Indicator Species of Different Managements in Natural Grasslands of Pampa Biome

Fernando Forster Furquim[1*], Gabriela Machado Dutra[1], Émerson Mendes Soares[1], José Pedro Pereira Trindade[2], Fernando Luiz Ferreira de Quadros[1]

[1] Universidade Federal de Santa Maria, Rio Grande do Sul, Brazil
[2] EMBRAPA CPPSUL, Bagé, Rio Grande do Sul, Brazil
Corresponding author email: ff.furquim@gmail.com

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Introduction

The Pampa biome in Rio Grande do Sul state is a natural ecosystem with a large biodiversity (Bilenca & Miñarro, 2004 and Boldrini, 2002).To maintain the *equilibrium* between biodiversity and forage production to herds, it requires a sustainable land-use that preserves the natural diversity and produce forage to the herds (OVERBECK, 2007). It can be accomplished through the adjustment of stocking rates after understanding the plant's responses to grazing. However, a study considering all areas of the Pampa biome and its present species would be complex, given the high number of plant species. In this context, selecting species that represent determined grazing managements could be an alternatively method of analysis.

The aim of this study was to identify indicator species of different grazing managements in the natural grasslands of Pampa biome.

Material and Methods

The experiment was conducted in a natural grassland of Pampa biome located at Bagé city (31° 18' S, 53° 57' W) in Rio Grande do Sul state. The area is located in a transition zone between the Southern Campaign and Southeast Hills and the climate is Cfb, temperate humid, according to Köpen classification with the historical average rainfall, of last 30 years, of 1446.2 mm and average temperatures of 18.7 °C (INMET, 2015). The area has no history of agricultural mechanization and, during the last 40 years, it was managed extensively with cattle and sheep herds at low stocking rates of < 0.5 animal unit ha^{-1}.

In June 2012, the experimental area was completely excluded from grazing of large herbivores and it was subdivided in three managements: two grazing methods (continuous stocking (CONT) and rotational stocking (ROT)) and an excluded area (EXCL). The animal entrance in CONT and ROT occurred in February 2013.

The vegetation was preferentially sampled transects with 1.25 m² of area were delineated (20 in CONT, 20 in ROT and 10 in EXCL). We used a modified Londo-scale (LONDO, 1976) to estimate the cover class of each vascular plant species. The vegetation survey was conducted from December 2014 to February 2015.

Aiming to characterize management practices, Indicator Species Analysis (Dufrêne and Legendre, 1997) was conducted using the 'indicspecies' package (De Cáceres and Jansen, 2012; R Development Core Team 2015). It was selected as candidates those species occurring in at least 10 % of the final reference sites. It also allowed combinations of up to five species. The *indicators* function was used to calculate indicator *specificities* and *sensitivities*. Finally, to reduce the possible indicators, *pruneindicators* function was used (De Cáceres et al. 2012).

Results and Discussion

The result of analysis showed two indicator species for each management and all of them, except one, were grasses (Table 1).

Table 1. Indicator value analysis, where A is specificity, B is sensitivity, sqrtIV is square root of the indicator value and Cover is pooled coverage (%).

Management	Final indicators[*]	A	B	sqrtIV	Cover
CONT	Erpl	0.7912	0.95	0.8670	100
	Asmo	0.5311	0.75	0.6311	
ROT	Axaf	0.7568	0.90	0.8253	100
	Pano	0.5660	0.95	0.7333	
EXCL	Saan	0.7385	0.70	0.7190	90
	Anlan	0.5347	0.60	0.5664	

[*]Anlan: *Anthaenantia lanata* (Kunth) Benth.; Asmo: *Aspilia montevidensis* (Spreng.) Kuntze; Axaf: *Axonopus affinis* Chase; Erpl: *Eragrostis plana* Nees; Pano: *Paspalum notatum* Flügge; Saan: *Saccharum angustifolium* (Nees) Trin.

The CONT management is characterized by two species frequently associated with overgrazing disturbance effects (e.g. excessive defoliation and trampling). Both are not palatable species. Exotic grass, *Eragrostis plana* is also associated with invasive processes in native grasslands areas and nowadays can be considered as a huge problem to native diversity of plant species of Pampa biome. In EXCL management, both species are unpalatable tussock grasses with tall size. The latter attribute can be the determinant success factor over other species in light capture. Two palatable native grasses were the indicator species of ROT management. It can be associate with the grazing tolerance with this species and with the rotational criteria applied in area: time to thermal accumulative of 375 degree-day (degree Celsius *per* day; DD) which allowed the elongation of 2.5 leaves *per* tiller of grasses of functional groups A (e.g. *Axonopus affinis*) and B (e.g. *Paspalum notatum*) (Cruz et al, 2010).

Conclusions and Implications

Indicator species analysis characterized accurately our grazing managements. This approach can be used to provide a simple (but accurate) vegetation data analysis.

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