Number, maps and facts: Agriculture leads environmental preservation

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Abstract

This paper presents the role of Brazilian agriculture in the preservation of native vegetation and palustrine and lacustrine ecosystems. After the approval of the New Brazilian Forest Code, farmers are required to register their rural property in the Rural Environmental Registry. By April 30, 2017, more than four million farmers were included, an area of approximately 408 million hectares. The collected data add up to hundreds of millions of polygons, requiring a computational effort and geoprocessing techniques to treat the data and turn it into information. The results indicate that the area reserved to vegetation preservation by farmers represents 20.5% of Brazilian territory, thus demonstrating the importance of the agriculture in environmental preservation.

1 Introduction

Brazilian agriculture has a new and powerful tool: the Rural Environmental Registry System (SiCAR in portuguese). SiCAR is an electronic registry for farms (rural properties) [1], that was created by the Brazilian Forest Service of Ministry of the Environment, as required by the Brazilian Forest Code (Law 12.651/2012) [2]. According to Brazilian Forest Code, in the Amazon biome, for instance, 80% of the farmland should be preserved. Until April 30, 2017, 4,104,247 farms were included in the system, totaling 407,999,690 hectares.

SiCAR includes data about the farm boundary and its internal parts: explored areas, permanent preservation, legal reserve, public infrastructure etc. There are 18 categories of pre-defined land use in SICAR. The boundaries of these categories are defined through Rapid Eye satellite images with 5 meters of spatial resolution. For each category, there is, in general, more than one polygon per farm that delimits it. All these data result in hundreds of millions of polygons, with associated attributes.

The goal of this paper was to analyze SiCAR database in term of the area reserved to preservation and conservation of native vegetation and water bodies in the country by the farmers. The entire SICAR database was processed by experts of the Strategic Territorial Intelligence Group (GITE) of Embrapa. The results reveal the important role of agriculture in environmental preservation and highlight trends about land use and occupation in Brazil.

2 Materials and methods

The data used in this paper were obtained from the website of the Rural Environmental Registration System of the Ministry of the Environment [1]. The download of data from the Ministry of the Environment of each of the 5,570 Brazilian cities resulted in a geocoded archive of more than 40 compacted Gigabyte. The data is provided in 18 different categories, for each farm, but for the purposes of this study, only four categories were considered: permanent preservation areas (PPA), legal reserve (LR), hydrography and native vegetation. In the city of Adamantina (São Paulo state), for example, the file containing the permanent preservation areas (PPAs) of farms has 1,754 polygons. Considering all cities in the state, there are around 800,000 polygons referring only to one of the 18 categories (PPA). Gathering PPAs and legal reserve areas, there are more than one million polygons to be processed to extract the area destined to native vegetation preservation in the 307,000 farms of São Paulo registered in the SICAR.

The following steps were performed to calculate the areas reserved to preservation by agriculture:

- Using the Geographic Information System ESRI ArcGIS, for each of the four categories, the "Repair Geometry" function was applied to correct geometry problems in the categories shapefiles;
- Each shapefile category was clip by the Brazil cities through the function "Intersects";
- After the "Intersects" function, each category was aggregated as a single polygon per city through the "Dissolve" function;
- In order to compose the “preserved vegetation” shapefile, the four shapefiles categories were then unified and the overlays were removed with the function "Union";
- After the unification of the four categories, the “preserved vegetation” shapefile was again re-organized in cities by the "Dissolve" function;
- the amount of areas reserved to vegetation preservation by the city was calculated through the "Calculate Area" function. .

The detailed method is described in the Embrapa project website[1].

3 Results

The Census of Agriculture 2006 [3], last census developed by Brazilian Institute of Geography and Statistics (IBGE), present 5,175,636 farm properties in Brazil. The concept of farm in both contexts, Census and SICAR, is quite similar. By comparing with Census estimate, almost 80% of Brazilian farms were registered in the SICAR (Figure 1) by April 2017. In the Northeast region, more than 1,510,000 units (62%) were not registered. In other Brazilian regions, the number of farm properties is higher than Census. For instance, in the North, the number of registered farmland is 26% higher than those included in the 2006 Census. An increase also occurred in the South (16%), Central West (17%) and Southeast (11%).

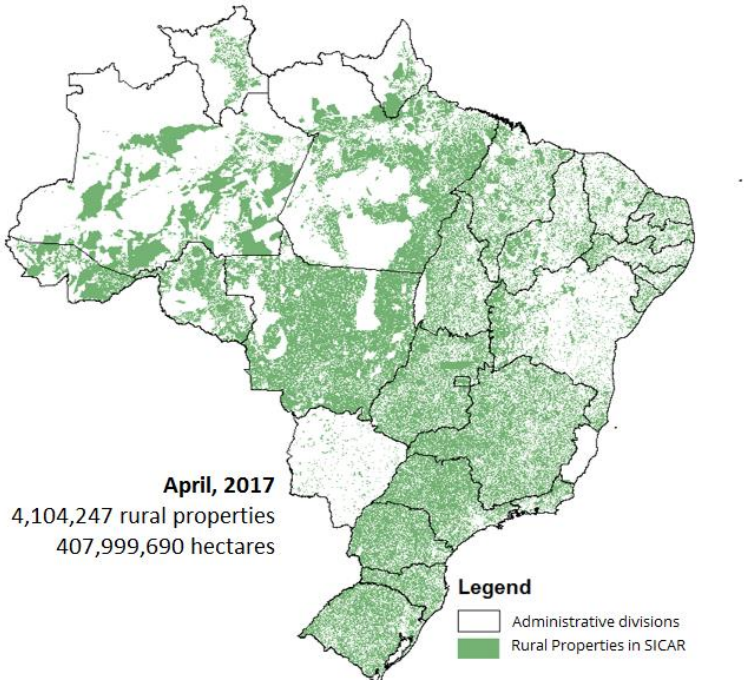

Figure 1: Rural Properties registered in SICAR by April, 2017.

For only two states – Espírito Santo and Mato Grosso do Sul – SICAR data is not available yet. Regarding to the area reserved to vegetation preservation, Southern region preserve 26% of the land, number well above what is required by the Forest Code (20% in that region). The same occurs in all other regions: in Southeastern region the farmers preserve 29%, Central-Western region 49%, North 56%, Northeast 50%.

[1] www.cnpm.embrapa.br/projetos/car/

In São Paulo State (Figure 2), the areas of permanent preservation, legal reserve and surplus vegetation in 309,360 farms, totalize 3,800,000 ha. This area represents more than 15% of the whole state and 22% of the rural area. The area reserved to vegetation preservation in farmlands in São Paulo is higher than all existing conservation units and indigenous lands together (4.5%). Throughout the country, the area reserved to vegetation preservation by farmers represents more than 20% of the national territory, while protected areas represents 13% of the whole country.

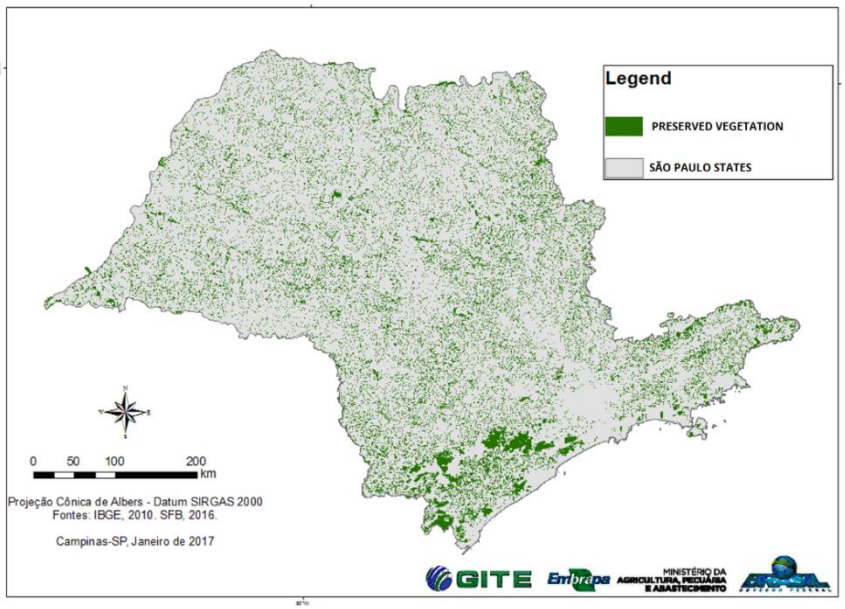

Figure 2: Areas destined to vegetation preservation in São Paulo State.

4 Conclusions

SICAR data shows that no one reserve areas to preserve native vegetation more than farmers in Brazil. The country allocates 66% of its territory to the protection of native vegetation. It would reach almost 75% if pastures located in Pampa, Cerrado, Pantanal, and Caatinga biomes are included. There is no detailed data about the quality of native vegetation [4]. However, the Environmental Regularization Program, to be included in SiCAR, will be adopted to promote the vegetation regeneration process.

The area reserved to vegetation preservation in farmlands represents 20.5% of Brazilian territory, while areas destined to native vegetation protection in conservation units, indigenous lands or unregistered lands represent 13.1%, 13.8%, and 18.9%, respectively.

At Embrapa website, SICAR data can be consulted and analyzed from different spatial perspectives such as cities, states or regions. State maps, aggregated data and summary indicators are also available, demonstrating the key role played by farmers and by agriculture in preserving and conserving native vegetation and waters of the country.

References

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