

# **SPATIAL-TEMPORAL DYNAMICS OF *PANTANEIRO* LIVESTOCK RAISING: AN ANALYSIS BASED ON THE CENSUSES FROM THE LAST 20 YEARS**

Ana Gabriela de Jesus ARAUJO<sup>1</sup>

Deivid Galdini SILVA<sup>2</sup>

## **Abstract**

This article presents a characterization of the extensive beef cattle raising in Brazilian Pantanal. The activity is passing through transformations that reposition the regional productive environment, with new actors and techniques. In order to present such dynamics and its intraregional variability, the article explored the Agricultural Census database and identified changes such as reduction in the size of livestock raising farms and increase in the herd size, besides a growth in the rate of planted pasture, to the detriment of native pasture areas, mainly in Southern Pantanal. Variates related to the behavior of the rural population in the municipalities were complementarily used, being collected in the Demographic Censuses and in an empiric research in farms in Aquidauana municipality. The results evidenced changes in the social composition, with reduction in familiar ties among the livestock raising actors, a growth in the number of workers living in the urban space, an increase in the total of rural dwellers with college degree, and a decrease in the income of such population, in spite of the increase in the rural population in most municipalities in the region. It is concluded that there are intraregional differences and trends for a more intensive livestock diversified in social and spatial terms.

**Keywords:** Livestock raising. Transformation. Census. Pantanal Matogrossense.

## **Resumo**

### **Dinâmica espaço-temporal da pecuária pantaneira: uma análise com base nos censos dos últimos 20 anos**

Este trabalho apresenta uma caracterização da estrutura produtiva da pecuária bovina extensiva de corte em municípios do Pantanal brasileiro. Considerando a importância da atividade para a economia desses municípios, bem como seu status de vetor para a conservação biológica da região pantaneira e para o *modus vivendi* da população local, torna-se relevante a pesquisa em torno da dinâmica sócio-espacial que envolve a produção pecuária nos últimos anos. A atividade vem passando por transformações que, sob a égide da globalização, reposicionam o ambiente produtivo do Pantanal e atribuem novas relações, com novos atores e técnicas, revelando novas racionalidades. O trabalho explorou a base de dados produzida pelos Censos Agropecuários em dois momentos, 1996 e 2006, para caracterizar as mudanças no sistema técnico da pecuária pantaneira. Apresenta uma análise da dinâmica da pecuária em sua variabilidade intraregional. De forma complementar, foram utilizadas variáveis relativas ao comportamento da população rural dos municípios pantaneiros, coletadas nos Censos Demográficos para os anos 2000 e 2010, com foco a identificar possíveis mudanças na qualidade de vida da população, bem como resultado de pesquisa empírica em fazendas de Aquidauana, Mato Grosso do Sul, que revelam escalas não captadas pelos Censos.

**Palavras-chave:** Criação de gado. Transformação. Censo. Pantanal Matogrossense.

<sup>1</sup> Instituto Nacional de Pesquisas Espaciais/Centro de Ciências do Sistema Terrestre - INPE/CCST. Av. dos Astronautas, 1758 - Caixa Postal 515 - 12201-970 - São José dos Campos - SP, Brasil. E-mail: ana.araujo@inpe.br

<sup>2</sup> Geógrafo e professor de Geografia. Av. dos Astronautas, 1758 - Caixa Postal 515 - 12201-970 - São José dos Campos - SP, Brasil. E-mail: deivid.galdini@hotmail.com.br

## INTRODUCTION

Along the last twenty years, the Brazilian Pantanal region has been undergoing transformations in the technical system for beef cattle raising. For Araújo and Bicalho (2011, p. 13), the specificities in such process reveal the change in the space and society involved with the *Pantaneiro* rural inhabitant, in the context of the globalization of production and consumption relations.

Traditionally, livestock raising in Pantanal has been characterized by homogeneity in its technical system and extensive production, based on the use of the environmental conditions (such as the native fields used as pasture), a production consolidated by raising calves for rebreeding and fattening at other places, and low technical intervention, either in nutritional, reproductive, or sanitary management (CORRÊA FILHO, 1955, p. 48; ZIMMER *et al*, 2008, p. 50; ALBUQUERQUE; SILVA, 2008, p. 175).

However, the Pantanal rural space has been reclaimed by new intentionalities and productive arrangements that reposition the region in the national cattle raising scenario. *Pantaneiro* people from families originated in the region and new actors settled in those municipalities practice a more intensive livestock raising and represent different rationalities in the system and production, forming a heterogeneous and multiple productive space on intraregional scale (ARAÚJO, 2011, p. 133). Besides the traditional breeding of calves for sale, livestock breeding and fattening phases are also practiced, as well as livestock breeding for differentiated and high commercial value production (such as Angus breed beef) and production under a certified organic system.

This article characterizes the evolution of the livestock raising productive space in the last two decades and demonstrates the urban and rural elements that compose it. Based on the primary and secondary data, the article shows the activity trajectories in Pantanal municipalities, highlighting the main disruptions and permanences in the different analysis scales.

The research assumes that the implication of new work techniques and capital composition creates new social-spatial arrangements and thus new territories (HAESBAERT, 2007, p. 78). Such fact is articulated with the theoretical-methodological conception that understands the space as the social life dimension that, when in movement, incorporates multiple sets of actions and objects, being constantly reorganized (SANTOS, 2002, p. 39).

Such approach of space relational dimension makes possible an analysis of the temporal evolution and the different contents that form the rural space in the Brazilian Pantanal referring to the beef cattle raising system.

## OBJECTIVE

The aims to analyze the productive space of the beef cattle raising, considering social-economic data from the Pantanal region in the period between 1996 and 2010, enabling the data spatialization and thinking on the recent activity trajectories in municipalities susceptible to floods.

## MATERIAL AND METHODS

Some initial questions were set for elaborating the article, such as: assuming a productive restructuration process from the 1990's, with the livestock raising repositioning in new market strategies, what is(are) the behavior(s) of the technical systems in *Pantaneiro* livestock raising?; what are the specificities of each analyzed municipality referring to the forms of adherence and resistance to the livestock raising productive restructuration?; what are the consequences for and the interferences of the populational dimension in such process, mainly referring to the change in quality of life in aspects such as income, work, and education of the persons involved in livestock raising production/? and how are such transformation dynamics spatialized in Pantanal.

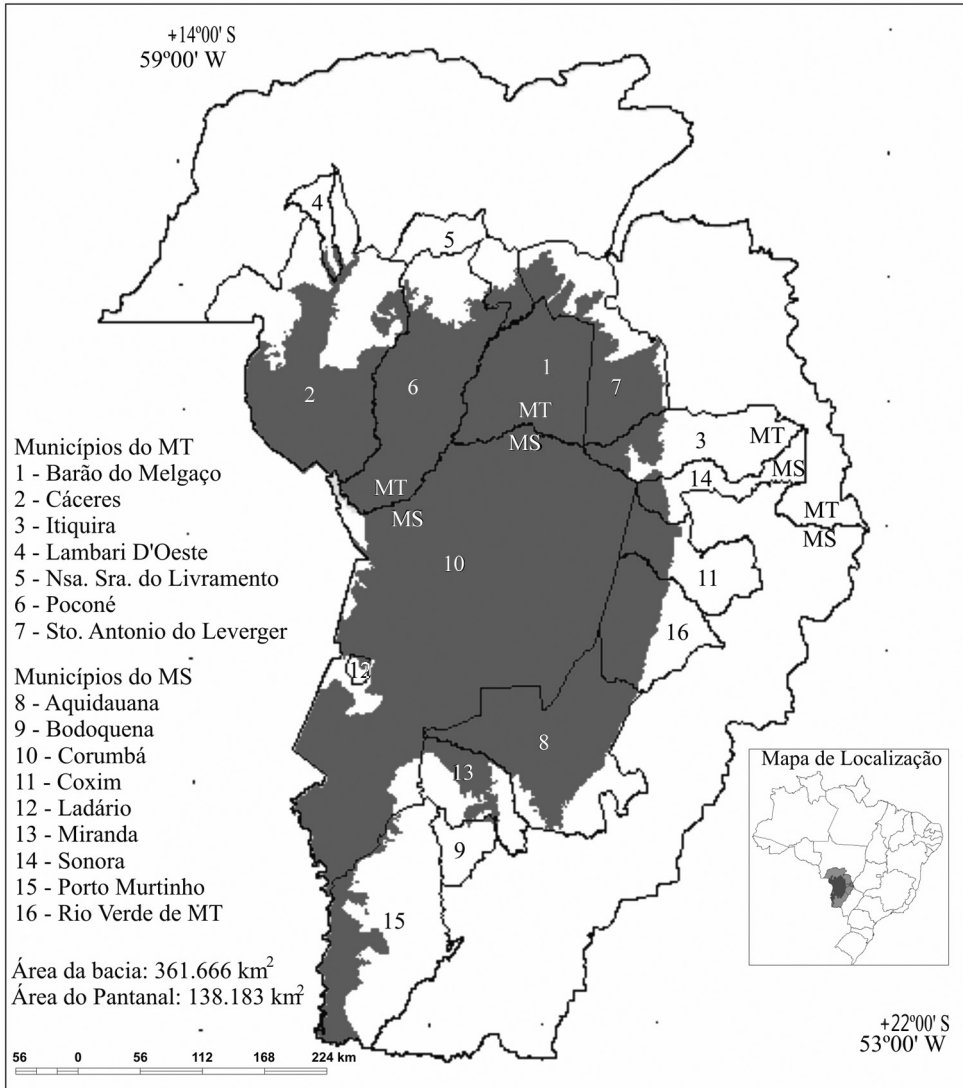
The path to answer such questions started in the collection of data from the Census in the *Pantaneiro* municipalities with significant cattle herd and susceptible to floods<sup>3</sup>: Barão de Melgaço, Cáceres, Nossa Senhora do Livramento, Santo Antônio de Leverger, and Poconé in Mato Grosso state (here grouped as Northern Pantanal) and Aquidauana, Corumbá, Coxim, Ladário, Miranda, Porto Murtinho, and Rio Verde de Mato Grosso in Mato Grosso do Sul state (here grouped as Southern Pantanal). The location of the study area is presented in figure 1.

The variates selected in the Agricultural Censuses were ruled by the features of properties with livestock raising and their technical system and were restricted to those likely to be compared between the 1995-6 and 2005-6 surveys, as the change in methodology from one census to another did not enable the comparison of some variates for such period. Variates related to income and education for the rural population, likely to be compared in 2000 and 2010 Demographic Censuses, were also collected.

Except for Ladário and Corumbá, which have their territories practically fully in the flooding plain, other municipalities have territorial area outside the Pantanal, in plateau portions in the Paraguay basin. Therefore, the information in the Censuses at municipal scale has its content masked with data of the rural population not only from the plain, but also from the plateau areas. For making up for such fact, the data survey was complemented with a collection of empiric data in 30 livestock raising farms located in the floodable plain in Aquidauana municipality, a significant producer in Southern Pantanal in 2010. The information at such finer spatial resolution scale could guide the thinking on the trajectory temporalities in the productive system in the floodable plain, showing data not collected in the Censuses, as well as confirming what was detected in such source.

The database formation by grouping data by date and subject and, finally, the elaboration of maps and viewing graphs using the SIG (*Sistema de Informação Geográfica* [Geographic Information System]) with Access and Terraview 4.1 software were performed after choosing the variates pertinent for the article object and collecting statistical data and maps for spatial indexation, available at IBGE website.

<sup>3</sup> The Pantanal is part of the Upper Paraguay basin (UPB), located between latitudes 15°30' and 22°30' South and longitudes 54°45' and 58°30' West. It is divided in subregions with different geomorphological, hydrological, and pedological configurations and vegetation composition (PCBAP, 1997, p. 297). Abdon and Silva (1998, p. 1707) identify 11 *Pantaneiro* subregions expressing different geoenvironmental dynamics among themselves; Padovani (2010, p. 62) identifies 25 subregions from flooding differences. In this article, the regionalization by Abdon and Silva is adopted, but only the municipalities with the largest herd and susceptible to floods are considered, excluding Itiquira, Lambari D'Oeste, Sonora, and Bodoquena municipalities.



**Figure 1 - Upper Paraguay basin, highlighting the Pantanal plain portion (gray) and the plateau portion (white) (ABDON AND SILVA, 1998, p. 1707)**

## RESULTS AND DISCUSSION

The evolution in the number of beef cattle herds in the Brazilian Pantanal between 1996 and 2006 is presented in figure 2. Proportionally, Mato Grosso achieved higher herd growth than Mato Grosso do Sul in such period. It is verified that only Ladário, Poconé, and Barão de Melgaço presented a decrease in the livestock number; Coxim, Rio Verde de Mato Grosso, and Santo Antônio de Leverger kept their herds as relatively stable; Aquidauana, Miranda, Porto Murtinho, and other Northern Pantanal municipalities presented an evident increase in herds, especially Nossa Senhora do Livramento.

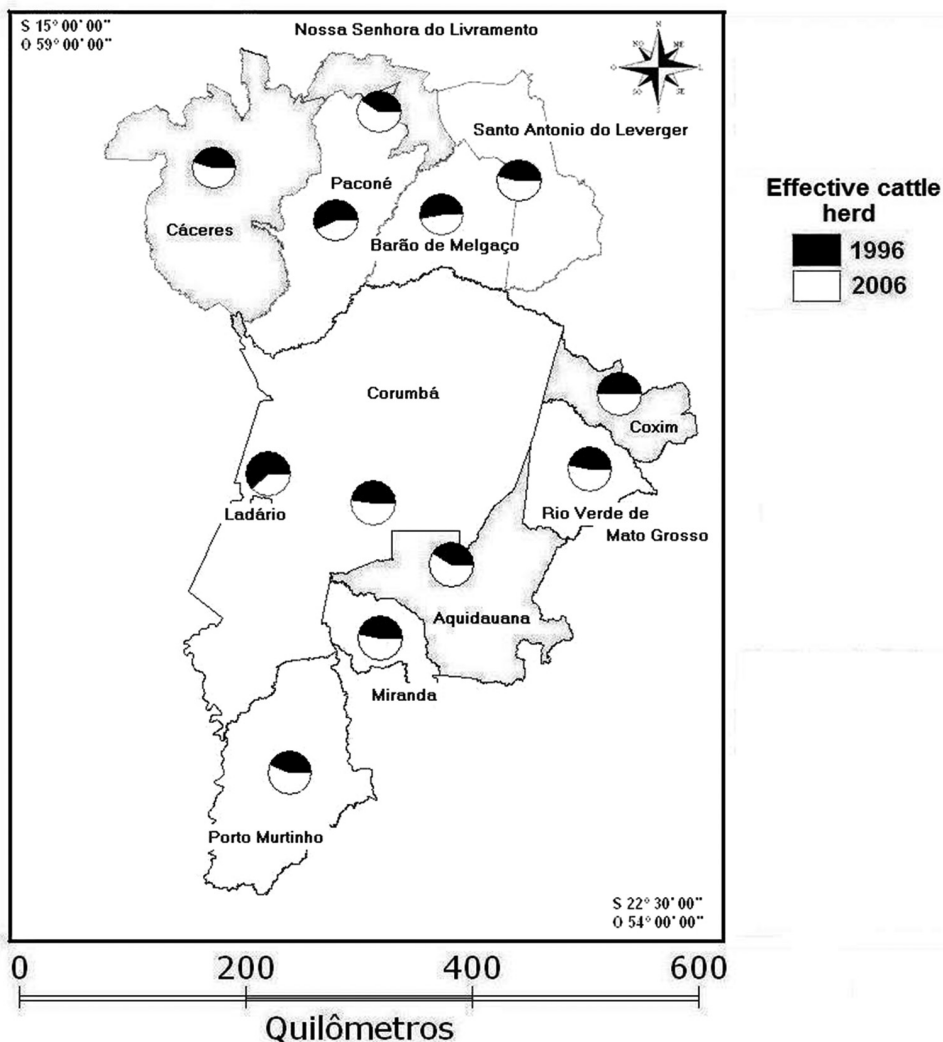


Figure 2 - Evolution of beef cattle herds in municipalities analyzed between 1996 and 2006 (IBGE)

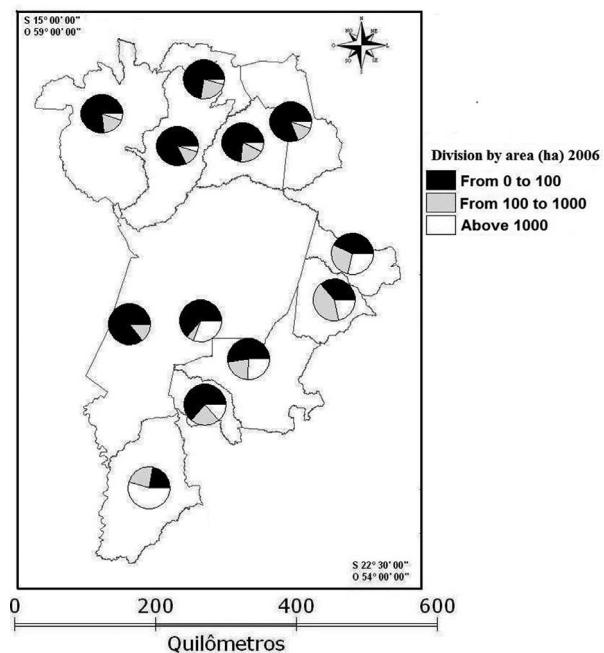
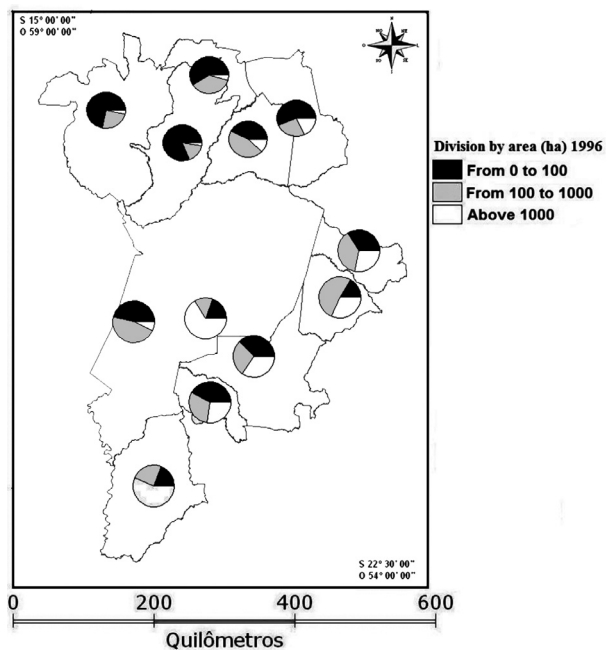
The evolution in the landholding structure in the region shows a process for changing the size of the rural properties (Figures 3 and 4). Silva and collaborators (2001, p. 149) indicated such landholding transformation trend since the 1980's, with a raise in the division of the properties, which historically had extensive areas for extensive cattle raising (above 100,000 hectares, for example). Indirectly, the trend proves what was surveyed by the interviews: a change in the *Pantaneiro* social organization, with the arrival of new actors that purchase parcels in the large traditional farms, either inherited and sold, besides the new territorial logics for the regional cattle raising and the livestock management techniques, consistent to the imperative for productivity and adjustment of the spaces available for breeding in each farm, such as semiconfinement and supplementation based on rations, sugar cane, and cotton seed.

Figures 3 and 4 show the percentages of cattle raising properties by area size. For Northern Pantanal, an increase in small properties (0 to 100 hectares) is seen, except in Cáceres; process attributed to the state policies for land reform in the region (ALMEIDA *et al*, 2014, p. 68). In Southern Pantanal, such class was only not altered in Coxim and Porto Murtinho, being significantly increased in Ladário, besides Corumbá and Miranda, which also received settlement projects created by INCRA (*Instituto Nacional de Colonização e Reforma Agrária* [National Institute of Settlement and Land Reform) in the period.

Referring to the class of large properties (larger than 1,000 hectares), only Cáceres, Poconé, and Coxim presented increase, while the other municipalities decreased the number of properties in such class, mainly Corumbá and Miranda. For the intermediate class (100 to 1,000 hectares), the same trend of reduction in properties is seen in Northern Pantanal and some municipalities in Southern Pantanal, such as Corumbá, Coxim, and Rio Verde de Mato Grosso; however, in other municipalities (such as Miranda and Aquidauana), the number of medium properties increased, reinforcing the hypothesis of incorporation of parcels from old farms by one of the heirs or new buyers.

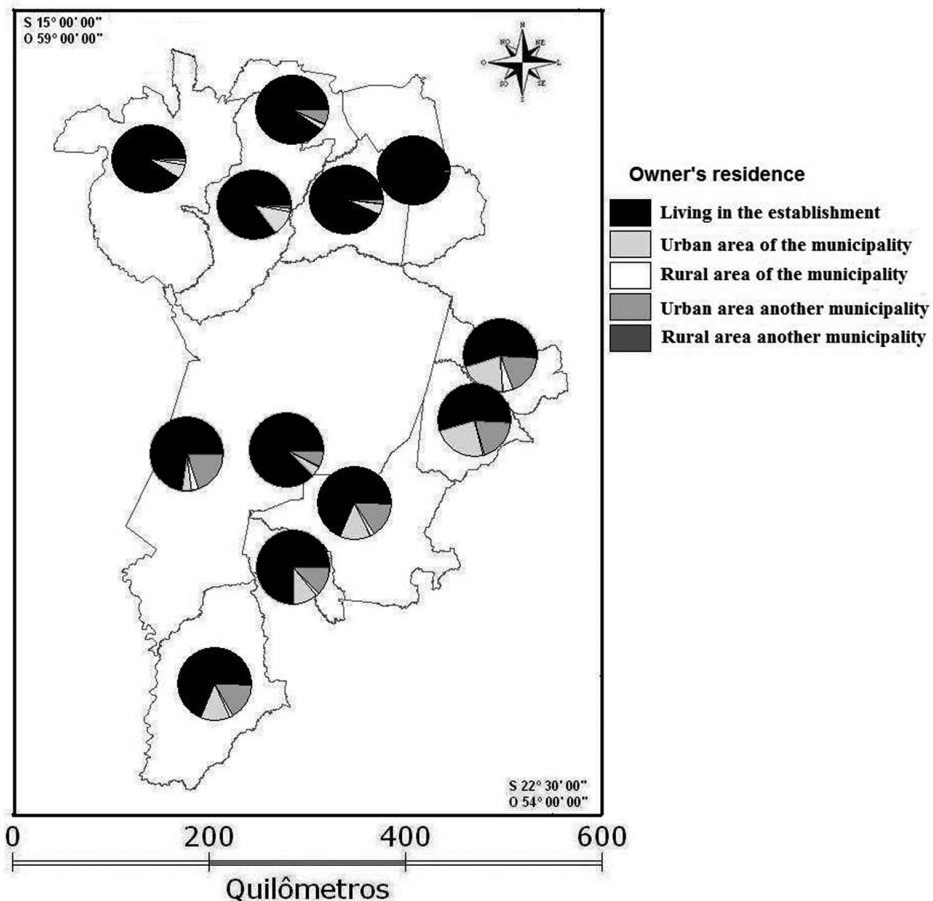
The field research in Aquidauana has verified the trend for fragmentation of large farms due to heritage. In such context, there is the sale for owners from other locations and even companies that begin to actuate in beef cattle raising. The large extension of the farms has been historically justified by the flood seasonability, which determines the access to pasture and to higher areas, safe for livestock during the flood period. Such change inaugurates new arrangements for the regional livestock raising. Besides the fragmentation, the rental of farm parcels has been frequent, for both traditional producers and new actors.

The territorial logic articulating livestock raising areas in a network is developed for long time in the region and is configured as a technique adaptive to the flood seasonability in the plain. However, the process of "owner change" (PROENÇA, 1997, p. 48) was pointed out in the interviews as an aggravation in the emergent flood situations, as many producers have less areas for dislocating their herds, find new fences in previously accessible pathways, or do not have supportive relations with the new producers, which would enable them to lend pasture or livestock shelters (BANDUCCI, 2007, p. 147). In such context, livestock were lost by drowning or isolation and starvation during the last extreme floods, such as in 1998, 2011, and 2014.



**Figures 3 and 4 - Proportion by size of areas of livestock raising farms in Pantanal in 1996 and 2006 (IBGE)**

Other configuration of the regional dynamics shown in the following map is the change in the producer profile, which, from the 2000's, began to live in other locations (most urban) instead of their previous condition as owning farmer living in the property (figure 5). For the Southern Pantanal municipalities, the change is more expressive in the peripheral ones, in the transition to the plateau, such as Coxim, Rio Verde, Aquidauana, and Miranda, suggesting the location of the actors in the non-*Pantaneiro* urban space, identified by Araújo and Bicalho (2011) and Silva and collaborators (2001). However, the central municipalities in the plain (such as Corumbá) and in Northern Pantanal have a great amount of owners living in the establishment, revealing the permanence of the more tradition rural individual in the region.



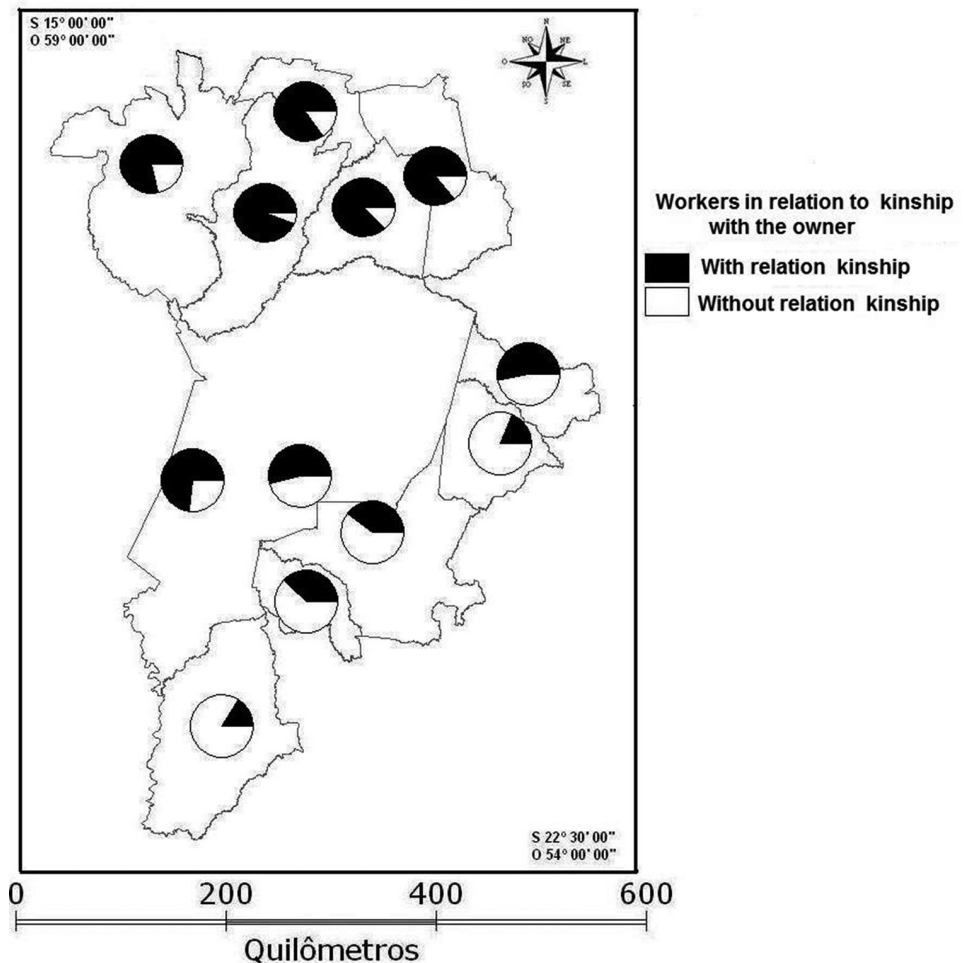
**Figure 5 - Proportion by living place of owners of livestock raising farms in Pantanal in 2006 (IBGE)**

The dynamics indicate a breeding modernization process with hiring of labor force and specialists for the new livestock raising requirements. Based on 2006 data,



low familiar ties between workers and owner are verified, mainly in the municipalities with higher production (such as Corumbá) or with strong modernized trajectory in the productive system (such as Aquidauana, Miranda, and Rio Verde de Mato Grosso) (Figure 6). Nevertheless, Northern Pantanal presents a permanence of production with familiar ties, except for Cáceres, Nossa Senhora do Livramento, and Santo Antônio de Leverger.

The situation is consistent to the paradigm of globalized production and commercialization. Such paradigm is operated in the more technical, scientific, and informational medium (SANTOS, 2002, p. 88) and is therefore demanding about technical instruction and formation and involves the incorporation of specialized professionals such as agronomists, veterinarians, zootechnicians, engineers, managers, and lawyers on territoriality and urban everyday (ARAÚJO; BICALHO, 2011, p. 121).



**Figure 6 - Percentages of workers in relation to kinship with the owner of livestock raising farms in 2006. (IBGE)**

The empiric research performed with producers in Aquidauana, the second largest producer in Southern Pantanal, confirms such trend of labor force specialization, for both traditional workers (rural workers and foremen) and the new acting technical group. The table below (table 1) shows the percentages of permanent and temporary workers in the three considered systems, categorized according to the employed productive system<sup>4</sup>, besides the changes realized by the producers of each system. It is seen that the three groups detect new requirements. All groups have intensified the use of permanent labor force, especially the *Pantaneiro* traditional productive system, which is used to employ few field and beach rural workers and to prioritize the temporary hiring for diverse services in the farm and livestock management (such as vaccination, fence refurbishing, and pasture cleaning) or even the labor force "lending" among neighbors, still practiced in farms visited in Aquidauana.

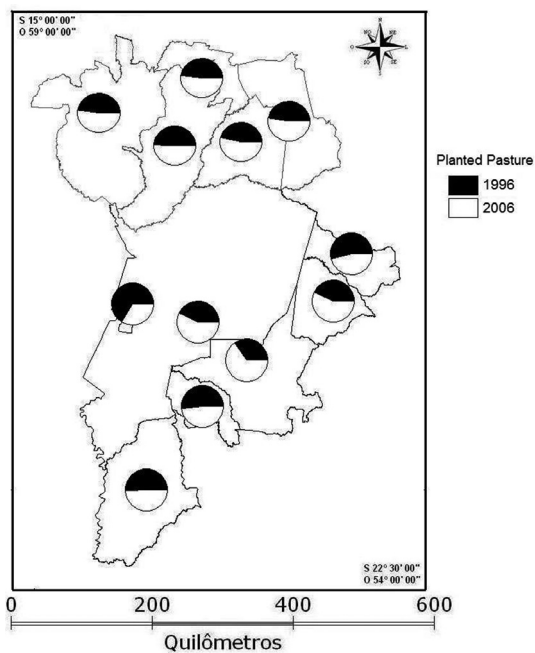
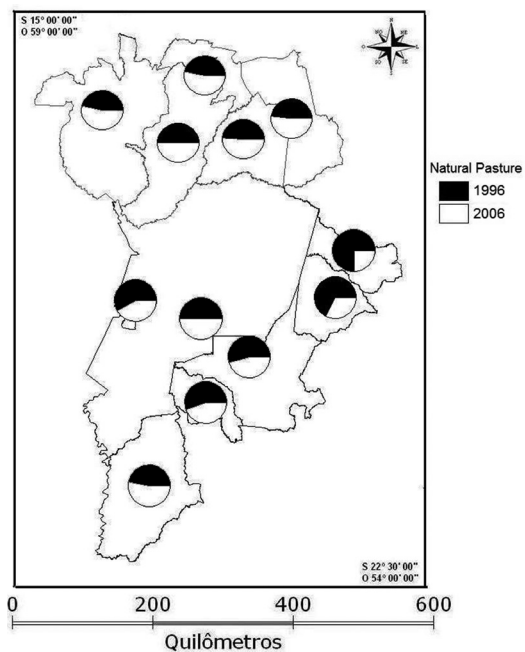
**Table 1 - Characterization of labor force for the farms analyzed in Aquidauana municipality**

Productive group of farms	Used labor force				
	Permanent	Temporary	Specialized	Changes and particularities in the last 20 years	
Traditional	27	15	0%	No changes	More qualified Willing to learn Temporary labor force lent from neighbors
	64%	36%			
Productivistic modernized	51	18	43%	No changes (14.5%) Decrease (14.5%) Increase (71%)	Same temporary labor force acting in several farms of the same owner Indigenous temporary labor force More qualified, willing to learn (linguistic and digital literacy)
	74%	26%			
Post-productivistic modernized	77	49	100%	Increase (100%)	Research, Apiculture and Ecological and rural tourism

Source: fieldwork, 2010.

Referring to the intervention in the physical-biological environment in Pantanal, addressing the opening of new areas and the replacement of the native pasture in the region, it is possible to see from figures 7 and 8 that there was a small decrease in native pasture areas in most municipalities, and such fact can indicate a stability in the process of devastation of *Pantaneiro* native pasture and even their valorization caused by systems claiming that their productions are adjusted to Pantanal's conservation and sustainability. Such fact does not happen in the municipalities with larger territorial area in the plateau (such as Coxim and Rio Verde de Mato Grosso) anymore. However, referring to the introduction of planted pasture, an expressive increase is seen, especially in Aquidauana and Corumbá municipalities, both with large flood plains and natural pasture. The reason for such phenomenon may be linked to the property fragmentation, which enables a productive space rearrangement, opening new areas for pasture forming.

<sup>4</sup> The grouping from specificities of the productive systems in the region was based on Araújo and Bicalho (2011, p. 78), performed for Southern Pantanal, and on Araújo (2011, p. 65), who identified three *Pantaneiro* livestock raising trajectories in Aquidauana. The most *traditional* trend keeps the productive landscape of the pioneers, who raised cattle using the natural configurations of Pantanal (native fields, salt beds, and clay pits) and low technological intervention and capitalization. And these are the two more *modernized* trends: one more capitalized and productivistic, dedicated to higher intensification of pasture and livestock (such as fullblood Nelore and young steer); and the other post-productivistic, specialized in luxury markets (such as Kobe beef) or in the "sustainable" market (such as organic meat and "green beef"). In such post-productivistic and modernized context, the different agents realize the production environment with their own interpretation, either prioritizing exotic pasture and smaller winter pastures or linking their production to the organic environment in Pantanal.



**Figures 7 And 8 - Evolution of natural and planted pasture in Pantanal farms between 1996 and 2006 (IBGE)**

The field survey has shown the heterogeneity in the pasture modification process. Such process varies among the livestock raising productive groups and demonstrates the differences in the interaction with the *Pantaneiro* environment, such as the temporality of the manners to incorporate the enterprises to a more modernized and intensive logic or the resistance of the traditional and post-productivistic producers, which see strategic advantages related to the low management cost and the nutritional quality for livestock in the native pasture or even the same argument for the *Pantaneiro terroir*<sup>5</sup>. Table 2 below shows the differences among farms that chose to replace the native pasture, proving the spatial-temporal dynamics of the productive systems in their specificities.

**Table 2 - Variability among farms on introduction of planted pasture in Aquidauana**

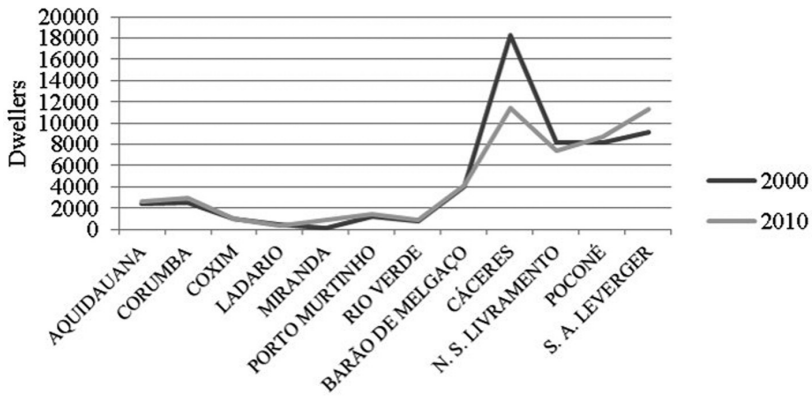
Productive group of farms	Time of Introduction of Planted Pasture			
	Before 1990	Between 1990–2000	After 2000	No Compliance
	Farms with Planted Pasture (%)	Farms with Planted Pasture (%)	Farms with Planted Pasture (%)	Farms with Native Pasture (%)
Traditional	12.5%	37.5%	62.5%	37.5%
Productivistic modernized	17.0%	67.0%	100.0%	0.0%
Post-productivistic modernized	12.5%	37.5%	62.5%	37.5%

Source: fieldwork, 2010.

The analysis of variates extracted from IBGE Demographic Census for the rural population of the twelve municipalities aimed to confront and articulate the information in order to verify a possible alteration in quality of life of such individuals between 2000 and 2010.

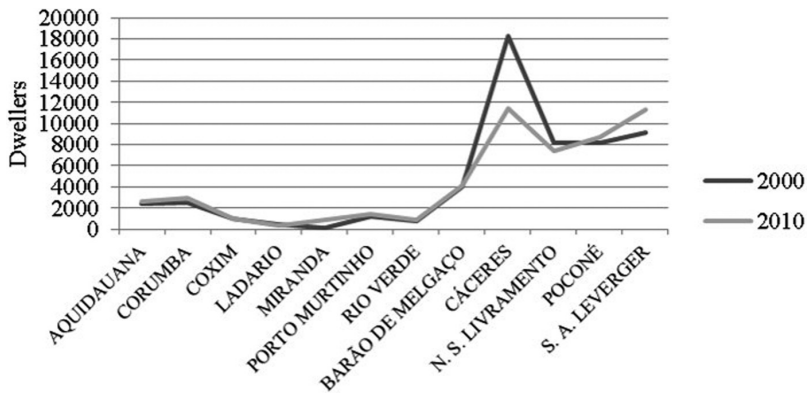
The number of dwellers in the rural space of the municipalities is presented in figure 9. The rural population in Pantanal showed a variation between the analyzed years in both states. While the number of rural dwellers decreased in Ladário, Nossa Senhora do Livramento, and mainly Cáceres, the other municipalities presented growth in the rural populations. In the first case, the rural flight in Ladário can be explained by the conurbation with Corumbá, which increase its population (both rural and urban) between 2000 and 2010. Miranda, Aquidauana, Corumbá, and Santo Antônio de Leverger and, in second level, Poconé, Barão de Melgaço, Porto Murtinho, and Coxim, were highlighted among the municipalities that presented demographic increase in rural population; the other municipalities remained stable (figure 9).

<sup>5</sup> According to Toniello (2007, p. 10), the term *terroir* is used in agriculture production to reference the geographic indication and the origin of products. Since the 1960's, the concept has been strengthened with the French wine produced in Bordeaux, which produces high quality wine in an association among relief, soil, climate, and certain grape species. Social-cultural aspects are also considered in the *terroir* of a product besides the environmental aspects, including the know-how singularity in the place, especially the interaction between society and environmental conditions, a relationship aligned to the paradigm of sustainability and conservation of the local knowledge.



**Figure 9 - Dwellers of rural areas in Pantanal between 2000 and 2010 (IBGE)**

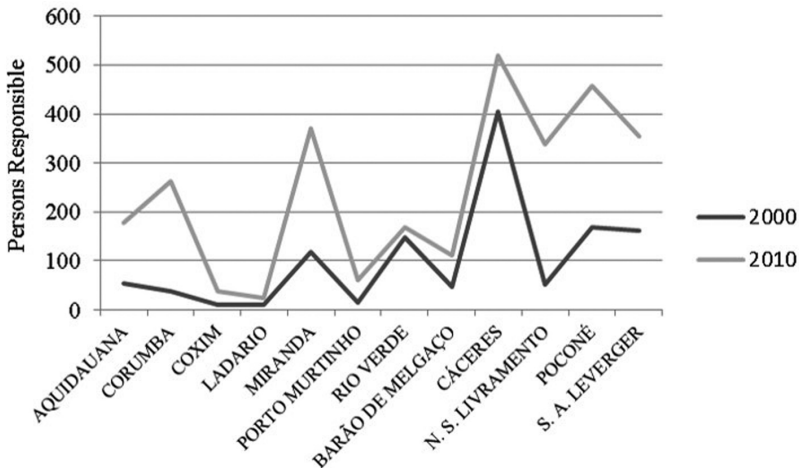
Figure 10 shows the evolution in the number of *Pantaneiro* rural dwellers with full college education. In general, there was an increase, except for Ladário and Corumbá (which presented a small decrease between 2000 and 2010) and Coxim (which remained stable). Aquidauana (which more than doubled its number of people with full college education) and Santo Antônio de Leverger (which increased from 25 persons in 1996 to 203 in 2006) municipalities were highlighted, followed by Miranda, Cáceres, Porto Murtinho, and Nossa Senhora do Livramento.



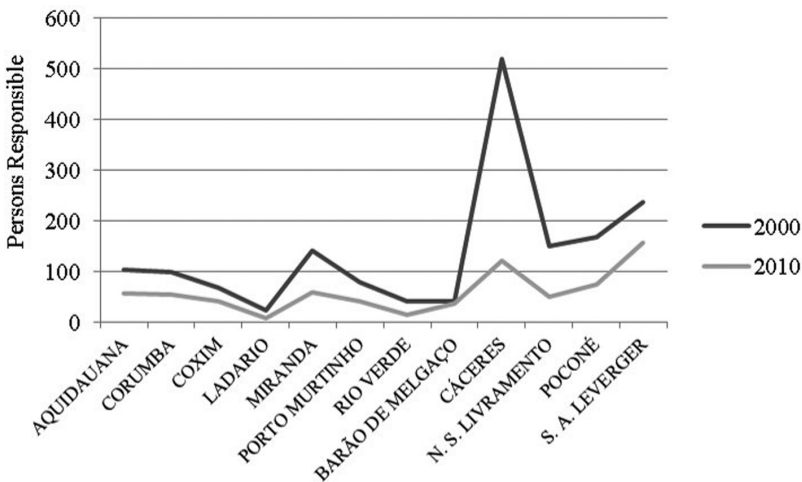
**Figure 10 - Persons responsible for rural dwellings with full college education in 2000 and 2010 (IBGE)**

Referring to the income of the rural population, an expressive growth is seen in the total of responsible persons with income of up to half minimum wage (MW), suggesting a worsening in the quality of life of such individuals with reduction in income (Figure 11). Corumbá increase from 38 to 262 persons responsible for rural dwellings in such class; Miranda increased from 118 in 2000 to 371 persons in 2010; and Nossa

Senhora do Livramento increased from 52 to 338 persons in 2006. For the groups with higher income (between 3 and 5 minimum wages), a substantial decrease in dwellers was seen in the whole region in 2006. Aquidauana, Miranda, Rio Verde de Mato Grosso, and Ladário were the municipalities that more reduced their numbers of persons responsible for dwelling in such range, followed by the other municipalities in Mato Grosso do Sul. In Northern Pantanal, Cáceres was highlighted, with a decrease from 519 in 2000 to 121 persons in 2010; Nossa Senhora do Livramento reduced such population by one third, from 151 to 49; Poconé reduced such group by half; and Santo Antônio de Leverger and Barão de Melgaço reduced such group in smaller proportions (Figure 12).



**Figure 11 - Income of persons responsible for rural dwellings with up to 1/2 MW between 2000 and 2010 (IBGE)**



**Figure 12 - Income of persons responsible for rural dwellings with between 3 and 5 MW between 2000 and 2010 (IBGE)**

It must be stressed that, by working at municipal scale, the generalization level of the IBGE Censuses does not enable the spatial indexation of differentiated and specific areas, as in the case of municipalities presenting floodable plain and plateau areas in UPB. However, the temporal evolution analysis and the visualization of the behavior of each municipality have enabled to visualize the social-spatial dynamics promoted by the regional livestock raising production within the capitalist productive restructuration process, which has been transforming the different locations under the aegis of globalization.

## CONCLUSIONS

The *Pantaneiro* livestock space has been permeated by new action and object systems that create new territories, setting a multiterritoriality condition.

The results have shown the evolution of the regional herd, especially for Northern Pantanal. They have also shown a reduction in the medium size of the livestock raising farms, suggesting changes in the meaning of the productive elements (such as land and the feasible property size for livestock raising in Pantanal). There was evolution related to the increase in the planted pasture areas and in the labor force qualification; such labor force lives in the urban space and has reduced its kinship ties with the owners of livestock raising farms. A decrease in income and advances in educational aspects, as well as in the need for qualification and specialization of the labor force (in order to remain inserted in economic structure of the more rationalized and demanding new livestock raising), was verified.

For analyses focused on *Pantaneiro* plain, it is suggested to use varied sources that work under a finer resolution and enable a more detailed visualization for such area. This combination of complementary scales (such as Pantanal subregions or even properties) can minimize the limitation of the approach at municipal level in IBGE Censuses. Finally, it was verified that the dynamics of the *Pantaneiro* livestock raising demonstrates disruptions and permanences, an own temporality, and multiple social-spatial arrangements in the Pantanal region.

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