

## Effects of traditional range enclosures and seasonality on herbaceous plants biodiversity in southern Ethiopia

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**Key words :** range enclosures, seasonal grazing, species richness

**Introduction** Traditional range enclosures have played important roles in the restoration of herbaceous plant biodiversity in degraded rangelands. In southern Ethiopia, the use of range enclosures has been ongoing for the last three decades due to changes in land use from nomadic to sedentary grazing (Angassa, 2007). We sampled six enclosures varied in age from 12-14 years, 17-24 years and 26-30 years old representing younger, medium and older age categories, respectively. The adjacent rangelands were continuously grazed.

**Materials and methods** Herbaceous vegetation was sampled by randomly locating 10 1×1 m<sup>2</sup> plots in the individual enclosures and the same numbers in adjacent grazed rangelands during two wet seasons (November 2003 and May 2004) and one dry season (February 2004) (n=120 plots). The proportion of grass basal cover (%) was estimated visually based on the area covered by grass base compared to bare ground. Herbaceous species richness was determined as numbers of species per unit area. Herbaceous biomass was hand harvested and reported as dry-weight (gm m<sup>-2</sup>). Abundance was direct counts. Diversity was assessed using the Shannon index.

**Results** The effect of management was significant for herbaceous biomass, grass basal cover, herbaceous species richness and diversity, but not for species abundance (Table 1). There was a strong seasonal variation by all variables (Table 1). The enclosure management had more herbaceous species richness (26 species) than the grazed rangelands (24 species). There was no clear evidence that the response of herbaceous variables to management changed with age of enclosures. Indeed, the effect of age was significant only for grass basal cover and herbaceous species richness (Table 1). Herbaceous species richness decreased with increasing age of enclosure (Estimate±SE-0.029±0.011). Herbaceous species richness was greater in the medium age (4.9±0.01 species m<sup>-2</sup>), than younger (4.8±0.1 species m<sup>-2</sup>) and older (4.6±0.1 species m<sup>-2</sup>) enclosures.

**Table 1** Analysis of variance for the effects of management, age and seasonality on herbaceous vegetation variables.

Response variable	Source	df	F	P
Biomass	Management	1	145.06	***
	Age	1	0.20	NS
	Season	2	114.31	***
	Management * season	2	23.80	***
Grass basal cover	Management	1	139.75	***
	Age	1	13.66	**
	Season	2	11.80	***
	Management * season	2	5.32	**
Abundance	Management	1	0.00	NS
	Age	1	3.43	NS
	Season	2	50.48	***
	Management * season	2	1.23	NS
Richness	Management	1	17.61	***
	Age	1	6.30	*
	Season	2	3.32	*
	Management * season	2	0.40	NS
Diversity	Management	1	13.18	***
	Age	1	9.11	NS
	Season	2	14.39	***
	Management * season	2	3.35	*

\*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ , NS  $P > 0.05$

**Conclusions** We found significantly greater herbaceous biomass and grass basal cover in the enclosures than in the grazed sites. The enclosures had more herbaceous species richness than the grazed rangelands. However, the older enclosures had no superior benefits over the younger in terms of herbaceous production, herbaceous species richness and diversity. From the current finding, it can be concluded that management and seasonality were more influential in driving the productivity and diversity of herbaceous plants in the rangelands of southern Ethiopia than age alone.