UTILISATION OF REMNANT BRIGALOW COMMUNITIES AND ADJACENT PASTURES BY THE BLACK-STRIPED WALLABY (MACROPUS DORSALIS)

BY

DEBRA WHITE

B.Sc (Hons), University of Southern Queensland

A THESIS SUBMITTED FOR THE DEGREE OF MASTER OF RESOURCE SCIENCE OF THE UNIVERSITY OF NEW ENGLAND, ARMIDALE, AUSTRALIA.

MARCH 2004
DECLARATION

I declare that the material contained in this thesis is my own work, and has not been previously submitted to any other University for another award. All information derived from the published or unpublished work of other researchers has been acknowledged in the text, and a complete list of references is provided.

Debra White
ACKNOWLEDGEMENTS

This work was carried out with approval from the Queensland Parks and Wildlife Service, Permit Numbers C6/000145/01/SAA and WISP00591902, the Tropical Beef Centre Animal Ethics Committee, Approval No. TBC124 and the Department of Primary Industries Central Animal Ethics Committee, Approval No. CEN 5.

The project was funded by the Queensland DPI Agency for Food and Fibre Sciences (Beef) and supported through the Department’s Study and Research Assistance Scheme.

I wish to acknowledge and thank my supervisors Dr. Carlo Gazzola (AFFS) and Prof. Peter Jarman (UNE). They have both been tremendous sources of guidance, support and encouragement. Without Carlo’s enthusiasm for a subject outside his mainstream interests, direction with statistical analysis and constructive criticism of the thesis, the commencement and completion of this project would never of happened as it has. Peter’s knowledge and passion for the study of macropods is inspirational. His direction with the project’s design and planning, willingness to spend precious time with me during university visits and encouragement are gratefully acknowledged.

The staff of Brigalow Research Station, in particular Anthony Barnes, Ross Whyte, Brett Ward and Doug Rynne, are thanked for the time they spent helping me with building and monitoring exclosures, spotlighting and in between fieldtrips keeping an eye out for radio-collared wallabies. I would also like to thank Ross and Brett for their friendship and provision of light-hearted social occasions during my stays at Brigalow.
The advice and help given by Mr. Gary Porter (QPWS) on trapping and radio-collaring wallabies is acknowledged. Amanda Davies, Sarah Mika, Susan White, Matthew Wilson and John Augusteyn are thanked for volunteering on fieldtrips.

A number of DPI and UNE staff assisted with various components of the project and their assistance is gratefully acknowledged. Ron Hendricksen for advice on exclusion design; Eric Anderson, Paul Back and David Orr for identification of plant species; Stuart Green for organising radio-collars and radio-tracking gear; and Kate McGregor for spending many hours teaching me everything there is to know about microscopic dietary analysis of faecal pellets.

I am thankful for the support I have received from my family and friends over the past four years. In particular, thank you to Matt and Nyree Kelly, for the friendship, accommodation and hospitality they provided during my stays in Armidale.

And finally, thank you to Nick, for everything.
This study arose out of the perceived problem that densities of the Black-striped Wallaby (*Macropus dorsalis*) in fragmented patches of Brigalow (*Acacia harpophylla*) vegetation were too high, causing detrimental impacts to their shelter habitat and competing with adjacent agricultural enterprises. The need for management of the Black-striped Wallaby has increased, with many primary producers within the Central Queensland (CQ) Brigalow Belt concerned that the species is a pest.

Effective management of a species relies upon knowledge of its requirements and functioning. The objectives of this study were to determine the sheltering and dietary preferences of a Black-striped Wallaby population at supposed pest density. The various components of the study were undertaken in the remnant scrub and adjacent pasture paddocks on Brigalow Research Station, near Theodore, Central Queensland.

Spotlighting confirmed a high density of Black-striped Wallabies existed at the study site. Spotlighting and faecal pellet counts also established that the wallaby population had a heterogenous distribution. Investigations into possible reasons for such a distribution were undertaken, assuming the wallabies’ habitat preference was based on differences in structural habitat attributes between the major Brigalow vegetation communities. However, analysis determined very few structural habitat attributes were significantly related to faecal pellet counts. Further research is required to determine if other factors (e.g. food availability, predation levels, grouping behaviour) can explain the heterogenous distribution of the population.
The extent of impact by the wallaby population in both the shelter habitat (scrub) and adjacent pasture paddocks was monitored. Scrub exclosures suggested that wallaby population was impacting upon scrub floristics, with noticeable increase in grass coverage, height and reproductive capabilities in wallaby excluded areas; however, more long-term monitoring is required to determine if the impact is at a level that is affecting scrub regeneration.

Monitoring of pasture exclosures indicated that a high level of wallaby grazing occurred and that the presence of cattle grazing was likely to encourage wallaby grazing, perhaps by creating short green pick. Complete removal of herbivore grazing allowed rapid regeneration of pasture biomass within one growing season, but encouraged domination by the introduced grass species and therefore created less diversity in plant species.

Microscope analysis of faecal pellets suggested that the wallaby species has not changed its usual feeding habits in response to pastoral development. Faecal pellet analysis suggests that the wallabies were not relying upon introduced pasture species for survival and that plant species within the remnant scrub were equally, or more significantly, important to the wallaby’s diet. Similar to previous reports, this study found that a wide variety of plant species were consumed by the wallabies, a large percentage of which were monocotyledons.

Generally, movement by individuals agreed with previous reports. Most radio-tracked individuals stayed within their small home-range all year round, moving directly out from shelter scrub at dusk to feed in adjacent pasture paddocks, returning at dawn. Exceptions, such as one individual who travelled much further along a wallaby barrier
fence each evening in order to reach feeding areas, suggests that the species can adapt their behaviour if required.

Ageing of a large collection of Black-striped Wallaby skulls determined the population to have a high proportion of juveniles and young adults. Mortality rate was higher in older animals, but low and consistent until about 7 years of age. The development of a sexing index from wallaby skull dimensions determined that the population consisted of a higher proportion of males than females, however mortality rates were similar for both sexes.

Carcass recording established the primary cause of death for individuals within the population was likely to be from dingo predation, particularly in the presence of a wallaby barrier fence.

The findings of the project present possibilities for management strategies, however a number of questions still remain. In particular, research investigating carrying capacity, long-term impacts and reasons for sheltering preferences, along with establishing the success and feasibility of different management strategies is required.
# TABLE OF CONTENTS

DECLARATION .............................................................................................. ii  
ACKNOWLEDGEMENTS ............................................................................ iii  
ABSTRACT ..................................................................................................... v  
TABLE OF CONTENTS ............................................................................... viii  
PUBLICATIONS ............................................................................................ xi  
LIST OF TABLES .......................................................................................... xii  
LIST OF FIGURES ....................................................................................... xv  
LIST OF APPENDICES ............................................................................... xviii  

CHAPTER ONE  INTRODUCTION ................................................................. 1  

1.1 THIS STUDY ........................................................................................... 1  

1.2 LAND USE CHANGE IN THE BRIGALOW BELT  
    BIOGEOGRAPHIC REGION .................................................................. 3  

1.3 FRAGMENTS IN AN AGRICULTURAL LANDSCAPE ................... 8  

1.4 MACROPOD RESPONSE TO LAND USE CHANGE IN  
    THE BRIGALOW BELT BIOGEOGRAPHIC REGION ...................... 10  

   1.4.1 The Black-striped Wallaby ......................................................... 15  

1.5 AIMS OF THIS STUDY ......................................................................... 16  

CHAPTER TWO  THE STUDY SPECIES, THE STUDY SITE  
AND GENERAL RESEARCH METHODS .................................................. 18  

2.1 INTRODUCTION .................................................................................... 18  

2.2 THE SPECIES ....................................................................................... 19  

   2.2.1 Description .................................................................................. 19  

   2.2.2 Distribution and Status ............................................................... 20  

   2.2.3 Sheltering Habitat ...................................................................... 22  

   2.2.4 Feeding and Diet ....................................................................... 23  

   2.2.5 Home Ranges ............................................................................ 23  

   2.2.6 Behaviour .................................................................................. 24  

   2.2.7 Reproduction and Longevity ..................................................... 25  

   2.2.8 General Management ............................................................... 25  

2.3 THE STUDY SITE – BRIGALOW RESEARCH STATION ............ 27  

   2.3.1 Purpose and General Description ............................................ 27  

   2.3.2 Location ..................................................................................... 27
2.3.3 Topography and Soils ........................................ 28
2.3.4 Native Vegetation ........................................... 29
2.3.5 Fauna .......................................................... 31
2.3.6 Water .......................................................... 33
2.3.7 Activities within Developed Areas ......................... 33
2.3.8 Current Wallaby Management ............................... 34

2.4 WEATHER CONDITIONS, SAMPLING AREAS AND
GENERAL METHODS .............................................. 35
2.4.1 Climate and Weather Conditions during this Study ... 35
2.4.2 Sampling Areas .............................................. 38
2.4.3 General Research Techniques ............................... 45

CHAPTER THREE  DENSITY, DISTRIBUTION AND
HABITAT USE ................................................... 48
3.1 INTRODUCTION .................................................. 48
3.2 METHODOLOGY .................................................. 50
3.2.1 General Wallaby Densities .................................. 50
3.2.2 Movement Patterns ......................................... 54
3.2.3 Utilisation of Remnant Vegetation ......................... 57
3.2.4 Shelter Preferences based on Habitat Structure ....... 60

3.3 RESULTS .......................................................... 66
3.3.1 General Wallaby Densities .................................. 66
3.3.2 Movement Patterns ......................................... 72
3.3.3 Utilisation of Remnant Vegetation ......................... 87
3.3.4 Shelter Preferences based on Habitat Structure ....... 91

3.4 DISCUSSION ...................................................... 98

CHAPTER FOUR  IMPACT LEVELS OF GRAZING AND
MOVEMENT ......................................................... 107
4.1 INTRODUCTION ................................................... 107
4.2 METHODOLOGY .................................................. 110
4.2.1 Exclosures ...................................................... 110
4.2.2 Faecal Pellet Counts – Pasture Transects .................. 119
4.2.3 Pad Coverage .................................................. 121
4.2.4 Water Usage ................................................... 123
PUBLICATIONS


# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2.1</td>
<td>Summary of research methods used and the localities where each was undertaken.</td>
<td>47</td>
</tr>
<tr>
<td>Table 3.1</td>
<td>Segment lengths and areas along the spotlight route taken for counting Black-striped Wallabies on Brigalow Research Station, 2002-2003.</td>
<td>52</td>
</tr>
<tr>
<td>Table 3.2</td>
<td>Habitat variables recorded with faecal pellets counts at 4m intervals along the three transects within three Sampling Areas.</td>
<td>61</td>
</tr>
<tr>
<td>Table 3.3</td>
<td>Classifying the transects whose habitat variables were monitored for correlation with faecal pellet density.</td>
<td>63</td>
</tr>
<tr>
<td>Table 3.4</td>
<td>Black-striped wallabies seen at each 10m Distance category.</td>
<td>67</td>
</tr>
<tr>
<td>Table 3.5</td>
<td>The mean density of Black-striped Wallabies in each Sampling Area.</td>
<td>68</td>
</tr>
<tr>
<td>Table 3.6</td>
<td>The length of time emergence persisted and the average number of animals emerging at the various Sampling Areas.</td>
<td>70</td>
</tr>
<tr>
<td>Table 3.7</td>
<td>The affect of Season on the average number of Black-striped Wallabies counted in stationary observation counts.</td>
<td>71</td>
</tr>
<tr>
<td>Table 3.8</td>
<td>Average emergence start time and length of time (AEST) spent emerging by Black-striped Wallabies in different seasons.</td>
<td>71</td>
</tr>
<tr>
<td>Table 3.9</td>
<td>The number of times each radio-collared wallaby was radio-tracked during day, evening and night periods.</td>
<td>74</td>
</tr>
<tr>
<td>Table 3.10</td>
<td>The number of times each radio-collared wallaby was detected in the Reference Site (remnant vegetation) and in the pasture.</td>
<td>75</td>
</tr>
<tr>
<td>Table 3.11</td>
<td>Recent and Old faecal pellet densities (m$^2$) for each Sampling Area, averaged across all Survey Periods.</td>
<td>88</td>
</tr>
<tr>
<td>Table 3.12</td>
<td>The average densities of Recent faecal pellets (m$^2$) in each Sampling Area during the different Survey Periods.</td>
<td>89</td>
</tr>
<tr>
<td>Table 3.13</td>
<td>The average densities of Old faecal pellets (m$^2$) in each Sampling Area during the different Survey Periods.</td>
<td>90</td>
</tr>
</tbody>
</table>
Table 3.14  Recent and Old faecal pellets densities (m²) each Season.  
Table 3.15  The effect of Distance-from-edge on Recent faecal pellet densities (m²).  
Table 3.16  The effect of Distance-from-edge on Old faecal pellet densities (m²).  
Table 3.17  Relationship of habitat variables to Recent and Old faecal pellet densities.  
Table 4.1a.  Timeline of events for pasture exclosures, Experiment 1.  
Table 4.1b.  Timeline of events for pasture exclosures, Experiment 2.  
Table 4.2  Number of pasture transects monitored and the length covered in the Sampling Area each Season monitored.  
Table 4.3  Variables monitored within the Scrub exclosures, Brigalow Research Station, 2000-2003.  
Table 4.4  Seasonal values of variables monitored within the Scrub exclosures, Brigalow Research Station, 2000-2003.  
Table 4.5  Percent ground cover by vegetation species recorded within the Scrub exclosures, Brigalow Research Station, 2000-2003.  
Table 4.6  Maximum heights of vegetation species recorded within the Scrub exclosures, Brigalow Research Station, 2000-2003.  
Table 4.7  Variables recorded during pasture exclosure monitoring, Experiment 1.  
Table 4.8  Percent ground cover and height of selected plant species recorded within the pasture exclosures, Experiment 1.  
Table 4.9  Variables recorded during pasture exclosure monitoring during 2002, Experiment 2.  
Table 4.10  Percent ground cover and height of selected plant species recorded within the pasture exclosures during 2002, Experiment 2.  
Table 4.11  Seasonal percent ground cover by wallaby pads in each of the vegetation categories of each Sampling Area.
Table 4.12  Percent of ground covered by wallaby pads in each of the vegetation categories of each Sampling Area.

Table 5.1  The number of pellets from each Season and Sampling Area that were microscopically analysed.

Table 5.2  Average count of species (± Ave. SEM) identified in pellets collected from each Sampling Area during Summer and Winter.

Table 5.3  Identifiable plant species recorded within pellets collected in the various Seasons and Sampling Areas.

Table 5.4  The proportion (%) of monocotyledon and dicotyledon parts recorded from faecal pellets collected from three Sampling Areas on Brigalow Research Station, during summer and winter 2002.

Table 5.5  The average proportion (%) of each Vegetation Category in Black-striped Wallaby faecal pellets collected on Brigalow Research Station.

Table 5.6  Proportion (%) of different plant parts in faecal pellets collected from Brigalow Research Station, 2002.

Table 6.1  Life table for Black-striped Wallabies on Brigalow Research Station.

Table 6.2  Number of male, female and unknown-sex carcasses recorded each season on Brigalow Research Station.

Table 6.3  The number of male, female and unknown-sex animals in each cause-of-death recorded, Brigalow Research Station, June 2000 to April 2003.

Table 6.4  The number of small, medium, large and very large carcasses recorded within each cause-of-death category.

Table 6.5  The number of Black-striped Wallaby carcasses found in each Sampling Area for each Cause-of-Death category.
| Figure 2.1 | A large male Black-striped Wallaby feeding in an improved pasture paddock. |
| Figure 2.2 | Current distribution of the Black-striped Wallaby (Macropus dorsalis). |
| Figure 2.3 | Location of the Study Site, Brigalow Research Station within the Queensland Brigalow Belt. |
| Figure 2.4 | Soil map for Brigalow Research Station. |
| Figure 2.5 | Major vegetation associations/communities recorded on Brigalow Research Station prior to clearing in 1970. |
| Figure 2.6 | Aerial photo of the Study Site, Brigalow Research Station, with the property boundary outlined in red and the remnant vegetation area outlined in yellow. |
| Figure 2.7 | Average monthly rainfall for Brigalow Research Station (based on data collected from 1974 to 2002). |
| Figure 2.8 | Monthly rainfall for Brigalow Research Station during the period of the study. |
| Figure 2.9 | Annual rainfall for Brigalow Research Station, 1974 to 2002. |
| Figure 2.10 | Aerial photo of Brigalow Research Station showing the four main Sampling Areas of the study, the wallaby fence, dams and Roundstone Creek. |
| Figure 2.11a-g. | Vegetation associations of each Sampling Area. |
| Figure 3.1 | Segments of the spotlight drive route that was undertaken to count the number of Black-striped Wallabies around the Reference Site. |
| Figure 3.2 | Modified trapping technique to facilitate capture of larger Black-striped Wallabies. |
| Figure 3.3 | Black-striped Wallaby faecal pellets. |
| Figure 3.4 | Densities of Black-striped Wallabies in each Sampling Area on each spotlight night. |
Figure 3.5a-e.  Diurnal radio-tracking locations.  

Figure 3.6a-e.  Seasonal radio-tracking locations.  

Figure 3.7  Average densities of Recent and Old faecal pellets (m$^2$) within each Distance-from-edge category, averaged across all Sampling Areas and all Survey periods.  

Figure 4.1a-b.  Scrub exclosures in Sampling Area 1.  

Figure 4.2  Diagram of scrub exclosures.  

Figure 4.3  A Half-Open pasture exclosure in a paddock of introduced pasture grass.  

Figure 4.4  Diagram of pasture exclosures.  

Figure 4.5  Measuring the amount of 10m covered by Black-striped Wallaby pads.  

Figure 4.6a-e.  Average density of Old and Recent faecal pellets along transects in Sampling Area 2.  

Figure 4.7a-b.  Average density of Old and Recent faecal pellets along transects in Sampling Area 3.  

Figure 4.8a-f.  Average density of Old and Recent faecal pellets along transects in Sampling Area 4.  

Figure 6.1  Plot of skull width (mm) by estimated age (months), fitted with hyperbola.  

Figure 6.2  Plot of skull length (mm) by estimated age (months), fitted with hyperbola.  

Figure 6.3  The length (mm) and age (months) of skulls collected from known-sex carcasses with fitted hyperbola lines.  

Figure 6.4  Determining the sex of unknown-sex skulls.  

Figure 6.5  The skull width to age relationship for determined-sex Black-striped wallaby skulls collected on Brigalow Research Station.  

Figure 6.6  The skull length to age relationship for determined-sex Black-striped wallaby skulls collected on Brigalow Research Station.
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 6.7</td>
<td>Number of skulls collected in each yearly age group.</td>
</tr>
<tr>
<td>Figure 6.8</td>
<td>Number of female-determined skulls and male-determined skulls collected in each yearly age group.</td>
</tr>
<tr>
<td>Figure 6.9</td>
<td>Mortality curves of male and female Black-striped Wallabies, from sex-determined skulls, collected at Brigalow Research Station, 2000-2003.</td>
</tr>
<tr>
<td>Figure 6.10</td>
<td>Number of male, female and unknown-sex carcasses in each yearly age group, from Brigalow Research Station 2000-2003.</td>
</tr>
<tr>
<td>Figure 6.11</td>
<td>Number of animals in each Cause-of-death category for each yearly age group.</td>
</tr>
<tr>
<td>Figure 6.12</td>
<td>The interaction of Season and Cause-of-Death on the number of carcasses found on Brigalow Research Station, 2000-2003.</td>
</tr>
</tbody>
</table>
# LIST OF APPENDICES

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Fauna species recorded on Brigalow Research Station.</td>
<td>208</td>
</tr>
<tr>
<td>B</td>
<td>Counts of Black-striped Wallabies, <em>Macropus dorsalis</em>, along the spotlight drive route.</td>
<td>210</td>
</tr>
<tr>
<td>C</td>
<td>Listing and grouping of vegetation species included in the Reference collection used in microscopic analysis of faecal pellets.</td>
<td>211</td>
</tr>
</tbody>
</table>