Discrimination of Pastures in Beef Cattle Production Systems with Remote Sensing-Based Vegetation Index

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Introduction

The objective of this study was to discriminate different pastures in beef cattle production systems using Normalized Difference Vegetation Index (NDVI) temporal data, from April 2013 to August 2015, at experimental pasture areas located at Embrapa Pecuária Sudeste - Canchim Farm, São Carlos – SP. Vegetation photosynthetic activity and production are related with NDVI values and this index has been utilized as an indicator on livestock production systems discrimination (Blanco et al., 2008, Alvarenga, 2015). The identification of degraded pasture areas is important as the recovery contributes, in the long term, to the mitigation of greenhouse gases (Oliveira, 2015).

Material and Methods

The study area is located at the Mata Atlântica biome (Brazilian Atlantic Forest with average annual precipitation of 1,362 mm, average annual temperature of 21.5ºC and humid subtropical climate. The experimental design had the following cattle production systems: (A) irrigated with intensive management and high stocking rate (INTIRRI_AL), (B) dryland with intensive management and high stocking rate (INTSEQ_AL) and (C) recovering pasture with medium stocking rate

(REC_ML).all pastures were managed in the rotational system. Descriptions of the three systems are in Table 1.

Table 1. Livestock (cattle) production systems description.

Production system	Grass	N dosage (kg/ha)
INTIRRI_AL	*Panicum maximum*	600
INTSEQ_AL	*Panicum maximum*	400
REC_ML	*Brachiaria decumbens; Brachiaria brizantha*	200

Values of NDVI were extracted from OLI/Landsat-8 images according to the methodology described by Conceição et al. (2015). Temporal data consisted of 30 cloud-free images, from April 2013 to August 2015. Values of NDVI of each production system were clustered in: dry period of 2013, 2013/2014 wet period, dry period of 2014, 2014/2015 wet period and dry period of 2015. Kruskal-Wallis ANOVA statistical analysis was applied in order to discriminate each production system in each described period ($p < 0.05$).

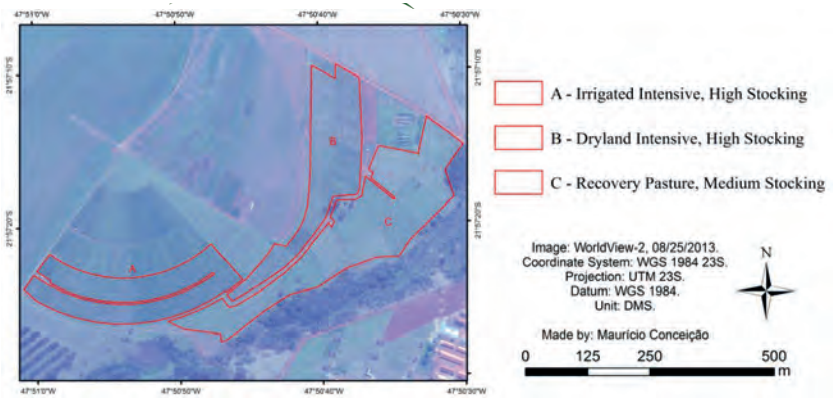

Figure 1. Study area experimental design with the three beef cattle production systems.

Results and Conclusions

Figure 1 shows mean NDVI values in each experimental area for each OLI/Landsat-8 image. In most days of the temporal series, recovering pasture (REC_ML) and dryland intensive pasture (INTSEQ_AL) had the highest and lowest mean NDVI values, respectively. Recovering pastu-

re had also higher mean NDVI value (0.72), than irrigated (0.70) and dryland (0.66) intensive managed pastures, and this can be explained by the cespitose habit of *Panicum maximum* grass cultivated in INTIRRI_AL and INTSEQ_AL, which forms clumps, exposing the soil. Light from soil surface decreases NDVI values due to non photosynthetic activity. (Table 1).

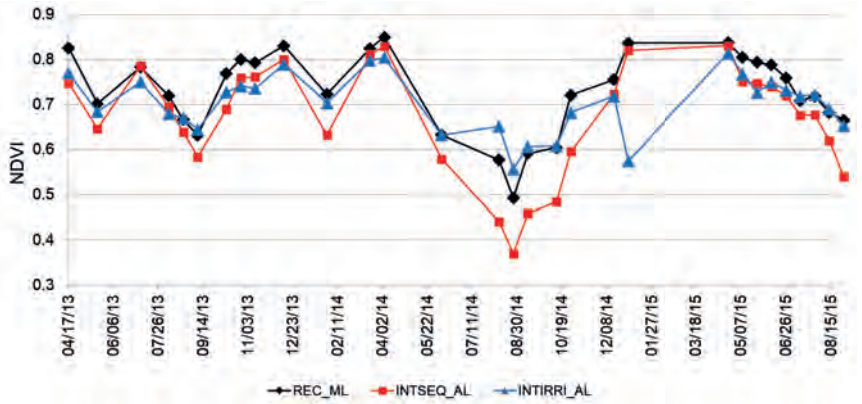

Figure 1. NDVI values for pastures in beef cattle production systems

Table 1. Seazonal NDVI values of pastures in beef cattle production systems.

Production system	DRY 2013 (6)*	WET 2013/14 (6)*	DRY 2014 (5)*	WET 2014/15 (4)*	DRY 2015 (9)*	2013-2015 MEAN (30)*
INTIRRI_AL	0.67ab	0.75a	0.65a	0.64a	0.73ab	0.70
INTSEQ_AL	0.69a	0.74a	0.53b	0.65a	0.70a	0.66
REC_ML	0.73b	0.79b	0.63a	0.73b	0.75b	0.72

* Landsat images

As expected, water availability and higher N dosage resulted in higher mean NDVI in the irrigated and intensively managed pasture (INTIRRI_AL), compared to the intensive managed dryland pasture (INTSEQ_AL), as a result of higher forage mass in the area.

In the dry period of 2013, dryland intensive (INTSEQ_AL) differed from the recovering pasture (INTREC_ML) but neither differentiated from the irrigated intensive (INTIRRI_AL). In 2013/2014 wet period, the recovering pasture differentiated from the *Panicum maximum*

experimental areas (INTIRRI_AL and INTSEQ_AL) which had similar NDVI. The irrigated intensive (INTIRRI_AL) and recovering pasture (INTREC_ML) were similar in the dry period of 2014 and different from the dryland intensive (INTSEQ_AL). Results had the same pattern in the wet periods of 2014/2015 and 2013/2014 and dry period of 2013 and 2015. Our findings contribute to monitor different beef cattle production systems. Futures works should consider *in situ* biomass data in order to correlate these data with NDVI values.

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