São Paulo, November 2016.

MATO GROSSO INSTITUTE OF AGRIBUSINESS ECONOMY
Collection and analyses of micro data from Mato Grosso Agribusiness

BASIS FOR MONITORING THE PCI PRODUCTION GOALS - MATO GROSSO

1. INTRODUCTION

In 2015, during the Climate Change Conference (COP-21), the Mato Grosso state government "established" commitments with the international community regarding local agriculture, tracing goals for 2030 aimed at: increased agricultural production, conservation of native forests and integration between Mato Grosso production chains, besides from other specific goals.

That being said, the aim of this study is to demonstrate the history and the progress of the analyses carried out by Imea, tracing a baseline for comparison against the PCI production goals, and thereby, monitor them.

2. METHODOLOGY

Table 1 summarizes the items that will be analyzed in the present report.

TABLE 1. Project items

1. Area	2. Productivity	3. Production
1.1 Soybeans	**2.1** Soybeans	**3.1** Soybeans
1.2 Maize	**2.2** Maize	**3.2** Maize
1.3 Eucalyptus	**2.3** Eucalyptus	**3.3** Eucalyptus
1.4 Teakwood	**2.4** Teakwood	**3.4** Teakwood
1.5 Pasture	**2.5** Beef	

2.1. AREA

The survey developed by the Mato Grosso Institute of Agribusiness Economy (Imea) for the 1st and 2nd harvests is based on geo-technology tools that allow the attainment and treatment of a large quantity of data and information. The analysis carried out with the help of remote sensing allows imaging the earth's surface through the capture and registration of the spectral response of the object. The method used is of unsupervised classification, which consists of interpreting the images from sensors and attributing meaning to the pixels as a function of numerical characteristics. These characteristics are attributed based on samples collected in the field, ensuring better quality of the data used, which is divided in classes (soybeans, maize, millet, cotton and others). After processing this information, a statistical characterization of the reflectance values for each class of information is carried out. Subsequently, the specific and previously known types of soil coverage are identified for the area. With the aim of ensuring the quality of the data, Imea validates the work using the Kappa index, which reveals the concordance degree between the data and measures the reliability and accuracy of the final estimation – in which the coefficients used vary between 0 and 1 (the closer to 1, the greater the quality of the data).

The mapping of planted forest areas, on the other hand, is different from that of the 1st and 2nd harvests because it uses the supervised classification method. This is followed by a temporal analysis and interpretation of physical changes of the environment for the selection of the areas proposed in the study.

2.2. PRODUCTIVITY

The consolidated productivity values are estimated differently for each crop. In the case of agricultural crops (soybeans and maize), Imea has been collecting the data since the 2007/2008 harvest along with market agents, producers and rural unions.

In the case of the beef cattle industry, however, productivity (C) is estimated through calculations that involve the quantity of meat produced (A), which is provided by IBGE, divided by the pasture area of the state (B).

$$\frac{A}{B} = C$$

A = Quantity of beef produced in the year
B = Area allocated for pastures
C = Quantity of beef produced per hectares in the year

The survey on the productivity of planted forests was based on a field study carried out during the month of October/2016 in the main production regions, as well as on information collected by e-mail with inventory of some rural properties associated to Arefloresta (Mato Grosso Association of Reforestation), totalizing data from 19 farms in 11 municipalities of Mato Grosso. Although planted forest areas were found in all regions, the productivity survey was not extended to some macro regions of Mato Grosso and, thus, the value considered for these regions was the average state productivity.

2.3. PRODUCTION

The production information for each crop is obtained through multiplying the area by the productivity of that crop.

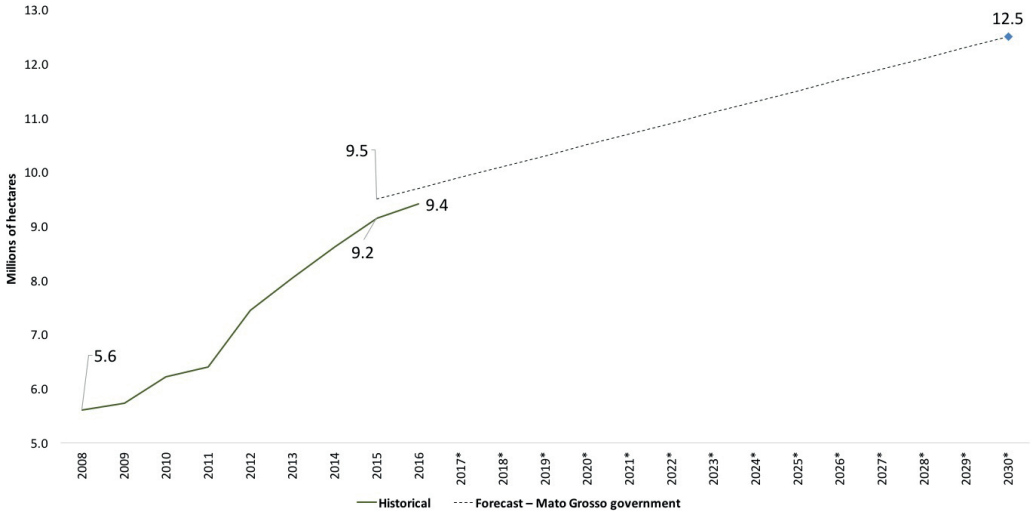
3. RESULTS

3.1. AREA ALLOCATED TO AGRICULTURE

With the separation established for area, productivity and production, the partial outlook demonstrates the relationship between the historical evolution of these indicators and the goals traced by the state government.

Graph 1 shows the evolution of 1st harvest areas in Mato Grosso, which are identified by Imea and the government forecast for these areas in 2030.

GRAPH 1. Evolution of agricultural areas in Mato Grosso and forecast for 2030



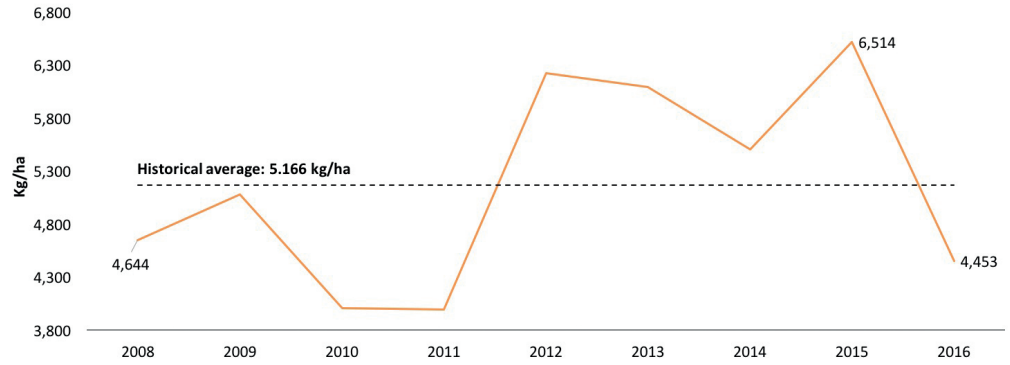
*Forecast. Source: Imea, Mato Grosso State Government.

All data on areas allocated to agriculture until 2016 (corresponding to the 15/16 harvest) are already consolidated, totalizing around 9.41 million hectares of soybeans and cotton in Mato Grosso territory. The expansion estimated by the state government for 2030 is of 32.86% with areas allocated to agriculture reaching 12.50 million hectares. It is worth highlighting that between the years of 2008 and 2016, 1st harvest areas allocated to agriculture expanded 67.72%, from 5.61 million hectares to the current 9.41 million hectares.

3.2. PRODUCTIVITY IN AGRICULTURE

With regards to productivity development, with the exception of maize, the numbers show stability. **Graph 2** and **graph 3** represent the evolution of these indicators for the two main crops in the state (maize and soybeans).

GRAPH 2. Evolution of maize productivity in Mato Grosso



Source: Imea.

GRAPH 3. Evolution of soybean productivity in Mato Grosso

*Forecast. Source: Imea.

It is possible to observe that soybean productivity barely changed in the last years and, even in years with good rainfall rates (important driver of productivity), the production indexes barely increased. Maize is and "exception" in this stability considering that since 2011, favored by the good rainfall rates and with the stronger insertion of hybrid and genetically modified seeds, the cereal has been registering much higher productivities than the historical average.

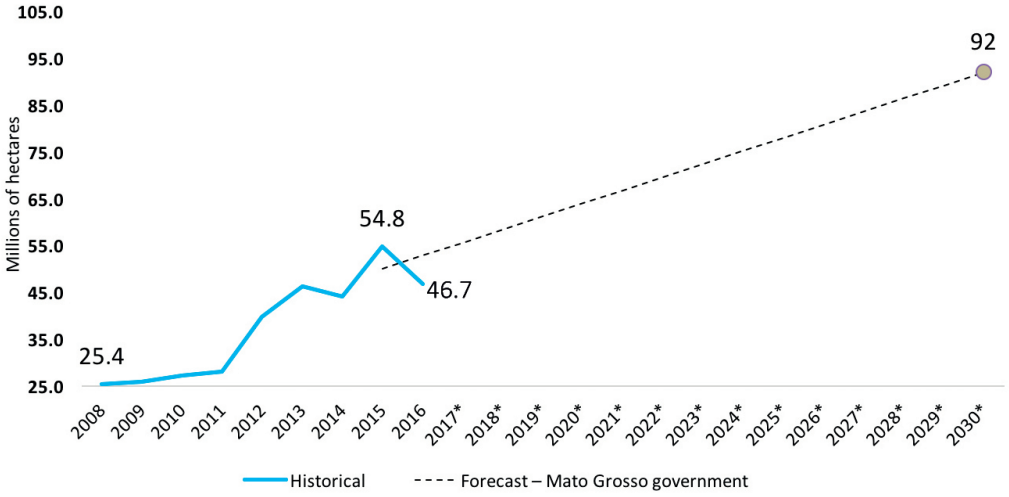
With the end of the sanitary break on November 9 of 2016, the 16/17 soybean harvest was considered officially "open". Thus, the area and productivity data of the 15/16 harvest for soybeans and maize are already consolidated.

3.3. AGRICULTURAL PRODUCTION

The production of grains, which is the area times the productivity, notably showed an increase in the last years in Mato Grosso, including the two main crops collected by Imea (maize and soybeans). **Graph 4** summarizes the evolution of agricultural production in Mato Grosso.

It is worth highlighting the expansion in the production of grains between the years of 2008 and 2015, in which the production of the three main agricultural crops of Mato Grosso increased by 115.76%. The forecast carried out by the state government establishes a production goal of 92 million tons of grains, which is 67.83% higher than the volume registered in 2015.

GRAPH 4. Evolution of agricultural production in Mato Grosso and forecast for 2030

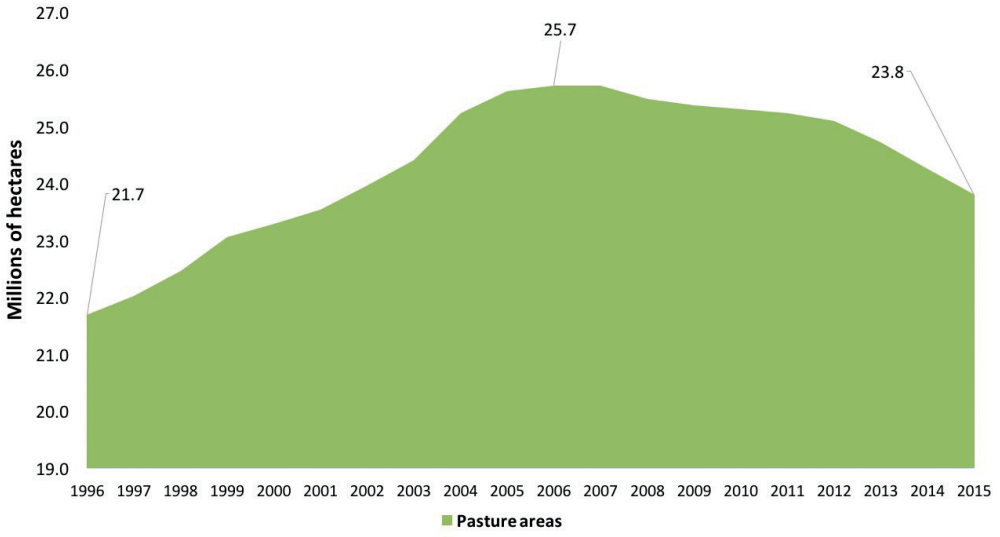


*Forecast. Source: Imea; Mato Grosso State Government.

3.4. AREA ALLOCATED TO CATTLE RANCHING (PASTURE)

The recovery of 2.5 million hectares of low productivity pastures by 2030 also figures among the goals established by the state government. **Graph 5** shows the evolution of pasture areas in Mato Grosso in the last years.

GRAPH 5. Evolution of pasture areas in Mato Grosso

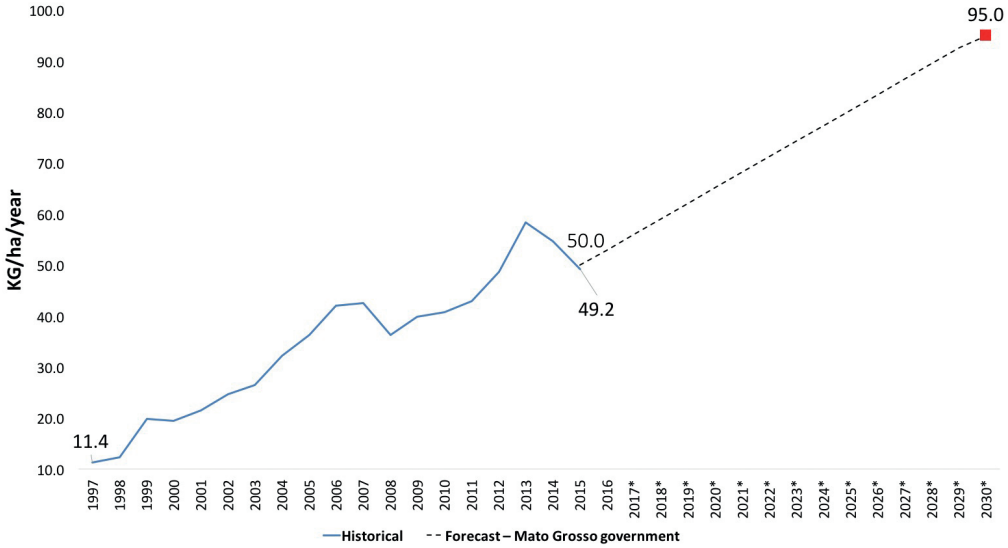


Source: Imea.

3.5. PRODUCTIVITY OF BEEF CATTLE PRODUCTION

The increase in the productivity of beef cattle production is included as one of the detailed targets of the "produce" stage of the state government plan for 2030. It is possible to note, through **graph 6**, that the expansion in the last 18 years in significant.

GRAPH 6. Evolution of productivity in Mato Grosso beef cattle production and forecast for 2030



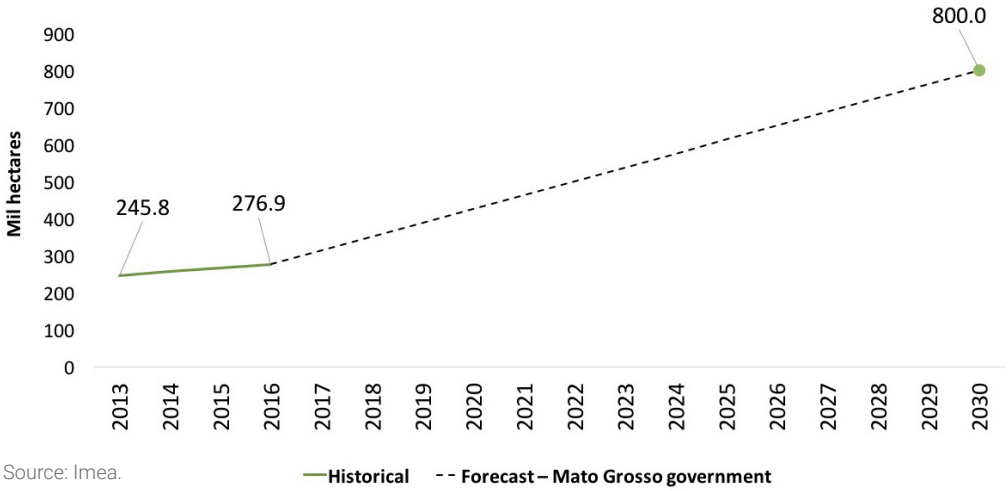
*Forecast. Source: IBGE, Imea, Mato Grosso State Government.

The goal established by the government for 2030 is of 95kg/ha/year, which is 92.96% higher than the value registered in 2015 (year of animal retention – less slaughters). As a basis for comparison, between 2000 and 2015 the productivity of beef cattle production increased by 152.67%, from 19.48 kg/ha/year in 2000 to 49.23 kg/ha/year in 2015.

3.6. AREA ALLOCATED FOR PLANTED FORESTS

Another goal established by the state government is to increase the planted forest areas in Mato Grosso to 800 thousand hectares by 2030.

GRAPH 7. Evolution of planted forest areas in Mato Grosso



Source: Imea.

The most recent forecast on the planted forest areas in Mato Grosso is from 2016, which is of 276.92 thousand hectares allocated to planting forests in Mato Grosso, out of which 67.63% of this value is eucalyptus and the rest is allocated to teakwood.

Despite the predominance of eucalyptus in the planted forest areas, the teakwood presented a faster growth in absolute numbers in the last years, especially in the center-south and west regions.

TABLE 2. Evolution of eucalyptus area in Mato Grosso (hectares)

Regions	2013	2016	Variation
Center-South	28,351	32,353	14.12%
Middle-North	37,702	24,808	-34.20%
Northeast	10,657	17,610	65.25%
Northwest	6,408	6,282	-1.97%
North	203	198	-2.27%
West	16,790	17,885	6.53%
Southeast	80,887	88,155	8.99%
Mato Grosso	**180,996**	**187,291**	**3.48%**

Source: Imea.

TABLE 3. Evolution of teakwood area in Mato Grosso (hectares)

Regions	2013	2016	Variation
Center-South	26,402	38,337	45.21%
Middle-North	4,070	3,785	-7.00%
Northeast	5,392	7,927	47.00%
Northwest	8,842	8,094	-8.46%
North	4,089	6,651	62.63%
West	15,105	24,241	60.48%
Southeast	894	604	-32.45%
Mato Grosso	**64,795**	**89,638**	**38.34%**

Source: Imea.

3.7. PRODUCTIVITY OF PLANTED FORESTS

Despite not being one of the goals to be "achieved" in the PCI of the COP-21, the productivity of planted forests was surveyed, considering that it is necessary to find the total production values.

With a larger area, and as a more consolidated crop, eucalyptus has been showing an improvement in productivity rates, as can be seen in **table 4**.

The teakwood productivity indicators, in turn, decreased between 2013 and 2016, despite the growth in the teakwood planted area in the last years. This shows that the crop can still improve its production per year, through the development of superior genetic materials and through improvements in forest management.

TABLE 4. Evolution of eucalyptus productivity in Mato Grosso (m^3/ha)

Regions	2013	2016	Variation
Center-South	149,13	188,08	26.12%
Middle-North	207,07	154,36	-25.45%
Northeast	174,65	173,37	-0.74%
Northwest	-	163,98	-
North	174,65	173,37	-0.74%
West	145,34	180,36	24.09%
Southeast	187,95	180,70	-3.86%
Mato Grosso	**174,65**	**173,37**	**-0.74%**

Source: Imea.

TABLE 5. Evolution of teakwood productivity in Mato Grosso (m^3/ha)

Regions	2013	2016	Variation
Mato Grosso	**169,95**	**147,46**	**-13.23%**

Source: Imea.

3.8. PRODUCTION OF PLANTED FORESTS

With a goal established to achieve 11.75 million m^3/ha by 2030, the production of planted forests should increase by 140% in order to meet the goals established by the state government. For eucalyptus, considering a 5.5-year cycle, the production in 2016 reached 6.27 million m^3/ha, representing an increase of 8.60% compared to 2013.

With a significant increase in planted area (38.34%) in the last three years, teakwood production has increased significantly. However, since the cutting cycle considered (11.66 years) is higher than for eucalyptus, the production of wood is considerably smaller.

TABLE 6. Evolution of eucalyptus productivity in Mato Grosso (m^3/ha)

Regions	2013	2016	Variation
Center-South	768,722	1,106,357	43.92%
Middle-North	1,419,436	696,244	-50.95%
Northeast	338,404	555,102	64.04%
Northwest	-	187,283	-
North	6,445	6,253	-2.99%
West	443,674	586,505	32.19%
Southeast	2,764,178	2,896,289	4.78%
Mato Grosso	**5,779,944**	**6,034,032**	**4.40%**

Source: Imea.

TABLE 7. Evolution of teakwood productivity in Mato Grosso (m^3/ha)

Regions	2013	2016	Variation
Mato Grosso	**1,025,848**	**1,239,221**	**20.80%**

Source: Imea.

4. FINAL REMARKS

With the data from the last 15 years, it is possible to observe significant evolutions in the main agricultural indicators of Mato Grosso, which is largely due to adaptations and adoption of new technologies in production. A proof of this is that the state has become the largest producer and exporter of agricultural products in the country.

Although the goals established for 2030 by the PCI program are less ambitious than the progress observed in the last 15 years, these are still audacious and difficult to be achieved considering that the incorporation of new technologies increasingly burden production costs.

In this context, although the agricultural production goals established by the state government through the PCI program are challenging, the 15/16 harvest numbers evolved according to planned, varying within the "confidence zone" established.

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ABOUT THE INPUT PROJECT

As the world responds to food security and climate change, Brazil holds a unique position of strength. Thanks to technological advances in agricultural practices and the recent success in curbing deforestation, land use is shifting towards more sustainable practices. Increasing its agricultural production needs while promoting environmental regularization and the conservation of its natural resources is a challenging agenda that brings huge opportunities to the country and to the productive sectors.

The Land Use Initiative (INPUT - Iniciativa para o Uso da Terra) brings together Agroicone with Climate Policy Initiative (CPI) in Brazil. It counts on a dedicated team of leading economists, lawyers, mathematicians, geographers and agronomists who work at the forefront of how to increase environmental protection and food production.

INPUT engages stakeholders in Brazil's public and private sectors and maps the challenges for a better management of its natural resources. Also, it mobilizes agents of the productive chains in order to promote compliance with the new Forest Code. In addition, the project aims at analyzing and influencing the creation of a next generation of low-carbon economy policies in Brazil.

In this project, besides from generating information about the alternatives for restoration of native forests and compensation of Legal Reserve areas, Agroicone is responsible for engaging the private sector in the challenges for compliance and creating sectoral solutions that enable large-scale implementation.

To learn more: www.inputbrasil.org

ABOUT AGROICONE

Agroicone was founded in 2013 by a group of specialists from ICONE - Institute for International Trade Negotiations. It resulted from 10 years of work by a cohesive team, which was responsible for the production of applied papers and studies, as well as qualified and skilled debates in global agricultural issues both locally and internationally.

The scope of Agroicone's work includes international trade negotiations, food security, public policies, land use change, market intelligence, sustainability, climate change, certifications, remote and satellite sensing technology and also the assembly of content and communication strategies for various value chains, especially: sugarcane, beef and dairy, grain commodities, perennial crops (planted forests and palm oil), bio-energy and those from smallholders.