519

Cattle walk further than 3 km from water in central Australia, but only if they have to!

Materne, C[1]; Taber, L[1]; Cowley, R[2]; Wirf, B[2]

[1] Northern Territory Department of Agriculture and Fisheries, Alice Springs

[2] Northern Territory Department of Agriculture and Fisheries, Darwin

Key words: carrying capacity; grazing behaviour; rangeland management; research adoption

Abstract

In arid central Australia pastoral leases are very large (2000–5000 km^2), with large paddock sizes (200–500 km^2), are often poorly developed with few waters, and some stations remain largely unfenced. Although cattle spend most of their time within 4 km of water, it is not uncommon for more than 50% of station area to be beyond 4 km from water. This has consequences for carrying capacity and utilisation of central Australian stations. If paddocks are stocked to total area rather than watered area, this can lead to high pasture utilisation within 4 km of water and low animal performance. Cattle landscape use was investigated in the Paddock Challenge project (Materne *et al.* 2025) to help inform producers about future development options and to test current carrying capacity methodology assumptions. The study used GPS collars to track the location of 280 cattle in nine paddocks on four stations. In this paper we examined the locational data to see how water location influenced cattle landscape use. The data can be used to identify future infrastructure investment and adjustment of stocking rates to optimise landscape use, and cattle performance and production. Cattle spent about 70% of their time within 3 km of water and 90% of their time within 4 km, but this depended on pasture utilisation. The higher the pasture utilisation, the further cattle walked from water. This is consistent with the current Northern Territory (NT) long-term carrying capacity (LTCC) methodology, which assumes cattle use all the area within 3 km and half the area between 3 and 5 km. Information about cattle landscape use was used by producers to inform management and development decisions. The results highlight new opportunities for improving cattle management and addressing environmental, production, and economic goals on Central Australia's commercial cattle stations. The locational data will be further analysed to look at the effect of land type, fire, rainfall and seasons on landscape use and link landscape use to animal performance.

Introduction

Arid rangelands in central Australia, with large pastoral leases and paddocks, often face significant infrastructure limitations. Water points are a large factor influencing cattle distribution and forage utilisation in northern Australian rangelands (Hodder and Low 1978; Tomkins *et al.* 2009). As a result, an estimate of watered area needs to be factored into the assessment of safe utilisation rates on extensive properties (Walsh and Cowley 2011). In central Australia, a 5-km grazing radius was recommended to capture most grazing pressure (Squires 1981), but Hodder and Low (1978) found cattle typically grazed within 3 to 4 km of water in good seasons and up to 8 km in

drier years. In the Barkly region, while cattle can range up to 11 km from water during the late dry season, 80–90% of their activity occurs within 5 km, and 65% of that is within 3 km (Fisher 2001; Cowley *et al*. 2020).

Current NT LTCC methodology assumes the majority of grazing occurs within 5 km of a watering point, most of which occurs within 3 km (Cowley and Walsh 2023). This has been reduced from 8 km (Bastin and Shaw 1988) and 5 km (Chilcott 2005) previously used in the region. The assumed watered area has a large impact on a station's estimated carrying capacity. The Paddock Challenge was a federally funded project aimed at evaluating the profitability of applying recommended carrying capacity on two pastoral properties in Central Australia. As part of the Paddock Challenge project, landscape use was monitored by GPS collars to provide local data to test the watered area assumptions of the carrying capacity methodology used in central Australia (Materne *et al*. 2025).

Table 1. Summary of cattle numbers fitted with a GNSS collar. * Very large unfenced area

Station	Paddock/ Watered area	Paddock area (km²)	Watered area (km²)	% >5km	No. of waters	Cattle class	n	Date
MGP	Brice's	239	65	45	2	Breeder	20	04/2023–05/2024
	Mary's	303	118	44	3	Breeder	20	05/2023–05/2024
	No.1	64	44	6	1	Breeder	20	05/2023–05/2024
LDV	Night	2960	754	40	31	Breeder	20	09/2023–05/2024
MDS	8- & 18-Mile	unfenced	238	*	10	Breeder	40	04/2023–08/2023
	8- & 18-Mile	unfenced	238	*	10	Steer	40	04/2023–08/2023
OMP	4 Pdk Rotation	195	78	35	2	Breeder	20	07/2023–12/2023
	4 Pdk Rotation	195	78	35	2	Steer	20	07/2023–12/2023
	Waterhouse	91	25	49	1	Breeder	20	09/2023–03/2024
	Waterhouse	91	25	49	1	Steer	20	09/2023–03/2024
	South Stuart	26	21	1	1	Steer	20	12/2023–04/2024
	North Stuart	20	11	22	1	Steer	20	12/2023–04/2024

Methods

Cattle landscape use was tracked with Global Navigation Satellite System (GNSS) collars. Three hundred GNSS collars were deployed across four stations and nine paddocks, between July 2023 and May 2024. Each paddock contained 20 collared animals per class, providing tracking data every 10 minutes (Table 1). Each collar was swapped approximately every 4 months depending on stations' planned activities. Data within 100–150 m of a waterpoint was excluded from the analysed data to remove the records of cattle camping at waters. GNSS data was processed using QGIS and Python scripting for spatial analysis and pattern identification, with data points filtered based on distance from water. Pasture utilisation (the percent of annual pasture growth eaten by livestock) was modelled in paddocks following Cowley and Walsh (2023) assuming cattle grazed within the watered area, defined as all the area within 3 km and half the area within 3 to 5 km. Where modelled data was not available,

drier years. In the Barkly region, while cattle can range up to 11 km from water during the late dry season, 80–90% of their activity occurs within 5 km, and 65% of that is within 3 km (Fisher 2001; Cowley *et al*. 2020).

Current NT LTCC methodology assumes the majority of grazing occurs within 5 km of a watering point, most of which occurs within 3 km (Cowley and Walsh 2023). This has been reduced from 8 km (Bastin and Shaw 1988) and 5 km (Chilcott 2005) previously used in the region. The assumed watered area has a large impact on a station's estimated carrying capacity. The Paddock Challenge was a federally funded project aimed at evaluating the profitability of applying recommended carrying capacity on two pastoral properties in Central Australia. As part of the Paddock Challenge project, landscape use was monitored by GPS collars to provide local data to test the watered area assumptions of the carrying capacity methodology used in central Australia (Materne *et al*. 2025).

Table 1. Summary of cattle numbers fitted with a GNSS collar. * Very large unfenced area

Station	Paddock/ Watered area	Paddock area (km²)	Watered area (km²)	% >5km	No. of waters	Cattle class	n	Date
MGP	Brice's	239	65	45	2	Breeder	20	04/2023–05/2024
	Mary's	303	118	44	3	Breeder	20	05/2023–05/2024
	No.1	64	44	6	1	Breeder	20	05/2023–05/2024
LDV	Night	2960	754	40	31	Breeder	20	09/2023–05/2024
MDS	8- & 18-Mile	unfenced	238	*	10	Breeder	40	04/2023–08/2023
	8- & 18-Mile	unfenced	238	*	10	Steer	40	04/2023–08/2023
OMP	4 Pdk Rotation	195	78	35	2	Breeder	20	07/2023–12/2023
	4 Pdk Rotation	195	78	35	2	Steer	20	07/2023–12/2023
	Waterhouse	91	25	49	1	Breeder	20	09/2023–03/2024
	Waterhouse	91	25	49	1	Steer	20	09/2023–03/2024
	South Stuart	26	21	1	1	Steer	20	12/2023–04/2024
	North Stuart	20	11	22	1	Steer	20	12/2023–04/2024

Methods

Cattle landscape use was tracked with Global Navigation Satellite System (GNSS) collars. Three hundred GNSS collars were deployed across four stations and nine paddocks, between July 2023 and May 2024. Each paddock contained 20 collared animals per class, providing tracking data every 10 minutes (Table 1). Each collar was swapped approximately every 4 months depending on stations' planned activities. Data within 100–150 m of a waterpoint was excluded from the analysed data to remove the records of cattle camping at waters. GNSS data was processed using QGIS and Python scripting for spatial analysis and pattern identification, with data points filtered based on distance from water. Pasture utilisation (the percent of annual pasture growth eaten by livestock) was modelled in paddocks following Cowley and Walsh (2023) assuming cattle grazed within the watered area, defined as all the area within 3 km and half the area within 3 to 5 km. Where modelled data was not available,

Table 2. Summary of time spent in relation to distance from water. * Estimate

Station	Paddock/ Watered area	Class	*N* range	Pasture utilisation (%)	Time (%) Distance from water <3 km	3–4 km	4–5 km	>5 km
MGP	Brice's	Breeder	n = 8-1	5-10	73.2	11.6	6.4	8.8
	Mary's	Breeder	n =11-1	5-10	56.6	13.9	4.4	25.1
	No. 1	Breeder	n =11-1	5-10	78.7	13.9	5.2	2.2
LDV	Night	Breeder-black coat	n = 7-3	5-10*	83.0	13.7	2.9	0.4
	Night	Breeder-white coat	n = 9-1	5-10*	85.6	11.6	2.1	0.7
MDS	8 & 18-Mile	Breeder	n =36-12	25-40	50.7	11.9	9.8	27.7
	8 & 18-Mile	Steer	n =17-14	25-40	50.3	13.4	9.2	27.1
OMP	4 Pad Rot.	Breeder	n =15-10	5-15*	70.2	8.8	9.6	11.4
	4 Pad Rot.	Steer	n =20-11	5-15*	74.8	9.3	6.9	9.0
	Waterhouse	Breeder	n =18-3	5-15*	69.5	16.7	10.9	2.9
	Waterhouse	Steer	n =20-3	5-15*	67.9	17.6	11.6	2.9
	Stuart South	Steer	n =18-3	5-15*	87.3	12.0	0.5	0.2
	Stuart North	Steer	n =16-3	15-30*	44.6	32.5	13.8	9.1

Paddock size will influence how cattle use the landscape. In the small 26-km^2 South Stuart paddock only 1% was beyond 5 km from water, which obviously limited use beyond 5 km. However, the pattern of paddock use was very similar to that observed in the massive 2960-km^2 Night paddock with 40% of the total area beyond 5 km from water. Both paddocks had low estimated pasture utilisation, and in both paddocks, time spent within 3 km from water was more than 80% and beyond 5 km less than 1%.

Although pregnant cows' increased water needs during late gestation leads them to visit water points more frequently (Creamer and Horback 2024), steers did not travel further from water than breeders, regardless of pasture utilisation levels, or whether over the cooler (MDS) or hotter (OMP) months. Similarly light-coated cattle are more heat adapted than dark-coated cattle (Barendse 2017), which could potentially influence time spent with distance from water. However, breeder time spent with distance from water on Lyndavale did not vary between coat shades. It is possible that heat stress was not an issue when data was collected, although it did include data during spring and summer.

In this study we estimated pasture utilisation for some locations, but we intend to model pasture utilisation for these sites in the future. Additionally, factors such as land type, fire, rainfall, and seasons and using the speed animals were travelling to distinguish between cattle grazing, walking, and resting will be examined, as well as linking landscape use to animal performance. Although this study was based on relatively small numbers of cattle, they represent real commercial enterprises. It provided an invaluable demonstration to producers of how their

cattle are actually using the landscape, opening up discussion on current management practices and planning future developments.

Conclusion

Data from the Paddock Challenge project provided insights into cattle movement patterns, highlighting that despite large paddock sizes, cattle class or coat colour, if stocked to the LTCC, cattle often used only a fraction of the available grazing land beyond 4 km. The influence of water and land type on grazing patterns warrants further exploration, particularly in relation to stocking rates and carrying capacity over different seasons. Investing in water infrastructure to better distribute grazing could reduce pasture utilisation and enhance animal performance and production in poorly watered areas.

Acknowledgements

This work was funded as part of the Rain Ready Rangelands project by the federal government Future Drought Fund Resilient Soils and Landscapes. Thanks to the producers on stations who assisted with cattle collar induction and collection.

References

Ash AJ, Stafford Smith DM (1996) Evaluating stocking rate impacts in rangelands: animals don't practice what we preach. *The Rangeland Journal* 18(2), 216–243.

Barendse, W. (2017) Climate Adaptation of Tropical Cattle. Annual Review of Animal Biosciences 5 (Volume 5, 2017), 133-150.

Chilcott C, Rodney J, Kennedy A, Bastin G (2005) Grazing Land Management – Central Australia Version. Meat and Livestock Australia Ltd.

Cowley R, Walsh D, Collier C, Jenner D, Hearnden M (2020) Forage Utilisation and Consumption patterns with Distance from Water. Northern Territory Government, Australia. Technical Bulletin No. 359.

Cowley R., Walsh D (2023) Modelling pasture growth and utilization in a large multi-watered paddock. Technical Bulletin No. 360. Northern Territory Government.

Creamer M, Horback K (2024) Consistent individual differences in cattle grazing patterns. *Applied Animal Behaviour Science* 271, 106176. Department of Animal Science, University of California, United States.

Fisher A (2001) Biogeography and conservation of Mitchell grasslands of northern Australia. Doctor of Philosophy thesis, Northern Territory University, Darwin.

Hodder R, Low W (1978) Grazing distribution of free-ranging cattle at three sites in the Alice Springs district, central Australia. *The Rangeland Journal* 1(2), 95–105.

Materne C, Taber L, Kain A, Anderson G, Cowley R, Wirf B, D'Abbadie C (2025) The Paddock Challenge: Who does it better – business as usual vs. recommended stocking rates? International Rangeland Congress, Adelaide.

Shaw K, Bastin G (1988) 'Land Systems and Pasture Types of the Southern Alice Springs District.' Technical Bulletin 136. Department of Primary Industry and Fisheries: Alice Springs.

Squires VR (1981) 'Livestock Management in the Arid Zone.' (Inkata Press: Melbourne)

Tomkins N, Williams S, Kearins S, James H (2008) Preliminary observations using GPS on the grazing distribution around water points for the Barkly Tablelands. In: 27th Biennial Conference of the Australian Society of Animal Production, pp. 24. Australian Society for Animal Production: Brisbane.

Walsh D, Cowley R (2011) Looking back in time: can safe pasture utilisation rates be determined using commercial paddock data in the Northern Territory? *The Rangeland Journal* 33, 131–142.