



LAND USE AND COVER MAPS FOR MATO GROSSO FROM 1985 TO 2019

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Abstract

The land use change characterized by the conversion of native vegetation and forests to pastures and agricultural crops is one of the biggest drivers of deforestation in tropical regions. At the expense of expanding livestock production and soybeans cultivation, the Amazon and Cerrado biomes in Brazil suffer from accelerated deforestation and losses of biodiversity. The state of Mato Grosso is one of the largest agricultural frontiers in the world and is one of the largest producers of commodities in the country. For understand this land use dynamics, the objective of this work was to evaluate the historic of land use in the state of Mato Grosso (1985 to 2019), using data from Mapbiomas. Thus, it was produced maps representing use in the years 1985 and 2019, which provide information on the expansion of agricultural crops and pastures on native vegetation. It was observed that native vegetation reduced area, with a conversion of 22.1 Mha or 28% loss between 1985 and 2019, while the pasture grew 165% with an area of 12.8 Mha. The agriculture class expanded by 349% (9 Mha) in relation to 1985. Therefore, the analyzed data set provides relevant information to understand the impact of land use in the state of Mato Grosso due to the expansion of agribusiness in Brazil.

Keywords: agriculture; deforestation; time series; MapBiomas

Presentation: <https://youtu.be/7k311ZwsEbA>

INTRODUCTION

The use and the land use change is a force of global importance, since global use changes in native forests and vegetation are being driven by the need to provide food, fibers and water for the growing world population, consequently this change is followed by the inadequate use of natural resources and considerable losses of biodiversity (FOLEY et al., 2005). The production of agricultural commodities for domestic and foreign markets is increasingly driving deforestation in tropical regions (HENDERS; PERSSON; KASTNER, 2015).

Over 30 years (1984-2014) in a study carried out by Marques et al. (2020), the transition between the Amazon and Cerrado biomes suffered more deforestation than the forests and savannas in each biome, with great losses of biodiversity due to the expansion of soybeans and cattle. Thus, an area of particular interest to understand this dynamic in Brazil is the state of Mato Grosso, where one of the most extensive agricultural frontiers in the world occurs (SIMOES et al., 2020).

The state of Mato Grosso produces 26% of soybeans, 35% of corn and 71% of cotton grown in Brazil (IMEA, 2020). In addition, it contains 15% of the country's cattle herd, being the state with the highest number of effective herd (13%), considering cattle, buffaloes, sheep and goats (INPE, 2020). The high productivity is associated with considerable environmental impacts, in particular deforestation, due to the agriculture production, so the processes of land use change in the state are of great importance for understanding the management of land use. from the earth (MILHORANCE; BURSZTYN; SABOURIN, 2020). Besides that, Mato Grosso has one of the highest deforestation rates in the Amazon region, 1,702 km² of forest were deforested just in 2019, with an increase in

deforestation rates by 14% from 2018 to 2019 (INPE, 2020).

Based on the above motivation, this paper describes a set of annual land use and land cover data for Mato Grosso from 1985 to 2019. Land use maps have been developed, which are temporally consistent and provide information on changes in native vegetation and expansion of agricultural crops, pastures and planted forest.

MATERIALS AND METHODS

The selected study area was the state of Mato Grosso, which comprehend the Cerrado, Amazon and Pantanal biomes and is the largest soybeans and cattle producing state in Brazil, with high levels of deforestation to the detriment of global agricultural expansion (GARRETT et al., 2018).

It was used the platform from the Project of the Annual Mapping of Coverage and Land Use (MapBiomias), covering the Cerrado biome in an annual historical series from 1985 to 2019 (MAPBIOMAS, 2020). In a first level, the MapBioma classifies the land use into six classes: forest, natural non-forest formation, agriculture, non-vegetated area, water bodies and unobserved and; in the second level it classifies in 12 classes (MAPBIOMA, 2020). These classes together, regardless of level, represent all land use coverage.

The classes of land use relevant to the analysis are verified at the second level and include areas of agricultural (agriculture) with annual and perennial crops and livestock farming, such as areas occupied with of pasture, referring to areas of natural or planted pastures. The different covers of natural forest and areas with natural non-forest formation, such as the rural formation observed with a predominance of herbaceous strata (dirty field, clean field and rupestrian field, existing in the Cerrado and the flooded areas, which can be observed in the Pantanal) were considered as a single class of native vegetation.

While areas with tree species planted for commercial purposes were designated as planted forest. Thus, the four analyzed classes were: agriculture, pasture, planted forest and native vegetation. The other classes observed in Mapbiomas were mining, not observed, bodies of water, urban infrastructure, other non-vegetated areas and mosaic of pasture and agriculture, that were aggregated in a class named in this work as others.

Thus, the classification procedure aiming an analysis of the history of land use was carried out from the survey of land use and cover statistics for the state of Mato Grosso. The land use maps were made according to the bases made available by MapBiomias (MAPBIOMAS, 2020) whose information was clipped for the state considering the Amazon, Cerrado and Pantanal biomes, representing data for the years 1985 and 2019.

Using ArcGis software, classes of land use, native vegetation, planted forest, agriculture, pasture and others were highlighted.

RESULTS AND DISCUSSION

In the state of Mato Grosso, in 1985, agriculture, pasture, planted forest and native vegetation together accounted for 99% of land use, while 1% were destined for the other classes defined by MapBioma (Figure 1). During a 34-year historical series, from 1985 to 2019, the landscape was changed and land uses were modified. Thus, in 1985 the class of native vegetation that includes natural forest and non-forest natural formations covered 88% of the territory of Mato Grosso, with approximately 79 million hectares (Mha). The total extension of the grazing class reached more than 7 Mha that year, with the largest expansion of land cover (8% of the territory). The minority classes of land cover evaluated in terms of extension were planted forest (110 ha, 0.0001%), other classes (7 Mha, 1%) and agriculture with 2 Mha (3%) (Figure 1).

Analyzing the rate of annual change of area in the different classes of land use and its trends between 1985 and 2019 (Figure 1), it is observed that the class referring to native vegetation was the only one that presented an area reduction, with a conversion of 22.1 Mha or 28% loss of natural forests and natural non-forest formations (native vegetation) between 1985 and 2019, while pasture grew 165% with an area of 12.8 Mha. The agriculture and forest plantation classes had the most areas expanded by 349% (9 Mha) and 42533% (46,968.64 ha), respectively, in relation to 1985.

The highest rate of annual land use change occurred between 1985 and 2007, with loss of natural forest and expansion of pasture and agriculture. Pasture had its greatest expansion in 1994 with gains of approximately 1 Mha (10%) that year and agriculture had its greatest expansion in 2004 with expansion also of approximately 1 Mha (21%). Annual land use changes for forest planting purposes occurred more rapidly between 1991 and 1995, but there were also high expansions until 2014.

The native vegetation class showed a large reduction in area between 1985 to 2019, with an average loss of -1% per year corresponding to -651,181 ha per year. This observation was more representative between the years 1994 to 2005, when there was an area loss of more than 13 Mha (average of -2% per year), the largest area loss observed for native vegetation was during 2003 with a loss of approximately 1.5 Mha (2%). These declines in the reduction of native vegetation in the late 2000s coincided with fluctuations in commodity markets and the implementation of several policy initiatives aimed at restricting credit for deforesters (MACEDO et al., 2012). Losses were lower from 2006 to 2019, on average, -0.5% per year or -3.8 Mha in that period.

The planted forestry class had the smallest extent, but showed rapid growth between 1991 and 1995, at an average rate of 164% per year in that period, with the highest annual growth in 1991 (652.5 ha, 473%). The agriculture class increased by an average of 5% per year in the period from 1985 to 2019. Excluding outliers in 1986 and 1987 (-1% reduction compared to the previous years), this class showed gradual growth in an area with higher rates in the period from 1988 to 2007, especially in 2004, which increased by 21% or expanded by 1.2 Mha in area. These periods corresponded to a boom in cropland because of the soy expansion, with the area planted in soy doubling from 3 to 6 Mha and production increasing by 85% (MACEDO et al., 2012).

Regarding the pasture class, there was an expansion between 1985 to 2019 with an average rate of 3% per year. The highest annual rate of pasture expansion was observed in 1994 (1.2 Mha, 10%), with a lower rate for other years (-3% to 8%). Accelerated area expansion for pasture took place from 1985 to 2007, an average of 5% per year, with an increase of 14 Mha in that period. The large-scale clearings of forest for pasture decreased rapidly after 2005, dropping over 70% from 2005 to 2006 alone because of market signals and policy measures aimed at reducing illegal deforestation (MACEDO et al., 2012). The year of 2019 was represented by keeping the area relatively equal to the previous year.

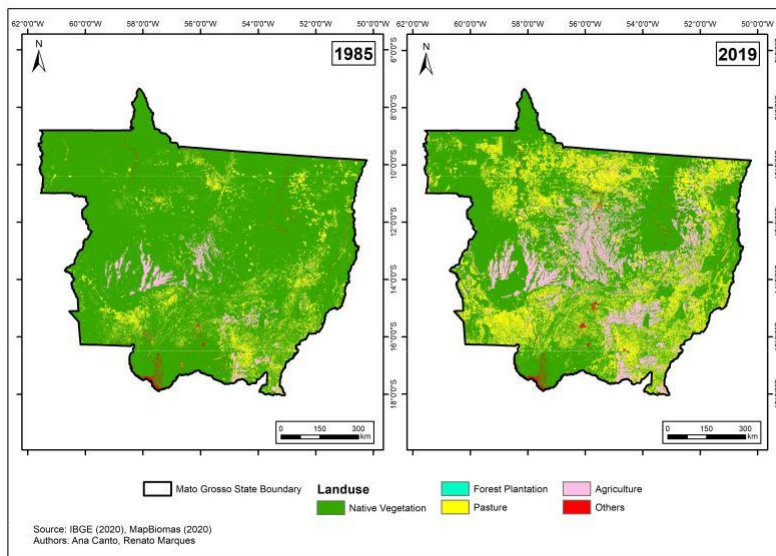


Figure 1: Map of land use and cover in 1985 and 2019 in the state of Mato Grosso

CONSIDERATIONS

From MapBiomas data presented in this work, there was a continuous reduction of native vegetation in the state of Mato Grosso and a greater expansion of agriculture and livestock areas. Thus, the intensification of production systems, especially those based on agriculture and livestock is essential to improve current land use management and to reduce pressure on deforestation. The state of Mato Grosso is located in one of the most extensive agricultural frontiers in the world, in addition, this state is the largest producer of cattle and soybeans from Brazil.

Consequently, assess which is the best productive strategy, aiming the preservation of forests and native vegetation, is extremely important for better land use management in the state.

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