

A Model of the Dynamics of Cattle Systems Types to study Greenhouse Gases Mitigation in the Brazilian Conditions

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This work reports on the development of a multiperiod linear programming model to optimize private profitability of the trajectories of land use of the most representative types of cattle production systems in Brazil. Each type of production system (TPS) carries intrinsic properties such as stocking rates, productivity, profitability and greenhouse gases emissions, among others. The decision variables correspond to the area of each TPS in each biome and each year. The model represents the dynamics of land use through transition of one type of production system to another, computing the costs associated with each transition. The dynamics of TPS is constrained by technically feasible transition pathways, financial resources available for investment, maximum greenhouse gases emissions, legally protected areas, dynamics of land use by other activities and the demand for cattle products over time. The model also considers, independently, the resistance of farmers to a change of the current TPS and to the adoption of a new TPS.

As a first test, the model prototype was run with data aggregated for Brazil for a 17 years period (2008 a 2025). The types of production systems allowed were: degraded pastures; extensive pastures; crop-livestock integrated systems; feedlot finishing and spare land (*i.e.* land that was left to other uses).

Seventy-five optimal solutions were obtained by combining five levels of availability of financial resources for investment and fifteen levels of emission constraints. Profit was sensitive both to financial resources available and to the maximum level of emission allowed. At a given (constrained) level of emissions, investments always increased profit. However, profit was more sensitive to emissions constraints under higher levels of investment and, therefore, returns on investment were lower when emissions constraints were tighter.

The next steps are the discussion of the model with experts on beef and dairy production in order to define regional data and to validate and refine the model. The sequence of those modeling studies will enable improved evaluation and substantiate public policies related to mitigation, particularly the Brazilian National Policy for Climate Change, and will also address the analysis of representative agriculture pathways.