# Is the Low Carbon Agriculture Credit Program impacting pasture area and quality in Brazil's Northeast Region?

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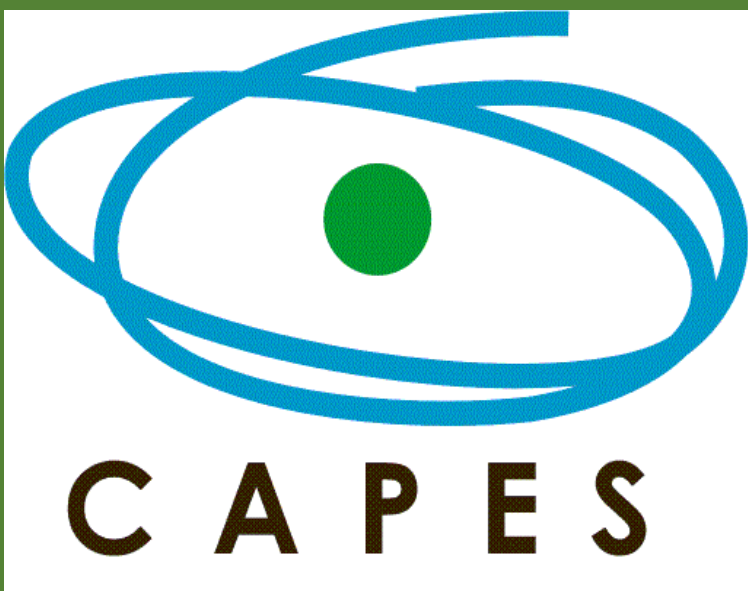Paulo, jbsferre@usp.br

# Is the Low Carbon Agriculture Credit Program impacting pasture area and quality in Brazil's Northeast region?

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## Overview

The Low Carbon Agriculture Plan (LCA Plan) has as a major goal a set of measures to mitigate emissions of Greenhouse Gases (GHG) between 36,1% and 38,9% of the total emissions until 2020 (Brazil, 2012).

To achieve these targets an important initiative of the LCA Plan was a particular rural credit program (LCA Program) introduced in 2010 at the federal level to encourage farmers to implement sustainable production systems in agriculture (SPS) (Bacen, 2011).

About 4.09 Mha of Brazil's Northeast region are occupied by degraded pastures, and it represents 15% of the total area of the pasture areas and 6% of the Northeast territory (IBGE, 2018a).

In this sense, the LCA subprogram for the recovery of degraded pastures (RDP) and the Crop-Livestock-Forestry Integration system (CLFI) have been recently adopted as instruments these can improve the quality of the pasture, while at the same time mitigating GHG emission levels (Brazil, 2012).

## Objective

This paper evaluates the impact of RDP and CLFI subprograms on the evolution of pasture areas in good and degraded conditions in the Northeast of Brazil, at the municipal level from 2013 to 2017.

## Data

A dummy variable is assigned with value of 1 for municipalities that had farmers who hired the RPD or CLFI credit lines and 0 otherwise.

The covariates for matching at the municipal level are: binary variables identifying the predominant biome; level of education of the producers by share (%) of the total pasture area; gross value of production per unit of area in agriculture; GDP per capita; altitude and total area (IBGE, 2018); and the amount of credit (from another source) used by the cattle ranchers (Bacen, 2018).

## Model

To flexibilize the selection hypothesis in the observables, we combined the pairing with the method of differences in differences, according to Heckman et al. (1997, 1998). Mathematically, the estimator is defined as

$$D_{t_0,t_1} = E\left[Y_{it_1}^1 - Y_{it_0}^0 | T_i = 1, X_i\right] - E\left[Y_{it_1}^0 - Y_{it_0}^0 | T_i = 0, X_i\right]$$

where $Y_{i,t}^d$ is the logarithmic of pasture area, for municipality $i$, in time $t$, with treatment status $d$; $T_i$ is a dummy variable of treatment for municipality $i$; and $t$ is the year associated with pasture area.
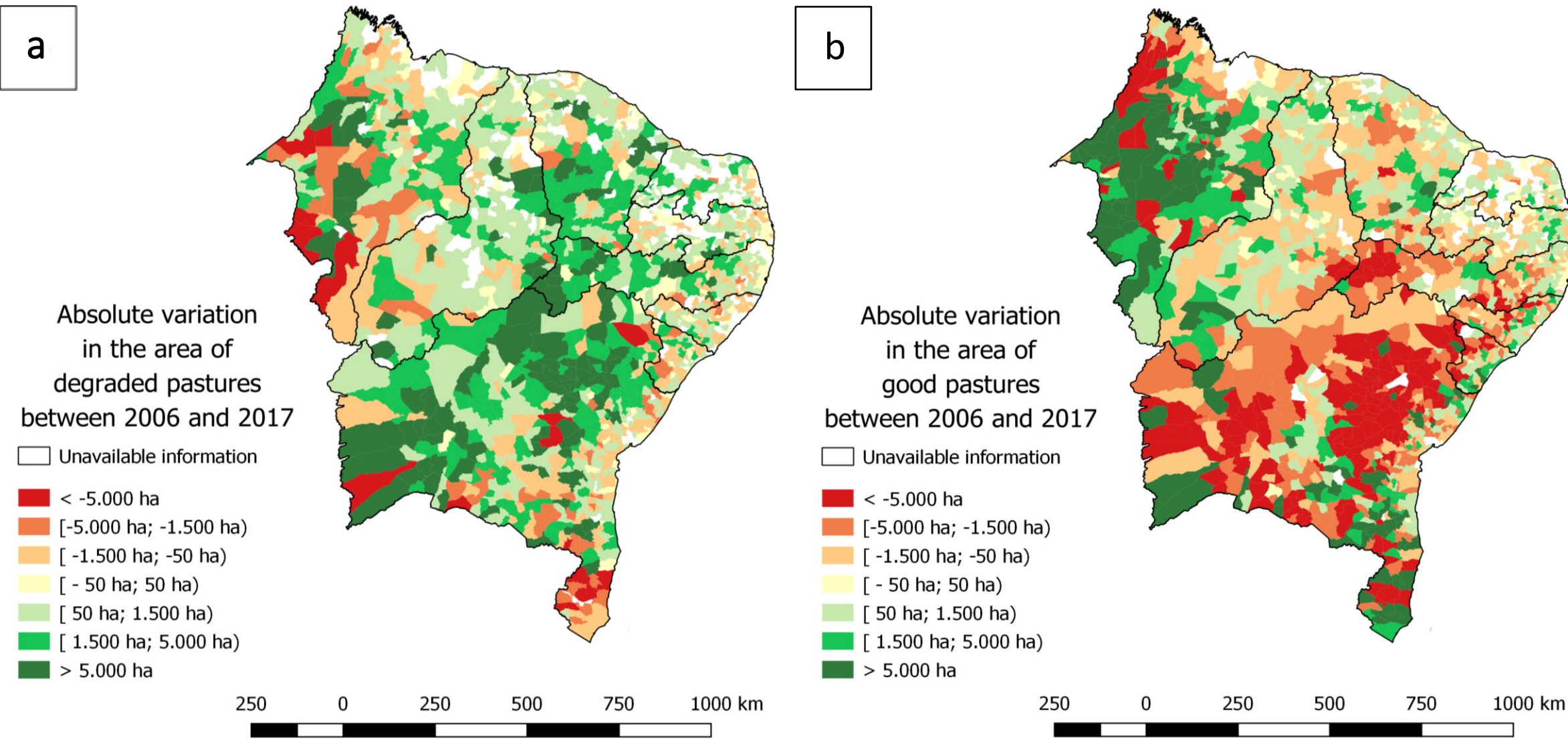
## Results

Evolution of pasture areas in Northeast region of Brazil, between 2006 and 2017

| | 2006 | | 2017 | |
|---|---|---|---|---|
| | Untreated | Treated | Untreated | Treated |
| Natural | 44.9% | 31.1% | 35.8% | 25.6% |
| Degraded | 6.6% | 5.9% | 10.2% | 7.4% |
| Good | 48.5% | 63.0% | 54.0% | 67.0% |

Impact evaluation of use of RDP or CLFI credit lines on evolution of pasture areas in Northeast region of Brazil, between 2006 and 2017

| | Natural pastures (placebo) | Degradeted pastures | Good conditions pastures | Mean bias | Nº Obs. |
|---|---|---|---|---|---|
| NN(1) whithout replacement | -0.76% (-0.0076) | -15.10% (-0.1637) | -2.17% (-0.0219) | 18.6% | 268 |
| NN(1) with replacement | 41.79% (0.3492) | -20.71% (-0.2321) | 7.98% (0.0767) | 8.4% | 953 |
| Radial | 23.44% (0.2106) | -10.47% (-0.1106) | -0.33% (-0.0033) | 5.4% | 727 |
| Kernel (PSM) | 21.49% (0.1946) | -10.72% (-0.1134) | -0.53% (-0.0053) | 6.9% | 930 |
| Kernel (Mahalanobis) | -9.35% (-0.0982) | -18.54% (-0.2051[5%]) | 16.7% (0.1490[10%]) | - | 945 |

Absolute variation in the area of degraded pastures between 2006 and 2017

☐ Unavailable information
▮ < -5.000 ha
▮ [-5.000 ha; -1.500 ha)
▮ [ -1.500 ha; -50 ha)
▮ [ - 50 ha; 50 ha)
▮ [ 50 ha; 1.500 ha)
▮ [ 1.500 ha; 5.000 ha)
▮ > 5.000 ha

250  0   250  500  750  1000 km

Absolute variation in the area of good pastures between 2006 and 2017

☐ Unavailable information
▮ < -5.000 ha
▮ [-5.000 ha; -1.500 ha)
▮ [ -1.500 ha; -50 ha)
▮ [ - 50 ha; 50 ha)
▮ [ 50 ha; 1.500 ha)
▮ [ 1.500 ha; 5.000 ha)
▮ > 5.000 ha

250  0   250  500  750  1000 km

## Policy implications

The amount of credit from the LCA Program used in the Northeast region municipalities is very low comparing with the size of degraded pasture areas. Moreover, the average credit resources between 2013 and 2017 of the treated municipalities used in the analysis was about US$ 0,5 million.

Credit resources have been contracted below the total amount available from the government and there is also lack of tools for monitoring, control and establishment of priority regions for the resources (still uncertain even for the federal government) (ABC Observatory, 2017).

Other characteristics of the LCA Program are also supposed to significant barriers to its expansion:
- Farmers face higher transaction costs in the LCA Program than other sources of credits because a very specific technical project to the management systems covered by the LCA program to be implemented is also a requirement (Brazil, 2012).
- Assad (2011) highlights the lack of technical knowledge on low carbon agriculture in Brazil from both farmers and professionals in the technical area, as well as the competition with other rural credits with lower interest rates, as reasons for the low demand for the LCA Program.