

## Ecosystem Services at Two Farms of Pampa Biome Using the “Toolkit for Ecosystem Service-Site-Based Assessment” Methodology

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### Introduction

Natural grassland in Pampa biome, in Southern Brazil, offers important ecosystem services (ES). Natural grasslands preserve soil and water and provide habitat for a wide range of flora and fauna. They are the principal source of forage for grazing animals, and thus, the base of milk and beef production in that region. Furthermore, the potential for rural ecotourism provides other social and economic benefits (Pillar et al., 2009). However, cultivation of soil in agriculture, excessive use of agricultural chemicals, and over stocking with livestock have caused soil degradation and loss of this pastoral ecosystem. The “Toolkit for Ecosystem Service-site-based Assessment” (TESSA) (Peh, 2014) is a methodology based in comparisons between two stages of soil conservation, in which one is considered as the “praiseworthy” and the other the “alternative”. The objective was to use TESSA on two farms that were members of the “Alliance for the Grassland” ([www.alianzadelpastizal.org](http://www.alianzadelpastizal.org)), which promotes livestock sustainability in Pampa biome through BirdLife International funds.

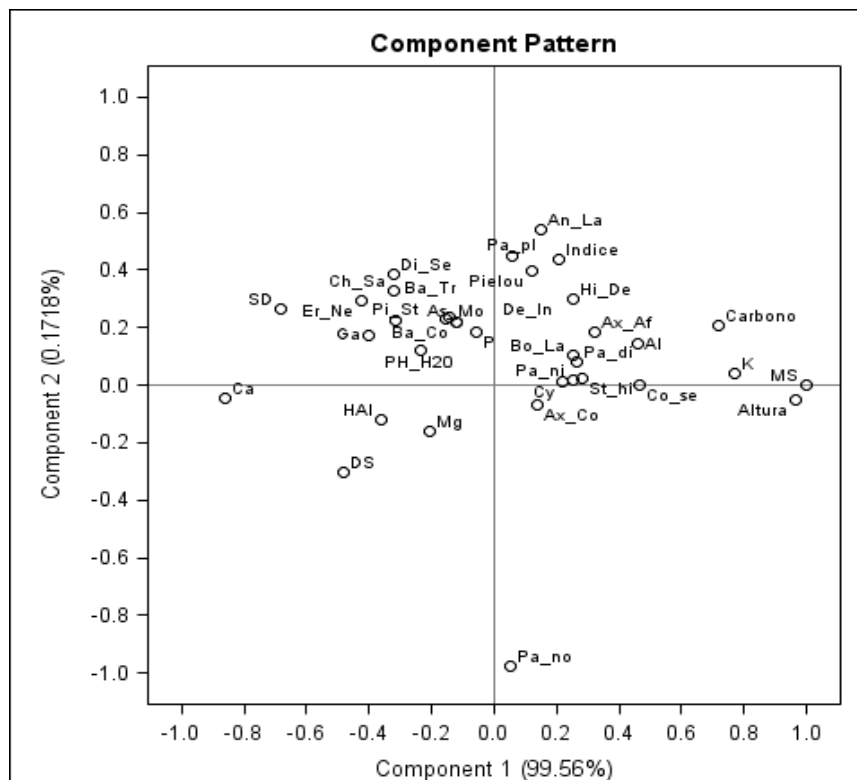
### Material and Methods

Two properties in Lavras do Sul, State of Rio Grande do Sul, Brazil, were selected for this study; a preserved natural grassland (P) and a natural grassland in recuperation (R). The P farm was chosen because their soil management practices include mowing, stocking rate adjustment and exclusion of areas as a seed bank and there is no cultivation in the last 60 years. In the R farm, four years of corn and wheat grain production with traditional soil cultivation practices and no fertilization. In each property there were chosen three transects in following the relief: top, middle and lower. On each transect, percentage of non-covered soil (NC) was visually evaluated. Samples of above ground vegetation biomass were taken and analyzed for dry matter (DM). Chemical and physical soil characteristics were determination of the EMBRAPA (1997). Global variance of observation were detected through multivariate analysis of principal components (SAS, 2010).

### Results and Discussion

The influence of previous management was analyzed using Principal Component Analysis (PCA) and relief classes were used as the analytic objective. The correlation shows five principal components. Components 1 and 2 explained the global variance of observations. Principal component number 1 explained 99.56% of data, indicating that vegetation biomass, height of vegetation, soil carbon and calcium, as the main indicators influencing this evaluation. Ecosystem Services parameters can be used as a vegetation biodiversity and soil quality indicator using TESSA methodology.

This toolkit helped to select and compare collection sites and to communicate to decision makers so that they can assess the net impact of these changes and, consequently, the benefits for conservation.



**Figure 1. Correlation matrix of Ecosystem Services indicators evaluated in two properties of Pampa biome through principal component analysis.**

Correlation matrix of variables of principal components 1 (99.56%) and 2 (0.1718%). Pa\_no= *Paspalum notatum*, Co\_se= *Coelorhachis selloana*, Ax\_Af= *Axonopus compressus*, Pa\_ni= *Paspalum nicorae*, Pa\_di= *Paspalum dilatatum*, St\_hi= *Steinichisma hians*, Pa\_pl= *Paspalum plicatulum*, Ax\_af= *Axonopus affinis*, An\_la= *Andropogon lateralis*, Bo\_la= *Bothriochloa laguroides*, Cy= *Cyperaceae*, De\_in= *Desmodium incanum*, Hi\_de= *Hipoxis decumbens*, Ga= *Gamochaeta sp*, Er\_ne= *Eragrostis neesii*, Di\_se= *Dichondra sericea*, Ba\_tr= *Baccharis trimera*, Ch\_sa= *Chevrulelia sarmentosa*, Pi\_st= *Piptochaetium stipoides*, As\_mo= *Aspilia montevidensis*, Ba\_co= *Baccharis coridifolia*, SD = non-covered soil percentage, Ca = Calcium, DS = soil density, Mg = Magnesium, HAL = H +Al, K = Potassium, Carbon = soil organic Carbon; Ph H2O; Al = aluminium; P = phosphorus MS = vegetal biomass dry matter, Altura = height of vegetal biomass.

## Conclusions and Implications

The soil coverage, vegetation biomass and height, must be considered when managing natural grassland at Pampa biome, as they showed to be good indicators of conservation and ecosystem services. The TESSA proved to be a scientifically sound measure of ecosystem services in natural grasslands. More training is needed to professionals understand the benefits and how to use the toolkit.

## References

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