Economics of greenhouse gas mitigation strategies in a north-eastern Brazilian beef production system

Katrin Agethen · Rogerio Martins Mauricio · Claus Deblitz

1 Thünen Institute of Farm Economics, Braunschweig, Germany
2 Universidade Federal de São João del-Rei, Brazil

Background and Approach

Typical beef production systems in North Eastern Brazil can be described as low-input low-output systems.

Those systems face several challenges: low productivity, low economic performance, pressure for alternative land uses and environmental impacts.

The imperative to make these systems more sustainable needs to consider farmers’ interests of performance and economic viability.

We address the following questions:
- How do available mitigation strategies affect the greenhouse gas emissions profile and intensity?
- And which impact do they have on farm economics and performance?

Study Site and Methods

Study Site
- Baseline: beef production system in Maranhão, Brazil, as described by CEPEA (www.cepea.esalq.usp.br/en)
- SPS scenario: bases on field observations of a beef farm (São Francisco do Brejão, Maranhão, Br)

Methods
- Economic analysis: TIPI-Cal tool, a production and accounting model used in the agrif benchmark network
- GHG emission calculation: IPCC 2019 refined methodology (Tier 1 / Tier 2)

Data and Results

The silvopastoral mitigation scenario (SPS scenario) includes six production system changes compared to the baseline:
- improved herd management,
- subdivision of pastures,
- rotational grazing practices,
- feedlot finishing,
- grassland diversification with legume integration,
- native tree regeneration and eucalyptus plantings.

Land coverage changes from 70 % open pasture and 30 % natural vegetation in the baseline to 50 % reserved for natural vegetation, 43 % covered with mixed pasture and 7 % mixed pasture with integrated Eucalyptus row plantings in the scenario.

Greenhouse gas emission (GHG) analysis results in higher emissions from the beef production activity per cultivated ha (+425 %, base: 700 ha in baseline vs. 500 ha in SPS scenario) but a reduction per kg liveweight added (-31 %).

Major increase derive from the higher stocking rate and from changes in land management.

Net sequestration potential of the soil is enhanced via improved land management.

Increased biomass production of pasture and woody species (incl. Eucalyptus, leguminous shrubs and regenerated trees) are additional (temporary) carbon sinks.

Note: The SPS scenario sets 29 % of the pasture in cow - feedlot finishing production.

Conclusions

Farm economics
- The overall farm profitability is positive for the SPS scenario, also remunerating land and labour costs in contrast to the baseline.
- The transformation requires high investments in forage production, animal production and labour force.

GHG mitigation
- A substantial reduction in GHG emission intensity (CO₂eq, per kg LW added) is possible: -29 % for cow-calf and -45 % for finishing production.
- The increased sequestration service of soil and forages and woody biomass helps to offset increased GHG emissions.

Overall
- The increase in land, labour and capital productivity is promising for farmers’ uptake of sustainable production methods.
- Support policies and financial support conditions need to consider the risk of rebound effects.

Note: The SPS scenario sets 29 % of the pasture in cow - feedlot finishing production.

Figure 1: Animal performance, feed characteristics and land management of the baseline and scenario (CC: Cow-calf, FIN: Feedlot finishing)

Figure 2: Annual greenhouse gas emissions in kg CO₂ equivalents per ha (left axis), and per kg liveweight (right axis) (CH₄, 28 CO₂eq; N₂O, 248 CO₂eq).

Figure 3: Whole farm costs, returns and profitability in 1,000 USD

Contact: Katrin Agethen · katrin.agethen@thuenen.de
Thünen Institute of Farm Economics, Bundesallee 63, 38116 Braunschweig
www.thuenen.de