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CATTLE DON'T NECESSARILY PREFER TO GRAZE IN RIPARIAN ZONES

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INTRODUCTION

Under extensive grazing, cattle exercise choice in where they graze and the pasture species they prefer to graze. Often, these choices are influenced by physical drivers in the landscape, such as slope, tree cover and proximity to water and supplements. However, the relative importance of these drivers under different grazing situations is poorly understood. This makes it difficult to manage cattle for optimum economic and environmental benefits. It is widely cited that cattle preferentially graze and spend time in riparian zones (Kauffman and Krueger 1984). This has negative impact on stream bank erosion (Buckhouse and Gifford 1976), ground cover and biodiversity. The objective of this study was to quantify animal movement in a riverine environment using global positioning system (GPS) technology and determine if there was a preference for frequenting and grazing in riparian zones and assess factors that may influence that preference.

MATERIALS AND METHODS

In each of two 500 ha paddocks in central Queensland, twelve Belmont red cows (LW = 450-550 kg) out of approximately 500 breeders were fitted with GPS archival units (BlueSky Telemetry Ltd, UK). Collars were fitted for 4 week periods in the late dry season (September), soon after calving in the wet season (January), just prior to weaning (March) and again during the early dry season (July). The GPS receiver unit was a µ-Blox 16 channel receiver with 2Mb of flash memory. The GPS antenna was located separately to the main unit so as to be orientated on the dorsal surface of the neck. The devices were programmed to collect GPS positional data, every 15 min for a period of 10 to 300 s from a minimum of 4 satellites. Collars were removed during musters and positional data and ambient temperature data downloaded using a wireless interface. There were no artificial watering points in the paddocks, with the exception of one trough in the most northern corner of Paddock 2.

During GPS collar deployments, visual observations were also made to ascertain behaviour during daylight hours; typically from 06:30 to 16:30. One observer was assigned to one cow fitted with a GPS collar. Observations were made through binoculars and observers remained at least 100 m from the animal to minimise interference with normal behaviour. Activity was recorded every 5 minutes and the percentage of observations over an hour was attributed to one of six categories; no observation, grazing, walking, ruminating, standing or lying down. Observations were planned to occur over one day in each deployment with 3 to 4 observers per paddock. Only six out of a possible 8 observation sessions were achieved. An assessment of pasture availability was made to coincide with the GPS observations along two transects (~2 km in length each having 50 sample points) per paddock (Tothill *et al.* 1992).

Both paddocks were characterized by a plentiful feed supply and a predominance of riparian areas adjacent to either the Fitzroy River, permanent open water or ephemeral gullies that support riparian communities. Riparian areas were considered to be within 50 m of a hydrological feature (ephemeral or permanent open water, river or creek). Preference for riparian areas was assessed by relating the proportion of GPS fixes in riparian areas to the proportion of the riparian area in each paddock (preference index; Manly *et al.*, 2002). A value >1 indicated preference for riparian areas, a value <1 the opposite. All animal and botanical data were combined by observation period and paddock, making a total of 8 data points for each variable. Statistically, these were assigned to paddock (1 or 2) or season (wet; January and March or dry; July and September) and analysed as a 2 x 2 factorial design.

RESULTS

Rainfall patterns were atypical with less wet season rainfall but more out of season rainfall than normal (Figure 1). Total standing dry matter (TSDM) varied from less than 2000 kg/ha in the early and late wet season (January and March) to almost 4000 kg/ha in the dry season (July and September) (Figure 1). Activity (distance travelled between GPS positions in m/h) exhibited a marked diurnal pattern with periods of high activity (>200 m/h) in the morning and late afternoon (Figure 2). Observations confirmed that this activity was related to a combination of grazing and walking behaviour (Figure 3) but neither grazing (R^2=0.49) nor walking (R^2=0.02), alone, were as closely correlated with GPS activity. There was little activity overnight and a nadir around midday, corresponding with peak ambient temperatures. Cattle rested for longer (6 h) during the day in warmer months with calves at foot (wet season) than they did in cooler months as dry cows (2 h). Cumulative distance travelled over 24 hours was not different between paddocks or season and averaged 4440 m/d (Table 1). Nevertheless, cattle appeared to walk approximately 10% further in the co

Riparian areas accounted for approximately 60% of the land area, but only 40 to 50% of animal positions (Table 1). This indicated that under relatively good pasture conditions, cattle did not preferentially enter riparian areas. However, the preference for riparian areas was higher (P<0.05) in Paddock 1 than Paddock 2. There was no effect of season on preference for riparian areas.

oler dry season.

Table 1. Total and riparian areas, and proportion of time spent in riparian zones by cattle in two riverine paddocks in the wet and dry seasons

	Paddock 1		Paddock 2				
Total area (ha)	528		526				
Riparian area (% total)	60.8		58.6			Probability *(P)*	
	Wet	Dry	Wet	Dry	s.e.	Paddock	Season
GPS fixes in riparian areas (% of total)	52.4	51.7	37.9	44.7	1.85	0.015	0.307
Preference index#	0.86	0.85	0.65	0.76	0.03	0.027	0.300
Distance (m/d)	4609	4893	3776	4481	467	0.399	0.496
DM yield (kg/ha)	1788	3585	1903	3198	109	0.430	<0.001

Proportion of GPS fixes in riparian area/proportion of area in riparian zone (Manly *et al.*, 2002).

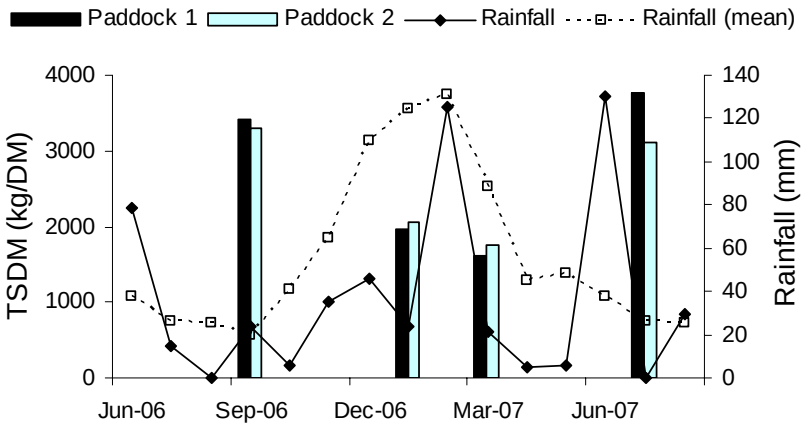

Figure 1. TSDM yield and rainfall over the study duration and mean monthly rainfall since 1953.

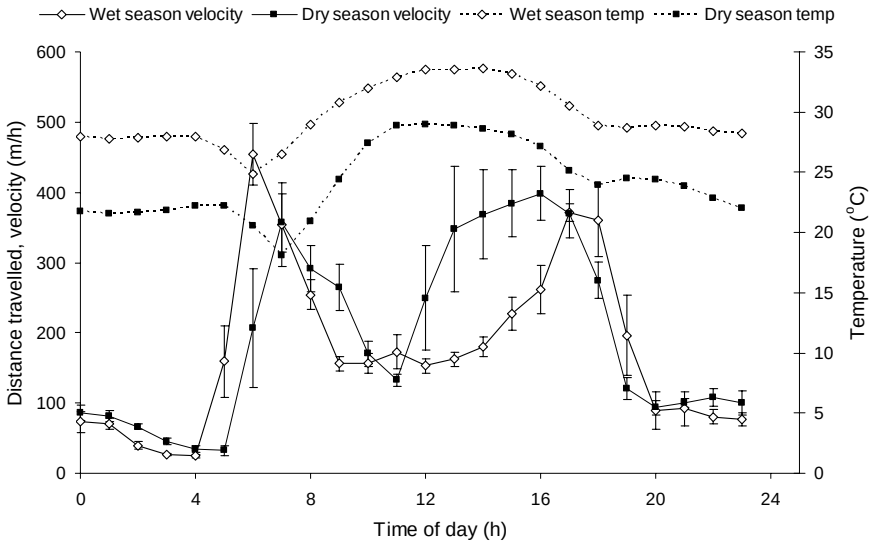

Figure 2. Mean±s.e. activity of cattle in dry and wet seasons over 24 h determined from GPS location data.

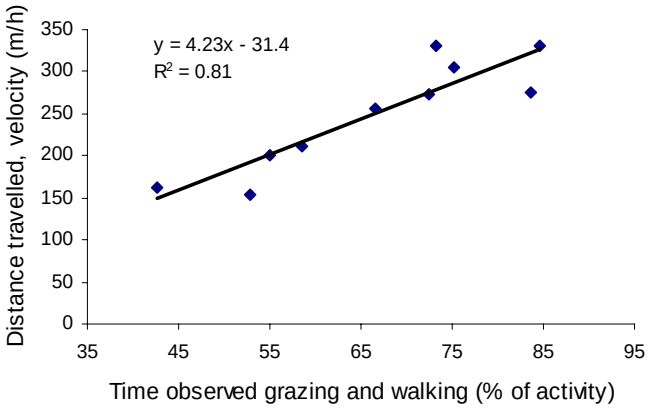

Figure 3. Relationship between the observed activity (% of grazing and walking observations per hour) and GPS recorded activity (velocity per hour) during daylight hours over four deployments.

DISCUSSION

As observed previously (Tomkins and O'Reagain 2007, Tomkins *et al.*, 2008), cattle followed a marked circadian activity pattern. There was a clear relationship between the duration of the midday nadir and season. However, season in this case was confounded by the presence of calves in the wet and their absence in the dry season. Data we have obtained from sites further north to the current site confirm that cattle rest for longer periods at higher ambient temperatures (Tomkins *et al.*, 2008) and it is likely that ambient temperature played a role in longer rest periods we observed in the wet season. The mean daily distance travelled by cattle was 4440 m, with a range of between 3557 and 6005 m. These distances were less than those recorded by Tomkins *et al.* (2008) by steers in 50 ha paddocks. However, in that trial total standing DM was less than 800 kg/ha, and cattle presumably increased their travelling distances in search of feed. Tomkins and O'Reagain (2007) tracked breeder cows in a 1400 ha paddock and these cows averaged over 8000 m/d. Clearly, cattle are capable of travelling large distances and these are related to the size of the paddock and the availability of feed (Hodder and Low, 1978). GPS data can give an estimate of activity over 24 hours without the need for visual

observations. However, visual observations can provide additional information about animal behaviour, data which is difficult to obtain with conventional GPS. In this study, we found a good relationship (R^2=0.81) between GPS velocity (distance travelled per hour) and the sum of grazing and walking behaviours. However, the relationship between GPS velocity and grazing was weaker (R^2=0.49), casting doubt on the possibility of using GPS activity as a proxy for grazing. Higher GPS fix rate that can differentiate between linear and angular speed may offer the possibility of discriminating between grazing and walking in free-ranging cattle (Guo *et al.*, 2006).

Both paddocks were characterized by a plentiful feed supply and a predominance of riparian areas. Under these conditions, we found that cattle did not prefer riparian areas. In fact, preference indices suggested that cattle discriminated against these areas in preference to non-riparian areas. The paddock effect showing decreased preference for riparian areas in Paddock 2 versus Paddock 1 may have been influenced by the presence of one artificial water point in that paddock. The unusual observation that DM yield was higher in the dry season than the wet season was attributed to heavier grazing pressure in the wet season and unseasonal rainfall patterns (Figure 1). Typically paddocks were spelled after weaning in May and June.

It is concluded that the preference by cattle for riparian zones can be modified by other attributes in the landscape. While GPS monitoring of cattle positions every 15 minutes provided information on general landscape use patterns, it was not sufficiently detailed to predict animal behaviours, specifically grazing. We were therefore unable to determine grazing intensity in riparian areas. In contrast to other cited work where the relative preference of livestock for riparian areas is high, in this study livestock did not preferentially grazing in riparian areas.

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