family being responsible for taking them out to graze each day. This has led to a perception by some people that goat meat is a ‘peasant meat.’

The lack of commercialism that is indicative of the goat industry globally reduces the possible impact of potential competitors. Few countries with large herds of goats have the infrastructure and food safety standards to pose a significant threat to Australia’s goat meat export industry. From my travels investigating the goat meat industry across the world in 2010 I would also say that I have not seen goats of the same consistently high quality as Australia’s feral and rangeland herd.
5.6.1 The United States of America

The US, our biggest market, has been attempting to establish a commercial goat industry for some time. The American Spanish Blood goat has evolved similarly to our feral goat. Although similar in type to Australian rangeland goats (Figure 5.14), the animals of this breed that I observed were significantly smaller than Australian goats.

Breeders in the US have imported the Kiko breed from New Zealand which is similar in type to our rangeland goat (Figure 5.13). These Kiko goats appear to exhibit a greater tolerance to the cold and wet conditions of much of the north of the US.

The Boer goats I observed were generally smaller in frame than any I have seen in Australia and appeared very soft animals. It was often mentioned to me that the mortality rate of the Boers was high as they were very susceptible to internal parasites.

Generally, from these observations, the US is not considered a potential significant competitor. The industry lacked solid commercial structure and infrastructure. Pest animals, mostly coyotes, caused substantial losses. In my opinion as a commercial rangeland goat producer, the country I observed in Texas, New Mexico and Tennessee, the US’s three major goat producing states, is not suited to running goats on a commercial scale. I was also surprised at the apparent lack of skill available for mustering goats, with producers supplementary feeding their animals to enable them to ‘gather’ or muster the goats.
5.6.2 China: competitor or potential market?

China is home to the world’s largest goat herd, however, precise population estimates are difficult due to the fact that the Chinese word for goat, ‘yang’, is the same as the word for sheep. Usually the Chinese will use the word for mountain ‘shan’ as a prefix to determine goat. Even with this differentiation, there was little separation between the goat and sheep industry data.

In 2010 during a meeting in Beijing with Mr Liu Quangde, a representative of the Chinese Animal Agriculture Association, I was told that due to the deterioration in land condition of the dry grassland areas, a new government policy had been introduced to limit grazing in traditional goat production areas. Goats and sheep were now being kept in sheds and raised intensively. Farmers were forced to go out into the fields and collect fodder by hand for their animals. This increase in labour was resulting in a decrease in animal numbers. It was noted that few young people were willing to work in this manner and were moving to the cities. I was told that 98% of the goat herd was owned by farmers who owned less than 100 head. Prior to the introduction of the environmental plan that forbade the grazing of animals in some areas, there had been a year on year increase in goat and sheep production of 27% from 1986. Even with this boost to their goat population, Mr Quangde said that China was only just supplying domestic demand with goat meat being the preferred meat of the Chinese people. He felt that the new intensive production being forced upon producers would result in a rapid reduction in production and force China to import significant quantities of goat meat.

Although in the past we have exported some goat meat to China, the lack of a free trade agreement limits our trade potential through the imposition of prohibitive tariffs (Yana Gao, Trade Development Officer MLA Beijing 2010, pers. comm., 9 August)

5.6.3 Brazil

Brazil’s agricultural industries are growing rapidly and although the Brazilian goat population is significant there has been little attempt to commercialise the industry. Its close proximity to two of our top three markets, the US and the Caribbean, mean that it is a potential threat. However, it would appear that an extremely large and growing domestic market is likely to absorb an increase in goat meat production for some time.
5.6.4 Pakistan, India and Africa

Much of the goat meat consumed in the Middle East is imported from Pakistan, India and parts of Africa. Figure 5.15 shows Pakistani goat meat being sold in a Bahraini supermarket. Generally this is cheap product of low food safety standards. Figures 5.16, 5.17 and 5.18 demonstrate the considerable differences in meat quality and food safety between Australia, India and the Middle East. It is unlikely that these countries will emerge as significant competitors due to their limited infrastructure and low food safety standards.

Figure 5.15: Pakistani goat meat being sold in a Bahraini supermarket October 2010

Figure 5.16: Local goat carcasses in a southern Indian wet market
Figure 5.17: Local goat in the wet market in Bahrain

Figure 5.18: Australian rangeland goat carcasses
6. The effect of the feral goat harvesting industry on groundcover in Western NSW

6.1 Introduction

Land degradation by feral goats is listed as a key threatening process under the Environment Protection and Biodiversity Conservation Act 1999 (Department of Environment, Climate Change and Water 2011). Globally, goats are often blamed for the degradation of environments with particular emphasis on arid areas (Wright 2004). Given that goats are capable of consuming a larger range of vegetation than other domestic livestock (Squires 1980; Downing 1986; Wilson & Mulham 1980; Norton, Kennedy & Hales 1990; Landsberg & Stol 1996; Taylor & Frudenholf 2001), it is possible that goats are simply the ‘last man standing’ in the ‘bar room brawl’ that is grazing mismanagement, surviving when other domestic stock can no longer source sufficient nutrition from an overgrazed landscape.

The goat's ability to use such a large portion of vegetation on offer can result in devastation of a landscape when stocking rate exceeds pasture growth and there are insufficient pasture rest periods. The dominant feature affecting pasture growth in the rangelands of Western NSW is rainfall variability (Ludwig et al. 1997). Management of this variability is difficult enough with controlled domestic stock, but management of feral herds and other wild herbivores requires considerable diligence. McKeon et al. (2004), report that the major cause of rangeland degradation is the failure to manage grazing pressure.

Feral goats comprise a portion of the grazing pressure in Western NSW, but their transient nature usually results in them moving on from an area before it is denuded. This report identifies land degradation caused by underweight goats being held in TGP fenced paddocks when the available vegetation has been used as possibly the most significant natural resource threat caused through the goat harvesting industry in Western NSW. Equally however, there is opportunity to capitalise on the goat's ability to make use of such a broad section of the vegetation to increase perennial grass density and plant biodiversity through good management of goat stocking rates in TGP fenced paddocks.

These possible outcomes are demonstrated in Figures 6.1 and 6.2. These photographs of TGP fenced goat paddocks located less than 50 km apart were taken on the same day. Both paddocks had experienced similar seasonal conditions and been used as goat paddocks for a similar time frame. The difference is striking – the paddock in Figure 6.1 is almost totally denuded through overstocking, while Figure 6.2 shows rangelands in a healthy, functioning state.

Figure 6.1: A degraded TGP fenced goat paddock in May 2009
6.2 Issue relationship to Western CMA targets

The Western CMA targets that are impacted by feral goats and the goat harvesting industry are detailed in Figure 6.3.

Figure 6.3: Western Catchment Management Authority targets that relate to the feral goat industry in Western NSW (Western CMA)
6.3 Harvesting effect on feral goat population

The difficulty in trying to quantify the effect of harvesting on the number of feral goats in Western NSW is that all elements affecting the outcome of both the harvesting operation and the goat population are variable. There is also a lack of measurement within the industry.

Variability exists in feral goat population density, goat reproduction rates, the portion of the entire feral herd that are actually harvested and disposal of underweight animals among other factors. The mobility of the animals also makes quantification of effect hard to pinpoint, with goats moving large distances affecting population rates in country that may or may not have been harvested.

We can, however, be reasonably sure that:

• Reproduction rates in the feral goat herd are affected by seasonal conditions, i.e. when seasons are good we can expect their population to increase (Pople et al. 1996; Parkes et al. 1996; Forsyth & Parkes 2004).

• An increase in the profitability of harvesting will result in an increase in numbers harvested (Forsyth & Parkes 2004; Forsyth et al. 2009).

• The point where it becomes unprofitable to harvest is affected by goat density and goat meat price (Forsyth & Parkes 2004).

• The number of feral goats in Western NSW is affected by surrounding populations, i.e. those in Queensland and South Australia (Parkes et al. 1996).

From 2002–2008 there were between 1 and 1.2 million goats slaughtered annually in Australia. In 2009 the number rose to 1.63 million and in 2010 to 1.67 million. This slaughter number of between 1.6 and 1.7 million appears to be holding with the total slaughter numbers for the first quarter of 2011 totalling almost 400,000 head (MLA 2011). This report has been unable to source any data or anecdotal evidence that suggests that the increase in slaughter numbers is linked to an increase in goat population, but rather an increase in the value of goat meat (harvester survey; Forsyth & Parkes 2004; Forsyth et al. 2009), as is indicated in Figure 4.3.

It is unknown what portion of the slaughter numbers have been sourced from ‘farmed’ rangeland animals and whether the increase in animals slaughtered can be accounted for with a corresponding increase in TGP fenced country.

Bellchambers (2004, cited in Forsyth & Parkes, 2004) suggests that harvesting promotes reproduction by removing the large males from the herd and allowing the females to access greater nutrition, however, anecdotal evidence suggests that the release of mature females from a harvested herd is extremely rare. Harvesters interviewed during the course of this project generally indicated that the underweight portion of a harvested herd are rarely re-released, usually being sold to a dealer who either grows them out or on-sells them to a producer. One harvester in the Lower Murray Darling Catchment indicated that underweight goats were often re-released there. It is possible that this is linked to TGP fenced paddock availability. A harvester located near Cobar indicated that the underweight goats were frequently re-released in that area, but all others, particularly in the north-western section of the state indicated that it was very rare for animals to be re-released.

Re-release of the underweight portion of the feral herd captured is affected by seasonal conditions through market price. Limited available pasture within TGP fenced paddocks reduces demand for small goats and subsequent dollar value of the animal. Harvesters are more inclined to re-release the small animals in the hope that they may harvest them at a later date rather than accept a negligible price. Harvesters with TGP fenced paddocks of their own will only re-release captured underweight goats if there is little pasture available within their paddocks.

Even though females above 25 kg will rarely be re-released, the fact that a female goat begins breeding at 15 kg body weight (as discussed in Section 3.3), means that a population of underweight animals will increase through reproduction.

The efficiency of harvesting is also highly variable and can be affected by climatic conditions and harvester skill. There have been attempts to measure the proportion of the total goat herd that is removed during a muster and results have varied between 26-80%. Similar results have been measured during water trapping activities (Parkes et al. 1996 citing Pickles unpublished data; Forsyth & Parkes 2004 citing Henzell 1984; Allen 1991; Thompson et al. 1999; Casburn et al. 1999; Elliot & Pearce 1998). A sustained harvesting program is necessary given that it is estimated that a mob can recover from a 60% reduction within two years of average seasonal conditions (Forsyth & Parkes 2004). Pople et al. 1996 suggest that the commercial harvesting of goats represents a sustained-yield operation because their numbers have fluctuated in a manner similar to red kangaroos and emus.
Even though harvesting results are variable, it could be described as a very target-specific pest control method. Currently in Western NSW, the feral goat population is increasing, with a good season resulting in high reproduction rates and seemingly held in check by record high prices for goat meat and ensuing increased interest in harvesting (Figure 6.4).

6.4 Harvesting industry effect on groundcover

It is difficult, if not impossible to gain a thorough understanding of the feral goat harvesting industry’s effect on groundcover through a two-dimensional examination of feral goat’s feeding characteristics and the number of animals harvested. Complexities within the issue, (as detailed in Table 6.1), are caused by goat density, seasonal conditions, country type, management of underweight goats, frequency and effectiveness of harvest, vegetation availability and the proportion of total grazing pressure that the harvested goats account for.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Variance and effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goat density</td>
<td>Affects actual stocking rate, vegetation consumed, and profitability of harvest</td>
</tr>
<tr>
<td>Market variations</td>
<td>Affects frequency of harvest, stocking rate required for landholder to be profitable and disposal of underweight goats</td>
</tr>
<tr>
<td>Underweight goats</td>
<td>Affects feral population when re-released or removed to TGP fenced paddocks, effects groundcover in TGP fenced paddocks (Detailed in Section 6.5)</td>
</tr>
<tr>
<td>Seasonal conditions</td>
<td>Affects reproduction rates and carrying capacity of landscape.</td>
</tr>
<tr>
<td>Country type</td>
<td>Hilly country attracts goats and causes soil erosion through run off.</td>
</tr>
</tbody>
</table>

It is also difficult to separate the impact of feral goats on vegetation from that of other herbivores such as domestic stock and kangaroos. The use of TGP fencing to totally remove feral goats from an area has the potential to demonstrate the effect of unmanaged feral goats on a landscape as demonstrated by McMurtrie et al. (2011). In the Cobar based study, a TGP fenced area with rotationally-based goat grazing management was seen to improve in both groundcover quality and quantity as compared to a non-TGP area where feral goats were controlled through water trapping. It is unclear though, whether the actual grazing management system had a positive effect on the groundcover over and above the removal of feral goats from the landscape.
Ludwig et al. (1997) reported an increase in the amount of bare ground and changes in the composition of vegetation caused by the overgrazing of domestic livestock. The transient nature of feral goats and the large scope of vegetation that is palatable to them should, in theory, result in less altering of the species composition. Harvesters indicated that although feral goats have been observed to cause environmental damage in areas where they are concentrated, their transient nature minimises their impact on groundcover.

Parkes et al. (1996) found that goats at average densities of 2/sq km consume 0.73 tonnes of dry matter per year. By comparison, rabbits at average densities of 300/sq km were estimated to consume 10 tonnes of dry matter per year (DEWHA 2008a, citing Newsome 1993).

Forsyth & Parkes (2004, citing a South Australian study by Tiver & Andrew 1997) found that 10 plant species were negatively affected by grazing by sheep, goat, kangaroos and rabbits, but grazing by goats alone was responsible for the negative impact on only one plant species (*Casurina pauper*).

Feral goats make up an ever altering proportion of the grazing pressure in Western NSW and their effect on groundcover varies accordingly, however, without a feral goat industry it is likely that much of the plain wire fenced country of Western NSW would be running feral goats well beyond its carrying capacity. Harvesters interviewed during the preparation of this report indicated that without a profitable goat industry, the many (largely unstocked) properties owned by absentee landholders would be grossly overstocked with feral goats. These harvesters were often actively engaged in encouraging absentee landholders to authorise mustering due to the profitability of the exercise.

Feral goat sales make up a component of the income of many properties in Western NSW. Should a property totally exclude feral goats it is possible that an increase in the stocking rate of domestic stock would cover the gap left by the loss of feral goat sales. However, if there was no goat industry but goats were not excluded from a property through fencing, an increase in stocking rate would not sustainably be possible.

### 6.5 The effect of harvested underweight goats on groundcover

As stated in the introduction to this chapter (Section 6.1), this report identifies overstocking of underweight goats in TGP fenced areas as the major risk to groundcover in Western NSW caused by the feral goat harvesting industry. Conversely, it also argues that careful management of goat grazing under controlled conditions can result in an improvement in rangeland condition.

Generally, goats that are less than 25 kg liveweight are considered ‘underweight,’ although, domestic demand from city-based butchers servicing an ethnic population are increasing the demand for goats in the 22-26 kg liveweight range.

Harvested underweight goats can influence groundcover by either their re-release as feral goats or the grazing pressure they exert in a TGP fenced paddock while ‘growing out’ to a saleable weight.

Re-release of harvested underweight goats occurs when either there is no TGP fenced paddock available, pasture conditions within TGP fenced paddocks have diminished, or limited market opportunities exist, generally because of seasonal conditions. Re-released animals sustain the feral goat population.

Land degradation within TGP fenced goat paddocks occurs when demand from re-stockers for underweight goats is minimal and prices are subsequently low. Landholders with underweight goats in TGP fenced areas are faced with the predicament of a lack of pasture being available to finish goats that they have already invested time and pasture into. The landholder then has the option of releasing or destroying the goats, or at times accepting a negligible price for them. During dry times underweight goats are sometimes given away and there have been times when even that was not possible. The fact that harvested goats have not had to be bought, and their ability to use such a large portion of the vegetation, coupled with their strong reluctance to die, can encourage landholders to hold onto goats much longer than they would other domestic stock in the hope that once pasture is available they will have animals to sell. This has a compounding negative effect when degraded paddocks are slow to recover from being overgrazed and don't receive the necessary rest from grazing to aid plant recovery. Consequently the growth rate of the animals slows and compounds the growth restrictions on vegetation.

The goat’s ability to use such a large portion of the available vegetation can result in desertification within TGP fenced paddocks as demonstrated in Figure 6.1. Funding for these paddocks often comes in the form of natural resource management grants to exclude feral goats from areas or to enable more effective feral goat control through amalgamating mobs for sale.
There are however many examples within Western NSW of TGP fenced paddocks being used for growing out underweight goats resulting in improved groundcover and vegetation diversity as illustrated in Figure 6.2.

Taylor and Frudenholf (2001) report on a 20-year grazing research study conducted at Sonora Research Station in Texas, USA, which I visited and observed during 2010. Pastures that prior to the study commencing were in a similar vegetative state were stocked with goats at consistently light (1 goat/6.6 acres), moderate (1 goat/3.3 acres) or heavy (1 goat/2.2 acres) rates. Regardless of stocking rate, all pastures carrying goats improved significantly in range condition and grass productivity. Today they have more plant diversity than other areas, including those that have been destocked for more than 50 years. The Sonora area has experienced land degradation through woody weed infestation attributed to overgrazing and the subsequent removal of fire from the landscape.

The importance of management cannot be overrated. Both good and bad outcomes are equally obtainable. While the goat is seen as the cause of land degradation within TGP fenced areas, it is the wielder of the tool, the land manager, who is ultimately responsible for the outcome.

### 6.6 Ability to influence goat effect on groundcover

There is potential for influencing the effect of the goat harvesting industry on groundcover. An increase in area under TGP fencing would result in landholders having a greater area under TGP management excluding feral goats and enabling a larger area for managed underweight goats, thus diluting the grazing pressure. A greater number of properties with their entire boundary TGP fenced and with control of water points would assist with management of grazing pressure in a more comprehensive manner.

Regulations and policing of these TGP areas would be ideal but probably not practical, however, it may be possible for areas TGP fenced under natural resource management grants to be held accountable for land degradation outcomes.

When seasonal conditions are limiting and there is no demand for underweight goats, producers are left with nowhere to go with these animals. Given that most producers would be unwilling to destroy the unsaleable goats, re-release as ferals is possibly a better option from a natural resource management view than continued holding in TGP fenced paddocks. If a feed lotting system were to prove successful for these goats it would have natural resource benefits for Western NSW.

The market has been shown to have the most influence on the number of goats harvested and could possibly be used further as an aid in the control of the feral goat population. As the goat meat market continues to develop, a financial reward for a quality product will further encourage good grazing management.
7. Animal welfare in the Western NSW goat meat industry

7.1 Explanation

Animal welfare is open to different interpretations but for the purpose of this report the five domains of potential welfare compromise as defined by Mellor and Stafford (2001) and described in Table 7.1, will be drawn on as they allow systematic assessment of an animal’s wellbeing. Mellor and Stafford note that, “compromise in the first four domains will usually be registered in welfare terms in the fifth domain, which represents the negative mental dimensions of an animal’s experience.” (Mellor & Stafford 2001, p 763).

Table 7.1: The five domains of potential welfare compromise as defined by Mellor and Stafford (2001)

<table>
<thead>
<tr>
<th>Domain</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water deprivation, food deprivation, malnutrition</td>
</tr>
<tr>
<td>2</td>
<td>Environmental challenge</td>
</tr>
<tr>
<td>3</td>
<td>Disease, injury, functional impairment</td>
</tr>
<tr>
<td>4</td>
<td>Behavioural or interactive restriction</td>
</tr>
<tr>
<td>5</td>
<td>Mental (and physical) suffering</td>
</tr>
</tbody>
</table>

Table 7.2: Key animal welfare issues in the goat harvesting industry as identified by this report, their domains of compromise (based on Mellor & Stafford 2001), and prevention methods within the goat harvesting industry.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Domain of welfare compromise</th>
<th>Prevention or correction method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unprofessional mustering techniques</td>
<td>3 &amp; 5 potential injury, anxiety, fear, distress</td>
<td>Mandatory NVD for sale of goats reduces ‘catchers and poachers’.</td>
</tr>
<tr>
<td>Trapping on water</td>
<td>1, 4 &amp; 5 potential hunger and distress for goats and wildlife</td>
<td>Providing adequate nutrition in the water trap in the form of fodder or large trap paddocks. Regular inspection removing goats and releasing wildlife.</td>
</tr>
<tr>
<td>Exposure of goats to heat and cold during yarding</td>
<td>2 &amp; 5 environmental challenge</td>
<td>Adequate shelter provided and yarding times minimised. Depot standards regulated.</td>
</tr>
<tr>
<td>Inadequate provision of feed and water during yarding</td>
<td>1 &amp; 5 water and food deprivation</td>
<td>Yarding times minimised, depot standards improved, harvesters to provide food and water either in fodder or goat-proof holding paddocks.</td>
</tr>
<tr>
<td>Lack of available nutrition for goats held in overgrazed paddocks</td>
<td>1 &amp; 5 food deprivation and hunger</td>
<td>Improved market for smaller goats. Further education on land management and regulatory measures for land managers.</td>
</tr>
<tr>
<td>Transporting goats long distances</td>
<td>1, 2, 4 &amp; 5 water and food deprivation, environmental challenge, behavioural restriction, anxiety and distress.</td>
<td>Adequate preparation and selection of animals for transport. Location of abattoir in close proximity to goat harvesting areas.</td>
</tr>
</tbody>
</table>
7.2 Physical welfare aspects

Australia’s feral goats have evolved in the semi-arid rangelands from a mix of once domesticated dairy, fibre and meat goats. As such, they are well adapted to hot conditions but due to a minimal layer of subcutaneous fat, they are susceptible to cold stress (Blood & Williams 2005). Goats use a large amount of fibrous browse in their diets and are generally considered nutritionally and water efficient by pastoralists. This high regard can result in overestimating the animal’s ability to be held off food and water in yards, and subsequent compromise of their health and welfare.

Male goats are very sexually aggressive. When held in yards they will often injure and sometimes kill females or less dominant males through sexual aggression.

Animals can suffer extreme stress during handling due to their feral background and subsequent lack of familiarity with people and dogs. This stress can result in death during transport, increased instances of salmonella (Schuster 2006), and reduced glycogen levels that diminish the eating quality of the meat.

The stressors that can impact on feral goats are described in Table 7.2, and include confinement, inadequate water and nutrition, mechanical noises, transportation and enforced exposure to dominant and aggressive animals. Physical signs of anxiety exhibited by goats include snorting, stamping and fleeing with head and tail erect. When under extreme stress, animals may lie down and ignore what is happening around them. This is particularly noticeable with dominant male goats.

7.3 Practical aspects of animal welfare within the feral goat harvest industry

7.3.1 Harvesting by landholders

Many landholders in areas with feral goat herds have constructed goat-proof paddocks using TGP fencing on their properties. These are used to hold harvested goats until a sufficient number are mustered to make up a truck load.

Although mustering standards are usually good, animal welfare issues arise in this situation when palatable vegetation is eaten out of the goat paddocks but goats are still kept there due to their not being enough animals for a truck load, or because underweight animals, not accepted by the abattoirs and having negligible value, are retained. As well as animal welfare issues (lack of adequate nutrition) and natural resource issues (land degradation) this situation also results in issues for the industry, with the perception that the poor condition goats and land degradation being seen by the public and government officials is due to goat grazing rather than poor management.

Animal welfare issues can also arise when landholders don’t have a goat-proof paddock on their property, and harvested goats are confined in yards for extended periods of time whilst waiting for a truck to deliver them to a depot or abattoir. Goats are seen as particularly tough and are treated much more harshly than sheep or cattle in relation to exposure to the elements and withholding water and feed. The fact that harvested goats are in a sense ‘free’ and any money made from them is a bonus often results in little effort extended on the care of the animals. In addition to animal welfare issues, this factor has negative implications for the industry as the quality of the goat meat diminishes.

7.3.2 Harvesting by contract musterers from government and privately owned lands

Goat mustering by contract musterers is almost always of a professional standard, with few animal welfare issues. However, problems can arise if goats are held in yards for extended periods of time. As contract mustering is often done during the warmer months when feral goats are concentrated around water points, welfare issues may arise if goats are held in yards during very hot days and have limited access to water.
7.3.3 Harvesting on a small scale (trailer loads) by people living in the rangelands

Historically small numbers of harvested feral goats were sold to depots for cash. This encouraged a lack of professionalism and ‘poaching’ within the industry. The introduction of the Goods and Services Tax (GST) resulted in ‘cleaning up’ the industry, however issues still arise with some depots accepting goats without NVDs. When making an NVD application, a Property Identification Code (PIC) must be supplied thus limiting applicants to property holders. Small goat runners will often poach goats off both government and private lands. These harvesters often ‘dog’ the goats, catching them by hand one by one to fill a trailer inconspicuously without the aid of yards and loading facilities. Goats are stressed and often bitten in the process, resulting in a poorer quality meat in addition to animal welfare issues. Although goats harvested in this manner are few in number, it must result in negative financial implications for the depot owners when on-selling the goats to abattoirs on a $/kg dressed weight basis, and this fact alone should discourage dealers from accepting goats without an NVD.

7.3.4 Goat depots

Goat depots are places located within goat harvesting areas that buy small lots of goats and amalgamate them into larger lines, then on-sell them to processors or exporters. Historically animal welfare issues have included extensive yarding times as a load was amalgamated, and lack of shade, shelter and feed at many depots that were put together in an often ad-hoc way with little regard for animal health. The increase in professionalism within the industry has resulted in significant improvements in animal welfare at depots. Their income relies on the margin of profit between buying and selling the animal, and so they are careful to minimise weight loss and stresses during holding time.

Case study - Gates Goats

Rick and Jo Gates have arguably the most sophisticated depot in the Western Division of NSW, selling over 100,000 animals in 2008 (Ware 2009) and over 150,000 in 2010 (Rick Gates pers. comm. 2011 20 May). Goats are weighed on arrival and males and females separated. They have access to goat paddocks that hold the smaller goats until they reach a saleable weight of 25 kg. These paddocks are carefully monitored. The underweight goats are sold to restockers when pasture availability is limited. The yards are covered and the trucking area is designed to minimise loading time and frustration. No goats are accepted without an NVD which minimises the portion of unprofessionally mustered and ‘poached’ goats. Animal welfare issues are minimised by the provision of shelter, water and feed, as well as the minimal holding time facilitated by sourcing a large number of goats in order to put loads together quickly.

7.3.5 Transportation

Transportation issues arise due to goat slaughter facilities being located in major centres, generally long distances from areas with high rangeland goat densities (see Figure 4.5). It is not uncommon for goats to be transported in excess of 1000 km from place of capture to slaughter. This is due to labour limitations and market access in rangeland areas.

7.4 Key driver for continued improvement

In their 1998 paper, Elliott and Woodford described the goat industry as “an assemblage of hunter-gatherers rather than as a sophisticated industry” (page 9). In the 2006 supply profile prepared by Peter Schuster, it was noted that the industry was becoming more professional and this was reflected in an increase in average carcass weight of 13% and reduced seasonality of supply. Given that the industry is only four decades old (Forsyth et al. 2009), the lack of professionalism that permeates a fledgling industry is now being replaced by efficient operations that are guided and regulated by relevant codes of practice and standard operating procedures.

This review identifies profitability as the key driver in the continued improvement in animal health and welfare standards within the feral goat harvesting industry. The trend towards harvesters being paid on a $/kg dressed weight basis has had positive ramifications on animal welfare. Carcasses that are bruised or otherwise damaged are condemned and the harvester is not paid for part or all of that carcass. Financial reward for quality product if the industry were to expand out of the commodity market would further encourage excellence in animal welfare.
7.5 The future of animal welfare in the goat harvest industry

The Australian rangeland goat industry has likely been through its darkest days in regard to animal health and welfare. The result of the increased profitability of the industry has been an increase in industry professionalism. The development of a premium market for the higher quality end of rangeland goat meat would accelerate the improvement in animal health and welfare issues.

National animal welfare standards and guidelines have been drafted and are expected to be implemented by mid-2012. They will affect the feral goat harvesting industry through increased land transport standards. The standards specify that goats must be unloaded and rested after each 32 hours of combined curfew and travel. The rest period must be of at least 12 hours duration and they must have access to feed and water. This has many practical problems due to the difficulty of holding goats. Establishment of more abattoirs in regional centres would be beneficial but is unlikely.

The review has not examined the animal welfare aspects of the live goat export industry except to say that strict standards are applied for transportation and the relatively short duration of the flight negates any transportation issues.

The adoption of best practice in animal health and welfare within the feral goat harvesting industry will be fundamental in ensuring the continued growth and strengthening of the industry and will have positive flow on financial, social and environmental affects in the areas of Australia’s rangelands that are home to goats.

Regulations such as the NVD have positive effects on professionalising the industry as well as facilitating the trace back path required by today’s consumers. Regulatory procedures enable government to enhance quality control and maximise the commercial benefit of the industry, and in doing so reduce the environmental cost of unmanaged feral goats.

Objective measurement of animal welfare issues within the rangeland goat industry can be in the form of average carcass weight, mortalities during transport, condemnations during slaughter, eating quality, productivity of managed goats and the state of land supporting rangeland goats.
8. How do we know what we don’t know? - Recommendations

In managing the industry and its subsequent implications for groundcover in Western NSW, it would be useful to know:

- How many goats are being harvested from Western NSW?
- How many are being managed behind TGP fencing?
- What percentage of these goats are being slaughtered annually?
- Is lot feeding of underweight animals an option?
- How does the Dry Sheep Equivalent (DSE) rating of a rangeland goat compare to the exotic breeds of sheep that are now common in Western NSW?

In order to understand more fully the extent of rangeland goats within the goat industry, the issue of ear tag requirements needs to be resolved and the NVD system refined to allow the collection of data.

It would also be useful to know how much of Western NSW is TGP fenced and whether landholders need more information and education on managing the change from extensive to intensive grazing. Subsequently, landholders acquiring natural resource management grants for TGP fencing need to be held accountable for the outcomes of their grazing management.

TGP fenced areas in Western NSW are used for grazing rangeland goats and exotic breeds of sheep. Anecdotal evidence suggests that there is equal potential to reduce groundcover through the overgrazing of both animal species. A review into the DSE ratings of these animals would enable more accurate grazing management by landholders.

Land degradation caused by underweight goats being held in TGP fenced areas has been identified in this report as possibly the major natural resource management issue caused by the feral goat harvesting industry. An investigation into the potential for lot feeding these animals as a means of reducing grazing pressure may be feasible.

This report has identified the market as having the most influence over how many feral goats are harvested. If reducing the feral goat population is seen as a natural resource management priority, investigation into the ability and feasibility of influencing the market needs to be initiated.
References


Blood, D, & Williams, R, 2005, The Grazing of Goats in the Pastoral Areas of Western Australia: Best Management Practice- July 2005, Department for Planning and Infrastructure, Western Australia.


Downing, BH, 1986, Goat and sheep grazing in shrub-infested semi-arid woodlands of New South Wales, Australian Rangeland Journal, 8(2), 140-150.


Taylor, CA & Fuhlendorf, SD, 2001, *Contribution of goats to the sustainability of Edwards Plateau rangelands; An overview of goat foraging research conducted by the Texas Agricultural Experiment Station*, Technical report 03-1, Texas Agricultural Research Station, Texas USA.


Appendix 1 - Secondary research bibliography


Blood, D, & Williams, R, 2005, The Grazing of Goats in the Pastoral Areas of Western Australia; Best Management Practice- July 2005, Department for Planning and Infrastructure, Western Australia.


Downing, BH, 1986, Goat and sheep grazing in shrub-infested semi-arid woodlands of New South Wales, Australian Rangeland Journal, 8 (2), 140-150.


Meat & Livestock Australia (MLA), 2007a, Animal health & welfare; Requirements for handling goats to maximise eating quality, Meat & Livestock Australia, Sydney.


Meat and Livestock Australia Ltd, Going into Goats, 2006, Meat & Livestock Australia Ltd.


Taylor, CA & Fuhlendorf, SD, 2001, *Contribution of goats to the sustainability of Edwards Plateau rangelands; An overview of goat foraging research conducted by the Texas Agricultural Experiment Station*, Technical report 03-1, Texas Agricultural Research Station, Texas USA.


Wilson, AD & Mulham, WE, 1980, "Vegetation changes and animal productivity under sheep and goat grazing on an arid Belah (*Casuarina cristata*) - Rosewood (*Heterodendrum oleifolium*) woodland in western New South Wales"; *Australian Rangelands Journal*, 2, 183-188.

