COMMUNITY UTILIZATION BY CATTLE AND KANGAROOS IN MULGA NEAR ALICE SPRINGS, N.T.

BOBBI S. LOW[1,2], ELAINE BIRK[3], C. LENDON[1], AND W. A. LOW[1]

ABSTRACT

Concurrent studies of the distribution and diets of red kangaroos and shorthorn cattle in a 153 square km paddock near Alice Springs have been under way since late 1970. Preliminary analyses of the data relative to mulga communities indicate that these communities are not highly preferred, but are relied on at some times. Kangaroos use mulga communities mainly after good rainfall and cattle use them as vegetation on other communities is consumed. Mulga-annual grass communities are preferred over mulga-perennial grass communities.

Cattle seem to take relatively small amounts of a wide variety of grass species, while kangaroos appear to consume larger proportions of fewer species. Enneapogon avenaceus, Aristida *spp.*, Tripogon, Eragrostis setifolia, E. xerophila *and* Fimbristylis *sp. were prominent in the stomach contents of kangaroos. Only* Eragrostis setifolia, E. xerophila, Enneapogon *spp. and* Aristida *spp. were slightly more prominent in the 24 species of grasses recorded in the faeces of cattle. The 20 monocot species found in the kangaroo stomachs indicates a broader diet than previously reported.*

INTRODUCTION

Of the 110,000 square km of usable rangelands in the Alice Springs district, over 25,600 square km are communities associated with mulga (Perry and Lazarides 1962). While mulga associations have long been recognised as important drought refuge areas for sheep (Ebersohn, 1971; Everist and Moule, 1952), their relationship to cattle and kangaroo populations is less well established. Earlier work (Newsome 1965a, b) indicated that red kangaroos in central Australia use wooded areas (including mulga woodlands) extensively for shelter in summer. Traditionally, mulga lands have been used as cattle production areas rather than as fattening areas, and cattle producers consider mulga communities as a drought refuge for cattle.

This study, part of a broad CSIRO investigation of arid land ecosystems, examines the preference for and some aspects of forage selection in mulga communities by shorthorn cattle and red kangaroos, and the manner and degree to which they exploit these communities.

STUDY AREA

The study area on Hamilton Downs Station, 48 km NW of Alice Springs, contains 153 km^2 of representative central Australian grazing land. It has a mean annual rainfall of 250 mm (Slatyer, 1962) but during the study period, rainfall was below average: 90 mm in 1970, and 130 mm in 1971. The paddock is fenced on three sides, restricting the movement of cattle but not kangaroos, and is bounded on the fourth side by the MacDonnell Ranges.

1. CSIRO Rangelands Research Unit, Alice Springs, N.T.
2. Present address: School of Natural Resources, University of Michigan, Ann Arbor, Michigan. U.S.A.
3. Department of Biological Sciences, Macquarie University, North Ryde, N.S.W.

There are three major land systems on the paddock (Stewart and Perry 1962), and nine major plant communities, described more fully by Low (1972). Mulga-perennial (37%) and mulga-annual grass (16%) communities comprise 53% of the area. Other communities include savannah woodland (20%), floodplains (13%), gilgaied plains (6%), foothills (4%), calcareous woodlands (1%), spinnifex grasslands (1%), and riparian areas (<1%). Two permanent waters and three dams make all communities accessible to stock for grazing.

In central Australia more than eighteen ground storey communities are recognised as associated (though not exclusively) with mulga (Perry and Lazarides, 1962). We have distinguished two major types of mulga associations in Kunoth Paddock realising that others may occur there as well. On acid red earths in the paddock mulga occurs in typical groves associated with drought-resistant understorey perennial grasses and shrubs. The hydrologic pattern of run-on accumulation in the groves is a much more favourable site for plant growth than the intergrove areas; plant sampling measurements following exceptionally heavy rains in March 1972 indicated that peak productivity in the groves compared to intergroves was shown to be in the order of 5: 1 (900 kg/ha: 180 kg/ha) (Ross and Lendon, 1973). The effect of this rainfall persisted as the temperatures dropped, and the seasonal influence on the plant community resulted in an influx of annual grasses and forbs. Percent frequency of occurrence of the common species gave *Eragrostis eriopoda* 53%, *Digitaria brownii* 45%, *Aristida contorta* 95%, *Helipterum floribundum* 88%, *Stenopetalum mutans* 25%, *Tribulus terrestris* 38%, *Boerhavia diffusa* 28%, and *Malvastrum spicatum* 30%. The shrub component of the mulga-perennial community includes *Eremophila gilesii* and *E. latrobei.*

On neutral red earths, the mulga often occurs in ungroved patterns and the understorey plants characteristically consist of a wide range of drought-evading "annual" shortgrasses and forbs. The plant sampling regime following the March 1972 rains showed the most frequently occurring species to be: *Aristida contorta* 53%, *Eragrostis eriopoda* 34%, *Enneapogon polyphyllus* 31%, *Helipterum charsleyae* 52%, *Stenopetalum mutans* 28%, *Ptilotus gandichandii* 29%, *Lepidium rotundum* 30%, and *Portulaca oleracea* 41%. The *Aristida* and *Enneapogon* species may perenniate during a sequence of good years.

The mulga-shortgrass communities include more grass and forb species than the mulga-perennial communities. Ground storey harvests in the summer include 22 species in the shortgrass areas and 15 species in the perennial grass areas. The boundary between the two communities may be either sharp or gradual, and frequently a mosaic pattern exists.

MATERIALS AND METHODS

Plant communities on the paddock were mapped from aerial photographs and confirmed by ground reconnaissance. The paddock was further divided into 0.65 sq km (½ mile square) cells marked on the ground by large alpha-numeric markers. Distribution of kangaroos and cattle was determined during early morning feeding periods by aerial survey from an altitude of 150 or 400 feet along east-west transects one mile apart for three out of every four weeks.

Stomach samples were obtained from a sample of about 10 kangaroos shot every six weeks on adjacent paddocks in communities assumed to be similar. Eight faecal samples were collected at monthly intervals either from within the mulga communities, or immediately after they were dropped by animals that were known to have been feeding in the mulga communities. Identification of the plant fragments in the samples from the two herbivores was determined by a modification of William's (1969) method involving staining of the bleached, mounted material for 1 minute with Nile Blue Sulphate, a fat sensitive stain.

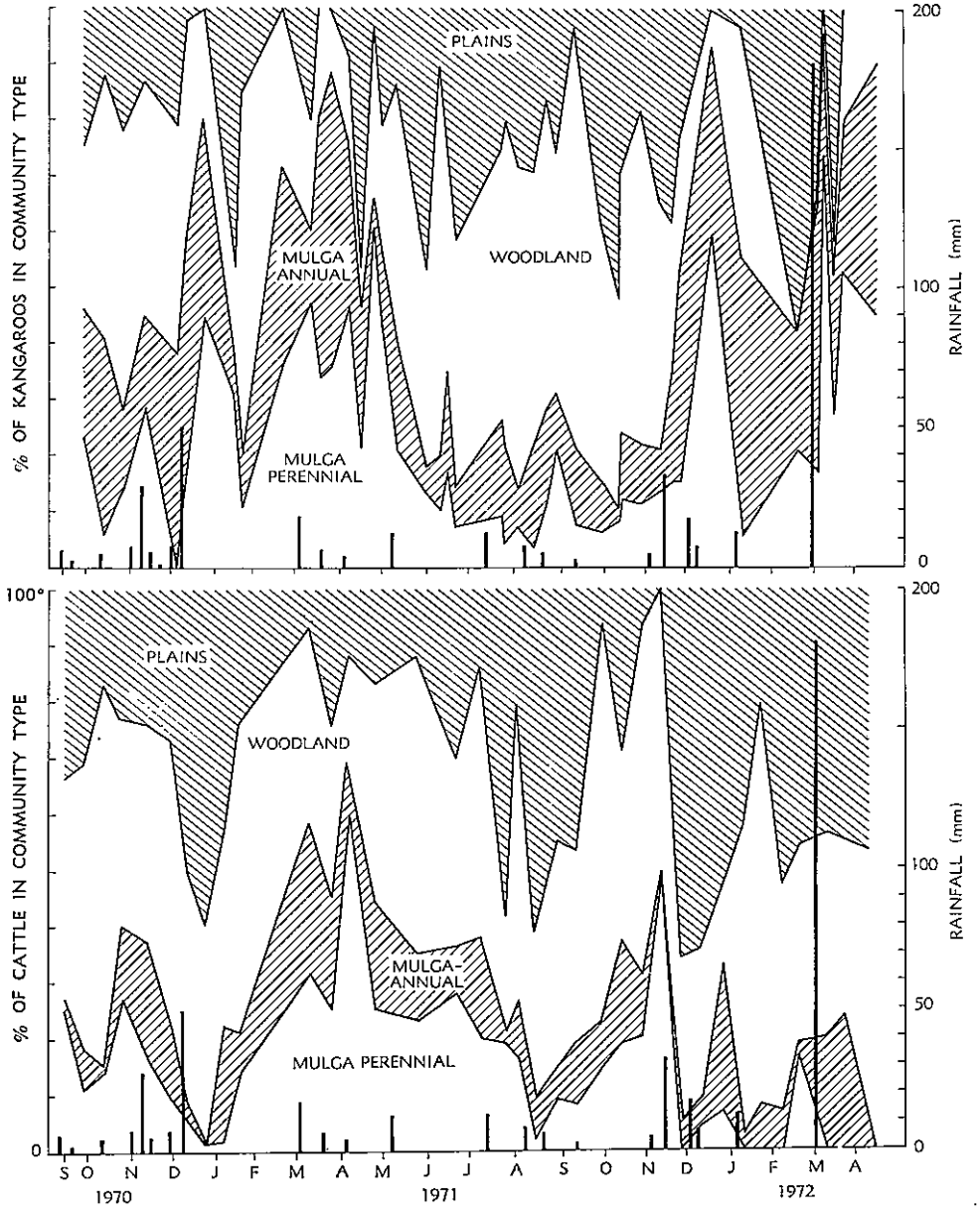

FIGURE 1
Distribution of kangaroos and cattle in mulga and other communities on Kunoth Paddock, September 1970 to April 1972.

NOTE: Open woodland includes savanna woodland, calcareous shrubby woodland and foothills; treeless plains include floodplains and gilgaied plains.

COMMUNITY UTILIZATION

Results

During the study period moderate drought to good forage conditions prevailed and a striking feature of community utilisation during this time was that both cattle and kangaroos made relatively little use of the mulga communities, despite the fact that mulga areas comprise over half of the paddock (Fig. 1). Twenty-five per cent of the cattle observed were feeding in the mulga communities (10.3% in mulga-annual, and 14.4% in mulga-perennial). Forty-six per cent of the kangaroos observed were feeding in the mulga communities (22.7% in mulga-annual, and 23.4% in mulga-perennial). Mulga shortgrass areas ranked third out of five (3/5) levels in a sequential use hierarchy for cattle and 2/5 for kangaroos during moderately dry to good summer conditions, and 4/5 for cattle and 3/5 for kangaroos in the winter. The mulga-perennial areas ranked 5/5 for cattle and 3/5 for kangaroos in the summer and 5/5 and 4/5 respectively in the winter.

Red kangaroos use both mulga communities to some extent in the summer when conditions are not too dry, but savannah woodland is preferred if conditions are dry (B.S. Low, ms in preparation). Cattle also use both mulga communities, moving into the mulga shortgrass areas when conditions are green to moderately dry, and into mulga perennial areas when conditions are dry and there is little vegetation in the other communities. Within the mulga perennial areas, cattle are distributed both in and between the groves, while red kangaroos appear to feed mostly in and at the edges of the groves.

Figure 1 also shows that both animals respond to forage conditions as a result of climatic events. Kangaroos tend to move into the mulga communities after heavy rains at any season. In December, 1970, kangaroo numbers during feeding periods increased in both the mulga-annual and mulga-perennial areas, although remaining lower in the perennial areas (Fig. 1). Cattle numbers decreased in both mulga communities and increased in the open areas, particularly the gilgais (Low 1972). In mid-April, 1971, kangaroos shifted from mulga-perennial and non-mulga woodlands to gilgaied plains areas, and after a period of high utilisation, shifted from gilgai and mulga-shortgrass areas back into the mulga-perennial areas. Throughout March and April, cattle showed a general trend of movement from floodplains and non-mulga woodlands to both mulga communities. During dry periods in October and November, cattle shifted into mulga communities; then, after periods of significant rains in November, moved out of the mulga into open areas and non-mulga woodlands. Red kangaroos, on the other hand, were primarily in the open and non-mulga woodlands until the November rains, when they shifted into mulga, principally mulga-annual communities. After further rains in December, these trends continued, with an increase in kangaroos in the mulga-perennial areas.

Discussion

The pattern of mulga use by kangaroos contrasts with Newsome's (1965a) suggestion that "mulga" woodlands near open areas were preferred by kangaroos for sheltering purposes. Our data indicate that kangaroos use the wooded areas differentially for feeding, depending on the condition of the ground storey vegetation.

Community use by cattle and kangaroos does not appear to be interdependent. Low and Low (1973) have shown that overall patterns of community utilisation may be quite different and show little correlation with each other. This suggests that both species are responding to environmental factors. One apparent exception to this lack of correlation are two cases where kangaroo numbers peaked in the mulga perennial community within a month after cattle had been feeding there. These observations lend some support to Newsome's (1965a, 1971) speculations that kangaroo populations in the pastoral areas have increased since the introduction of cattle owing to both an increase in watering points and removal of dried perennial grasses with consequent exposure of greenshoots which are accessible only to kangaroos. These observations warrant further investigation.

TABLE 1

Grass species found in stomach contents of red kangaroos and faecal samples from cattle feeding in mulga communities near Alice Springs, 1970 to 1971

Species	1970 Aug.	1970 Sept.	1970 Oct.	1970 Nov.	1971 Jan.		1971 Feb.	1971 Mar.		1971 Apr.	1971 May		1971 June		1971 Aug.	1971 Oct.	1971 Nov.
	R	R	C	C	R	C	C	R	C	C	R	C	R	C	R	C	R
μ *Aristida* spp. (*A. contorta* principally)	√	*	√	√	**	*	*	**	√	△	**	√	**	√	*	.	
μ *Dactyloctenium radulans*		√		.	√		.	√					√		√		√
μ *Danthonia bipartita*			.				.				√			.	√		
μ *Digitaria coenicola*			.	.	△					√		0					
μ *Enneapogon avenaceus, E. polyphyllus*	*	*	.	0	*	√	0	**	0	0	**	.	**	0	*	0	
μ *Eragrostis eriopoda*					△			√									
μ *Eragrostis setifolia, E. xerophila*		√		.	△		0	*	√	△	△	√	√	.	√	.	
μ *Paspalidium constrictum*							.										
μ *Thyridolepis mitchelliana*	√	√	0	0	√	0	0	√	.	0		√		√	√		
μ *Tragus australianus*			.		√	.	.	√				.		.			
μ *Tripogon loliiformis*					△	.	.	√	0	.	△		√	0	√		**
Fimbristylis sp. (Sedge)		√			△			△					△		√		**
Astrebla pectinata															√		
Bothriochloa ewartiana			.			.	.		.	.							
Brachiaria miliiformis	√		.		√	.	.		0	.							
Chloris acicularis					√	.	.		.	.	√		√		△		
Chloris scariosa				.	√	0	.	√	.	.	√				√		
Chrysopogon fallax					√		.		.								
Dicanthium sericeum							0										
Eragrostis barrelieri					√	0	.			0				.			
Eriachne mucronata									.								
Panicum decompositum	√			.			.		.								
Sporobolus caroli		√	.	.						.					√		
Themeda australis	√			.	√	.	.		.	.				0			
Total species eaten	6	7	9	10	16	11	18	10	13	13	8	5	8	8	12	3	3
Number shared during same period		4			10			6			3		4				

** Highly dominant in all animals in sample.
* Dominant or principal plant species eaten by most animals in sample.
△ Dominant in some individuals from the sample.
√ Present in moderate amounts.
0 Minor amounts.
. Trace amounts.
R Kangaroos. C Cattle.
μ Species found only in mulga communities.

DIETARY PREFERENCES

Results

Only grass species and *Fimbristylis*, a sedge, in kangaroo stomach contents and cattle faecal samples are compared in this paper. Unidentified monocotolydenous material was 4% for cattle and 5% for kangaroos; dicotolydenous material averaged 25 to 30% (10 to 55%) in cattle faeces and 20 to 25% (2 to 35%) in kangaroo stomach contents; fibrous material averaged 40 to 50% (20 to 70%) in cattle faeces and 30% (15 to 40%) in kangaroo stomach contents. Fibrous material remained fairly constant throughout the study period for kangaroos, while maximum values were reached in cattle in the driest periods and minimum values after heavy rains. Since the materials from the two animals were taken from two different digestion states, direct comparison is not possible. Further work using comparable material is necessary to establish the relative values of diets of the two animals.

Table 1 summarises the monocot species found in stomach samples of kangaroos collected while feeding in mulga areas, and faecal samples from cattle observed feeding in mulga communities. There appears to be broad overlap in the grasses consumed, and cattle tend to be less selective, having more even quantities of all grasses, whereas kangaroos tend to take larger proportions of fewer species. A notable exception is January, 1971, a month after a good rainfall when a wide variety of grasses were present. It appears that the grasses were available to kangaroos in January, but not available until February for cattle, probably due to height of grass.

Aristida spp. (*A. contorta, obscura, jerichoensis, latifolia* and *brownii*) were regularly dominant in kangaroo samples, and frequently dominant in cattle faeces. Only *Eragrostis setifolia-E. xerophila* of the remainder of the grasses found in mulga areas became a dominant item in the faeces of cattle. In kangaroo stomachs *Enneapogon avenaceous-E. polyphyllus* were dominant throughout the year, and *Eragrostis setifolia-E. xerophila, Tripogon* and *Fimbristylis* were dominant following suitable climatic events. It is notable that *Eragrostis eriopoda*, the dominant grass in the mulga perennial community, appeared only in the diet of kangaroos and not in cattle. It was eaten only while it was putting out new shoots following a December rain. *Thyridolepis mitchelliana*, although not dominant in the diet, was a constant item in the diet of both cattle and kangaroos.

A further case of diet changing in response to climatic and forage conditions is shown following the good summer rain in November, 1971. Kangaroos collected shortly after the rain had been eating *Tripogon loliiformis* and *Fimbristylis* sp. almost exclusively.

Discussion

Shown in Table 1 are a number of grasses that are not associated with mulga communities. It is apparent from their presence that neither herbivore utilises mulga areas exclusively at any time but exploits other communities simultaneously.

Our findings agree generally with Chippendale's (1968a, b) findings that cattle tend to be general feeders and kangaroos more selective. The preliminary information on forbs indicates that these plants make up a much higher proportion of the diets of both animals than Chippendale found. Chippendale's work was conducted during the 1957-65 drought and kangaroos were collected from gilgaied plains where they had concentrated. These gilgais are dominated by *Eragrostis setifolia* and he found this to be the major item in the diet. Our study was conducted over a greater diversity of range communities under a variety of climatic conditions and we found that both cattle and kangaroos use the gilgaied areas after light rains in dry times (Low, 1972; B. S. Low, ms in preparation). During these periods little growth is shown in any community except the gilgais and floodplains. The diet composition reflects these facts.

Chippendale (1968a) also found that *Eragrostis eriopoda* (woolybutt) was widely available to kangaroos, but never found fragments in the diet. This species appears to have a very low position in the preference hierarchy. However, external factors can influence the preference. Field observations during the dry late winter of 1971 showed that when surrounding areas were dry, and a plot of woolybutt was irrigated, red kangaroos broke through the electrified fence to feed on the green woolybutt.

ACKNOWLEDGEMENTS

As in any interdisciplinary study, we are indebted to a number of people for stimulation and assistance: Ray Perry, Rod Hodder, Kevin Jones, John Pollock, Peter Hanisch, Allan Johns, Bob Millington, Max Ross, Warren Müller, Don Abel and Owen Williams of various CSIRO groups, Catherine Kemper of Macquarie University, pilots Bob Horne and Ozzie Watts of Alice Springs Aero Club, and Bill Prior and Damian Miller of Hamilton Downs Station.

REFERENCES

CHIPPENDALE, G. M. (1968a)—Plants grazed by red kangaroos *Megaleia rufa* (Desmarest), in Central Australia. *Proceedings of the Linnean Society of New South Wales* **93**: 98-110.

CHIPPENDALE, G. M. (1968b)—A study of the diet of cattle in Central Australia as determined by rumen samples. Northern Territory Administration (Darwin) Technical Bulletin No. 1.

EBERSOHN, J. P. (1971)—Native communities in Queensland's sheep country. *In* "Plants for sheep in Australia". *Ed.* J. H. Leigh and J. C. Noble. (Angus and Robertson: Sydney).

EVERIST, S. L., and MOULE, G. R. (1952)—Studies in the environment of Queensland. 2. The climatic factor in drought. *Queensland Journal of Agricultural Science* **9**: 1-113.

LOW, W. A. (1972)—Community preference by free ranging Shorthorns in the Alice Springs District. *Australian Society of Animal Production* **d**: 381-386.

LOW, B. S., and LOW, W. A. (1973)—Feeding interactions of red kangaroos and cattle in an arid ecosystem. III World Conference on Animal Production. Melbourne 1973. (in press).

NEWSOME, A. E. (1965a)—The abundance of red kangaroos, *Megaleia rufa* (Desmarest) in Central Australia. *Australian Journal of Zoology* **13**: 269-287.

NEWSOME, A. E. (1965b)—The distribution of red kangaroos *Megaleia rufa* (Desmarest) about sources of persistent food and water in Central Australia. *Australian Journal of Zoology* **13**: 289-299.

NEWSOME, A. E. (1971)—Competition between wildlife and domestic livestock. *Australian Veterinary Journal* **47**: 577-586.

PERRY, R. A., and LAZARIDES, M. (1962)—Lands of the Alice Springs Area, Northern Territory, 1956-57. *CSIRO (Australia) Land Research Series* Number **6**: 208-36.

ROSS, M. A., and LENDON, C. (1973)—Understorey productivity in central Australian mulga communities. *Tropical Grasslands* (in the issue reporting this symposium).

SLATYER, R. O. (1962)—Lands of the Alice Springs Area, Northern Territory, 1956-57. *CSIRO (Australia) Land Research Series* Number **6**: 109-128.

STEWART, G. A., and PERRY, R. A. (1962)—Lands of the Alice Springs Area, Northern Territory, 1956-57. *CSIRO (Australia) Land Research Series* Number **6**: 9-19.

WILLIAMS, O. B. (1969)—An improved technique for identification of plant fragments in herbivore faeces. *Journal of Range Management* **22**: 51-52.