

II SIGEE – Second International Symposium on Greenhouse Gases in Agriculture – Proceedings



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Organizadores

Roberto Giolo de Almeida (Coordenador)

Patrícia Perondi Anchão Oliveira

Maurício Saito

Cleber Oliveira Soares

Lucas Galvan

Lucimara Chiari

Fabiana Villa Alves

Davi José Bungenstab

Embrapa

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Embrapa Gado de Corte

Av. Rádio Maia, 830, Zona Rural, Campo Grande, MS, 79106-550

Fone: (67) 3368 2000

Fax: (67) 3368 2150

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IPCC TIER 2 Approach to Estimate Enteric Methane (CH₄) Emissions in the Livestock Sector of the Amazon Biome

Leila Sheila LISBOA¹, Vinícius Costa Gomes de CASTRO², Lucieta Guerreiro MARTORANO³, João Maria do AMARAL JÚNIOR⁴, Luis Gustavo BARIONI⁵, Patricia Perondi Anção OLIVEIRA⁶

¹Mathematician, PhD in Agricultural Systems Engineering and CAPES/PECUS post-doctorate fellow; ²Master's degree student of the Graduate Program in Animal Sciences (UFPA/UFRA/Embrapa Eastern Amazon), CNPq fellow; ³Agronomical engineer and meteorologist, ⁴PhD in agrometeorology, researcher A of Embrapa Eastern Amazon and professor at PPGCA/UEPA; ⁵Doctorate student of the Graduate Program in Animal Sciences (UFPA/UFRA/Embrapa Eastern Amazon), CAPES/Embrapa fellow; ⁶PhD Animal Sciences and Grazing, researcher A at Embrapa Agricultural Informatics; ⁷PhD in Sciences, researcher A of Embrapa Southeast Livestock.

E-mail: lucieta.martorano@embrapa.br

Introduction

The Brazilian state of Pará features a large bovine herd, which amounted to around 20 million heads in 2014, the fifth largest producer in the country (IBGE, 2015). In quantitative terms, this herd's greenhouse gases (GHG) emissions classify it among the five largest enteric methane (CH₄) emitters in Brazil. The countrywide assessments and scenarios forecast by Barioni et al. (2007) indicated that the values obtained in 2007 might decrease by 2025 due to better efficiency in beef cattle farming Brazil. Those authors forecast increases by 7.4% in the country's herd and by 25.4% in meat production in face of enhanced productivity indicators. Meanwhile, methane emissions were estimated to increase by 2.9%, meaning a decrease by 18% per meat unit produced compared to 2007.

According to Berndt (2012), there are different strategies to decrease GHG emissions by livestock farming, particularly concerning the activity, nutritional, and reproductive managements, besides the adoption of integrated production systems. Techniques such as crop-livestock-forest (CLF) integration may be adopted so that Pará meets those

nationwide GHG reduction forecasts. Among the cities in the state, Paragominas stands out for its effort in employing production systems that result in lower GHG emission indicators, supported by the obtention of the “Green City” seal in the Amazon. This study aimed to estimate enteric methane emissions by the beef cattle herd in the state of Pará based on TIER 2 of the Intergovernmental Panel on Climate Change (IPCC).

Material and Methods

The data used in the study on the number of cattle heads in the state of Pará refer to the period between 2006 and 2015, obtained from the Agriculture and Livestock Defense Agency of Pará (ADEPARA). The information on the bromatology of the main forage grasses grown in the state, as well as data regarding supplementation, were taken from the technical- scientific literature. In order to calculate emissions, the methodology developed by the IPCC (IPCC, 2006) was employed using the methodological assumptions of TIER 2 (Table 1). This methodology allows estimating emissions for each animal category and is based on the estimated gross energy and digestible energy intakes while taking into account the energy requirements for maintenance, growth, and activity. The weight of each animal category, mean daily weight gain, diet quality, and production system were analyzed.

Table 1. TIER 2 approach	
Metabolic functions and other estimates	Equations
Maintenance	$NEm = Cfi.(Weight)^{0.75}$
Activity	$NEa = Ca.NEm$
Growth	$NEg = 22.02 (BW/C.MW)^{0.75}.WG^{1.097}$
Draft Power	$NEwork = 0.10.NEm.hours$
Ratio of net energy available in diet for maintenance to digestible energy consumed (REM)	$REM = [1.123 - (4.092.10^{-3}.DE\%) + [1.126.10^{-5}.(DE\%)^2] - (25.4/DE\%)]$
Ratio of net energy available for growth in diet to digestible energy consumed (REG)	$REG = [1.164 - (5.160.10^{-3}.DE\%) + [1.308.10^{-5}.(DE\%)^2] - (37.4/DE\%)]$
Gross Energy	$GE = [(NEm + NEa + NEwork)/REM + (NEg/REG)]/ DE\%/100$
Emission Factors	$EF = [GE.(Ym/100).365/55.65]$

Results and Conclusions

It was observed that the total enteric methane emissions differed among the mesoregions of Pará. Only the mesoregion comprising the South and Southeast of the state showed an increase in enteric methane emissions between 2006 and 2015 since the state's cattle herd is concentrated in this region. On the other hand, the lowest enteric methane emission values were found in the mesoregion of the Low Amazon and Marajó, where the state's most expressive buffalo herd is found. In 2006, this value was 0.3 times lower than that obtained in the Belém Metropolitan Area and Pará Northeast mesoregion and 0.075 lower than that obtained in the same year for the Southwest and Southeast mesoregion of the state. 2014 and 2015 had the lowest emissions among the nine years analyzed, except in the South and Southeast mesoregion of the state, which had opposite values. Therefore, 2014 had emissions of 302.62 Gg.year⁻¹ while the emissions in 2015 were of 308.36 Gg.year⁻¹ (Figure 1).

It is concluded that the highest estimated emissions are associated with the mesoregions featuring the largest bovine herd in Pará and that the highest emissions took place in 2015.

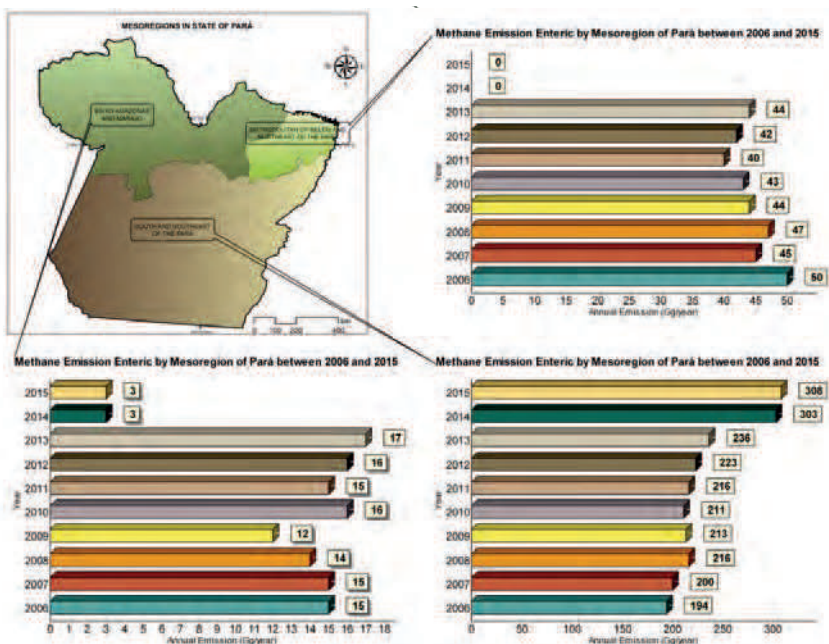


Figure 1. Enteric methane emission in the mesoregions of the state of Pará.

References

BARIONI, L. G.; LIMA, M. A.; ZEN, S.; GUIMARÃES JÚNIOR, R.; FERREIRA, A. C. **A baseline projection of methane emissions by the brazilian beef sector: preliminary results.** In: GREENHOUSE GASES AND ANIMAL AGRICULTURE CONFERENCE. Christchurch, New Zealand. p. 32-33. 2007.

BERNDT, A.; SOLORZANO, L. A. R.; SAKAMOTO, L. S. **Pecuária de corte frente à emissão de gases de efeito estufa e estratégias diretas e indiretas para mitigar a emissão de metano.** In: SIMPÓSIO DE NUTRIÇÃO DE RUMINANTES, 2013, Botucatu. SIMPÓSIO DE NUTRIÇÃO DE RUMINANTES, 2013.

IBGE - Instituto Brasileiro de Geografia e Estatística: Pesquisa Pecuária Municipal, 2015. Available in <<http://www.sidra.ibge.gov.br/bda/agric/>>. Access: 17 may 2016.

IPCC. Guidelines for National Greenhouse Gas Inventories: Chapter 10: **Emissions from Livestock and Manure Management. Volume 4: Agriculture, Forestry and Other Land Use.** 2006.

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