Ecosystem response to cell grazing in Australian rangelands

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Introduction Cell grazing was introduced to Australian pastoralists in the early 1990s . Initially it received strong criticism by many rangeland scientists .However ,the pastoral industry has largely accepted cell grazing as having a valid role in the options for management ; this is based largely on the observed improvements in rangeland condition and profitability in some locations . There is still a dearth of scientific data on ecosystem responses and changes under cell grazing . This study relates to research conducted since 1996 .

Aim The aim of this research was to develop an understanding of the ecosystem response to cell grazing ; it included a comparison with conventional (continuous) grazing systems .

Method Study sites on commercial scale cells adjacent to conventional grazing locations have been established across an array of rangeland types and climatic regimes . All sites are in the summer-dominant rainfall zone in northern Australia and run cattle .

Results /Discussion Table 1 summarises important data ,with other results presented in the following paragraphs .

Table 1 *Landscape Function Analysis (LFA) ,soil ,plant and microbial data for conventional and cell grazing sites .*

Site	Rainfall (mm)	Great Soil Group	Grazing system	Stock . Rate(ha/LSU/year)	LFA indices (%)			Bulk Density (g/cm³)	Grass Cover (%)	Plant Density (no ./m²)	Microbe Activity (g of cellulose consumed)
					Stability	Infiltration	Nutrient cycling				
1	670	Black earth	Conventional	12 .0	53	33	23	1 .7	0 .8	3 .0	0 .04
			Cell	12 .8	58	33	26	1 .6	11 .8	2 .0	0 .02
2	670	Grey earth	Conventional	1 .6	51	27	21	1 .5	2 .9	2 .6	0 .01
			Cell	12 .8	51	30	26	1 .5	5 .9	3 .3	0 .21
3	490	Black earth	Conventional	4 .3	35	37	31	-	9 .7	12 .1	12 .14[1]
			Cell	1 .7	59	57	54	-	26 .5	21 .6	9 .29[1]
4	590	Grey clay	Conventional	4 .0	-	-	-	-	79 .0	-	-
			Cell	0 .1	-	-	-	-	66 .0	-	-

[1] These data refer to tensile strength of cotton strip

Sites 1 and 2 These sites are on the same property .On Site 1 ,cell grazing exhibited a 50% increase in the frequency of a naturalised legume (*Rhynchosia minima*) compared to the conventional . There were substantial differences in the cyanobacteria species between cell and conventional grazing . Nitrogen-fixing cyanobacteria were present on both sites .

Site 3 Biological soil crusts were present under cell grazing but not under conventional grazing .

Site 4 There were no significant changes in bulk density over the graze-rest period under cell grazing .However ,soil porosity ($P < 0.01$) and infiltration rate ($P < 0.1$) were both significantly higher at the end of the rest period compared to the end of the previous graze period . Bulk density was significantly higher and soil moisture holding capacity lower at 10-30 cm ,and porosity lower in the 1-5 and 6-7 cm depths under conventional compared to cell grazing .Selective grazing occurred in both grazing systems .Rainfall amounts and timing in the rest period appeared to be the critical factors affecting both pasture recovery and changes in the soil physical properties in cell grazing .

Conclusions The results indicate that ,under a well-managed grazing enterprise in a range of environments ,many ecosystem parameters perform at a higher level under cell grazing than conventional grazing . Current work includes a wider range of environments and includes a focus on whether the rest-graze periods under cell grazing can enhance the activity of biological soil crusts ,particularly the N-fixing cyanobacteria . It is anticipated that further results may provide clearer guidelines for grazing management to enhance ecosystem functioning and consequent sustainable livestock productivity .