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## Mitigation of environmental impacts of beef cattle production in southern Brazil – evaluation using farm-based life cycle assessment

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### Abstract:

Numerous mitigation strategies have been proposed in order to reduce environmental impacts from beef cattle production. In this sense, this study aimed to evaluate the effects of additive changes in the animal and pasture management of a beef cattle production system typical of south Brazil (baseline scenario – BS), in terms of climate change, land use and fossil depletion. These changes included: increasing the forage production; improving the forage quality; introducing legumes to replace nitrogen fertilization; improving the reproductive rates and; increasing the forage utilization efficiency. It was also considered the stabilization of the soil carbon (C) stocks in a long-term perspective. In BS was estimated, per kg of live weight gain, the greenhouse gas (GHG) emission of 22.5 kg of CO<sub>2</sub> equivalents; the land use of 234.8 m<sup>2</sup>a and; 0.004 kg of oil equivalents in fossil depletion. Changes in forage production and quality resulted in GHG emissions equivalent to 7.8 – 20.7% of the BS and, to 0.5 – 1.2% of the BS with reproductive animal improvements. Land use reduces 9.4 – 30.6 times with these changes. The introduction of legumes to replace the nitrogen fertilizers engendered negative values of fossil depletion. The intensification of pasture utilization results in GHG emissions corresponding to 0.5% of the BS, and in a land use 32 times lower. Considering the long-term stabilization of soil C stocks, the systems that received nutritional and reproductive improvements presented reductions of GHG emissions from 2.5 – 3.2 times. A sensitivity analysis indicated the possibility of all short term improved scenarios become net sinks of C if gradual increments of root / shoot ratios in the range of values suggested by Intergovernmental Panel on Climate Change for Pampa Biome were applied. The scenarios confirm the hypothesis that productive improvements and environmental protection are not contradictory, and highlight the importance of biomass C dynamics and regional peculiarities in mitigation of environmental impacts from forage-livestock systems.

**Key words:** Global warming. Grassland restoration. LCA. Rotational grazing. Soil carbon stocks. Sustainable intensification.

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