

Changes in cattle herd composition and its implications on greenhouse gases emissions in Mato Grosso do Sul State between 2010 and 2014

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Introduction

Cattle ranching is a major agricultural activity in Central Brazil and it plays a major economic role in Mato Grosso do Sul State. In the last few years, local agricultural development has been influenced by other agro-industries, mainly sugar cane and eucalyptus forestry, expanding over grazing areas, causing herd displacements but also leading to changes on local production systems. Herd numbers show a tendency to decrease, while beef production keeps stable. This means improvements on individual husbandry techniques as well as a general re-arrangement of herd structure. This can have important consequences on greenhouse gases (GHG) emissions from the sector in the area. In this context, the goal of this study was to explore the implications of changes on cattle herd size and structure as well as land use change on GHG emissions per unit beef produced per unit of area used for cattle grazing in Mato Grosso do Sul State.

Material and Methods

Cattle herd data for the years 2010 and 2013 were obtained from the Animal Health Agency of Mato Grosso do Sul (IAGRO). The database includes all foot-and-mouth disease vaccination registers for

all 79 local municipalities of the State, recording numbers of animals vaccinated, according to sex and age range in months (0 to 12; 12 to 24; 24 to 36 and over 36 months of age). This database also provides information on transit of cattle for slaughter within and outside the State, which was used to estimate emissions per slaughtered head produced in Mato Grosso do Sul. There were other sources of information regarding slaughter numbers, as from the "*Sistema de Informações Gerenciais dos SIF (SIG-SIF)*" from the "*Ministério da Agricultura Pecuária e Abastecimento*" and, also, from the "*Sistema IBGE de Recuperação Automática (SIDRA)*" available from the internet portal of the "*Instituto Brasileiro de Geografia e Estatística (IBGE)*". Their numbers are close to those from IAGRO, however they do not consider animals sent for slaughter in other States as well animals brought in from somewhere else.

Data related to Land Use Change (LUC) were kindly made available by the "*Associação dos Produtores de Soja e Milho de Mato Grosso do Sul (APROSOJA/MS)*", from the database of their "*Sistema de Informações Geográficas do Agronegócio de Mato Grosso do Sul (SIGA/MS)*" which, twice a year, carries out a detailed survey on land use in Mato Grosso do Sul, using remote sensing techniques (satellite imagery), validated by a comprehensive ground truthing.

Methane emission rates from enteric fermentation for each specific age range i.e. category under local conditions are not available in the literature. The most suitable data found for the scope of the study was from Demarchi et al (2003a) and Demarchi et al (2003b). The authors found CH₄ emission factors for different cattle weight categories and seasons with a diet based on *Brachiaria brizantha*. Since this is an exploratory study, other sources of GHG emissions or carbon sequestration from cattle husbandry or LUC were not included.

Results and Conclusions

As shown on Table 1, for the period between 2010 and 2013, results show a decrease of both, grazing area (6.8%) and cattle herd (6.3%) while the number of animals sent to slaughter in the period increased 6.2%, meaning a general improvement on efficiency.

Table 1. Changes in cattle husbandry and related greenhouse gases emissions indicators in Mato Grosso do Sul State between 2010 and 2013

Indicator (unit)	Year 2010	Year 2013	(%)
Pasture area (ha)	21.819.304	20.327.800	-6,8%
Total cattle herd (head)	20.820.881	19.518.592	-6,3%
Cattle sent to slaughter (head)	3.685.045	3.912.757	6,2%
kgCO ₂ eq from young cattle (00-24 months)	6.261.249.194	6.518.198.348	4,1%
kgCO ₂ eq from adult cattle (over 24 months)	15.270.467.940	13.134.358.167	-14,0%
Total kgCO ₂ eq emissions from cattle	21.531.717.134	19.652.556.515	-8,7%
kgCO ₂ eq per head cattle sent to slaughter	5.843	5.023	-14%
Head sent to slaughter per head in the herd	0,18	0,20	13%
Head sent to slaughter per female >36 months	0,53	0,64	21%
Head sent to slaughter per ha pasture available	0,17	0,19	14%
kgCO ₂ eq/kg per kg beef* per ha pasture	0,00000119	0,00000110	-7,7%

* kilogram of beef as carcass equivalent

An important change on cattle herd structure in Mato Grosso do Sul could be noticed. There was an increase on number of young animals in the herd (1.1% for 00-12 months and 7.5% for 12-24 months) while animals between 24-36 months and older than 36 months decreased 11.8% and 14.9% respectively. This means that there were less mother cows producing a slightly higher number of calves. As well, steers were being finished faster, since number of animals sent to slaughter have increased. This leads to a smaller area of pastures and, therefore, average stocking rates have increased in the period.

This change on herd structure affected the State's total estimated CH₄ enteric emissions from cattle. Total estimated herd emissions decreased 8.7%. This number raises to 14% when emissions per head cattle sent to slaughter is considered.

This kind of estimates, especially without specific emissions rates for different animal categories, as well as important animal husbandry details on pasture quality and feeding leaves some uncertainty regarding the absolute GHG emission values. The available figure adopted for CH₄ emissions, especially for younger animals might

overestimate emissions from this category. As well, feeding cattle to speed up finishing reduces total enteric emissions per unit beef produced, but in the other hand, leads to GHG emissions somewhere else. This balance should be considered in the future, through more in-depth studies. Also regarding uncertainty, on the other hand, mother cows usually graze poorer quality pastures, what leads to higher CH₄ emissions per head. In this study, since the same methane emission rates were used for the initial and final year, and there was a decrease of 12.4% in the number of females above 36 months of age in the herd, results presented can be considered conservative in this regard.

Finally, regardless of emission rates adopted for calculating emissions, the fast and substantial decrease of 7.7% on emissions per unit beef produced per unit of area within three years, clearly shows that improvements on general herd efficiency can have an important reflexes on GHG emissions. Finally, as indicated by these numbers, improved cattle ranching efficiency in Brazil, led by higher average stocking rates, leads to substantial reductions on GHG emissions from the sector.

References

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