INPUT

Iniciativa para o Uso da Terra

CERRADO

PATHS TO SUSTAINABLE TERRITORIAL OCCUPATION, LAND USE AND PRODUCTION

SOYBEANS EXPANSION AREA

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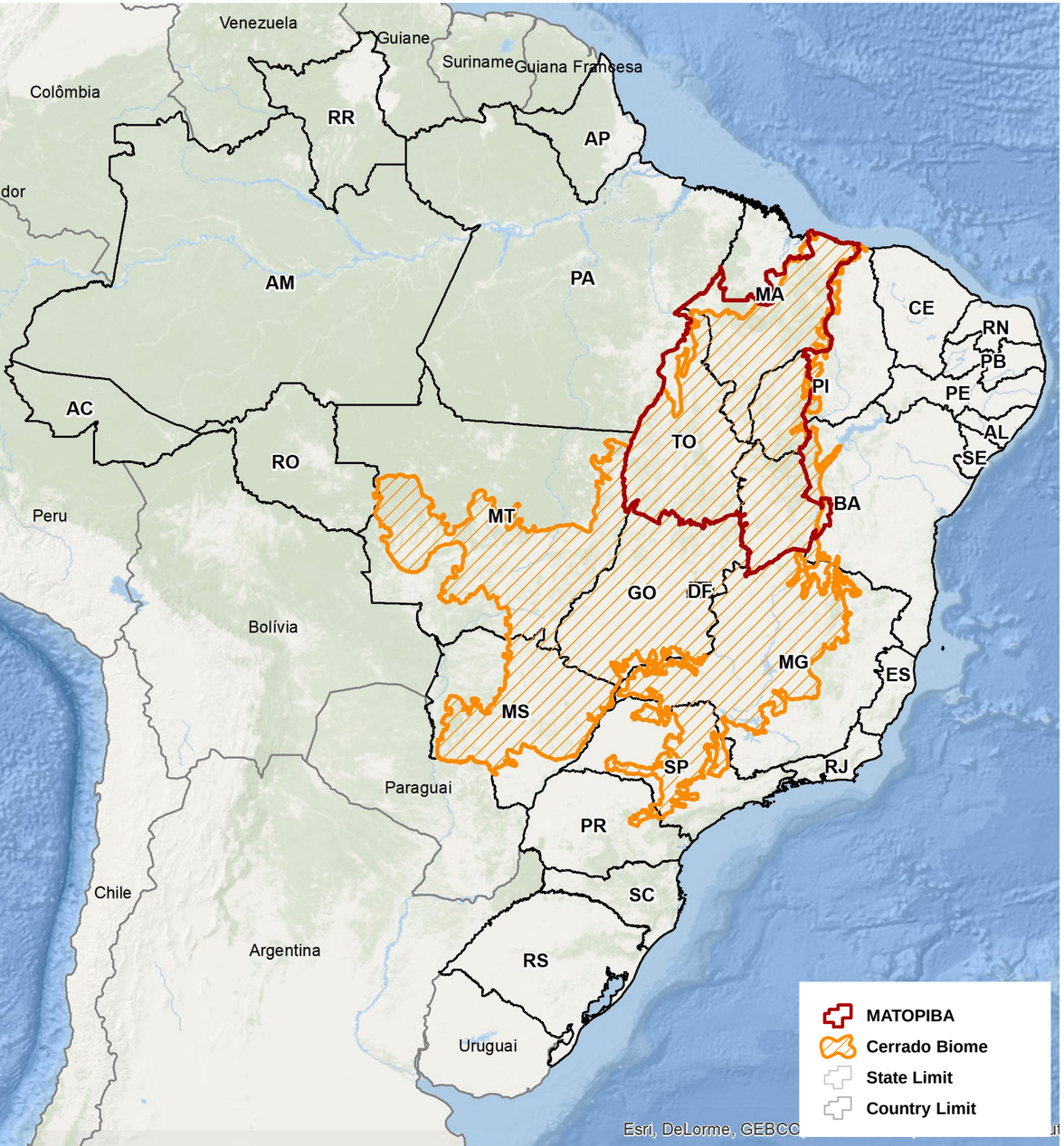
AGRICULTURE IN THE CERRADO

THE CERRADO BIOME



The Brazilian Cerrado, which is characterized as a tropical savannah, is the **second largest biome in South America**. Its area of **200 million hectares** is equivalent to the sum of the territories of Spain, France, Germany, Italy and United Kingdom.

This biome occupies 22% of the Brazilian territory, comprising **11 states** and the **Federal District.** It covers entirely the state of GO and the FD and considerable portions of the states of TO, MS, MT, BA, MG, MA, PI, SP besides from a small portion of the states of RO and PR. Other disjoint portions occur in the states of AP, AM, PA and RR.

Due to its geographical position and ecological characteristics, the Cerrado plays an **important role for Brazilian society** in terms of biodiversity and maintenance of natural resources, particularly water resources, as well as the agricultural production developed within its territory.

The **MATOPIBA** is a region that comprises the portion the Cerrado biome within the states of Maranhao, Tocantins, Piaui and Bahia. It is currently considered the great national agricultural frontier.

STATES OF THE CERRADO AND ITS AREAS (MILLIONS OF HA)

MATOPIBA
71 million ha

- TO 25.3
- MA 21.3
- BA 15.1
- PI 9.3

OTHER STATES
133 million ha

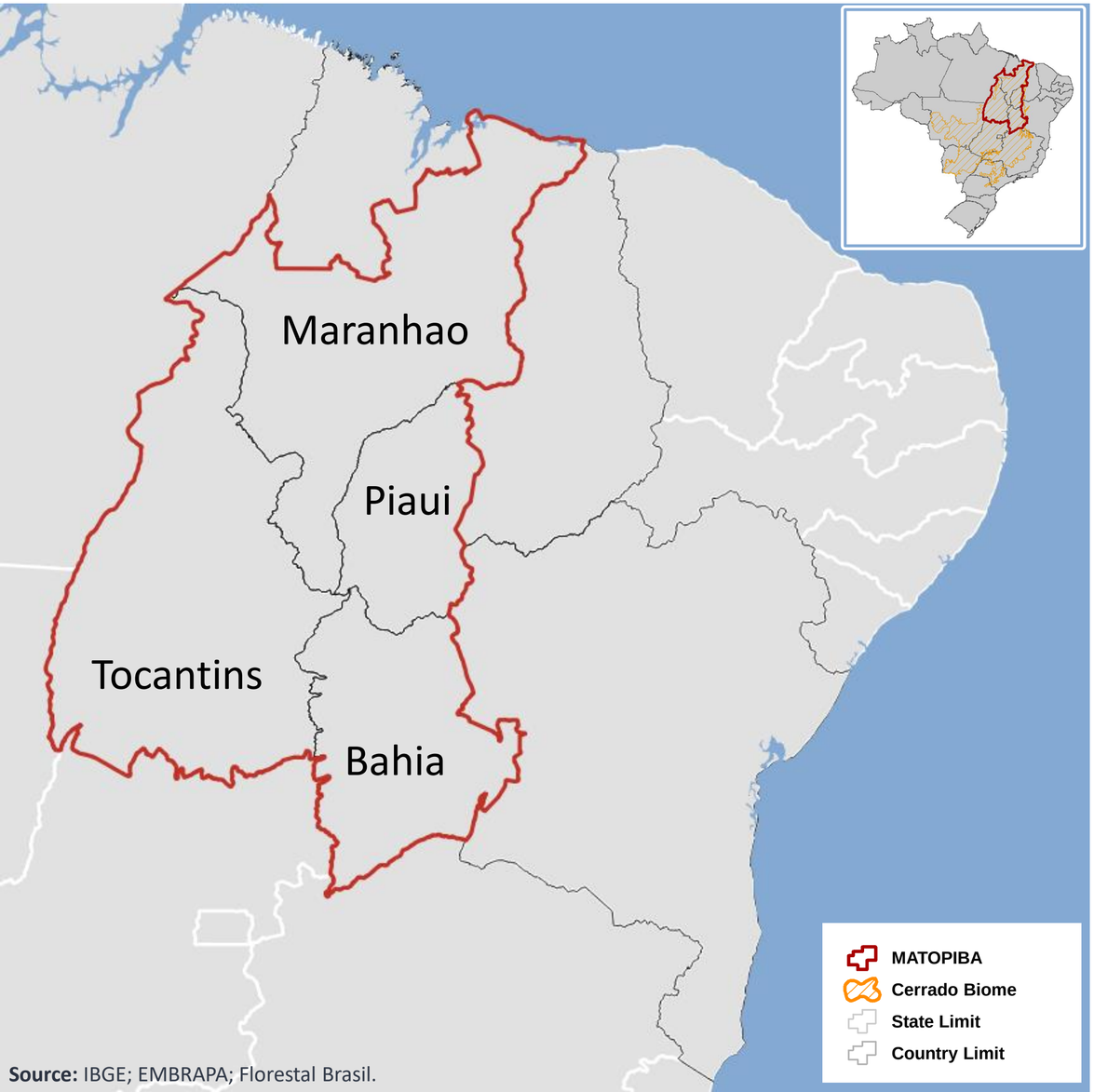
- MT 35.9
- MG 33.4
- GO 33
- MS 21.6
- SP 8.1
- DF 0.6
- PR 0.4
- RO 0.05

Sources: IBGE; EMBRAPA, 2015

THE MATOPIBA

Total area (%)

MAranhao 33%; **TO**cantins 38%; **PI**aui 11%; **BA**hia 18%



Source: IBGE; EMBRAPA; Florestal Brasil.

Embrapa's Strategic Territorial Intelligence Group (GITE) was responsible for delimiting the region. The criteria used were the agrarian, agricultural, infrastructure, socio-economic and natural contexts, considering, especially, the **presence of the Cerrado within the states**, which corresponds to 90% of the total region.

Despite its deficiency in infrastructure, agricultural activity in MATOPIBA expanded due to its soil characteristics, favorable rainfall regime and, especially, to the price of land. With continuously growing production volumes and promising growth expectancy, the region is highlighted as the **main agricultural frontier** in Brazil.

By 2022, according to projections of the Ministry of Agriculture, Livestock and Food Supply (MAPA), the country will reach around 70 million ha of farmed lands, out of which **MATOPIBA** will comprise around 10 million ha and should produce between 18 and 24 million tons of grains.

General Data

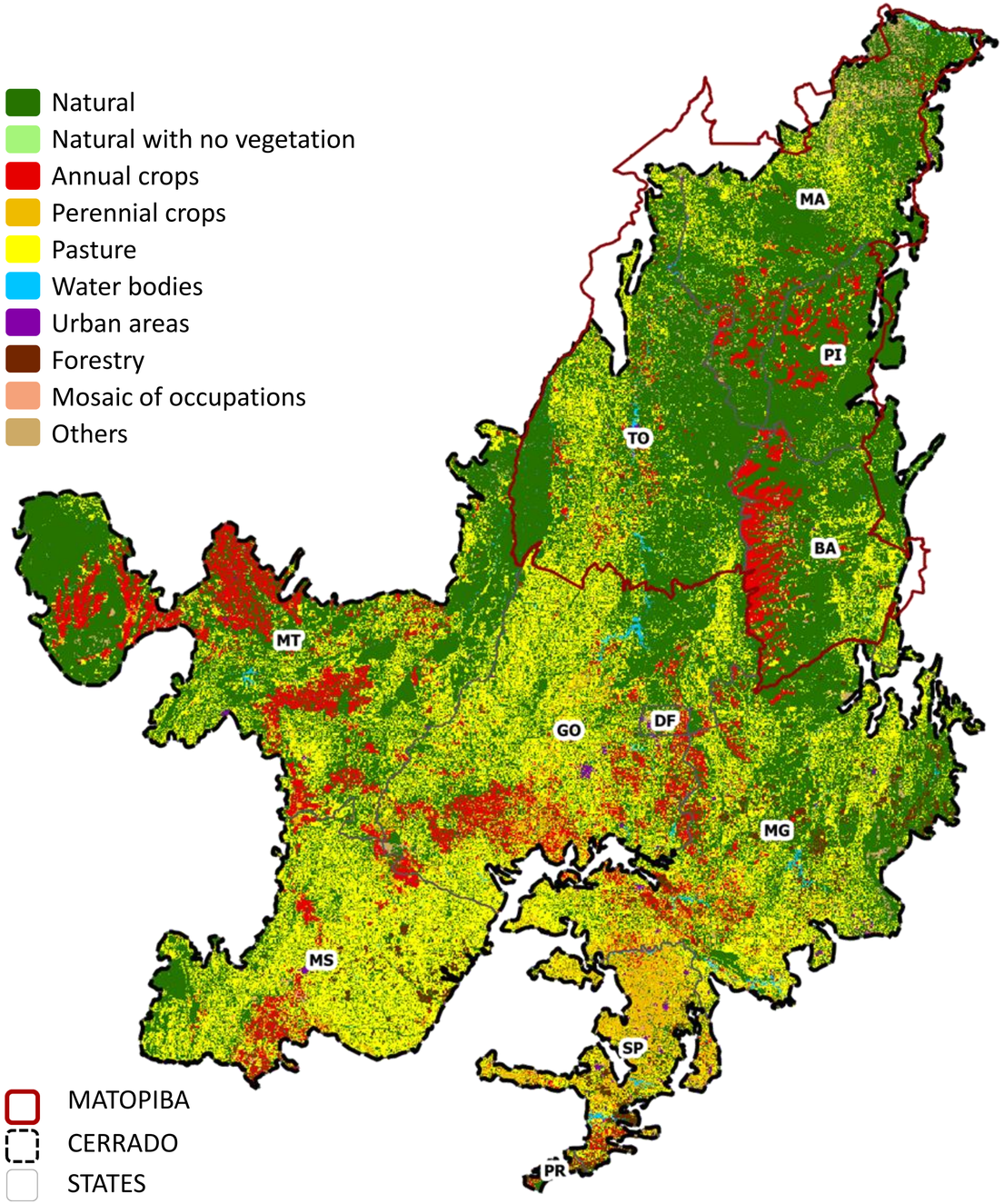
- **6** Millions of habitants
- **73** Million ha
- **31** Micro-regions
- **337** Municipalities

Source: MAPA, 2017

Agrarian Status

- **324** agricultural establishments (33,929,100 ha)
- **46** conservation Units (8,334,679 ha)
- **35** indigenous lands (4,157,189 ha)
- **36** quilombola areas (258,709 ha)
- **781** rural settlements (3,033,085 ha)

LAND USE

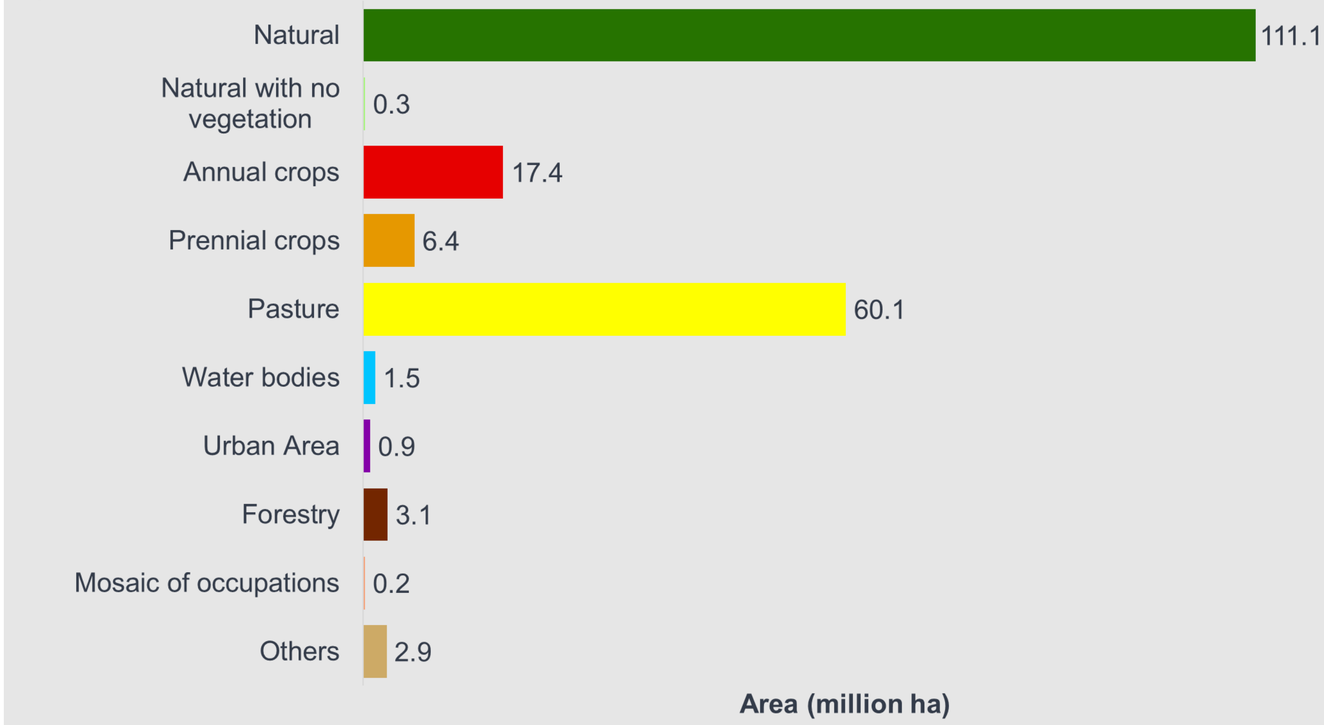


According to INPE, in 2013, **54%** of the Cerrado (204 MH) was covered by **native vegetation (111 MH)** and **46%** was occupied by **anthropic uses (93 MH)**.

Pasture areas are the most highlighted among the anthropic uses, covering **60 million hectares**, and occupying **30%** of the Cerrado area. Annual and perennial crops, on the other hand, occupy **24 million ha (12%).**

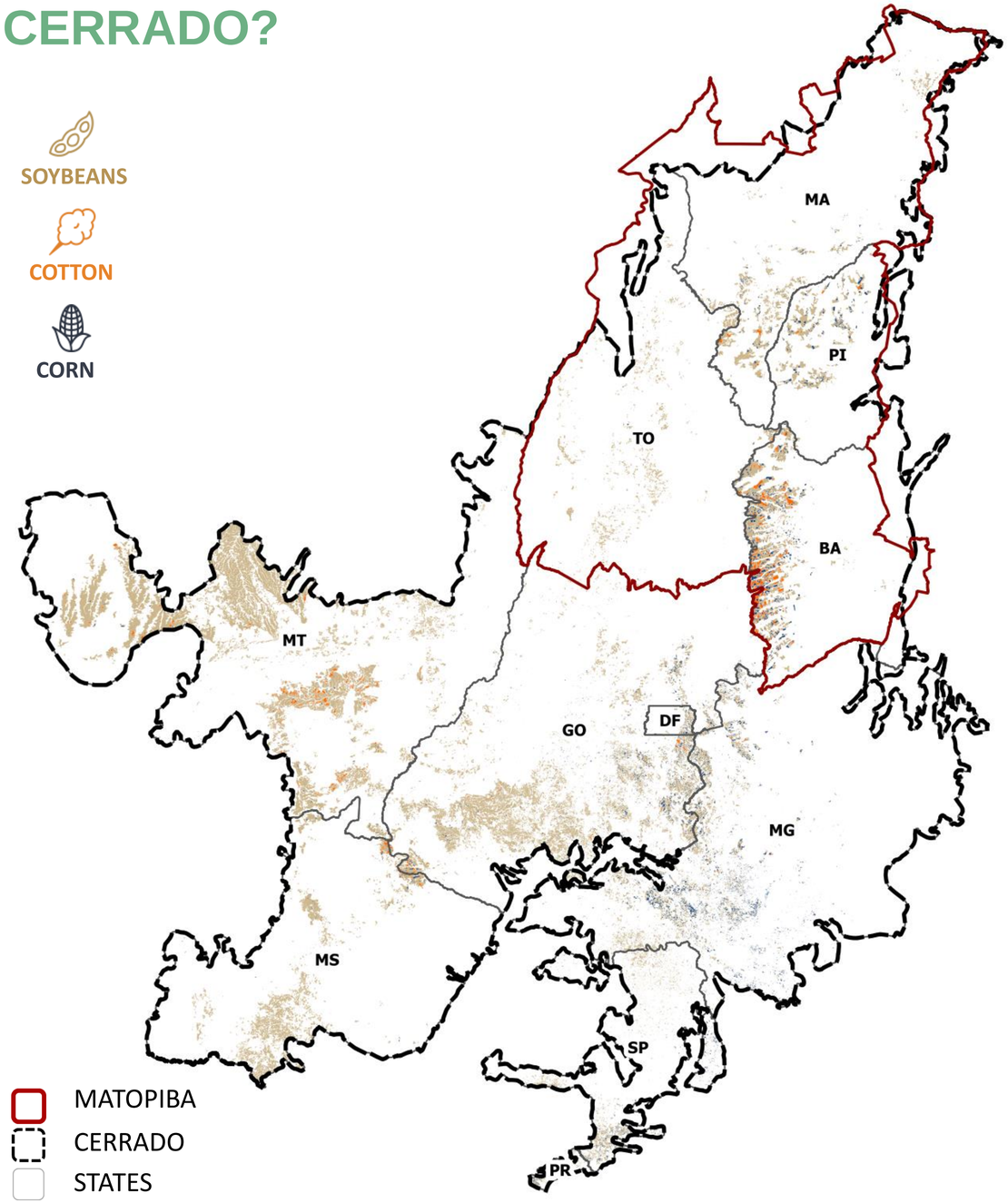
Annual crops, with 17.4 million hectares (9%), predominate over perennial crops, which occupy **6.4 million hectares (3%).**

LAND USE IN THE CERRADO



Source: Terraclass Cerrado (2013)

WHAT MAKES UP ANNUAL CROPS IN THE CERRADO?



According to a study carried out by Agrosatélite, **annual crops** in the Cerrado are mainly made up by **SOYBEANS**, **COTTON** and **CORN**.

Soybeans are the predominant crop in the Cerrado, occupying an area of **15.6 million ha**, which represents **90%** of annual crops. Approximately **52%** of all soybeans in Brazil are within the Cerrado biome.

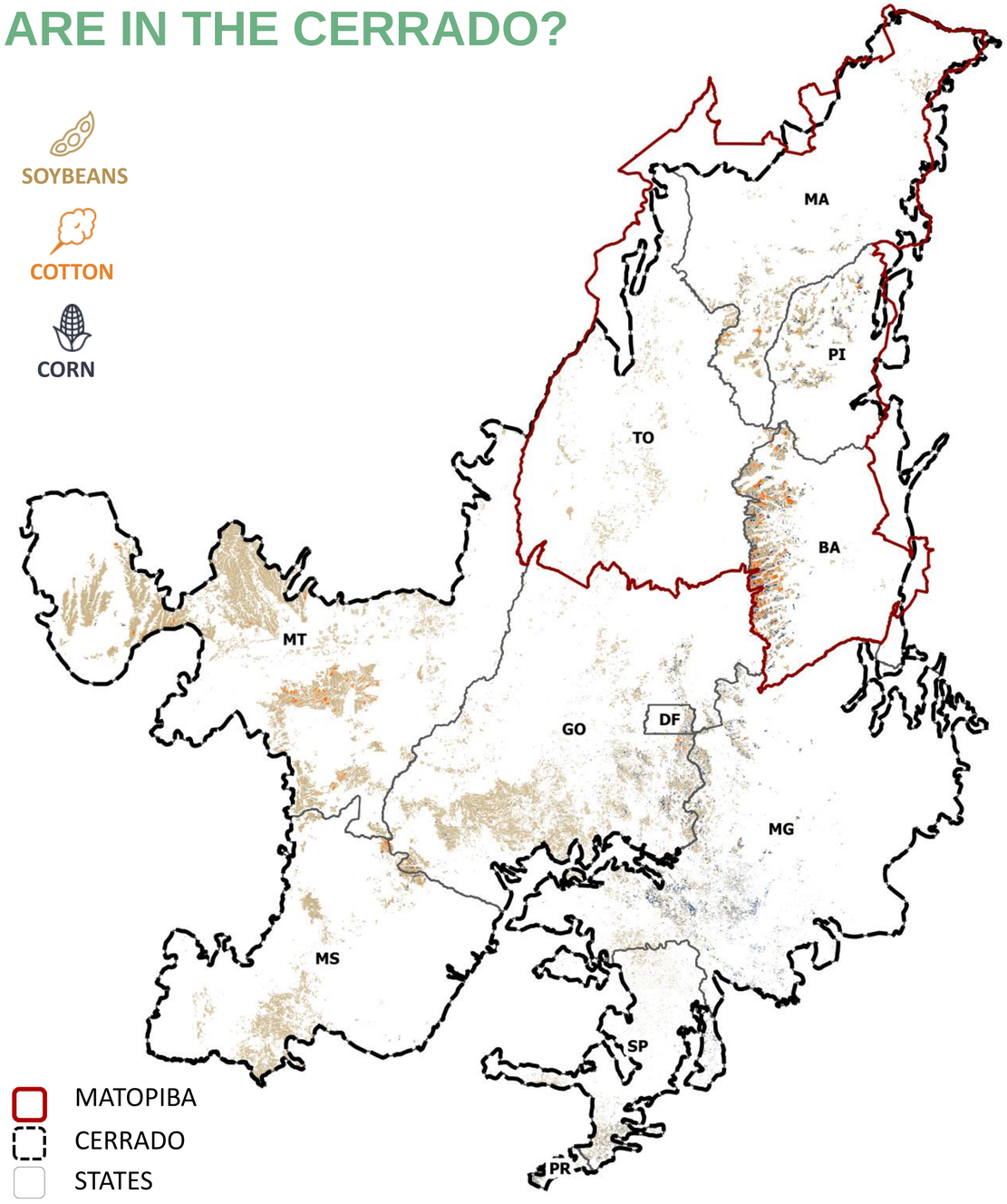
The **first crop corn** and **cotton** areas together occupy a total of **1.7 million ha**, which corresponds to **10%** of annual crops. Although it is a small area compared to soybeans, half of all cotton areas in Brazil are within the Cerrado.

BREAKDOWN OF ANNUAL AGRICULTURE:

	SOYBEANS	COTTON	CORN
Area (millions of ha)	15.6	0.5	1.2
Participation in annual crops of the Cerrado	90%	3%	7%
Participation in cultivation area of Brazil	52%	50%	25%

Source: Agrosatélite – Rudorff, Risso et al., 2015

WHERE AND HOW MUCH ANNUAL CROPS ARE IN THE CERRADO?

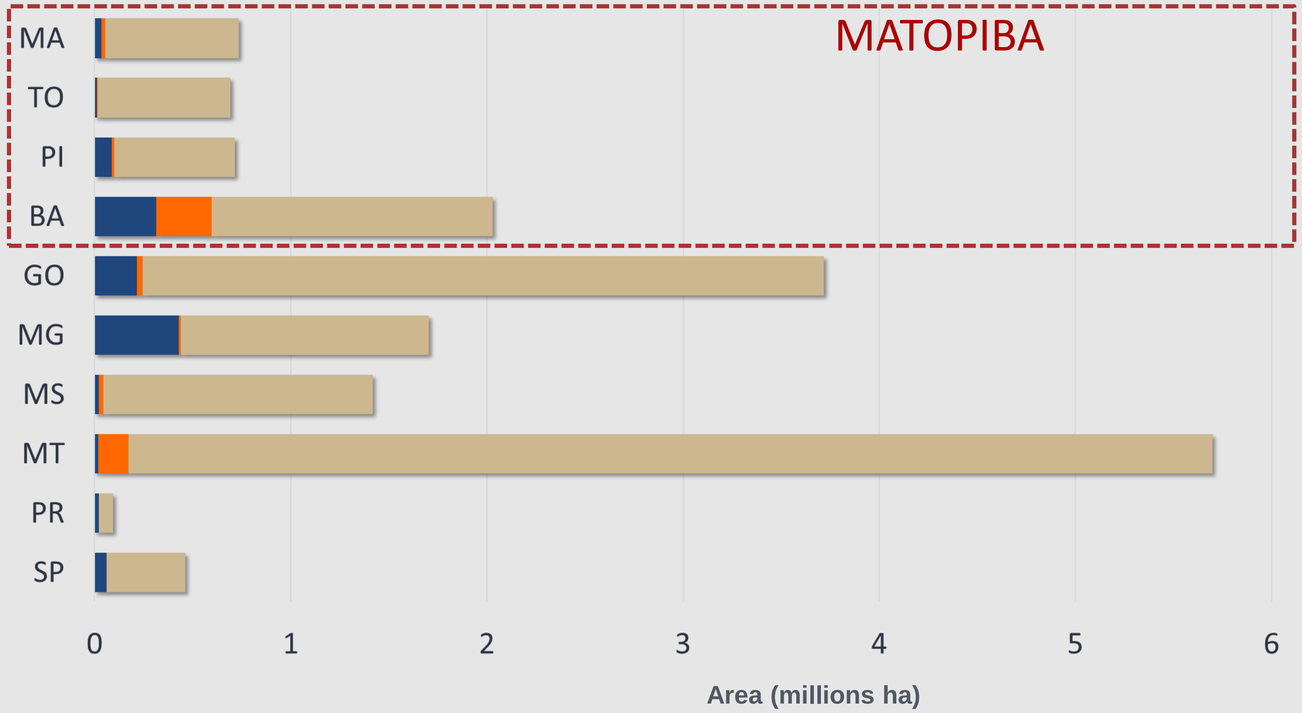


Also according to the Agrosatélite study, **soybean** areas are concentrated, specially in the states **MT e GO**, which together account for **57%** of the total production in the Cerrado (35% and 22%, respectively).

On the other hand, **cotton** production is concentrated in the states of **BA** and **MT**, which together account for **82%** of total production in the Cerrado. Meanwhile, the production of **maize** is concentrated in the states of **BA, GO and MG**, with **78%**.

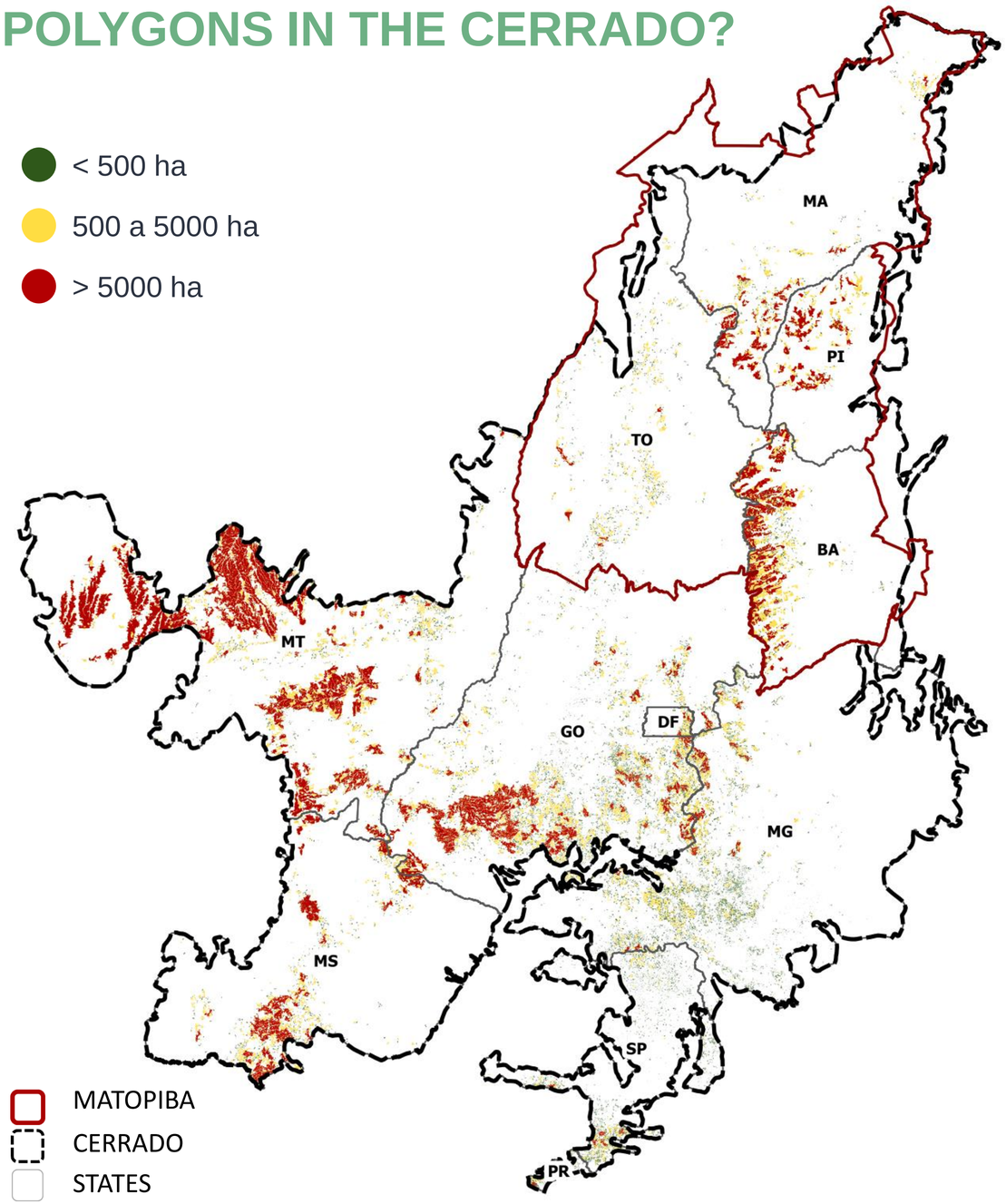
The **MATOPIBA** region, in turn, concentrates **22%** of the cultivated area of soybeans in the Cerrado. In this region, **Bahia** is the state with the largest soybean area, accounting for 9.2% of the total cultivated in the Cerrado.

BREAKDOWN OF ANNUAL CROPS BY STATE:



Source: Agrosatélite – Rudorff, Risso et al., 2015

WHAT IS THE SIZE OF AGRICULTURAL POLYGONS IN THE CERRADO?

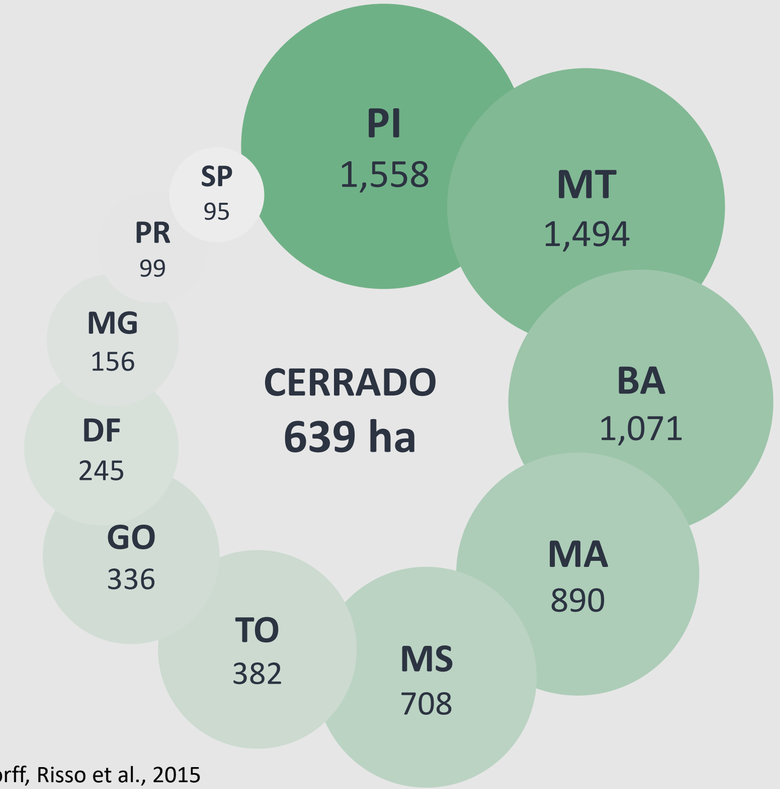


The **annual crop polygons were classified according to their size** aiming to view how agricultural areas are distributed within the Cerrado. Although the analysis evaluates the size of the continuous polygons and not the size of these areas within the properties, it is possible to have an idea of the agricultural areas in the Cerrado.

The states with the **largest agricultural areas** (largest polygons) are **PI, MT** and **BA**, with an average of more than 1,000 ha. On the other hand, the states with the **smallest continuous areas** (smallest polygons) are **SP** and **PR**.

The result of the analysis reflects the type of agriculture in different regions of Brazil, where PR is characterized by **family agriculture**, with smaller properties. MT, PI, BA, in turn, are located in regions with **agricultural frontiers**, where large estates are predominant.

AVERAGE SIZE (HA) OF AGRICULTURAL POLYGONS BY STATE:



Source: Agrosatélite – Rudorff, Risso et al., 2015

AGRICULTURAL EXPANSION IN THE CERRADO

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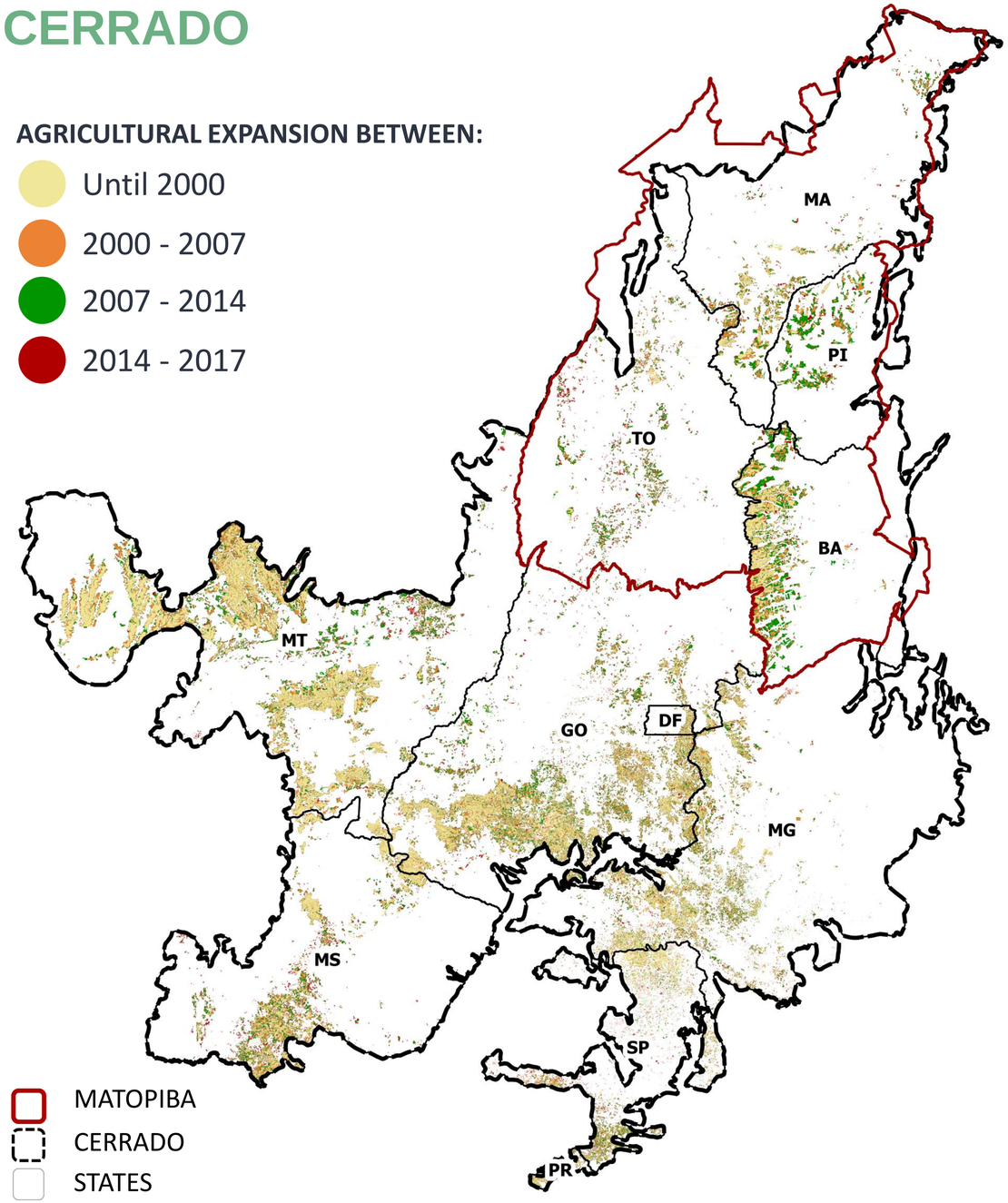
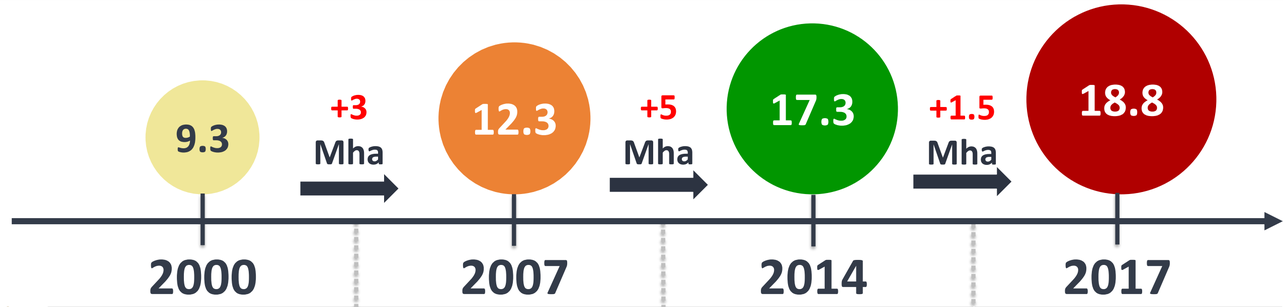


According to data from Agrosatélite, between 2000 and 2017, **the area with annual crops in the Cerrado grew 9,5 millions hectares**, representing an 102% growth. Most of this growth (5 million ha) occurred between 2007 and 2014.

While the **cotton** and **maize** areas remained almost constant between 2000 and 2017, the production of **soybeans increased 108%**, accounting for all the growth of annual crops in this period.

EXPANSION OF AGRICULTURE IN THE CERRADO (Millions of hectares)

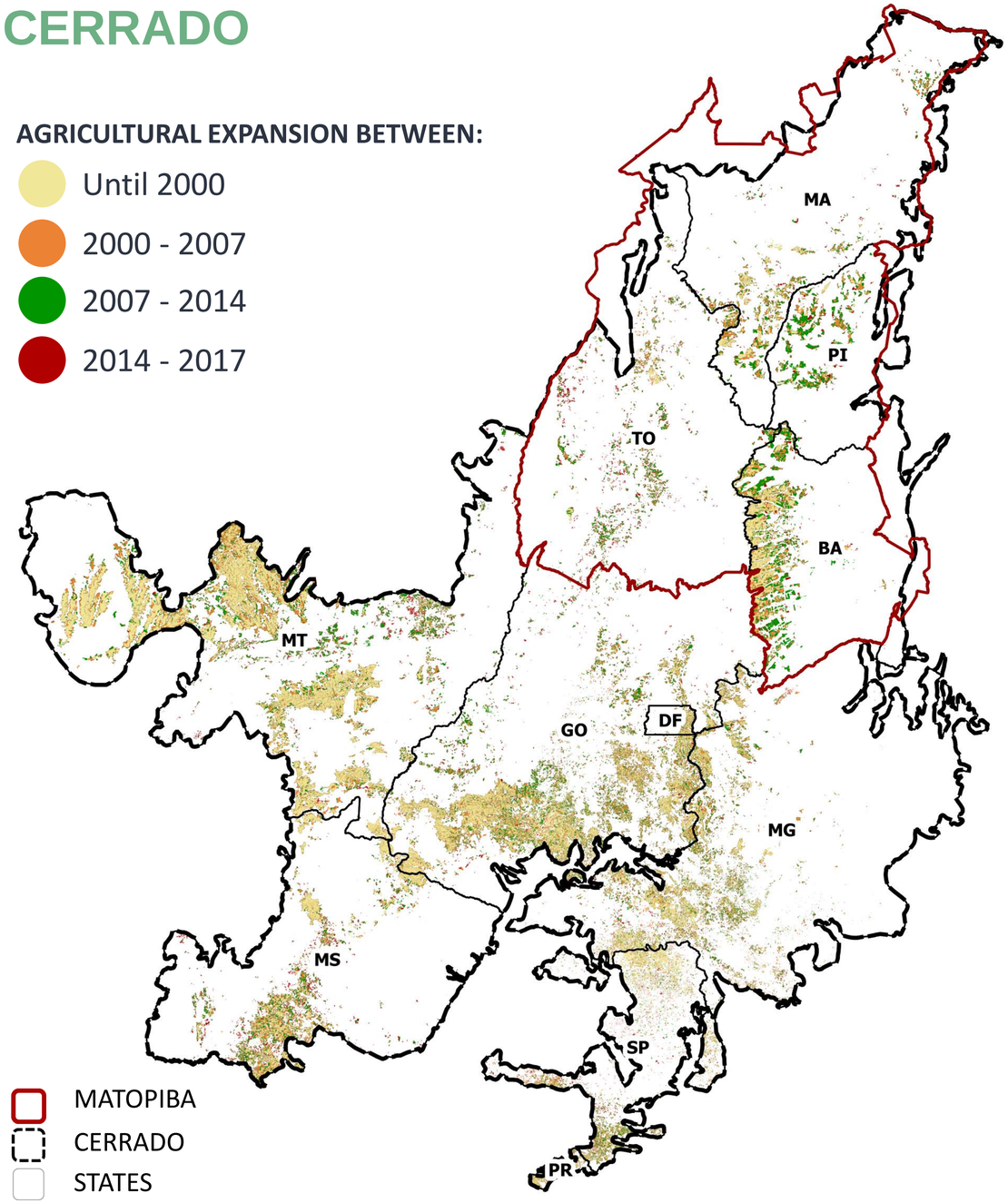


	2000	2007	2014	2017
SOYBEAN	7.5	10.1	15.6	17.1
COTTON	1.3	1.4	1.2	1.2*
CORN	0.5	0.8	0.5	0.5*

Source: Agrosatélite – Rudorff, Risso et al., 2015

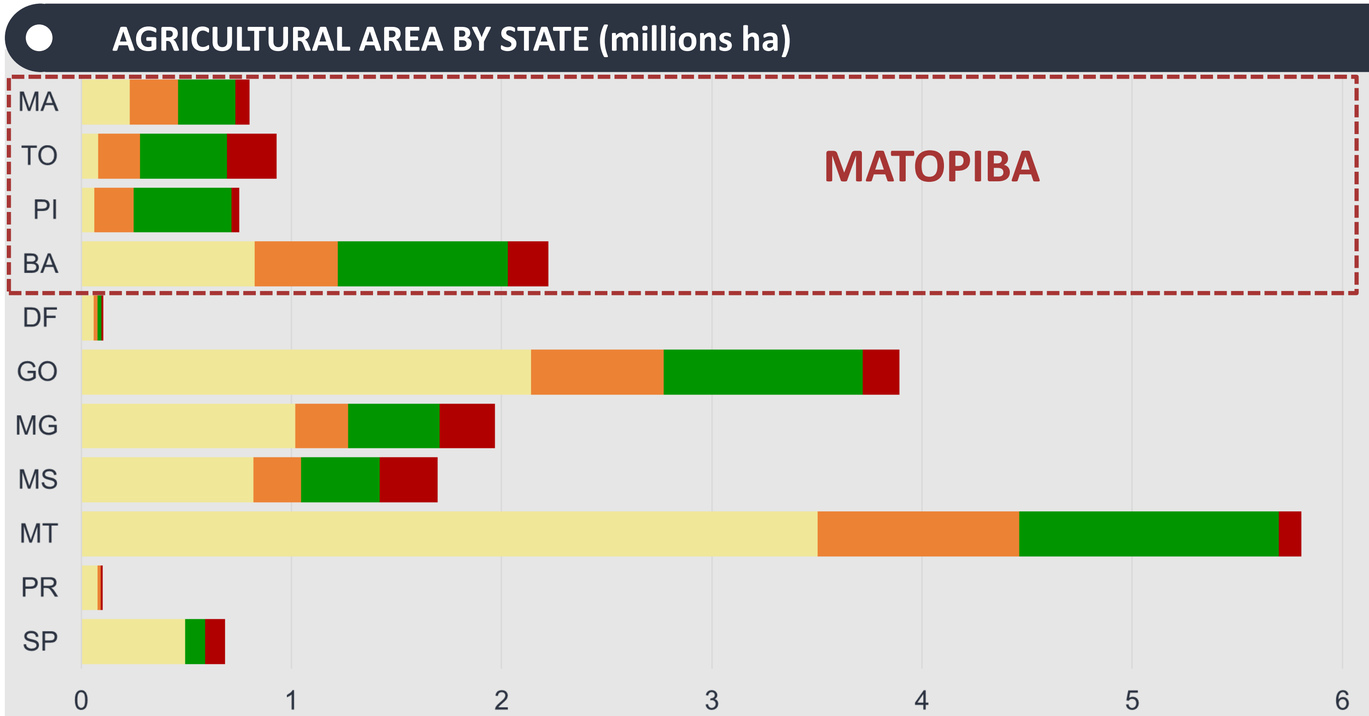
*the planted area for cotton and corn crops were not mapped for the year 2017. In order to present these data, it was considered that the area of cotton and corn in 2017 is the same as in 2014.

AGRICULTURAL EXPANSION IN THE CERRADO



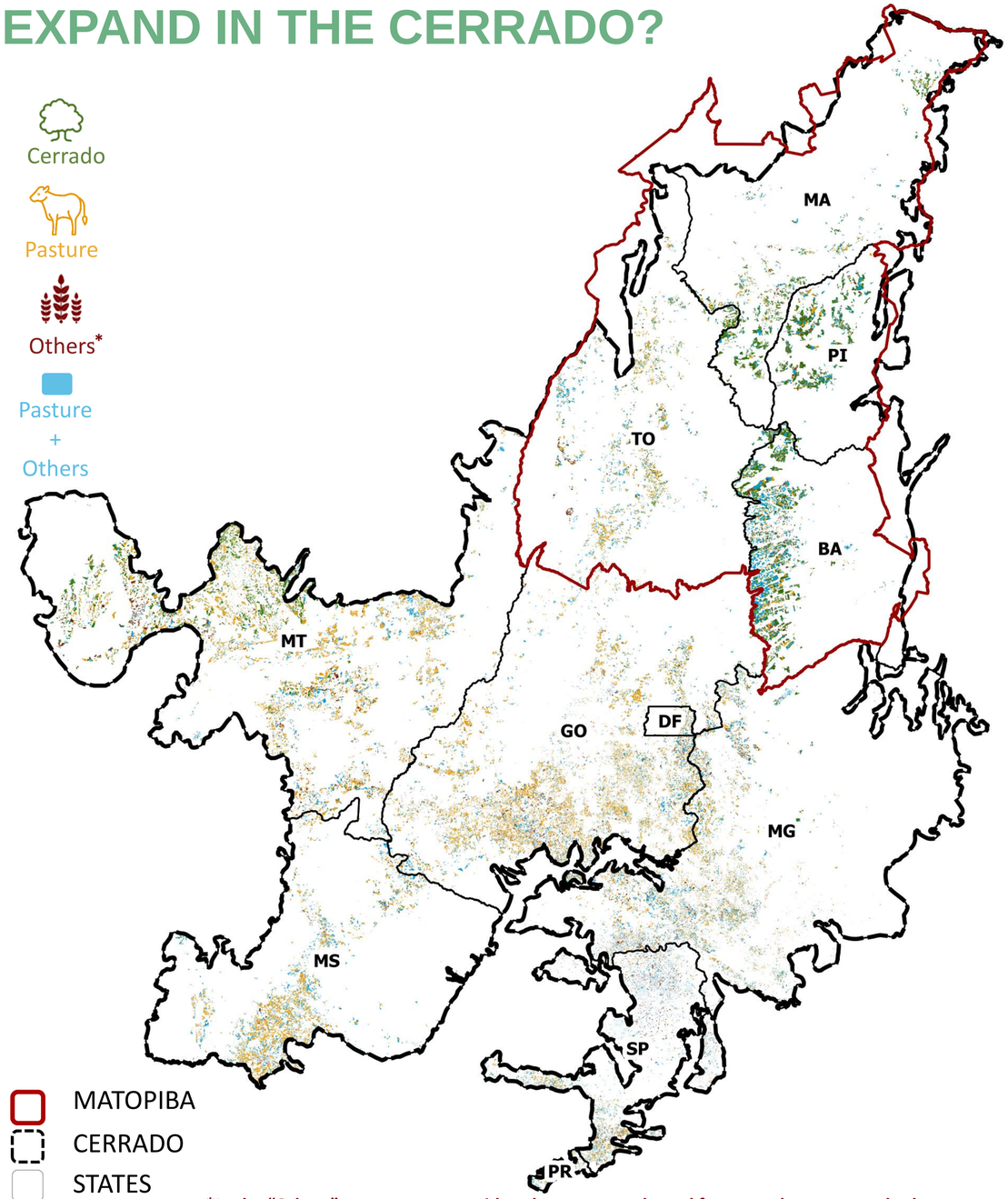
The states of **MT and GO** accounted for **43% of the expansion of annual crops** in the Cerrado biome in the period from 2000 to 2017. In the **MATOPIBA** region, the area went from 1.2 MH to 4.7 MH, which represents an **increase of 291%.**

The expanded area in **MATOPIBA** was not very expressive in absolute numbers (3,5 MH). However, it is possible to observe an expansion phenomena in the agricultural activity of the region, which becomes clear when observing the growth in percentage terms (291%). According to MAPA[2], this phenomena has been occurring due to the **soil characteristics**, **favorable rainfall regime** and the **price of land**, despite the lack of infrastructure in the region.



Sources: Agrosatélite – Rudorff, Risso et al., 2015; MAPA, 2017

OVER WHAT USES DID AGRICULTURE EXPAND IN THE CERRADO?



*In the "Others" category are considered sugarcane, planted forests, other crops and other uses.

Although the increase in agricultural area totaled 8MH, **land use change occurred in 10.6 MH**, where 4.5 MH was in the period from 2000 to 2007 and 6.1 MH in the period from 2007 to 2014. This area is 2.5 MH larger than the total agricultural expansion area.

This difference is due to an intense land use change that can result in the expansion of some agricultural areas, simultaneous to the retraction of other agricultural areas due to **abandonment or substitution with another crop**. Also, soybeans may be used for the **renovation of sugarcane fields**. Thus, an area may have been mapped as soybeans in 2000 and as sugarcane in 2014, therefore being counted as land use change, when it is actually occupied, most of the time, by sugarcane fields.

In the **Cerrado biome** as a whole, **most agricultural expansion occurred over pastures**, accounting for 57% and 51%, respectively, in the periods from 2000 to 2007 and 2007 to 2014. Although the percentage relative to the area decreased, there was an increase of 0.5 MH in agricultural expansion over pastures.

Between these two periods, **the proportion of expansion over vegetation decreased from 32% to 25%**, although in terms of area this expansion remained the same. In turn, agricultural expansion over the **Others category increased considerably, from 11% to 24%,** which is equivalent to an area of 1 MH, thus being mostly responsible for the change in expansion dynamic between the two periods.

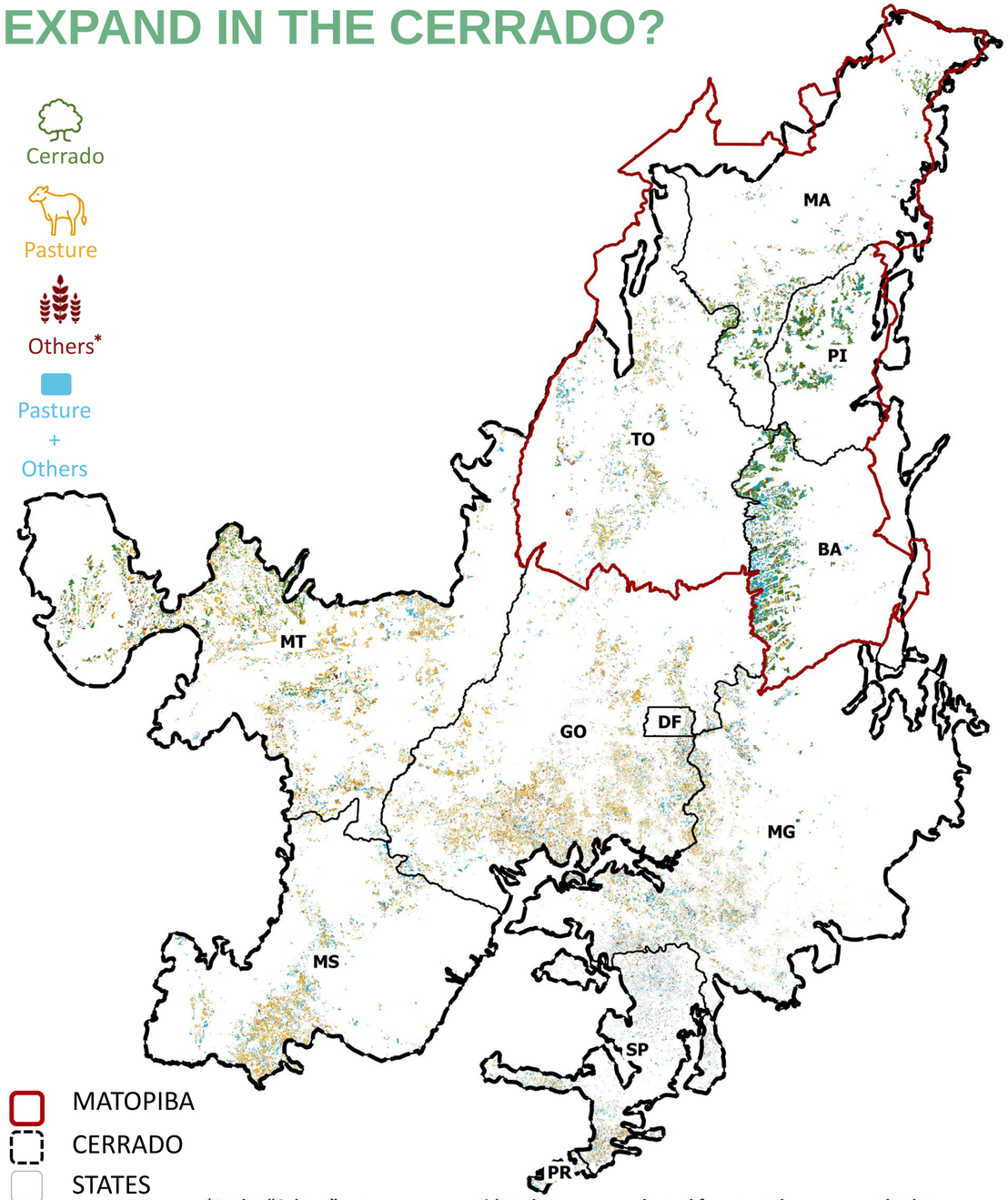
Between 2014 and 2017 the expansion occurred in pasture and in oters was not differentiated, making up only class called "pasture+others". Expansion over this class was **92%** (3.6 MH), while **8%** (0.3 MH) occurred over native vegetation.

AGRICULTURAL EXPANSION OVER:

		CERRADO	PASTURE	OTHERS*	TOTAL
2000/07	Millions hectares	1.4	2.6	0.5	4.5
	%	32	57	11	100
2007/14	Millions hectares	1.5	3.1	1.5	6.1
	%	25	51	24	100
2014/17	Millions hectares	0.3	3.6		3.9
	%	8	92		100

Source: Agrosatélite – Rudorff, Risso et al., 2015

OVER WHAT USES DID AGRICULTURE EXPAND IN THE CERRADO?



*In the "Others" category are considered sugarcane, planted forests, other crops and other uses.

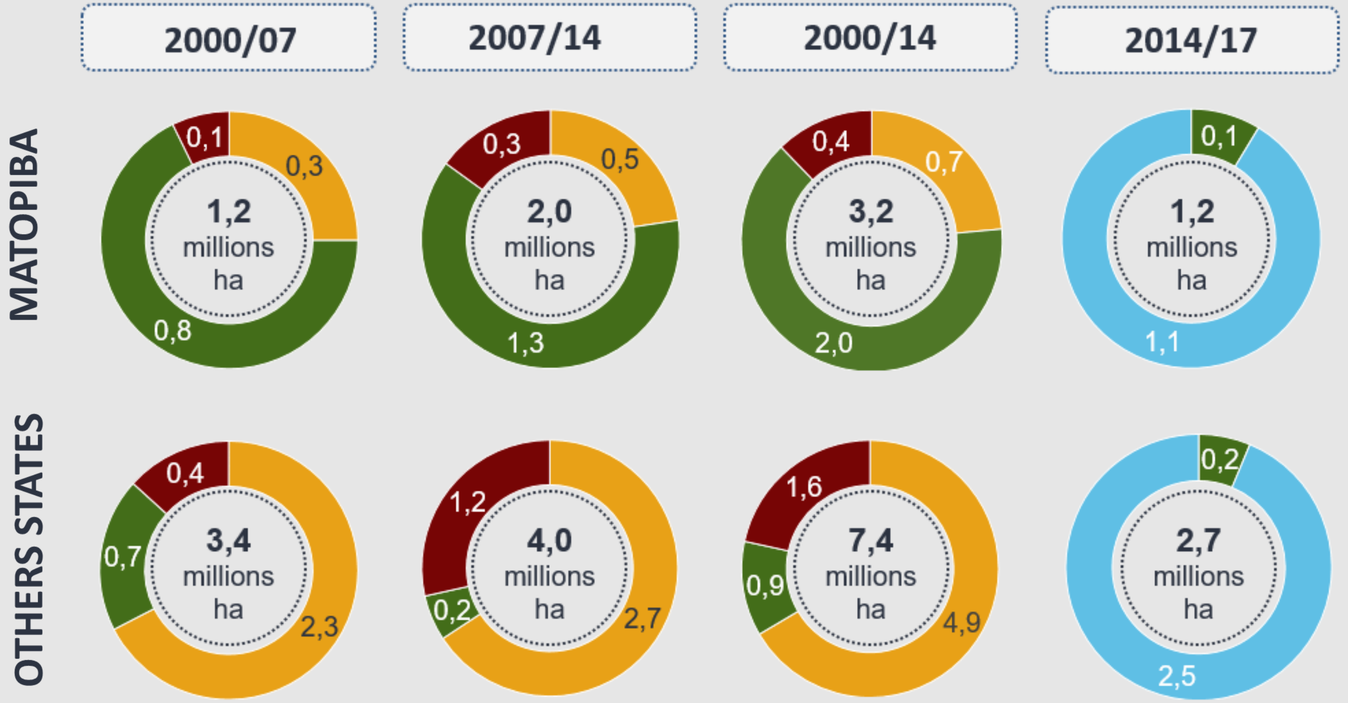
The **MATOPIBA** region has an expansion pattern different from that of the Cerrado. In this region, **agriculture has been expanding mainly over native vegetation**. This was observed in both analyzed periods, 2000 – 2007 and 2007 – 2014.

Approximately **65%** of all expansion in MATOPIBA was over native vegetation, totaling **2 MH** of areas converted for agriculture. Expansion over pastures, in turn, totaled **0.7 MH**, representing **22%** of all expansion over pastures in the region.

On the other hand, in the **other states of the Cerrado**, approximately **70%** of expansion occurred in pasture areas, a pattern observed in both of the analyzed periods. Between 2000 and 2007, total expansion in these states totaled **3.4 MH**, where **2.7 MH** were in pastures, **0.7 MH** over Cerrado and **0.1 MH** over other land uses. In turn, between 2007 and 2014, expansion totaled **4 MH**, where **2.7 MH** were in pastures, **0.2 MH** in Cerrado and **1.2 MH** in other uses.

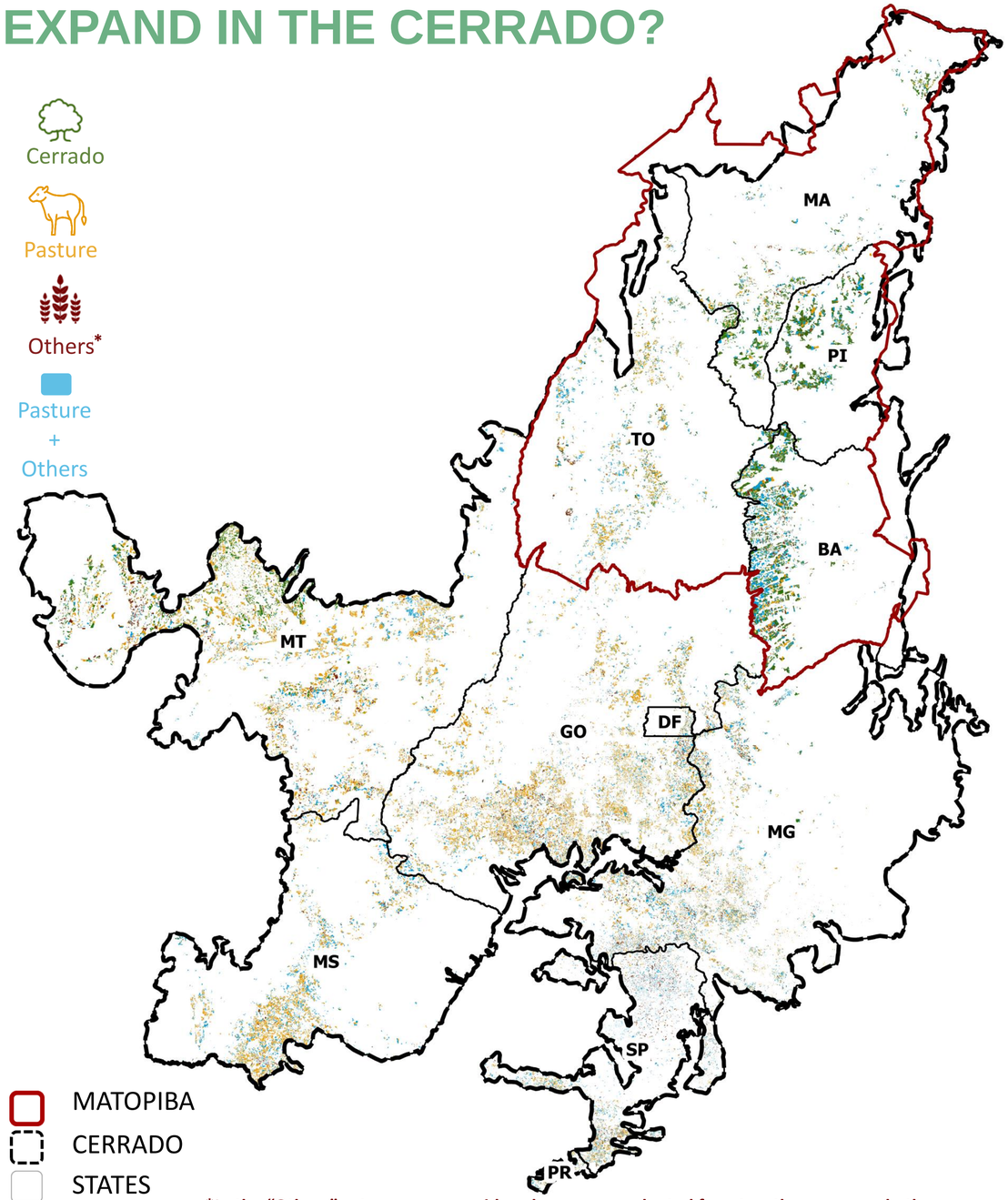
Between 2014 and 2017, the expansion over vegetation was **0.3 MH**, with **0.1 MH** in MATOPIBA and **0.2 MH** in other states. The expansion of agriculture over pasture + others was **1.1 MH** in MATOPIBA and **2.5 MH** in other states.

AGRICULTURAL EXPANSION BY REGION:



Source: Agrosatélite – Rudorff, Risso et al., 2015

OVER WHAT USES DID AGRICULTURE EXPAND IN THE CERRADO?



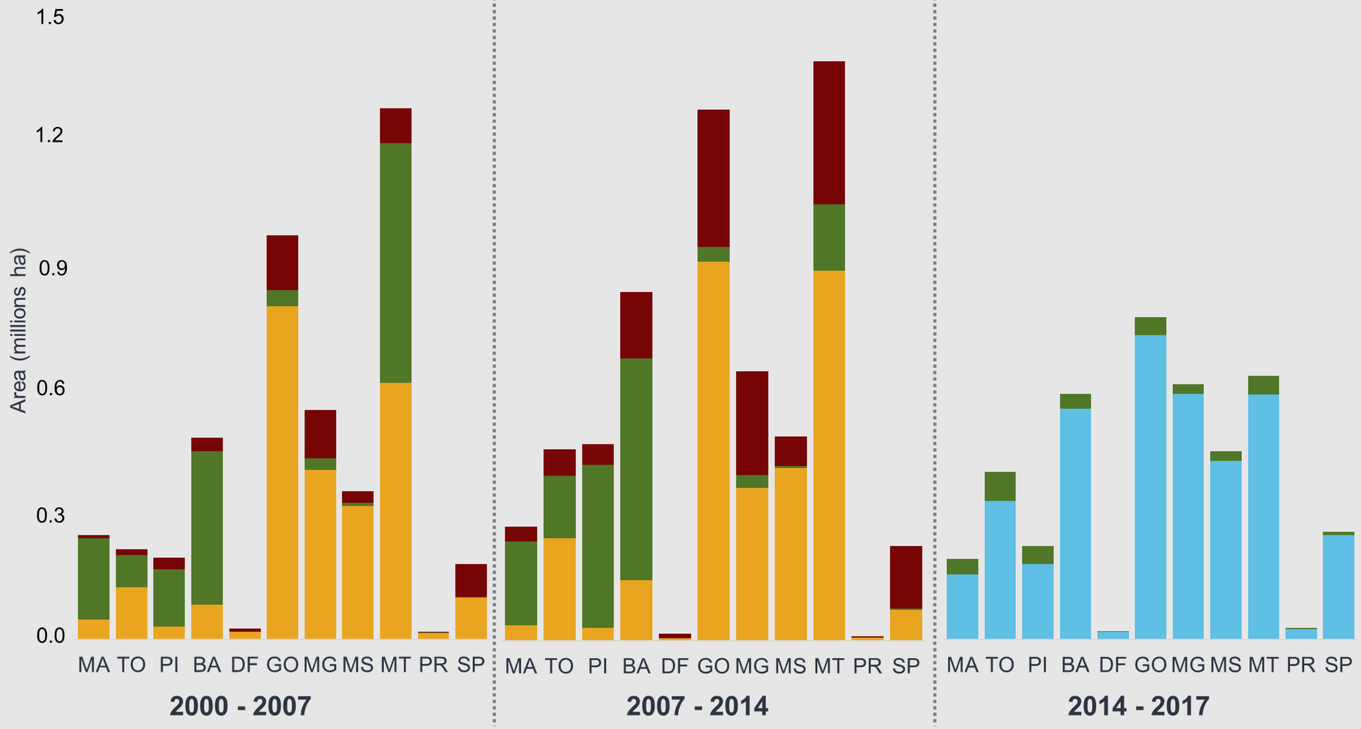
*In the "Others" category are considered sugarcane, planted forests, other crops and other uses.

It is possible to observe a **change in the expansion pattern throughout time.** Between 2000 and 2007, Mato Grosso was the state with most agricultural expansion over native vegetation, accounting for 40% of this expansion.

In turn, between 2007 and 2014, while MT expands mostly over pastures, **BA, PI, TO and MA become the states with the largest agricultural expansion over native vegetation.**

Between the years 2014 and 2017, soybean expanded mainly over "pasture + others" areas, hasn't a marked pattern for MATOPIBA, as observed in other years.

AGRICULTURAL EXPANSION BY STATE:



Source: Agrosatélite – Rudorff, Risso et al., 2015

HOW MUCH MORE WILL IT EXPAND?

WHAT IS THE SIZE OF THE EXPANSION?

According to data from the **FIESP Outlook 2027**, the soybean area in Brazil will **grow 5.8 million ha** between the period from 2016/17 to 2026/27.

In turn, data from the study "**Agribusiness Projections – Brazil 2015/16 to 2025/26**", carried out by the Ministry of Agriculture, Livestock and Food Supply (MAPA), **soybean area will grow**, approximately, **10 million ha** by 2026.

Considering the proportion of soybean area in the Cerrado relative to the production area in Brazil, which is of 52%, it is estimated that by **2027 soybean area in the Cerrado will grow between 3 MH and 5.2 MH**, according to FIESP and MAPA models, respectively.

However, considering that the main current agricultural frontiers are in the Cerrado, it is possible that the Biome's participation in agriculture will be even higher in the future.

WHERE TO ALOCATE THESE 3 – 5.2 MILLION HECTARES UNTIL 2027?

OUTLOOK FIESP 2026/27		MAPA 2025/26
30.3	Increase in the **production of soybeans** (millions of tons) **in Brazil**	33.5
5.8	Increase in the **soybean area** (millions of ha) in **Brazil**	10
3	Increase in the **soybean area** (millions of ha) in the **CERRADO***	5.2

(*) Considering that 52% of the soybean area in Brazil is in the Cerrado, this is the proportion found in 2014, according to Agrosatelite data.

Sources: FIESP, 2017; MAPA, 2017

PASTURES:
THE AGRICULTURAL OPPORTUNITY OF THE CERRADO

AGRICULTURAL SUITABILITY

For a more **optimized and sustainable** agricultural expansion, it is necessary to seek for territories in already cleared areas, avoiding **new deforestations**, but also without setting aside the factors that enable **better production opportunities**.

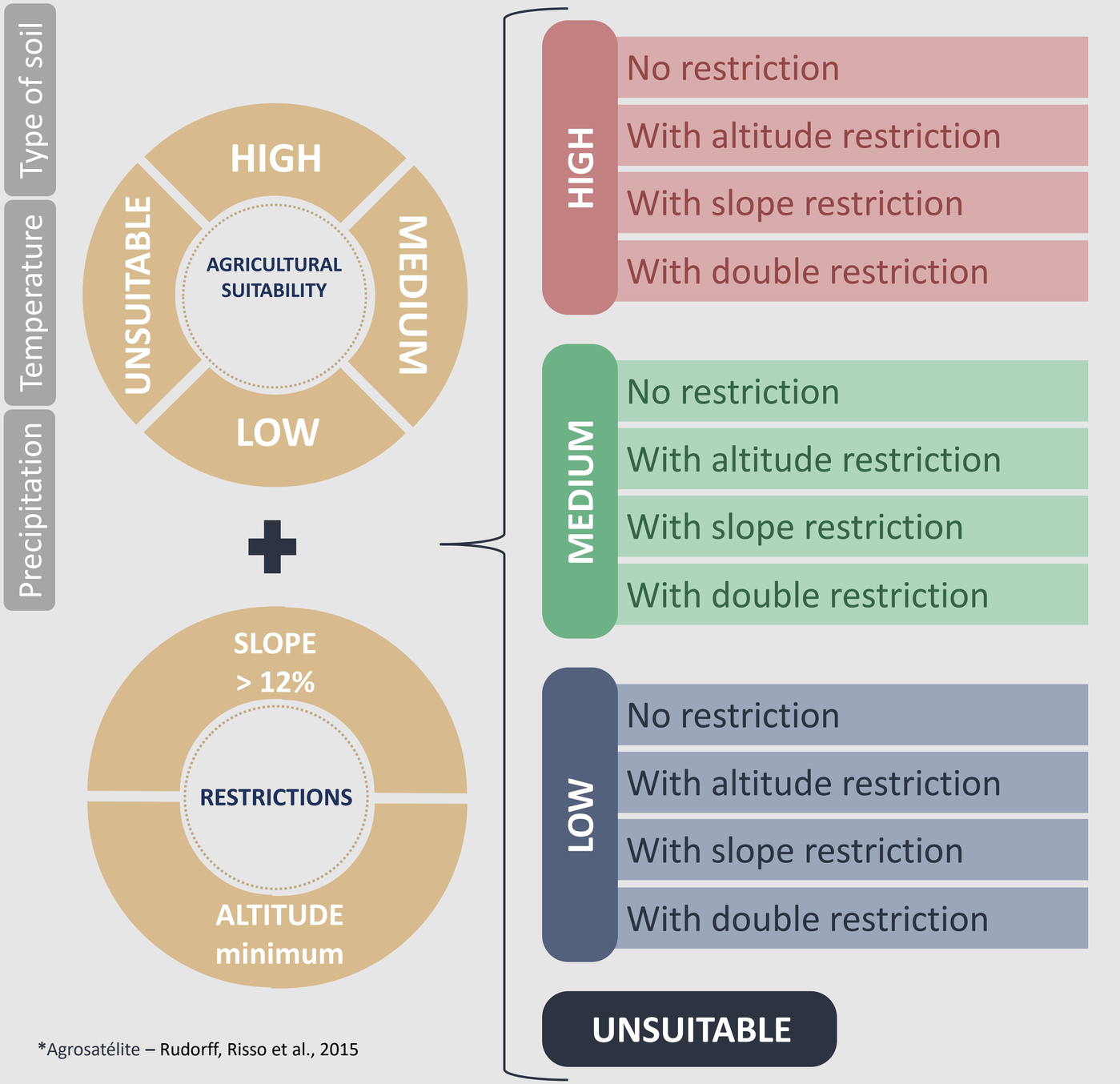
When seeking for areas with potential for agricultural expansion, and that are already cleared in the Cerrado, we find a large quantity of **PASTURES,** which are generally **underused by livestock production**, having stocking rates inferior to 1 head/ha. In this scenario, **livestock intensification** is a solution to improve the yields of the activity and an alternative to **free areas for agriculture**.

The **first factor** to identify the pasture areas with best opportunities for agriculture is **AGRICULTURAL SUITABILITY**, since it shows if certain area is appropriate for the cultivation of a certain crop or not.

In this study, the agricultural suitability from the Agrosatelite* report was used. The suitability data cover all anthropic and vegetation areas of the Cerrado. The methodology used was similar to the one adopted for the Climatic Risk Agricultural Zoning (ZARC) for soybeans. ZARC is established based on **TYPE OF SOIL** and a historical series of **TEMPERATURE** and **PRECIPITATION.**

Besides from the agricultural suitability classification, the possibility of a **slope restriction** (area with slope greater than 12%), due to impediment or difficulty for use of machinery in lands above this slope, and/or **altitude restriction** (minimal altitude of crops in the 2014 harvest). The final classification is as shown in the figure.

AGRICULTURAL SUITABILITY IN THE CERRADO



*Agrosatélite – Rudorff, Risso et al., 2015

AGRICULTURAL SUITABILITY IN PASTURE AREAS

In order to obtain the agricultural suitability only in pasture areas, **agricultural suitability** data were cut out with **pastures from Terraclass Cerrado 2013**. Since both mappings were carried out in different years (agricultural suitability in 2014 and Terraclass Cerrado in 2013), some pasture areas according to TC Cerrado were not classified in terms of suitability.

Thus, **the pasture area evaluated in this study, according to its agricultural suitability, totals 49.1 MH**, representing more than 80% of total pasture areas according to Terraclass Cerrado 2013.

In order to **identify the most appropriate land use for each area**, taking into account its vocation, the suitability categories were grouped in the following manner:

- **Can be allocated to agriculture:** areas with **high** and **medium** agricultural suitability and **no restriction** for agriculture.
- **Can be allocated to agriculture or livestock:** areas with high and medium agricultural suitability, but with **altitude restriction**. In some situations, these areas can be used for agriculture, although they area not preferential areas for this use. Furthermore, these areas can be used for livestock production.
- **Can be allocated to livestock or restoration:** areas with high and medium agricultural suitability, but with **slope restriction**, which hinders mechanization; areas with **low agricultural suitability** and areas **unsuitable** for agriculture. These areas are not recommended for agriculture because they do not present favorable or adequate conditions for cultivation. They can be allocated to livestock production, intensive or not, or for the restoration of Legal Reserves, for example.

CAN BE ALLOCATED TO AGRICULTURE

- HIGH NO RESTRICTION
- MEDIUM NO RESTRIÇÃO

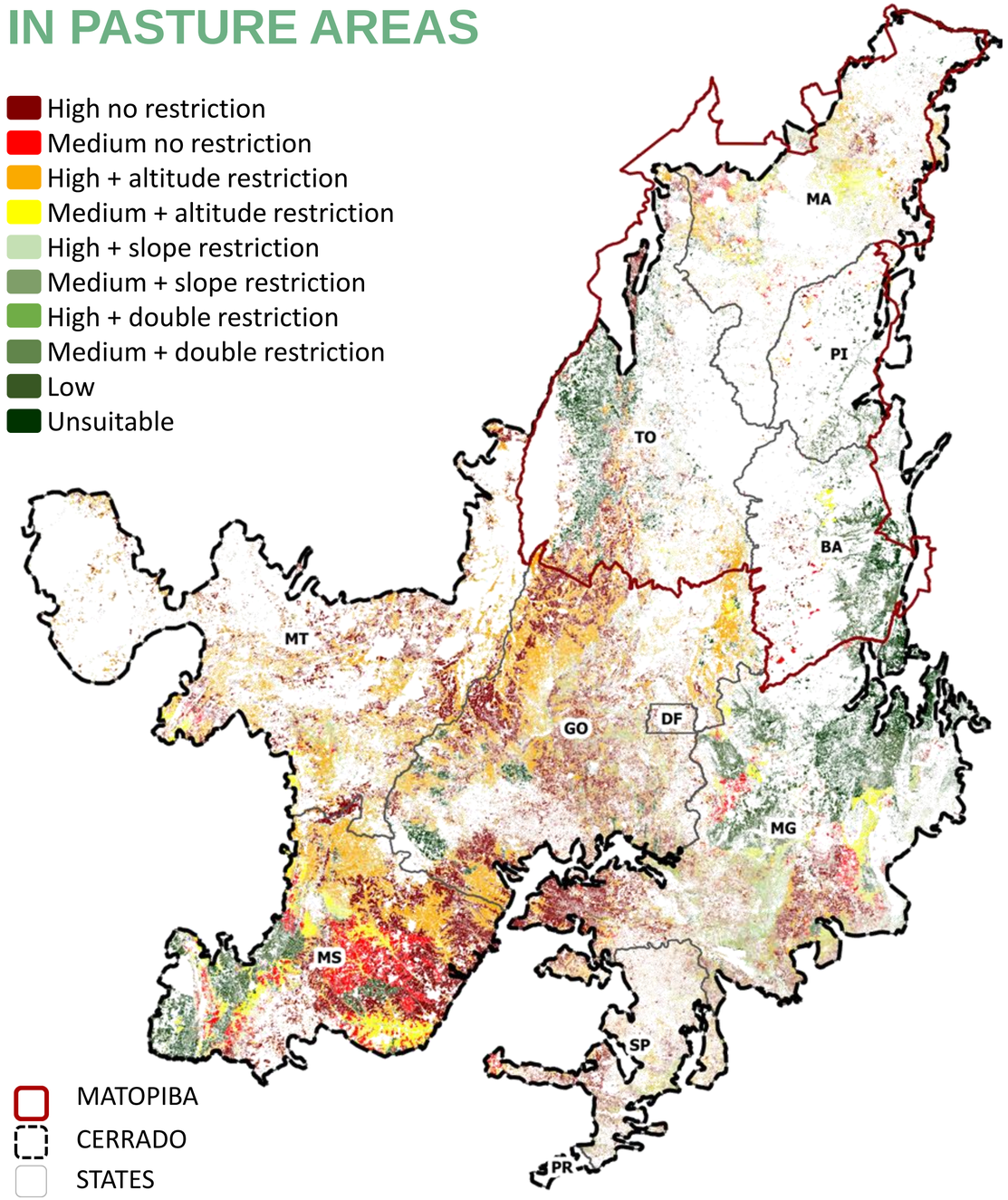
CAN BE ALLOCATED TO AGRICULTURE OR LIVESTOCK

- HIGH + ALTITUDE RESTRICTION
- MEDIUM + ALTITUDE RESTRICTION

CAN BE ALLOCATED TO LIVESTOCK OR RESTORATION

- HIGH + SLOPE RESTRICTION
- MEDIUM + SLOPE RESTRICTION
- HIGH + DOUBLE RESTRICTION
- MEDIUM + DOUBLE RESTRICTION
- LOW – ALL
- UNSUITABLE

AGRICULTURAL SUITABILITY IN PASTURE AREAS

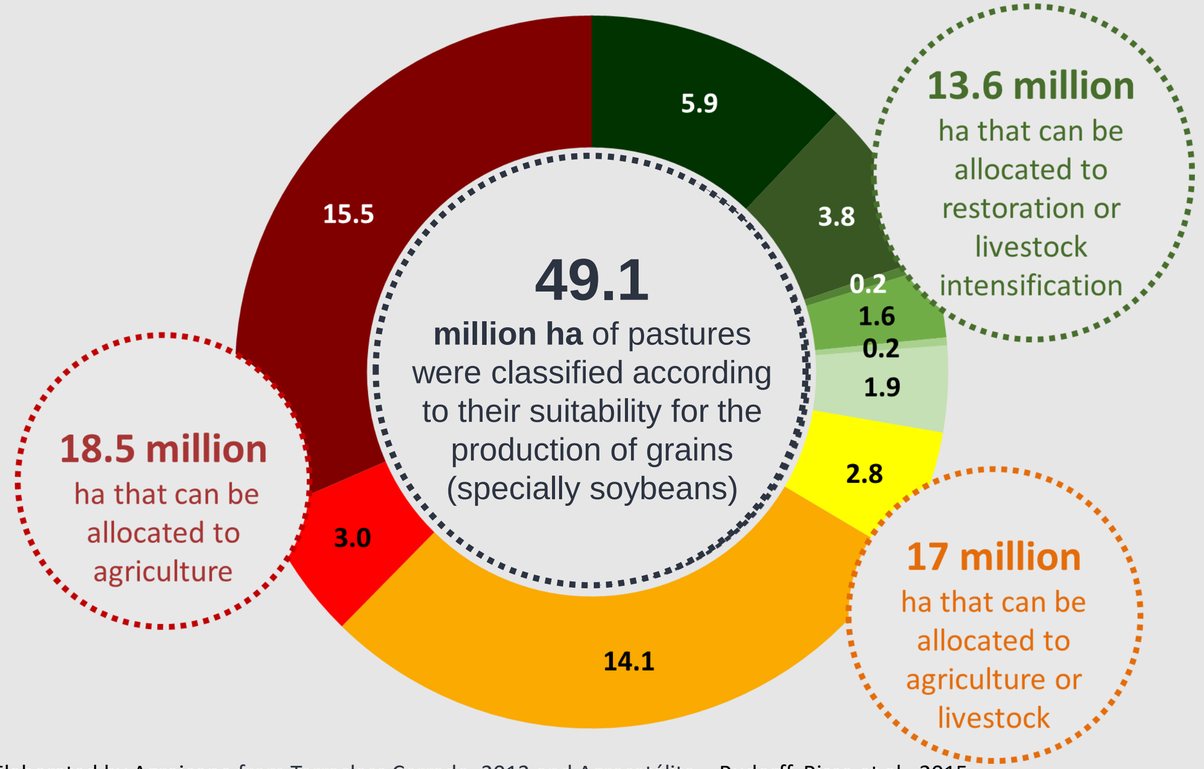


The analysis of agricultural suitability in pastures of the Cerrado biome resulted in the identification of **18.5 MH of pastures with high and medium suitability and no restrictions for the production of soybeans**, which can be allocated to agriculture.

17 MH of pastures have high and medium suitability and **altitude restriction** but, in some cases, could be used for agriculture, besides from being used for livestock production.

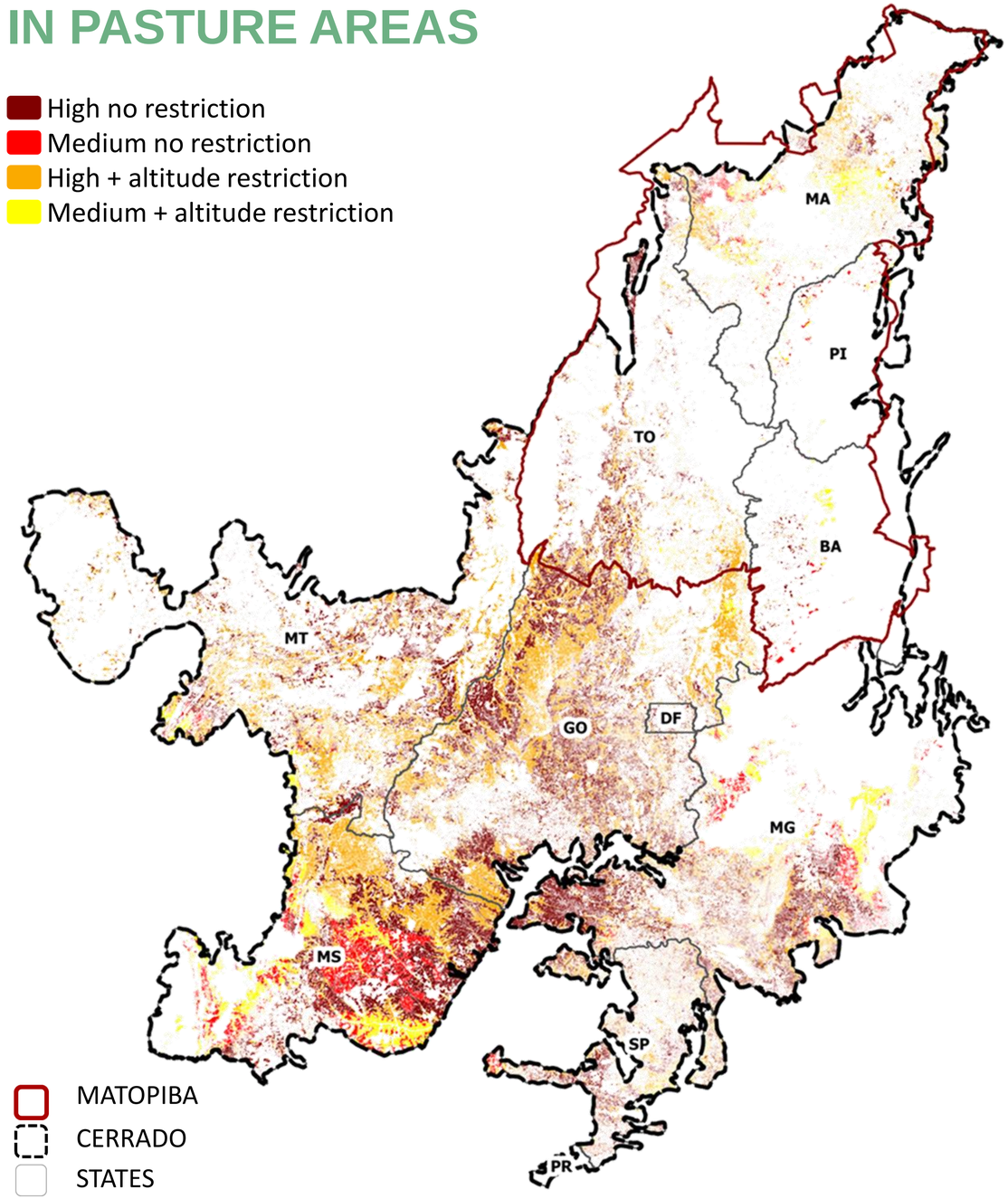
An area of **13.6 MH is not interesting for agriculture,** because it has slope restrictions, low suitability or are unsuitable for agriculture. Thus, these areas are good candidates to be used for **livestock intensification** or for **forest restoration**.

AGRICULTURAL SUITABILITY IN THE CERRADO



Sources: Elaborated by Agroicone from Terraclass Cerrado, 2013 and Agrosatélite – Rudorff, Risso et al., 2015.

AGRICULTURAL SUITABILITY IN PASTURE AREAS

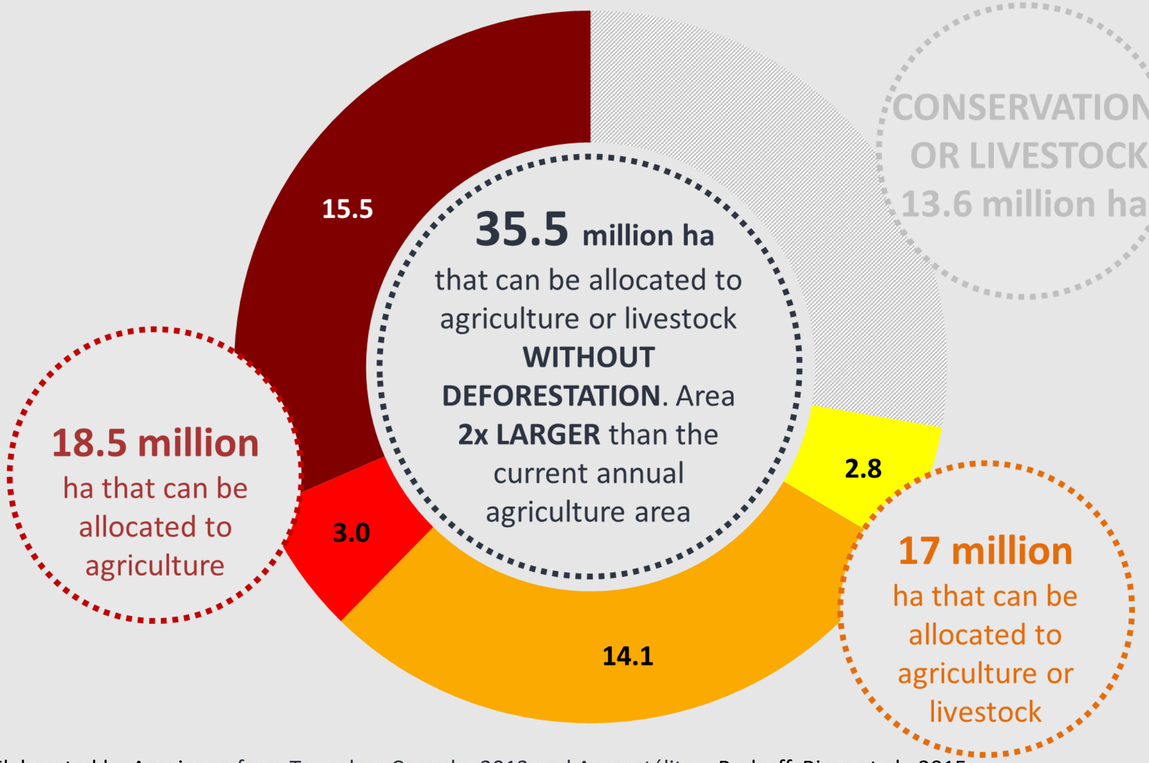


Together, the areas with high or medium agricultural suitability and no restrictions or altitude restrictions, that is, the **areas that can be allocated to agriculture**, total **35.5 MH**.

Using only pastures with high and medium suitability and no restrictions (18.5 MH), it is possible to **double the annual agriculture planted area** in the Cerrado (17.4 MH in 2013), **WITHOUT the need for new deforestations**.

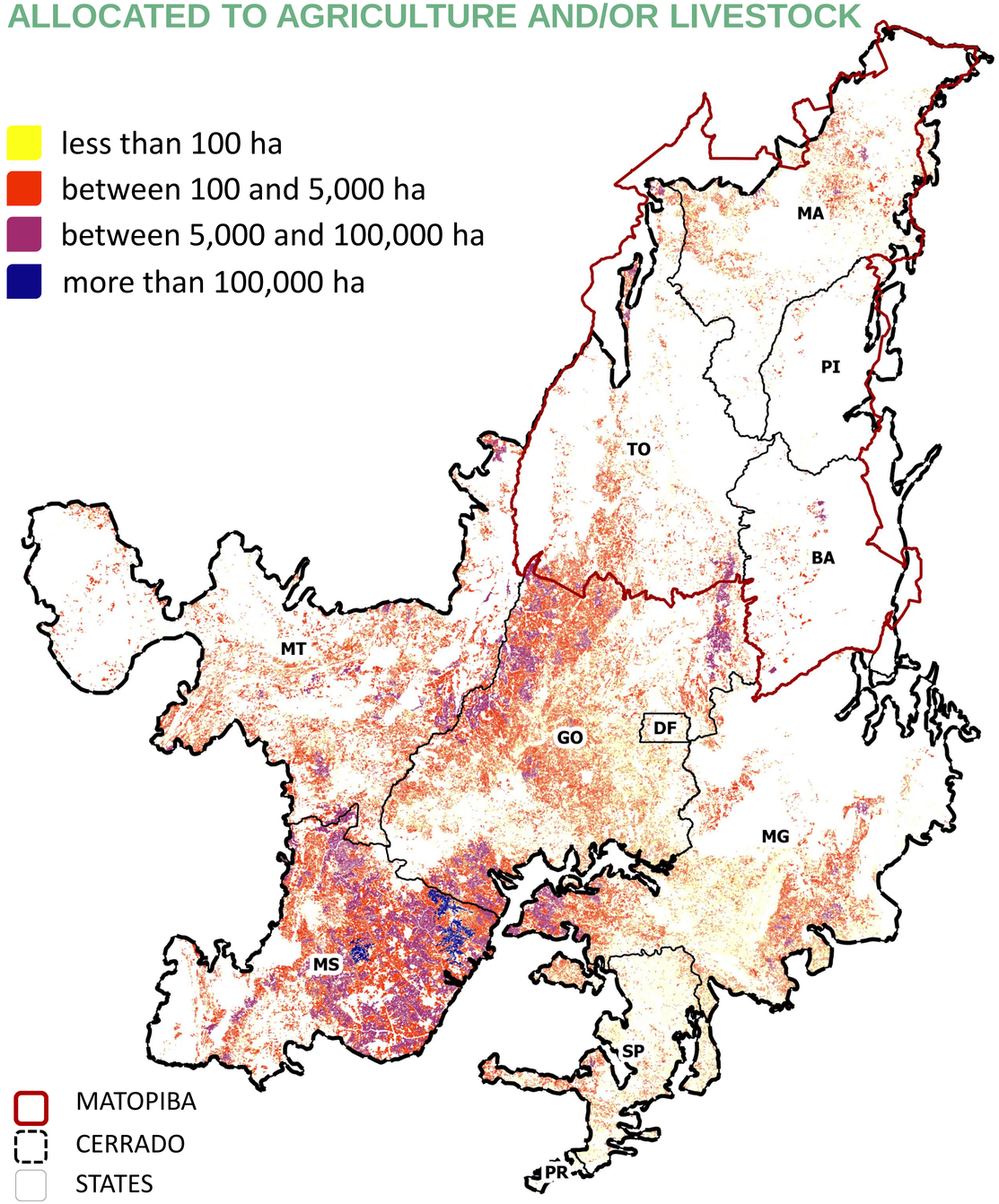
These pastures that can be allocated to agriculture should be the **focus in the territorial planning of the Cerrado**, because they are the great opportunity for sustainable agricultural expansion. It is necessary to select the areas of greatest interest among all, taking into account expansion patterns, the demand for land for livestock, the infrastructure and logistics of the regions.

AGRICULTURAL SUITABILITY IN THE CERRADO



Sources: Elaborated by Agroicone from Terraclass Cerrado, 2013 and Agrosatélite – Rudorff, Risso et al., 2015.

SIZE OF THE PASTURE POLYGONS THAT CAN BE ALLOCATED TO AGRICULTURE AND/OR LIVESTOCK



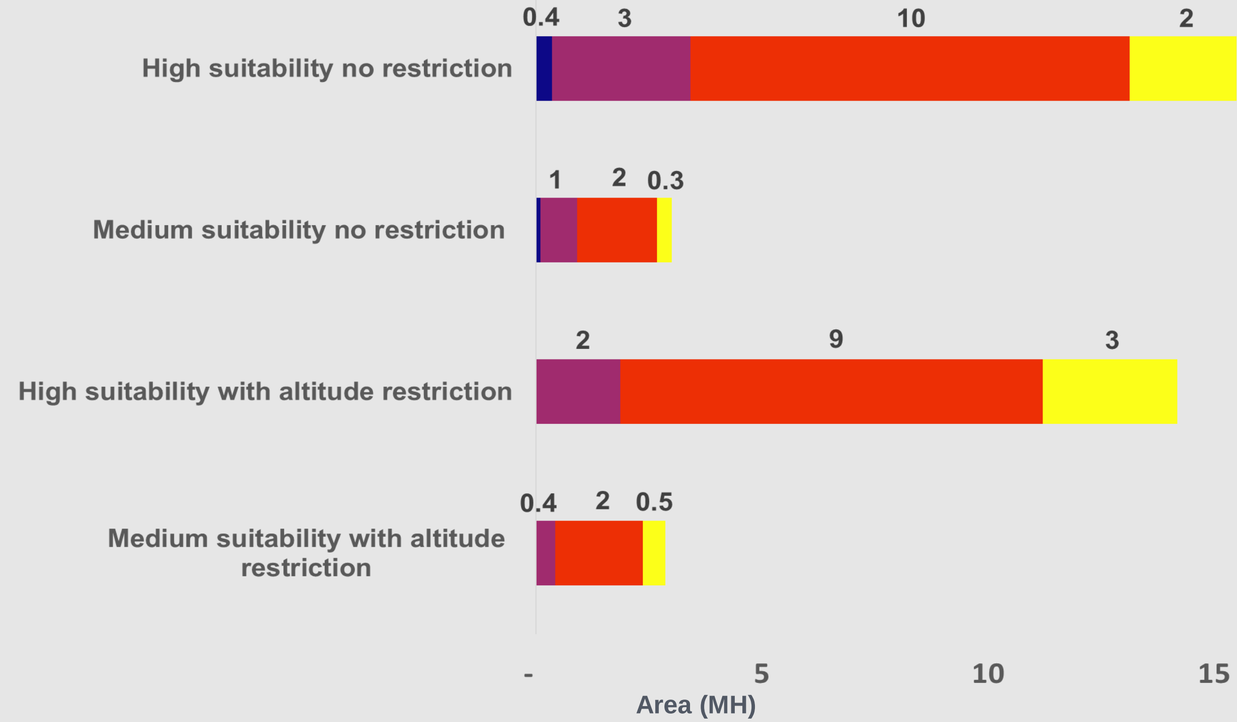
Soybean production is largescale agriculture, thus, larger areas are considered more appropriate for its expansion. Therefore, **the identification of large, continuous pasture areas that can be allocated to agriculture** supports the selection of the best opportunities for expansion.

The result of the division into **four categories of size** of the pastures with high or medium suitability and no restrictions for agriculture or with altitude restrictions indicates that:

- **Most pastures, 64%** (22.8 MH), are in continuous blotches with areas between 100 and 5,000 ha in extension.
- Others **17%** (6.2 MH) have areas between 5,000 and 100,000 hectares, while only **1.3%** (0.5 MH) have areas superior to 100,000 ha.

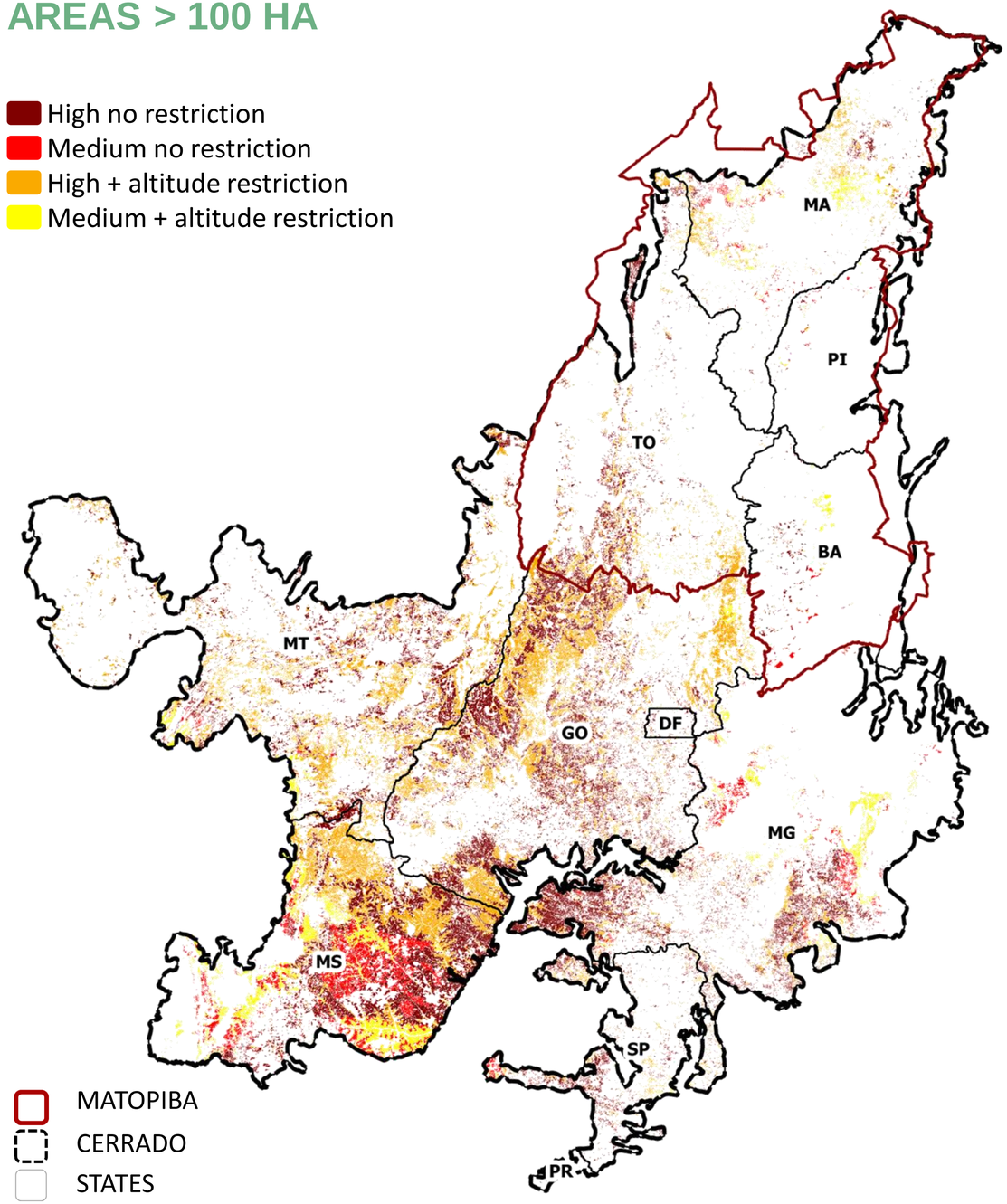
That is, **83% (29.8 MH) of pasture areas are in large blotches (> 100 hectares)** and only 17% (6.2 MH) are in blotches smaller than 100 hectares.

AREA BY SIZE OF POLYGONS (MH)



Sources: Elaborated by Agroicone from Terraclass Cerrado, 2013 and Agrosatélite – Rudorff, Risso et al., 2015.

AGRICULTURAL SUITABILITY IN PASTURE AREAS > 100 HA

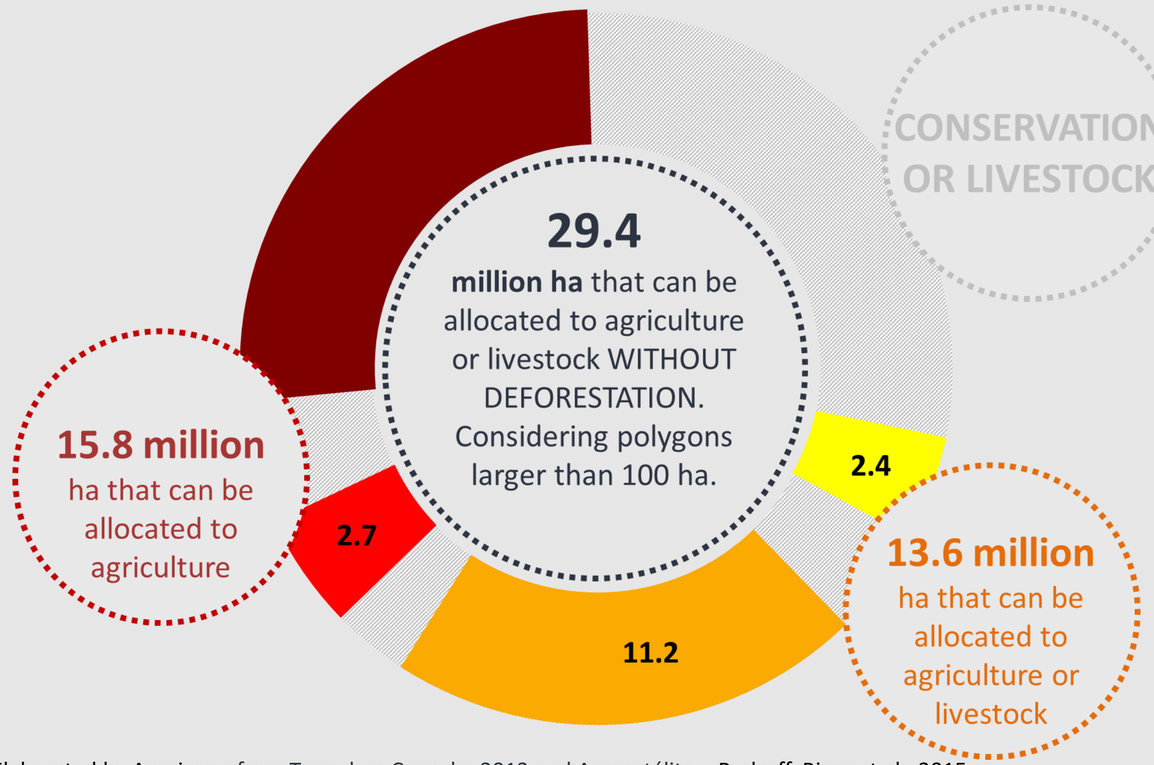


In order to evaluate the best opportunities for agricultural expansion, only the **areas that are appropriate for agriculture** (high and medium suitability with no restriction and with slope restriction) and **with at least 100 hectares in extension** were selected**.**

This analysis identified **29.4 MH in pasture blotches larger than 100 hectares and appropriate for expansion of agriculture or livestock production.** That is, almost all of the area that can be allocated to agriculture and/or livestock production (83%) has more than 100 ha in extension.

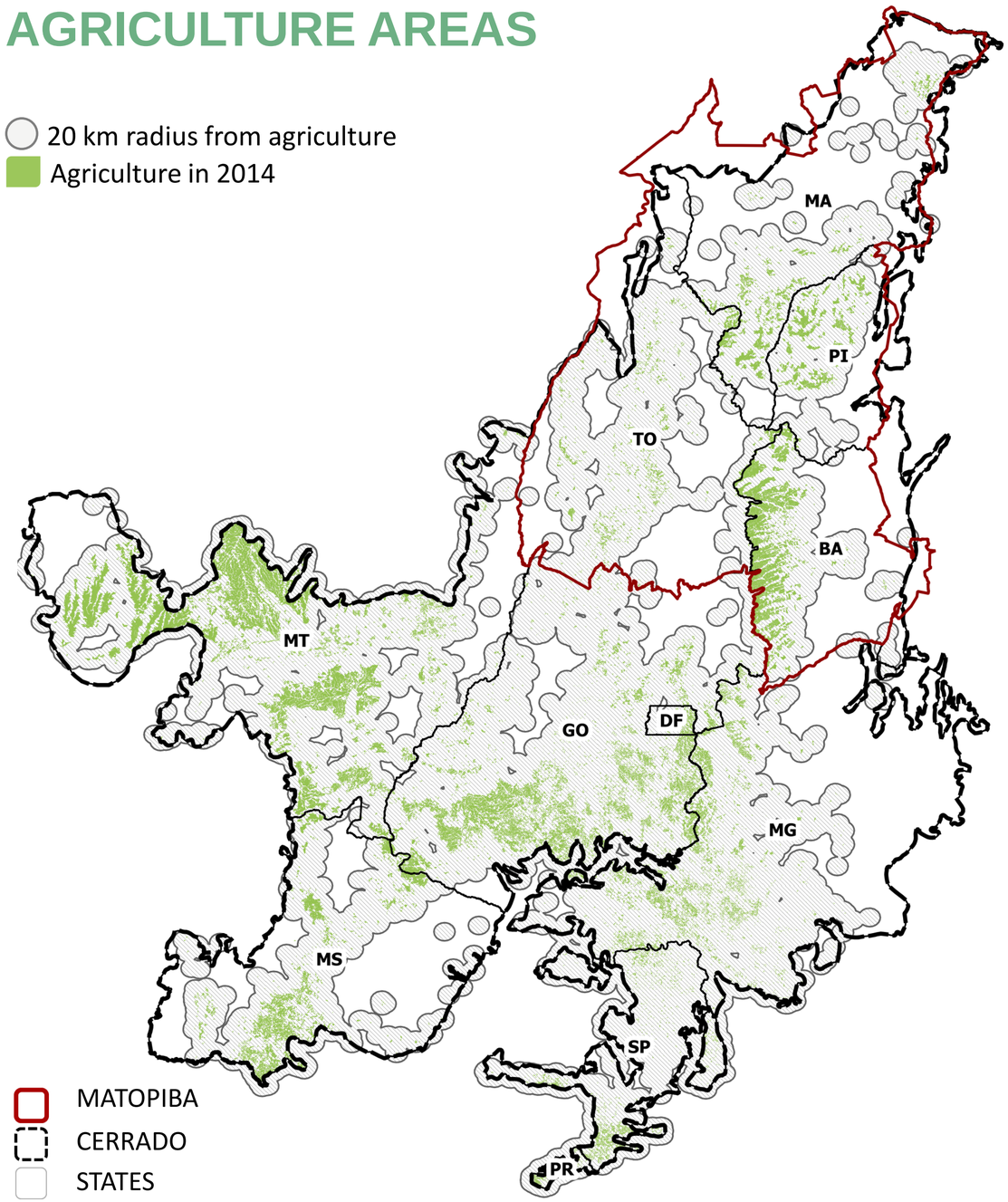
Of this area, **15.8 MH (54%)** have high and medium agricultural suitability and no restriction for agriculture and **13.6 MH (46%)** have high and medium suitability, but pose altitude restrictions.

AGRICULTURAL SUITABILITY IN THE CERRADO



Sources: Elaborated by Agroicone from Terraclass Cerrado, 2013 and Agrosatélite – Rudorff, Risso et al., 2015.

20 KM RADIUS FROM AGRICULTURE AREAS

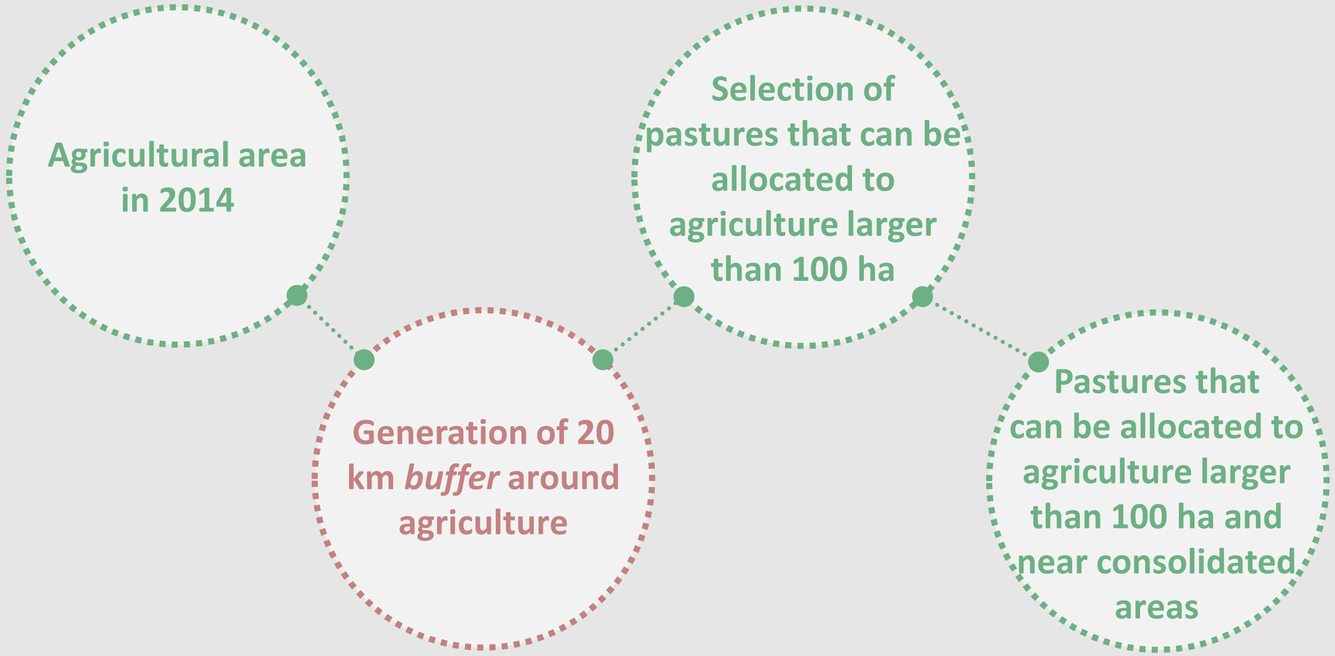


Another factor that should be taken into consideration when evaluating the most interesting areas for agricultural expansion is the **proximity to already existing agricultural areas**.

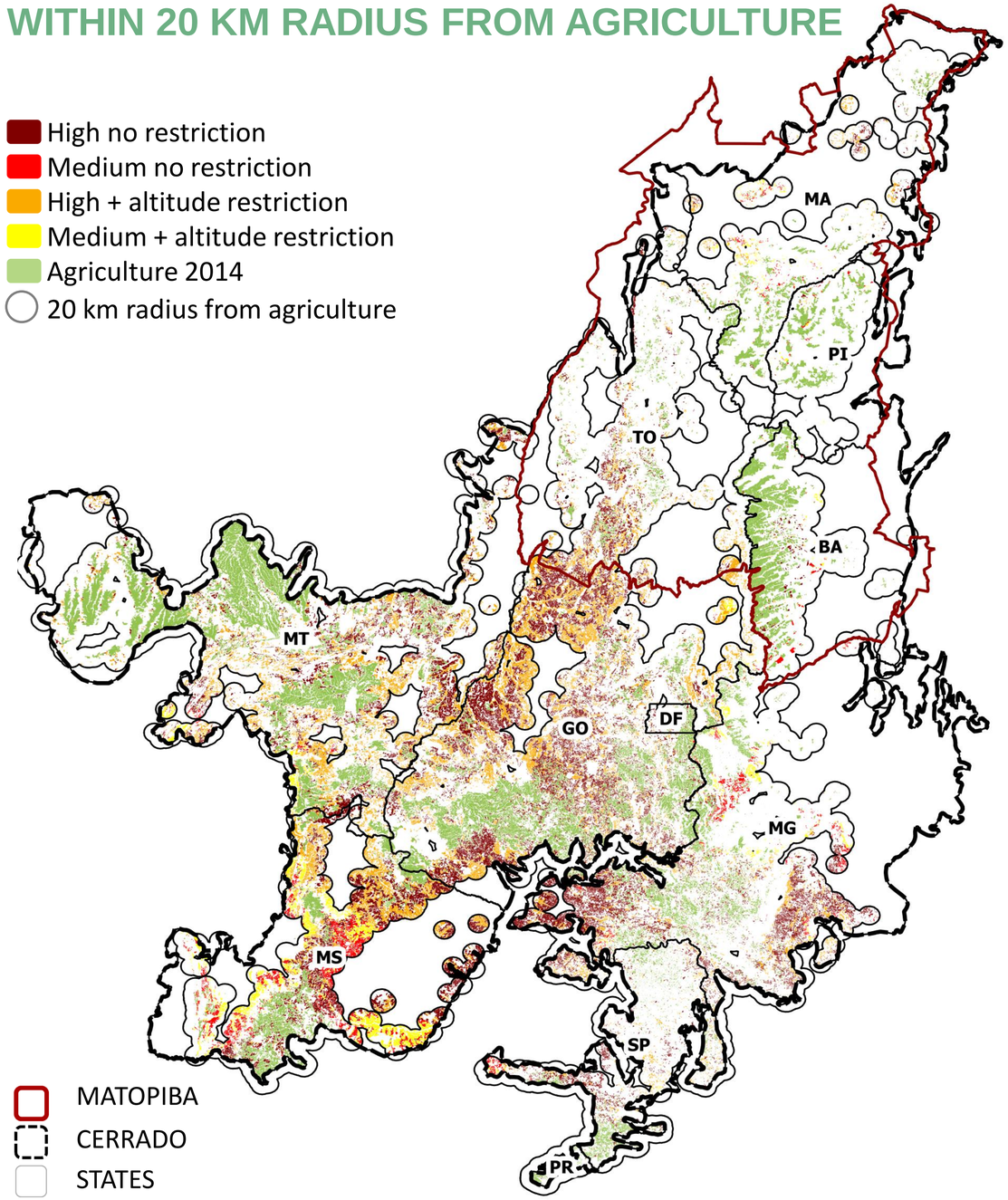
It is assumed that new agricultural areas tend to be allocated close to **already consolidated areas**, because these regions would already have **infrastructure** and **logistics** to store and distribute the production.

To analyze this factor, a **second selection** was carried out, considering areas that, in addition to being larger that **100 hectares,** are within a **20 km** radius from another agricultural area. The agricultural area data in 2017 was not used as the database to build radius because these data were not available when the analysis was carried out.

METHOD



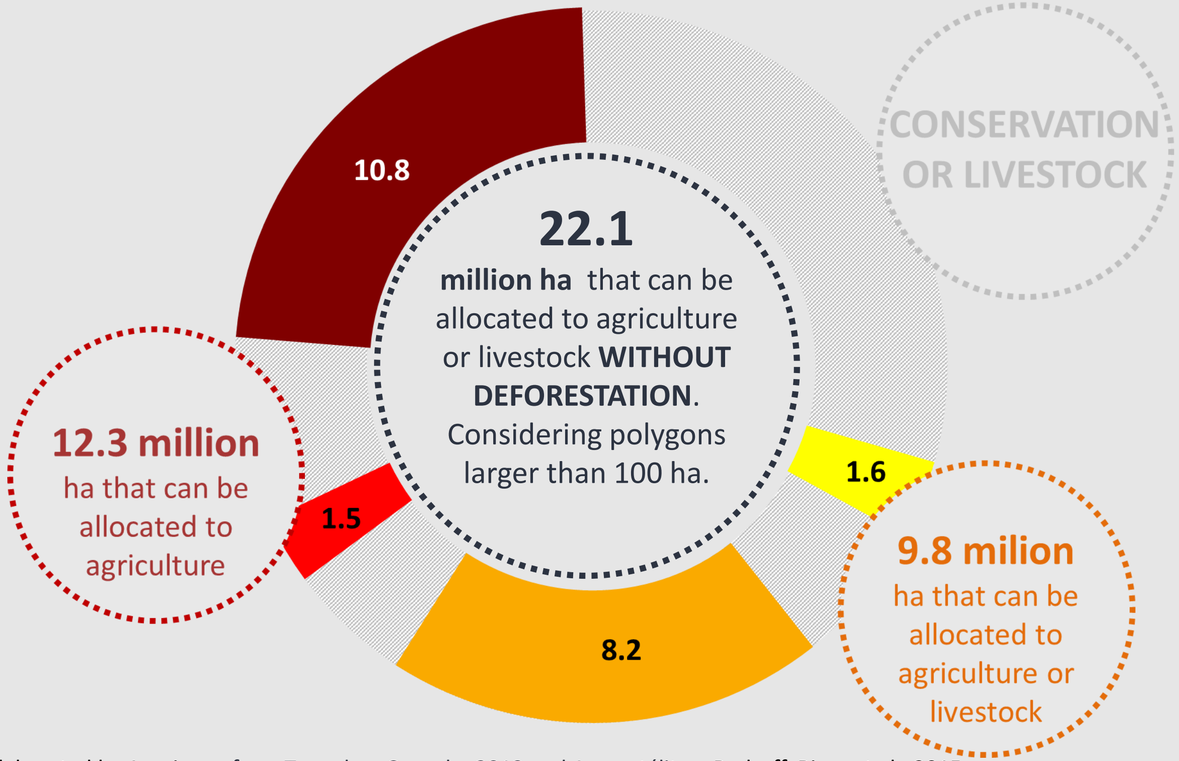
AGRICULTURAL SUITABILITY IN PASTURE AREAS WITHIN 20 KM RADIUS FROM AGRICULTURE



The selection of pastures that can be allocated to agriculture and/or livestock production that **are close to consolidated agriculture areas** (20 km radius) and that **are extensive** (areas larger than 100 hectares) resulted in **22.1 MH** of pastures with these characteristics. Out of the total area, **10.8 MH** have high and medium suitability and no restrictions for agriculture.

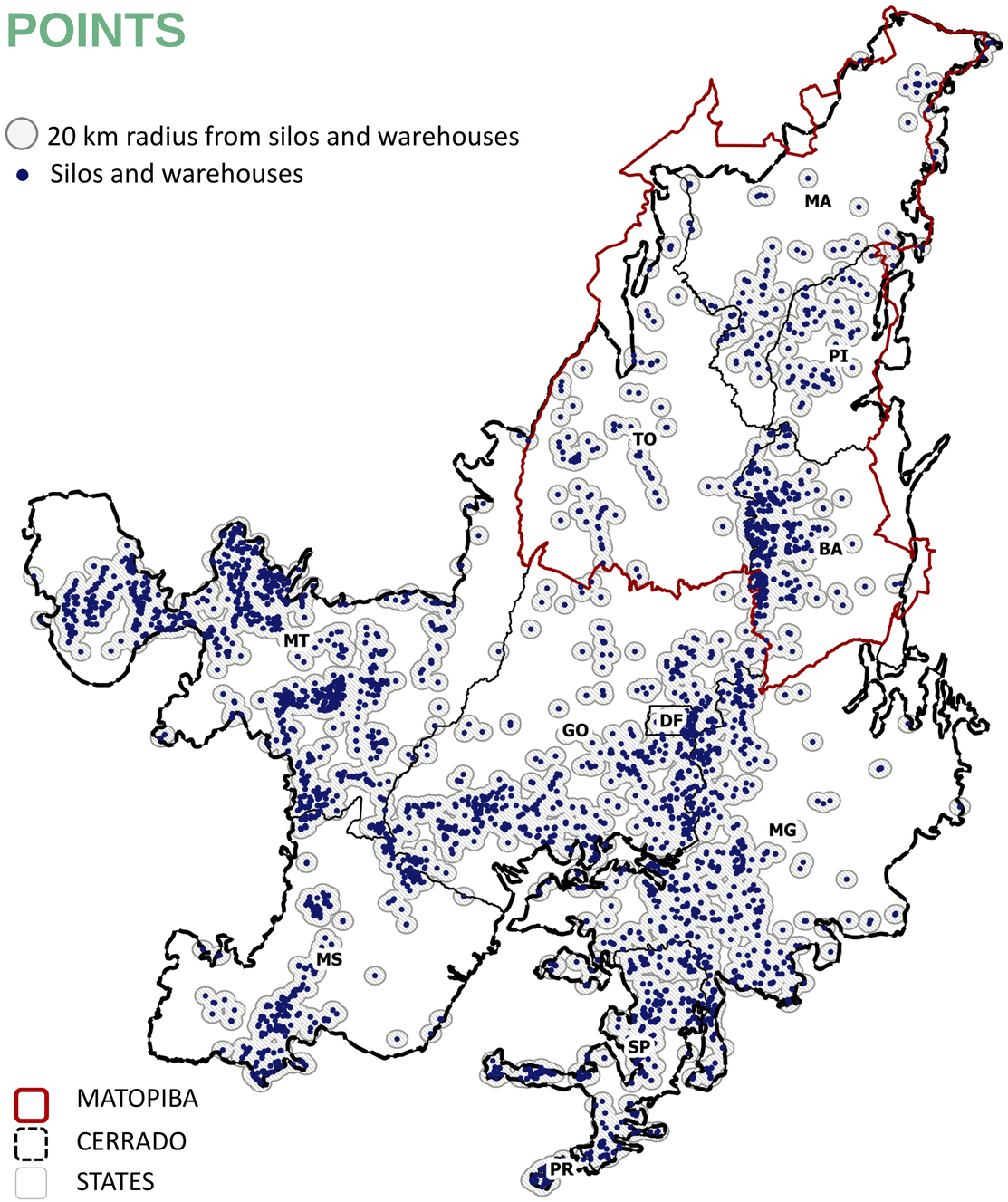
These 22.1 MH selected represent **62% of the total** of pastures that can be allocated to agriculture and/or livestock (35.5 MH). This shows that, even selecting the areas based on the size of the blotches of pasture and proximity to agriculture areas which would be most interesting for agricultural expansion, **there is still a considerable area for agricultural expansion over pastures.**

AGRICULTURAL SUITABILITY IN THE CERRADO - AROUND AGRICULTURE



Sources: Elaborated by Agroicone from Terraclass Cerrado, 2013 and Agrosatélite – Rudorff, Risso et al., 2015.

20 KM RADIUS FROM STOCKING POINTS

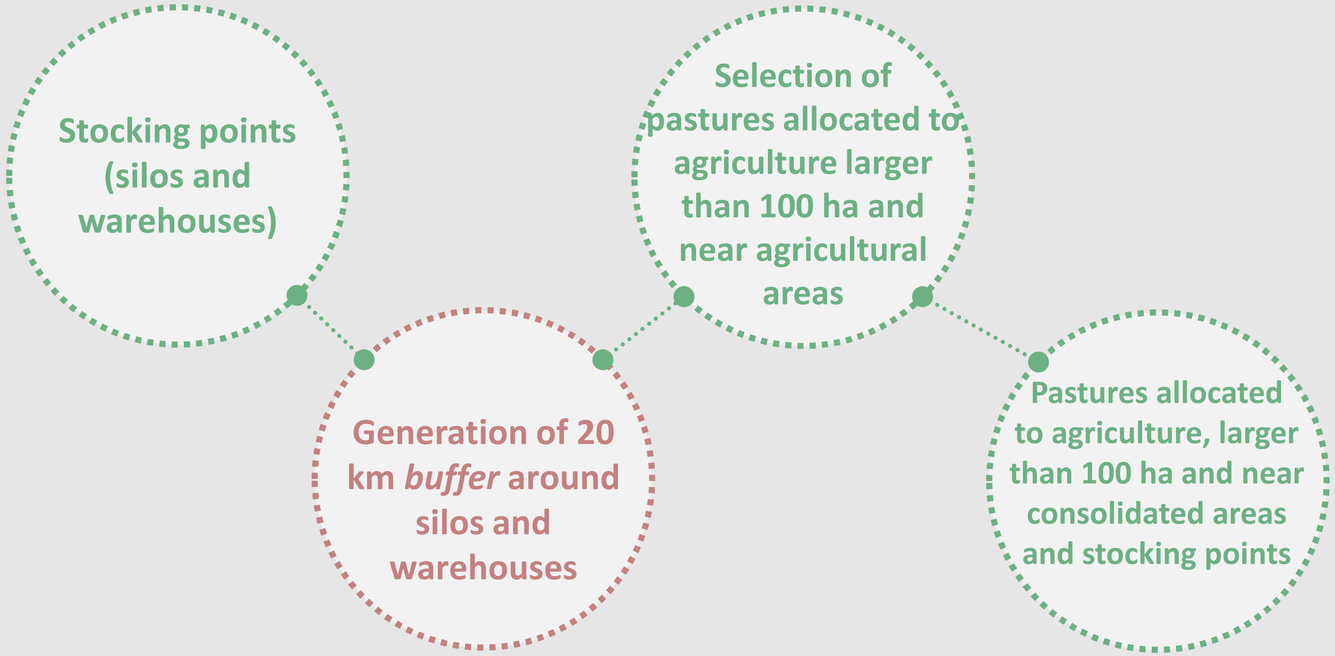


A last factor considered in order to find the best opportunities for agricultural expansion was the **proximity to stocking points**.

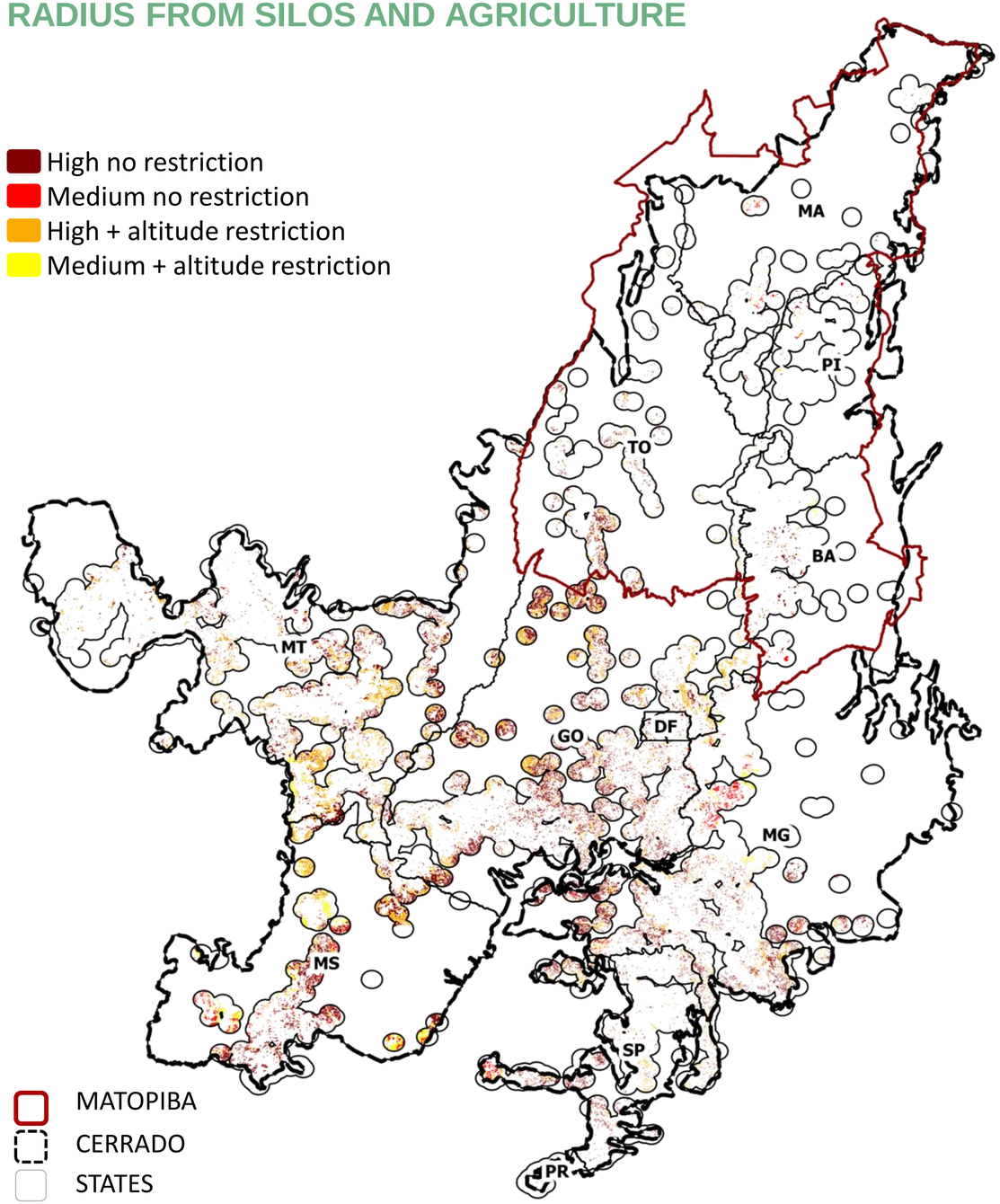
It is assumed that areas with existing infrastructure, for example, to **store the production**, are most interesting for agricultural expansion.

In order to evaluate this factor, pastures that, besides from being larger than 100 hectares and within a 20 km radius from some agricultural area, were also **within a 20 km radius from some stocking point (silo or warehouse)** were selected.

METHOD



AGRICULTURAL SUITABILITY IN PASTURES WITHIN 20 KM RADIUS FROM SILOS AND AGRICULTURE

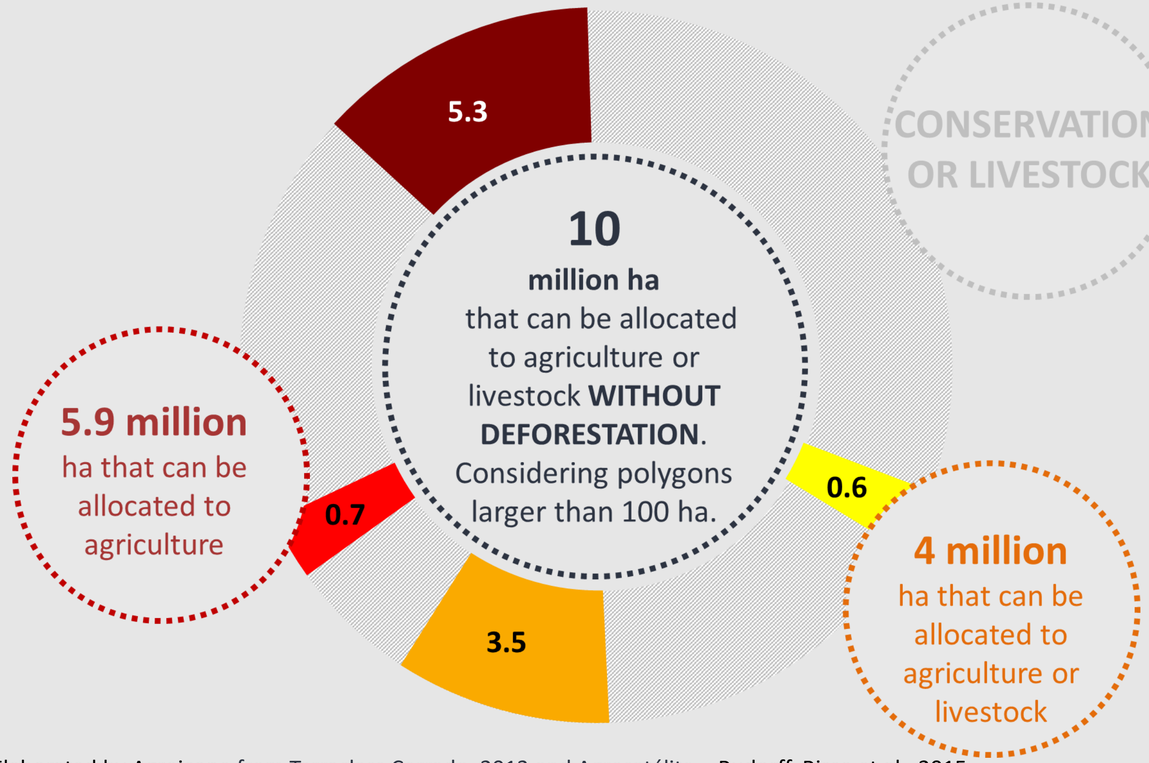


This combination of analysis resulted in what we can consider a selection of the pastures that meet all evaluated criteria: **allocated to agriculture** (high and medium suitability with no restrictions or altitude restrictions), in continuous areas **larger than 100 ha** and located **within a 20 km radius from agriculture areas and stocking points** (silos and warehouses).

Based on the factors evaluated, **10 MH of pastures that can be considered the best opportunities for agricultural expansion** were identified, which represent **28%** of the total areas that can be allocated to agriculture and/or livestock production. These areas are **VERY HIGH priority for agricultural expansion**.

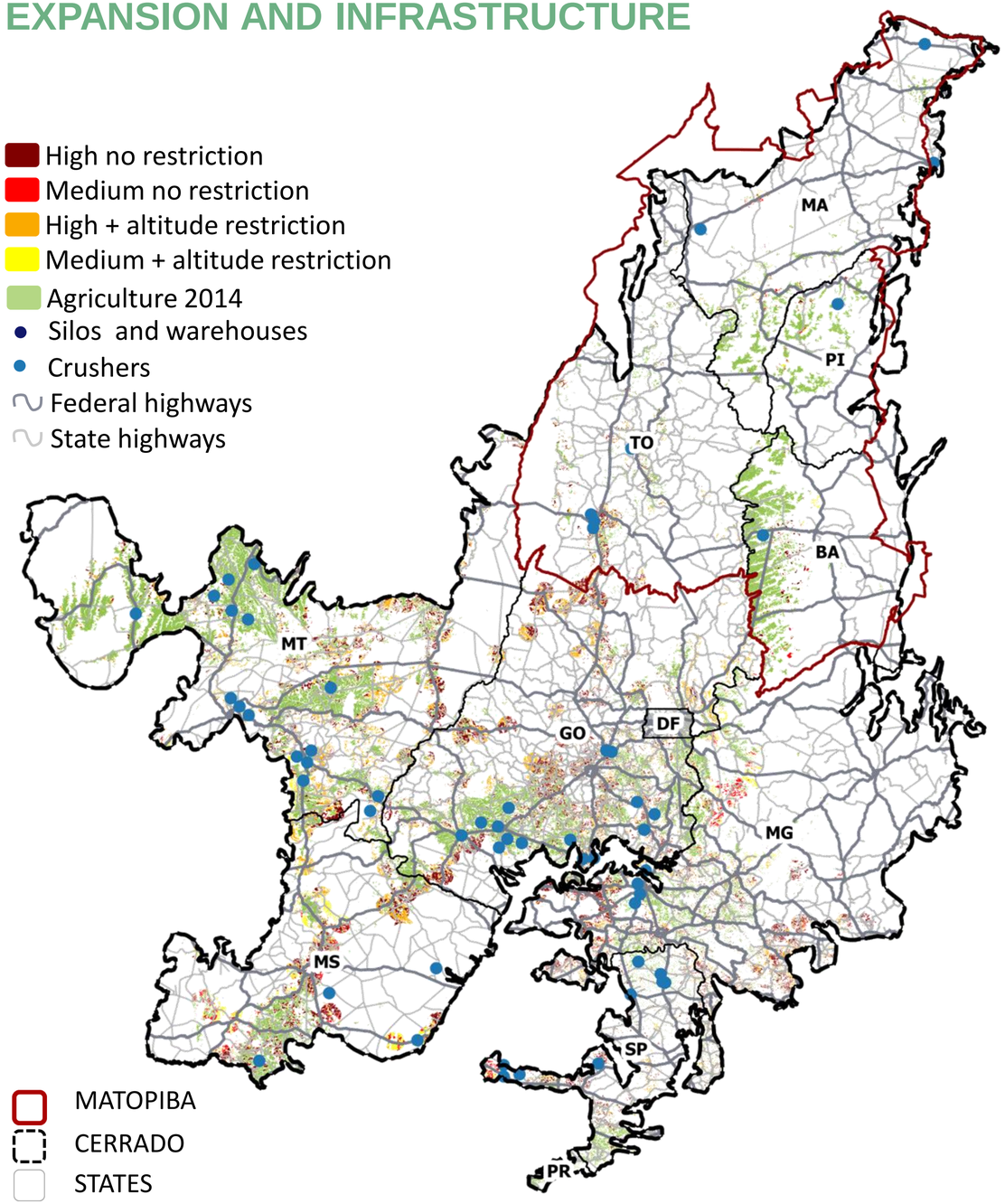
Out of this total, **59% (5.9 MH)** have high or medium suitability with no restrictions for agriculture, while **41% (4 MH)** have high or medium suitability, however, with altitude restrictions.

AGRICULTURAL SUITABILITY IN THE CERRADO



Sources: Elaborated by Agroicone from Terraclass Cerrado, 2013 and Agrosatélite – Rudorff, Risso et al., 2015.

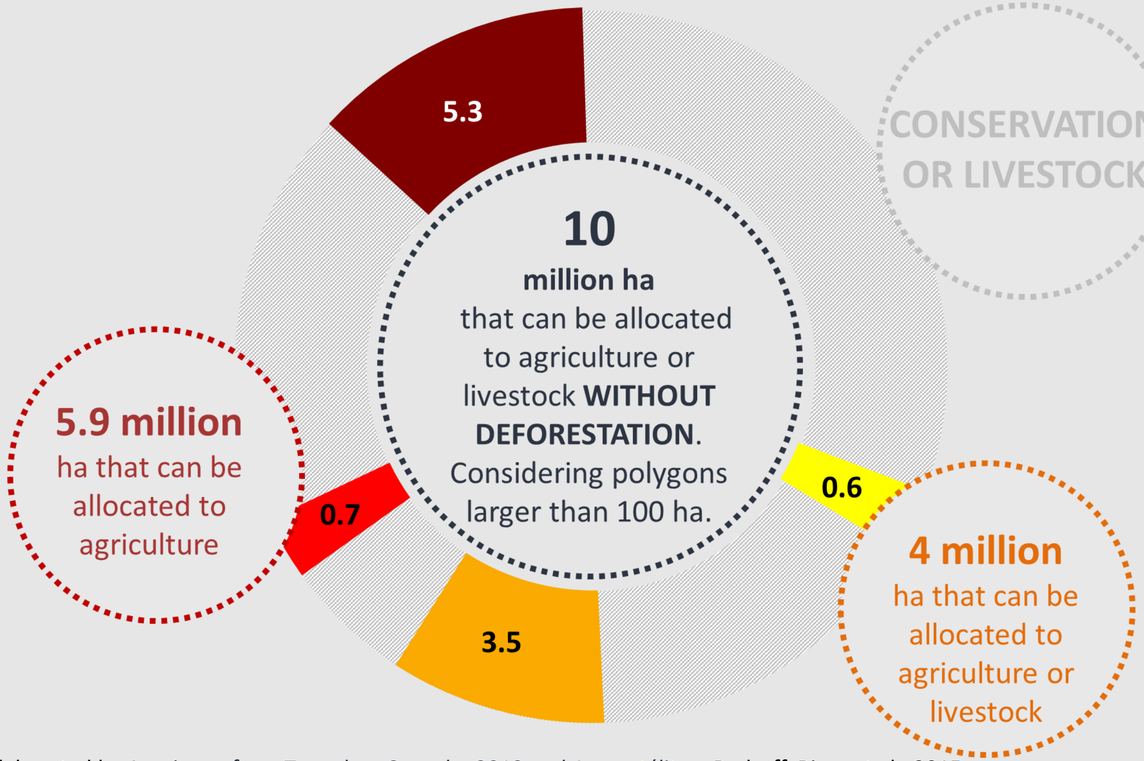
BEST OPPORTUNITIES FOR AGRICULTURAL EXPANSION AND INFRASTRUCTURE



Most of the pastures selected as the **best opportunities for agricultural expansion (10 MH)** are in regions that have **robust infrastructure**, which is represented here by the **industries** (grain crushers), **highways and roads** and by **stocking points** (which were used as area selection factors).

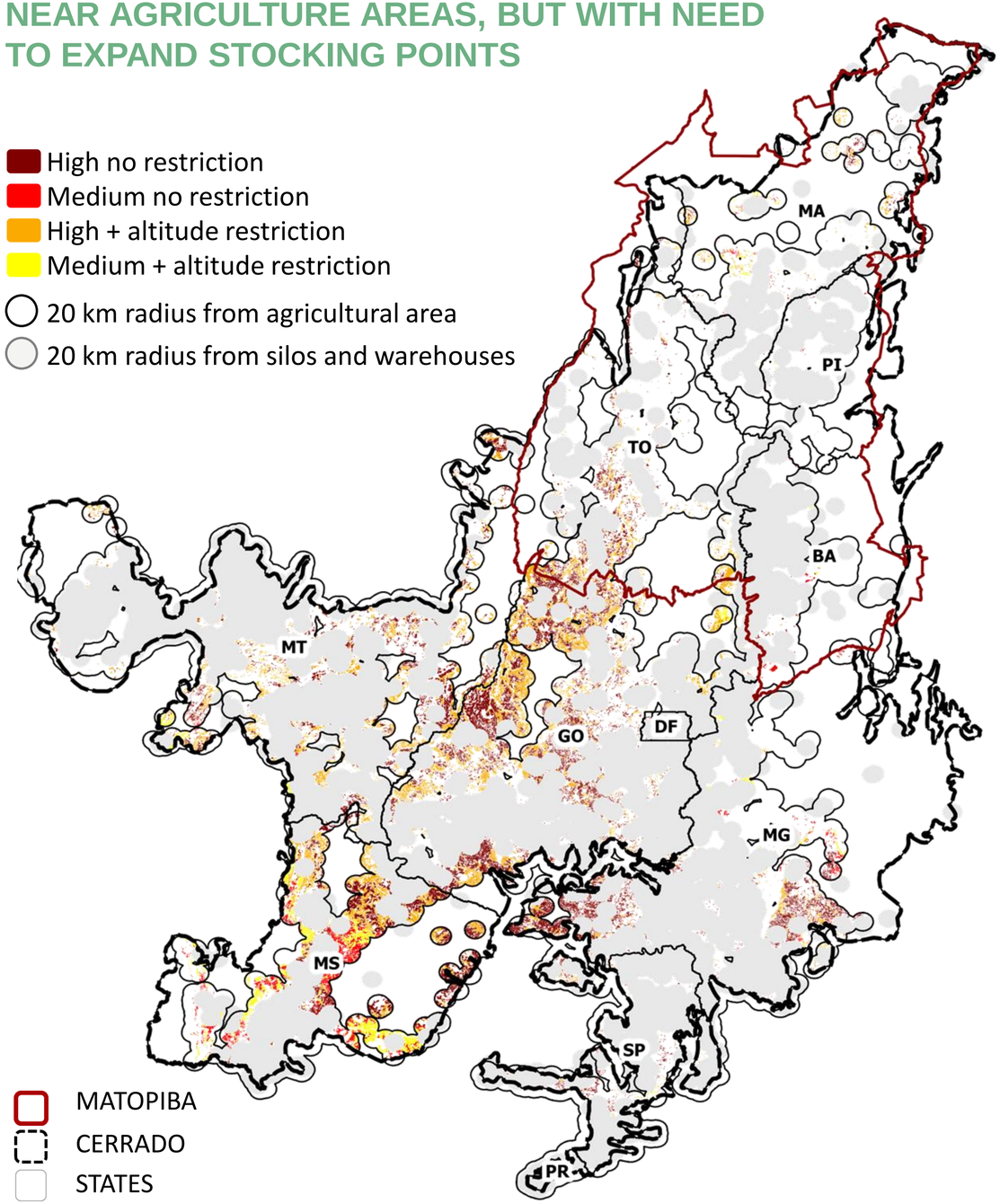
This shows that it is still **possible to expand agricultural production in areas appropriate for cultivation and in regions where infrastructure** to stock and distribute the production are available.

AGRICULTURAL SUITABILITY IN THE CERRADO



Sources: Elaborated by Agroicone from Terraclass Cerrado, 2013 and Agrosatélite – Rudorff, Risso et al., 2015.

OPPORTUNITIES FOR AGRICULTURAL EXPANSION NEAR AGRICULTURE AREAS, BUT WITH NEED TO EXPAND STOCKING POINTS

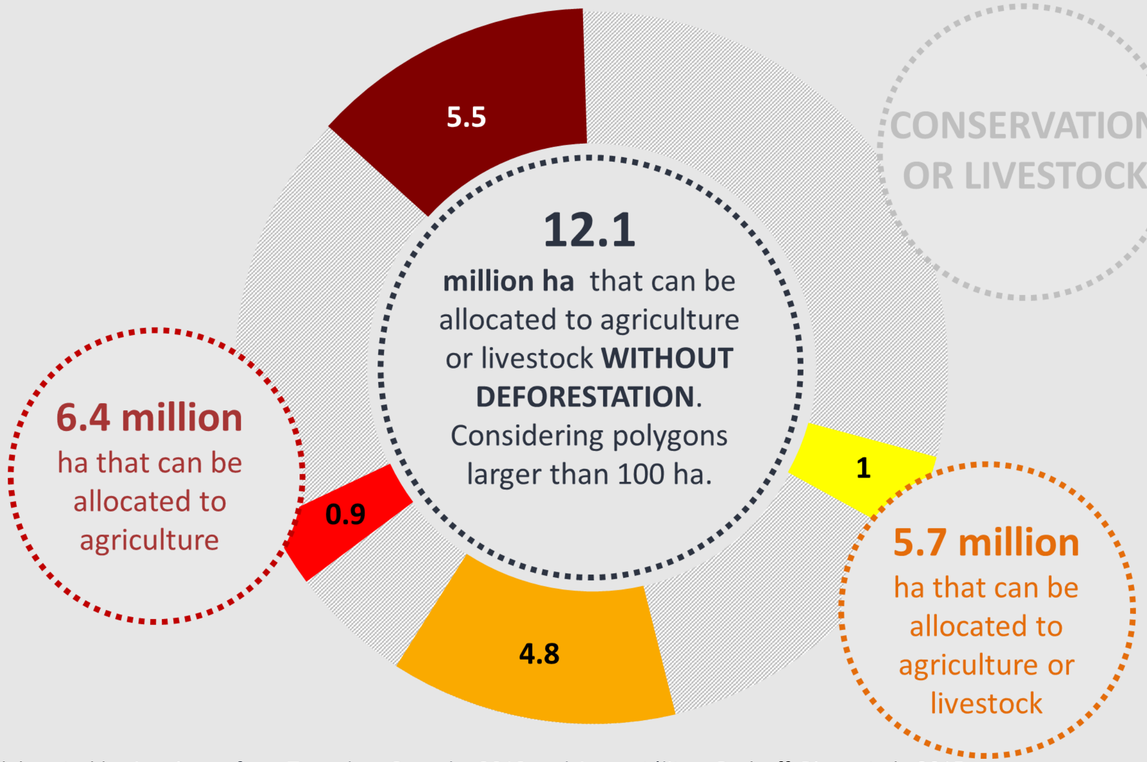


Some areas (**12.1 MH**) represent opportunities for agricultural expansion, but, although they meet the other criteria for selection of best areas, they are **not within a 20 km radius from any silo or warehouse.**

These are **HIGH priority areas for agricultural expansion**, because they are appropriate for agricultural production and **border consolidated agricultural areas** (20 km radius from the limit of the agricultural areas). Although they are not within a 20 km radius from the stocking points, they are **not necessarily far away from these points** and, the production could probably be stored in the closest silos and warehouses that have available storage capacity.

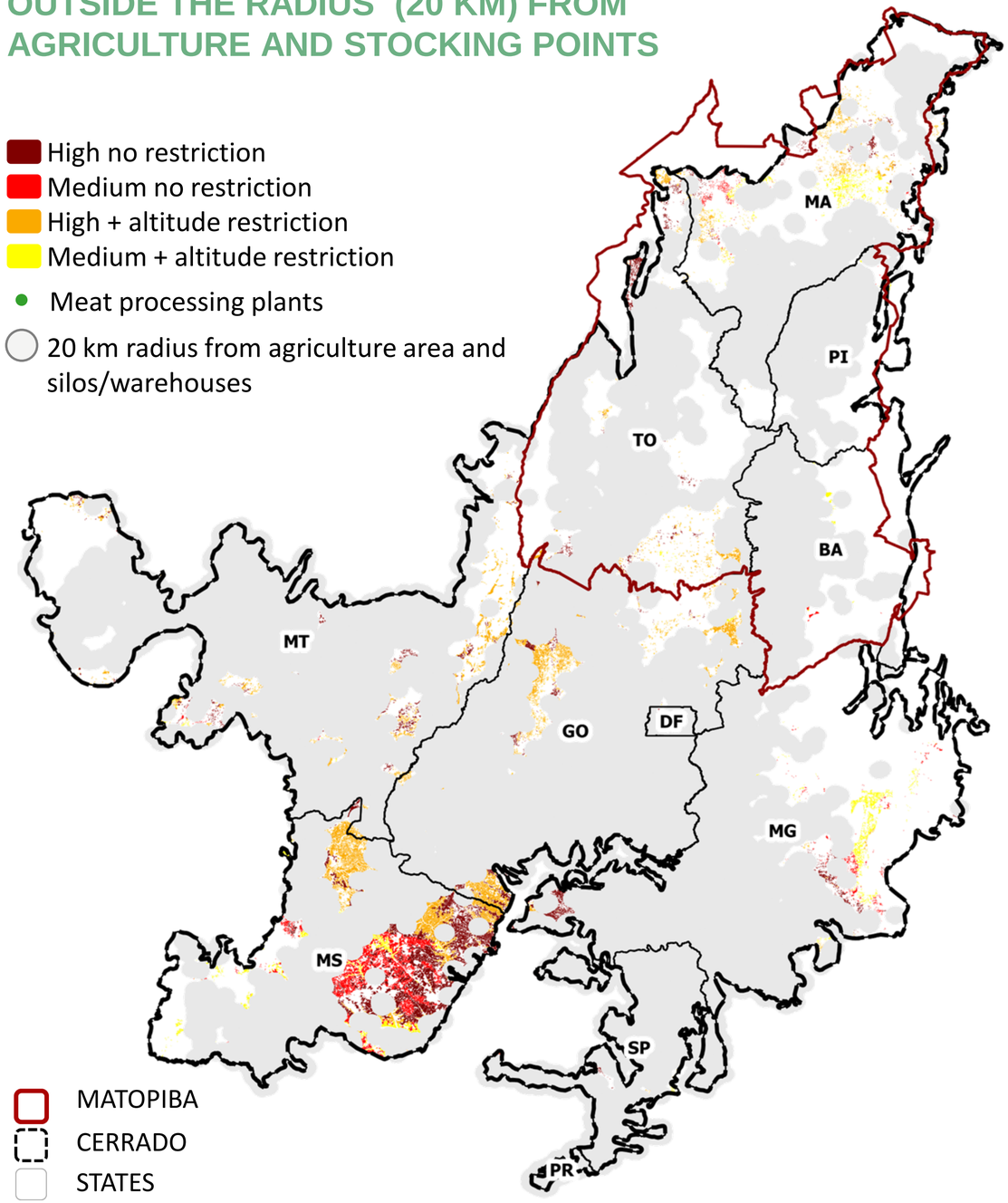
In the areas more distant from the existing storage points or those with available capacity, **new silos and warehouses could be installed or expanded.**

AGRICULTURAL SUITABILITY IN THE CERRADO



Sources: Elaborated by Agroicone from Terraclass Cerrado, 2013 and Agrosatélite – Rudorff, Risso et al., 2015.

OPPORTUNITIES FOR AGRICULTURAL EXPANSION OUTSIDE THE RADIUS (20 KM) FROM AGRICULTURE AND STOCKING POINTS

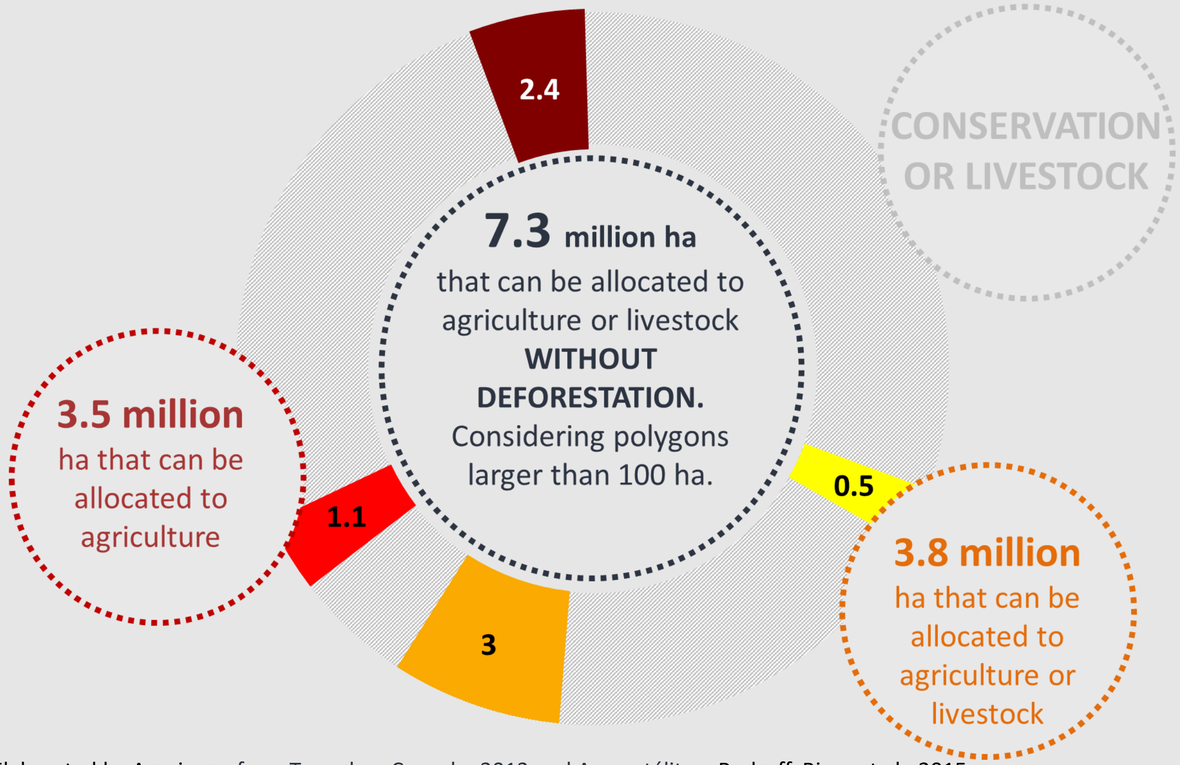


Lastly, some pastures (**7.3 MH**) have **good conditions for agricultural production**, showing high or medium suitability with or without altitude restrictions, and are **larger than 100 hectares**. However, they **are not within the 20 km radius** from agricultural areas or stocking points.

Agricultural expansion in these areas can be interesting, because they are suitable for such activity, however, **this expansion would require expanding stocking points**, which tend to be at greater distances.

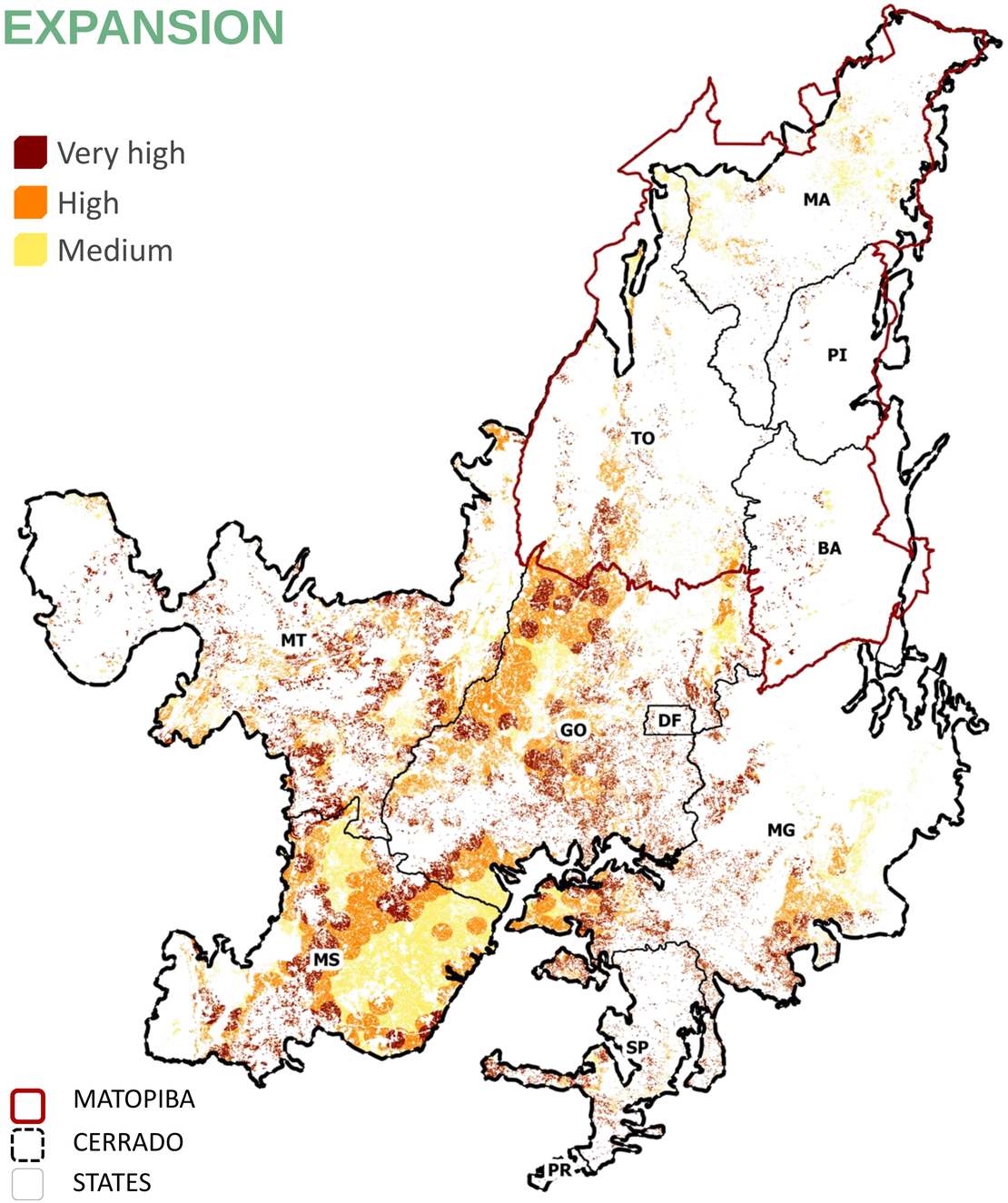
Agricultural expansion in these areas can also mean the occupation of territories with consolidated livestock production and without the need for intensification, where specific infrastructure for this activity already exists. In these cases, agricultural expansion in this region would not be recommended. For these reasons, these areas are indicated as **MEDIUM priority for agricultural expansion**.

AGRICULTURAL SUITABILITY IN THE CERRADO



Sources: Elaborated by Agroicone from Terraclass Cerrado, 2013 and Agrosatélite – Rudorff, Risso et al., 2015.

PRIORITIES FOR AGRICULTURAL EXPANSION



THE **AGRICULTURAL EXPANSION PRIORITY** was classified in the following manner:

VERY HIGH PRIORITY

- Areas with **high** and **medium agricultural suitability with and without altitude restriction**.
- Are larger than **100 ha**.
- **WITHIN** 20 km buffer from agriculture areas.
- **WITHIN** 20km radius from stocking points.
- Area with more infrastructure and better logistics for distribution of production.

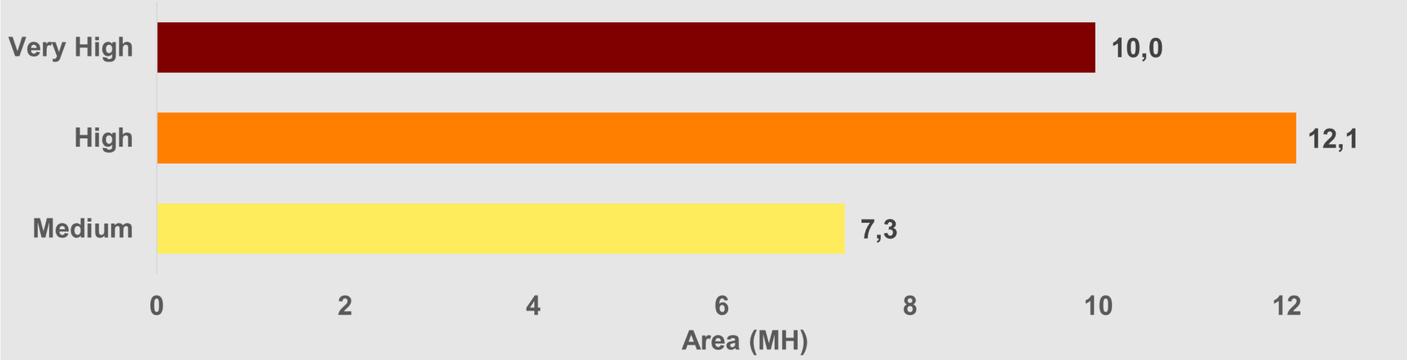
HIGH PRIORITY

- Areas with **high** and **medium agricultural suitability with and without altitude restriction**.
- Are larger than **100 ha**.
- **WITHIN** 20 km buffer from agriculture areas.
- **OUTSIDE** 20 km radius from stocking points.
- Areas indicated for the **installation of new stocking points.**

MEDIUM PRIORITY

- Areas with **high** and **medium agricultural suitability with and without altitude restrictions.**
- Are larger than **100 ha**.
- **OUTSIDE** 20 km buffer from agriculture areas.
- **OUTSIDE** 20 km radius from stocking points.
- Necessary investment in stocking infrastructure.

PRIORITY FOR AGRICULTURAL EXPANSION



FINAL REMARKS

AGRICULTURE

In 2014, the area occupied by **annual crops** represented 9% of the Cerrado biome (17.4 MH), where **soybeans alone represented 90%** of this total (15.6 MH). Maize and cotton, on the other hand, represent only 10% (1.7 MH). The soybeans planted in the Cerrado are equivalent to **52% of the soybeans produced in Brazil.**

The production of soybeans in the Cerrado is growing fast. In the period between 2000 and 2014, **the area planted with soybeans increased by 8** MH (3 MH over native vegetation), representing a **growth of 87% in the annual crops areas** in the Cerrado. In the next years, the forecast is that the production of soybeans will continue to increase. The projected growth for the period between 2014 and 2017 is between 3 and 5.2 MH.

Between 2000 and 2014, **agricultural expansion in the Cerrado followed two distinct patterns**, defined by two regions: while in the **states outside of the MATOPIBA region** only 12% of the agricultural expansion occurred over native vegetation, **in the MATOPIBA region most agricultural expansion (68%) occurred over native vegetation**, characterizing this region as one of the current agricultural frontiers in Brazil.

PASTURE

Pastures occupy 30% (60 Mha) of the Cerrado territory. A large part is characterized by it low productivity. Therefore, **livestock intensification** and, consequently, the freeing of low productivity pasture areas, is an important **strategy to promote agricultural expansion while avoiding the conversion of new native vegetation areas.**

The **classification of the best areas for agricultural expansion**, taking into account not only agricultural suitability, but also the size of the areas, proximity to agriculture areas and stocking points, resulted in: **10 MH of pastures with very high priority for agricultural expansion; 12.1 MH** of pastures with **high priority;** and **7.3 MH** with **medium priority**.

This analysis showed that **just the pastures classified as very high priority are enough to support the growth of the soybean area projected for the period from 2014 and 2027** (5.2 MH). Also, another 24.2 MH of pastures with some degree of priority for agriculture and 19.8 MH of pastures without priority for agriculture would remain, which could continue to be used for livestock production.

OTHER APPROACHES

INFRASTRUCTURE: The pastures classified as **high and medium priority for expansion**, have appropriate soil and climatic conditions for agriculture, but are far away from stocking points and/or agriculture areas. Some of these areas can be in regions mostly occupied by livestock production. Others, however, can be in areas with low productivity livestock production that could be replaced by agriculture. Considering this, it is fundamental to understand how the territory is configured based on the industries and infrastructure and its influence on the territory's land use dynamic in order to carry out efficient territorial planning and avoid competition between different production activities.

OPPORTUNITIES FOR CONSERVATION: In turn, part of the **19.8 MH of pastures identified as no priority for agricultural expansion** due to inadequate agricultural suitability, can undergo livestock intensification, resulting in the freeing of areas that can be **allocated to the recovery of native** vegetation, for example, to meet LR deficits. In order to reconcile different land use demands, agricultural expansion planning must be carried out together with **conservation planning** and the identification of the risks of conversion of existing vegetation areas.

CLIMATIC RISK: Lastly, evaluating the effect of climate on crop failures throughout the years and its impacts in monetary and production terms helps understand the risks of occupying areas not appropriate for agriculture.

REFERENCES

Associação Brasileira Indústrias Óleos Vegetais (ABIOVE). **Capacidade Instalada da Indústria Brasileira de Óleos Vegetais, Empresas e Unidades Industriais**, 2016. Atualizado por Agroicone em 2017. Disponível em:< http://www.abiove.org.br/site/index.php?page=estatistica&area=NC0yLTE=> Último acesso em: 21 fev. 2018.

Agrosatélite Geotecnologia Aplicada. **Análise Geoespacial da Dinâmica das Culturas Anuais no Bioma Cerrado: 2000 a 2014** / Rudorff, B.; Risso, J. et al., 2015. Florianópolis, Santa Catarina, Brasil, 2015.

Companha Nacional de Abastecimento (CONAB) - **Sistema de Cadastro Nacional de Unidades Armazenadas**. Disponível em: < http://consultaweb.conab.gov.br/consultas/consultaArmazem.do?method=acaoListarConsulta> Último acesso em: 21 fev. 2018.

EMBRAPA - Empresa Brasileira de Pesquisa Agropecuária. **MATOPIBA: Caracterização, Agendas e Agência,** 2015. Disponível em: <https://www.embrapa.br/gite/projetos/matopiba/matopiba.html> Ultimo acesso em: 07 maio 2018

Florestal Brasil**. O que é o MATOPIBA?** Disponível em: <http://www.florestalbrasil.com/2016/01/o-que-e-o-matopiba.html> Ultimo acesso em: 02 maio 2018

Federação das Industrias do Estado de São Paulo. Outlook **Fiesp 2017: projeções para o agronegócio brasileiro** / Federação das Industrias do Estado de São Paulo - São Paulo: FIESP, 2017. Disponível em: <http://apps2.fiesp.com.br/outlookDeagro/pt-BR> Ultimo acesso em: 02 maio 2018.

Instituto Brasileiro de Geografia e Estatística (IBGE). **Limites estaduais em 2015**. Disponível em: <https://mapas.ibge.gov.br/bases-e-referenciais/bases-cartograficas/malhas-digitais.html> Ultimo acesso em: 02 maio 2018

MAPA - Ministério da Agricultura, Pecuária e Abastecimento. Projeções do agronegócio : Brasil 2016/17 a 2026/27. Secretaria de Política Agrícola. – Brasília : MAPA/SPA, 2017. Disponível em: < http://www.agricultura.gov.br/assuntos/politica-agricola/todas-publicacoes-de-politica-agricola/projecoes-do-agronegocio/projecoes-do-agronegocio-2017-a-2027-versao-preliminar-25-07-17.pdf> Último acesso em: 02 maio 2018.

TERRACLASS. **Mapeamento do Uso e Cobertura da Terra do Cerrado, projeto Terraclass Cerrado 2013**. Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA) e Instituto Nacional de Pesquisas Espaciais (INPE). Brasília-DF, 2015. Disponível em: < http://www.dpi.inpe.br/tccerrado/> . Acesso em: 21 fev. 2018.