



Grassland conservation and productivity index to monitor livestock ranching sustainability using fuzzy logic

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Sustainable livestock ranching requires adequate framework for analysis, diagnostic and monitoring. The Pantanal is a complex and dynamic tropical wetland where extensive livestock was established over 200 years ago. However, in recent decades this activity is becoming less sustainable due to several factors such as the loss economic competitiveness and limitation of productive capacity. In order to identify the main aspects and indicators related to sustainable ranch in the Pantanal were realized several expert meetings through a participatory process. Among these aspects highlighted the pasture productivity and quality due to presence of abundant natural pastures areas in the region. In this complex and uncertain system, the fuzzy logic was adopted in order to develop a grassland conservation and productivity index (GCPI). The construction process involved the following steps: definition of membership functions; definition of knowledge base in form of inference rules; model validation and correction. Four indicators were selected based on scientific studies and experts meetings: 1) pasture conservation status (PCS); 2) forage value index (FVI); 3) fire severity degree (FSD) and 4) degree of invasion of exotic species (DIES). The PCS indicate if the grassland is conserved, in degradation, degraded or dominated by invading species. FVI indicate the functional forage composition and quality of pastures. FSD indicate the fire intensity on different vegetation communities and DIES indicate the extent and severity of invasion on natural vegetation of the pastures located in permanent preservation areas (e.g. wetland areas). Each indicator variable has a fuzzy partition associated with your domain, formed by fuzzy sets representing each linguistic term. These indicators and respective classes were used to support decision rules and build a model based on to expert knowledge to manage uncertainty. To perform the inferences and subsequent analysis was used the Webfuzzy software, 255 inference rules were generated and validated. As example of rule: "If PCS is optimum and FVI is optimum and FSD is severe and DIES is high then index is regular". The GCPI was calculated with the Fuzzy model, from zero to one, classified into three categories: good, regular and critical. Exhaustive simulation of the model of the GCPI index were made with the input class of each indicator, to validation and adjustments with the end-users. Thus, the GCPI was considered adequate to monitor and to evaluate grasslands from Pantanal' ranches. This index comprise one of the attributes of the fuzzy decision-making tool for livestock sustainable production systems in Pantanal region.

Keywords: Fire, forage value, indicators, invaders plants, rangeland

Acknowledgments: Embrapa and CPP provided funding support. We would like to thank several individuals and stakeholders, which contributed to the validation of this index.