POLICY BRIEF:

SOURCING BEEF CATTLE AND DEFORESTATION IN MATO GROSSO

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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 sectorial solutions that enable large-scale implementation.

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.

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ABOUT THE PROJECT OF GORDON AND BETTY MOORE FOUNDATION

Through a Roadmap process with key actors of the chain, the project aims to build a long-term vision for the beef sector aimed at sustainable origination and reducing deforestation in the chain, including the challenges to promote the intensification of cattle ranching and the implementation of the Forest Code.

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EXECUTIVE SUMMARY

Sustainable beef requires efforts in the production chain to ensure that cattle are not reared in deforested or embargoed areas, or areas with other socio-environmental problems. This document assesses Mato Grosso, Brazil’s largest cattle ranching state (30.3 million head, 4.6 million of them slaughtered in 2016, according to the Brazilian Institute of Geography and Statistics - IBGE) and which has regions where the relationship between cattle ranching and deforestation, mainly to the north, in the Amazon biome, is marked.

The approach here is to identify municipalities where the rate of deforestation is high and this factor’s relationship to cattle breeding and/or rearing systems in which slaughterhouses do not monitor the herd. The term “indirect supplier” has been used for ranchers who own animals raised in breeding, rearing or breeding and rearing systems that are sold to ranchers to be reared and/or finished and who will later sell them on directly to slaughterhouses. The dairy herd was also considered, as it may supply calves (and cows) to the beef cattle chain.

Animal Transport Permits (GTAs) were also analyzed, which identify cattle movements in Mato Grosso. Most of the animals transported - within a municipality - are going to be fattened, which is carried out by indirect suppliers.

The investigations, based on secondary municipal data and the identification of areas at risk of deforestation, suggest the existence of a range of situations. Properties in regions with high rates of deforestation and remaining forests must be a priority for the verification of animal origins if the supplier has purchased animals from other properties in the vicinity. Efforts to improve cattle ranching productivity, technical assistance and agricultural extension for ranchers are more effective in combating deforestation than monitoring sourcing, especially in regions where agrarian reform has created settlements and a concentration of smallholdings. Regions where cattle breeding and rearing is concentrated but which have a low rate of deforestation should be observed.
INTRODUCTION

The state of Mato Grosso is very important in Brazil’s agribusiness as it has the largest cattle herd in the country, at 30.3 million head in 2016, and slaughters the most animals - 4.6 million head that same year, according to IBGE data. Despite the approximately 90% reduction in deforestation from 2004 to 2014, from 11,800 km$^2$ to 1,100 km$^2$, the state still accounts for the second highest rate of deforestation in the Amazon, at 1,500 km$^2$ in 2016, which presents a challenge in view of its objective to ensure sustainable sourcing of livestock (Prodes, 2017).

Pressure from the market, government and society at large has made sustainability a serious issue for the production chain, especially in regard to guaranteeing that animals are not reared in areas that face socio-environmental risks. In this context, greater attention must be paid to farms that provide calves for fattening and slaughterhouses have no policy to monitor sourcing.

Ranchers who breed, rear or breed and rear cattle are referred to as “indirect suppliers.” These cattle are traded with other farms for fattening or finishing, which supply slaughterhouses. As the monitoring done by slaughterhouses is limited to suppliers of cattle ready for slaughter - direct suppliers - the source of these animals, from breeding and rearing areas, is not included, making it difficult to prove if they are from deforested areas.

Given this scenario, this study sets out to answer the following questions:

1) Where are indirect suppliers in the state of Mato Grosso?
2) Is there a relationship between indirect suppliers and deforestation?
3) Where is the largest growth of the breeding and rearing herd?
4) How large are these indirect suppliers?
5) Is there a concentration of animals in breeding and rearing systems in municipalities with a significant area of rural settlements?
6) What are the slaughterhouses’ risk areas as regards sourcing?

The methodology used is based on the identification and study of municipalities where there is most uncertainty about sustainable sourcing from indirect suppliers, analyzing two secondary data points: i) the breeding, rearing and breeding and rearing (considered to be breeding-rearing) herd in Mato Grosso and, ii) the dairy herd, to assess indirect suppliers of beef cattle.

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1 Animals in the breeding system are aged up to 12 months and in the rearing system are aged up to 24 months.
Furthermore, two points in time - the years 2006 and 2014, given the lack of data outside these periods - were examined, in terms of: (i) variation of the herd between these two years, and (ii) the concentration of animals in the periods. The sources of information on the herd were the 2006 Agricultural Census and the Municipal Livestock Farming Survey, both by the IBGE, in addition to data from the Mato Grosso Institute of Livestock Farming Defense (INDEA). The PRODES project at the National Institute of Space Research (INPE) was consulted for information on deforestation in Mato Grosso. The Terraclass project (INPE), the Rural Environmental Registry (CAR) and the National Institute of Colonization and Agrarian Reform (INCRA) served as a reference for data on settlements, land use and size of rural properties in the state.

This document is part of a series of studies on beef cattle ranching and the state of Mato Grosso as part of the Land Use Initiative (INPUT) project. The studies are available at: www.inputbrasil.org.
From 2006 to 2014 the cattle herd in Mato Grosso increased by approximately 10% to 28.6 million heads (IBGE-PPM). This growth was more significant in the municipalities of Colniza, Nova Bandeirantes, Cotriguaçu, Paranaíta and Juína, in the northwestern part of the state, and in Santo Antônio do Laverger, in the south (Figure 1). In this same period the herd of cattle in the rearing, rearing-breeding and rearing system increased by 47%. This accounts for 30% of the state’s cattle herd and 24% are up to 12 months old. Among the municipalities with the highest concentration of breeding-rearing farms are Cáceres, Vila Rica, Aripuanã, Porto Esperidião and Cocalinho.

Figure 1: Variation of the herd in the municipalities of Mato Grosso from 2006 to 2014

In analyzing the growth of the number of animals in breeding and/or rearing systems in the municipalities from 2006 to 2014, Colniza, to the Northwest, Cáceres and Porto Esperidião, to the Southwest, Vila Rica and Confresa to the Northeast and Alta Floresta, in the north of the state stand out (Figure 2). With the exception of Cáceres and Porto Esperidião, the municipalities are in the Amazon biome.

Largest growth in the herd of calves in this period occurred in regions where there was also an increase in the number of animals in breeding and/or rearing systems - that is, in the northwest, southwest and northeast. The municipalities with the most
A significant increase in calf numbers were Cãceres, Vila Bela da Santíssima Trindade, Juara, Alta Floresta and Juína (Figure 3). Using the Pearson Correlation Index\(^2\), for

\[^2\text{Measures the degree of linear relationship between two quantitative variables. The coefficient varies between -1 and 1, with -1 when there is a perfect negative correlation between the variables, 0 when there is no correlation and 1 when there is a perfect positive correlation.}\]

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**Figure 2: Variation of the breeding-rearing herd in the municipalities of Mato Grosso from 2006 to 2014**

```
Variation (heads)
< 15,000 45,000 - 95,000
15,000 - 45,000 95,000 - 171,062
```


**Figure 3: Variation of the calf herd in the municipalities of Mato Grosso from 2006 to 2014**

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Variation (heads)
<0 20,000 - 45,000
0 - 20,000 45,000 - 110,263
```

growth rate in these two variables - calves and animals in breeding and/or rearing systems - for 2006 to 2014 produces a value of 0.89, representing a high correlation.

The dairy cattle herd also grew most in the regions mentioned (Figure 4) - Northwest, Southwest and North of Mato Grosso. The variation in the number of these animals was most significant in the municipalities of Terra Nova do Norte, Nova Canaã do Norte, Colíder, Porto Esperidião, Vila Bela da Santíssima Trindade, Jauru, Juruena and Colniza. However, in this case the Pearson Correlation Index was low, close to zero, both for the variation in the dairy cattle herd and breeding and/or rearing herd, and the variation in the dairy cattle herd and the calf herd. That is to say, this variable cannot be used to evaluate the indirect beef cattle suppliers.

Figure 4: Variation of the dairy herd in the municipalities of Mato Grosso from 2006 to 2014

By including deforestation in the analysis, based on PRODES-INPE, there was a 4% increase in accumulated deforestation from 2006 to 2014 in the state of Mato Grosso, from 199,000 km² (19.9 million ha) to 207,000 km² (20.7 million ha) in the Legal Amazon. The municipalities identified with the highest growth rate for deforestation in the period were: Colniza (1,000 km² or 100,000 ha), Nova Bandeirantes (552 km² or 52,200 ha), Cotriguaçu (423 km² or 42,300 ha), Juara (405 km² or 40,500 km Peixoto de Azevedo (401 km² or 40,100 ha), Feliz Natal (396 km²
or 39,600 ha) and Aripuanã (395 km² or 39,500) (Figure 5). The municipalities with the largest area of accumulated deforestation up to 2014 were: Juara (7,931 km² or 793,100 ha), Querência (5,130 km² or 513,000 ha) Alta Floresta (4,937 km² or 493,700 ha), and Vila Bela da Santíssima Trindade (4,619 km² or 461,900 ha).

Figure 5: Variation in the deforested area in the municipalities of Mato Grosso from 2006 to 2014

It is worth highlighting the distribution of deforestation in the state of Mato Grosso by land category. According to data from the Action Plan for Prevention and Control of Deforestation in the Legal Amazon (PPCDam), between 2012 and 2015 deforestation in the state was concentrated mainly in private areas (72% of total deforestation, especially with large polygons). Of secondary importance in terms of area, rural settlements accounted for 22% of the total deforested area in the period.

It is worth noting that Colniza, Cotriguaçu, Juara and Aripuanã, in addition to increasing deforestation rates also have a large area of forest, which should be observed more carefully (Graph 1).

Thus, based on the variables evaluated in this section, 21 municipalities sourcing beef cattle were identified as vulnerable (with a risk of deforestation) in Mato Grosso: Alta Floresta, Aripuanã, Brasnorte, Cáceres, Cocalinho, Colniza, Confresa, Cotriguaçu, Feliz Natal, Gaúcha do Norte, Juara, Juína, Marcelândia, Nova Bandeirantes, Nova Ubiratã, Peixoto de Azevedo, Porto Esperidião, Querência, São Félix do Araguaia, Vila Bela da Santíssima Trindade and Vila Rica (Figure 6). Note that this survey is based on the cross-referencing of up-to-date data.
Graph 1: Deforestation and possible deforestation in municipalities with a higher variation or concentration of animals in breeding and rearing systems in Mato Grosso

Source: INPE-Prodes; TerraClass 2012 and 2013

Figure 6: Municipalities with a risk of deforestation in an economic radius of 150 km from slaughterhouses in the state

Source: IBGE - PAM; IBGE - Agricultural Census; Agroicone estimates based on Indea (2016); INPE-Prodes.
THE FEATURES OF RURAL PROPERTIES AND SETTLEMENTS IN MATO GROSSO AS REGARDS THE SOURCING OF CATTLE

On taking a sample from the Rural Environmental Registry (CAR) as a database, the farmland area in Mato Grosso was analyzed and, additionally 500 hectares (ha) was the cut-off point separating small and medium-sized properties from large ones.

From a sample of 25,400 units in the CAR up to December 2015, 17,800 had pastureland, totaling 7.65 million hectares (Figure 7). Among these properties, which account for 43% of the state’s area, 19% have a total area under 100 hectares.

Figure 7: Land use and coverage (left) and deforestation area (right) for properties registered in CAR

Source: Rural Environmental Registry (CAR); Terraclass 2012 and 2013

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3 It should be noted that the CAR sample December 2015 was composed of data on 25,400 registered properties out of a total of 140,600 units registered up to that month in Mato Grosso, representing 69% of the total area registered in the state. Such a sample was used because there was no data for all the units registered up to then. Currently, there are 180,500 properties registered, totaling 690,000 km².
Fourteen thousand farms have fewer than 500 hectares of pasture, totaling 1.6 million ha, concentrated in the central-west of Mato Grosso. Those with 500 ha of pasture or more - 3,800 properties - account for 6.3 million hectares of pasture, and are in the south, with a portion running from the northeast to the southeast of the state (Figure 8).

As for the area of deforestation in these properties, between 2006 and 2016 there was an increase of 226,000 hectares (5.4%) in the areas below 500 ha of pasture, while in the units over 500 ha, the increase was 193,000 hectares (3.5%). Considering the municipalities where there is a greater concentration of and/or variation in deforestation, Peixoto de Azevedo, Colniza, Nova Bandeirantes, Cotriguaçu, Aripuanã, Querência, Vila Rica, Juína and Alta Floresta have a higher number of properties with under 500 hectares of pasture, while Feliz Natal, Gaúcha do Norte, Marcelândia, Juara, Nova Ubiratã, Brasnorte, São Félix do Araguaia and Vila Bela da Santíssima Trindade have most properties with more than 500 ha of pasture.

Doing the same analysis for the herds in breeding and/or rearing systems, it was found that of the municipalities with the highest concentration and/or variation of these animals, Colniza, Cotriguaçu, Aripuanã, Vila Rica, Cáceres and Alta Florets have...
most properties with fewer than 500 ha of pasture, while Porto Esperidião, Juara, Confresa and Cocalinho have most properties larger than 500 ha.

Based on INCRA data from 2015, 416 settlements were identified in 82 municipalities in Mato Grosso, occupying 4.3 million hectares, or 5% of the state’s area. Of the total pasture area in the state (18 million ha), 1.88 million ha are on settlements (10% of the state total). As for the total deforested area, 11% was on rural settlements, representing 2.3 million hectares by 2014 (Figure 9).

Among the municipalities with the highest concentration in and/ or variation of indirect animals and also with large settlement areas: Confresa, Colniza, Vila Rica, Caceres, Juara and Cotriguaçu. Confresa, Colniza and Vila Rica have a large area of pasture on settlements and the highest concentration of animals in breeding and/ or rearing systems (Graph 3).
Graph 3: Municipalities with the highest herd concentration and/or variation in breeding and/or rearing systems and rural settlements (2006-2014) in Mato Grosso

Figure 9: Distribution of pasture areas (in 2014), deforestation (in 2016) and settlements (in 2015) in Mato Grosso

Source: INCRA; INPE-Terraclass; INPE-Prodes
INTEGRATED ANALYSIS: CRITICAL AREAS FOR SOURCING CATTLE IN MATO GROSSO

After analyzing the variables of deforestation, land use, the herd in breeding and/or rearing systems, and the dairy herd in terms of variation and concentration, 21 municipalities were selected which are sensitive as regards sourcing by slaughterhouses. A second cut was made from these based on the area subject to legal deforestation. The municipalities displaying the following variables were chosen: i) high variation in deforestation and high possibility of deforestation; ii) low variation in deforestation and high possibility of deforestation; iii) high variation in deforestation and low possibility of deforestation. This resulted in 16 municipalities in critical areas for sourcing: Alta Floresta, Aripuanã, Brasnorte, Cáceres, Cocalinho, Colniza, Confresa, Cotriguaçu, Juara, Juína, Nova Bandeirantes, Peixoto de Azevedo, Porto Espiridão, São Félix do Araguaia, Vila Bela da Santíssima Trindade and Vila Rica.

The 16 municipalities described above had 3.2 million animals in the breeding and/or rearing systems in 2014. That is, 36% of the estimated indirect supplier herd in Mato Grosso, which was 8.7 million head, and 11% of the total cattle herd in the state. These municipalities that same year accounted for 2.2 million head of calves, or 32% of the calves in the state.

For the other variables analyzed, these municipalities accounted for 30% of the accumulated deforestation in Mato Grosso up to 2014, and 47% of the variation in deforestation from 2006 to 2014. In addition, 25% of the state’s pasture area is concentrated in these municipalities, totaling 4.6 million hectares, of which 662,000 hectares (14% of the total) are pastures in settlement areas.

ECONOMETRIC ANALYSIS OF THE RELATIONSHIP BETWEEN INDIRECT SUPPLIER HERDS AND DEFORESTATION

The Panel Data methodology4 was used to analyze whether there was a direct relationship between the number of animals in the breeding and/or rearing systems (indirect suppliers) and the rate of deforestation. This relationship was studied in the municipalities where there is a risk of deforestation, and in all the municipalities in Mato

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4 According to Hsiao (2002), a set of longitudinal data, or in a panel, is that which follows a certain sample of individuals over time, and so provides multiple observations on each individual in the sample.
Grosso in the years 2006 and 2014. The methodology was used because of the limited data available, which increased the number of observations and the number of degrees of freedom and decreased the collinearity between the explanatory variables (Hsiao, 1986). In addition, using a log-log equation made it possible to linearize the model.

**TWO EQUATIONS WERE ESTIMATED:**

(a) \( \ln(\text{desm}_i) = a_0 + \ln(\text{indiretos}_i) * a_1 + \ln(\text{indiretos}_i) * \text{dummy} * a_2 + \mu \)

(b) \( \ln(\text{desm}_i) = b_0 + \ln(\text{indiretos}_i) * b_1 + \text{dummy} * b_2 + p \)

Where: \( \text{desm}_i \) is the rate of deforestation in municipality \( i \) in 2006 and 2014; \( \text{indiretos}_i \) is the herd of animals in the breeding and/ or rearing systems (indirect suppliers) in municipality \( i \) in 2006 and 2014 (number of head); and dummy is the binary variable, indicating 1 for the municipalities with a risk of deforestation (21 municipalities selected as mentioned above) and 0 for the other municipalities in Mato Grosso state; \( \mu, \) and \( p \) are the error terms.

Hausman (H0: random effects model; H1: fixed effects model), Chow (H0: pooled model; H1: fixed effects model) and Breusch-Pagan (H0: pooled model; H1: random effect model) tests were performed for the above equations to identify among the random effects, fixed effects or pooled data models which should be used. The result indicates that the most appropriate approach to the analysis is the random effects model (Table 1). The equations were then estimated and the results are presented in the table 2.

**Table 1: Hausman, Chow and Breusch-Pagan test results**

<table>
<thead>
<tr>
<th>Test</th>
<th>Test Stat.</th>
<th>Prob.</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EQUATION (A)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hausman test</td>
<td>1.33</td>
<td>0.5133</td>
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<td>Chow Test</td>
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<td>Breusch-Pagan test</td>
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<td>0.0000</td>
<td>Random effect is best suited</td>
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<td></td>
</tr>
<tr>
<td>Hausman test</td>
<td>1.02</td>
<td>0.3127</td>
<td>Random effect is best suited</td>
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<tr>
<td>Chow Test</td>
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<td>Fixed effect is best suited</td>
</tr>
<tr>
<td>Breusch-Pagan test</td>
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<td>0.0000</td>
<td>Random effect is best suited</td>
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TABLE 2 - ESTIMATED EQUATIONS

<table>
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<tr>
<th>EQUATION (A)</th>
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<th>Valor</th>
<th>Desvio padrão</th>
<th>p-valor</th>
<th>R²</th>
<th>Prob. estat. F</th>
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</thead>
<tbody>
<tr>
<td>constant</td>
<td>8.2273</td>
<td>5.4395</td>
<td>0.1315</td>
<td>0.0416</td>
<td>0.0027</td>
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<td>indirect</td>
<td>0.1543</td>
<td>0.5106</td>
<td>0.7627</td>
<td></td>
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<td></td>
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<tr>
<td>indirect * dummy</td>
<td>0.2210</td>
<td>0.0544</td>
<td>0.0001</td>
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</table>

<table>
<thead>
<tr>
<th>EQUATION (B)</th>
<th>Coefficient</th>
<th>Valor</th>
<th>Desvio padrão</th>
<th>p-valor</th>
<th>R²</th>
<th>Prob. estat. F</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>7.9644</td>
<td>1.0703</td>
<td>0.0000</td>
<td>0.0435</td>
<td>0.0020</td>
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<tr>
<td>indirect</td>
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<td>0.0991</td>
<td>0.0720</td>
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<td>0.4045</td>
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</table>

According to the results, equation (a) indicates that a 1% increase in the herd owned by indirect suppliers leads to a 0.15% increase in the rate of deforestation. The variable, however, was not statistically significant. By means of the dummy it was possible to note that the herd owned by indirect suppliers in municipalities with a risk of deforestation affects deforestation more significantly, as a result of the parameter estimated for this variable (indirect suppliers * dummy), in comparison to the herd owned by indirect suppliers in the other municipalities in Mato Grosso.

Equation (b) reiterates the impact of the indirect suppliers herd on levels of deforestation in the state’s municipalities. When the dummy variable is analyzed, in the municipalities at sourcing risk, the deforestation rate is higher than the other municipalities, reinforcing the importance of differentiating action in those places.

However, in both equations the R² statistic presented a low value, which implies that the herd owned by indirect suppliers is not able to explain a significant portion of the variance in deforestation. This result is consistent, since there are other factors that impact deforestation and that were not considered in this study. In addition, the limited data on variables restricts further investigation.

In summary, econometric analysis shows that the indirect suppliers’ herd is positively related to deforestation in the selected municipalities at sourcing risk, but that the indirect suppliers’ herds alone do not explain deforestation.

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5 The presence of heteroscedasticity was observed in the estimated equations, a problem that was corrected by the White method.
ANALYSIS OF ANIMAL TRANSPORT PERMITS IN MATO GROSSO

The Ministry of Agriculture provides for the inspection of animal transport in Decree No. 5,741 of March 30, 2006. Documentation is mandatory whatever the route. The official animal transport paperwork in Brazil is the Animal Transport Permit (GTA), which contains information on origin, destination and sanitary conditions, as well as the purpose of the transport.

GTAs from 2014 to 2016, issued by INDEA, were surveyed to identify the purpose of the animal transport, origins and destinations, the number of heads transported for fattening, representing the animals in the breeding/rearing systems (the indirect suppliers’ herd), and to analyze municipalities with a risk of deforestation where animals are transported for slaughter.

From 2014 to 2016 the number of GTAs for cattle fell from 838,000 to 609,000, totaling 18.4 million and 12.8 million heads, respectively, transported with the main reasons for transport in 2016 being fattening (62%), slaughter (25%) and breeding (11%), a pattern similar to that observed in 2014 and 2015. The animals from the

Graph 4: Number of GTAs issued and animals transported originating in Mato Grosso

Source: INDEA. Prepared by: Agroicone.
municipalities identified as at risk of deforestation accounted for approximately 30% of the cattle transported in the state.

Focusing on animals transported for fattening, as they are from breeding/rearing systems (indirect suppliers) and would go on to slaughterhouses, the 40 municipalities in Mato Grosso that transported such animals accounted for 62% (4.9 million heads) of the total number of animals sold for fattening in 2016. Of these 40 municipalities, 14 are at sourcing risk (Cáceres, Vila Bela da Santíssima Trindade, Juara, Juína, Alta Floresta, Porto Esperidião, Vila Rica, Brasnorte, Cotriguaçu, Nova Bandeirantes, Confresa, Peixoto de Azevedo, Cocalinho and Colniza), sending 2.23 million heads for fattening.

The 40 municipalities that received the most animals for fattening in 2016 accounted for 58% (4.6 million heads) of the total number of animals transported for this purpose. Twelve of these 40 municipalities are at sourcing risk (Cáceres, Vila Bela da Santíssima Trindade, Juara, Alta Floresta, Juína, Porto Esperidião, Vila Rica, Brasnorte, Cotriguaçu, Cocalinho, Confresa and Peixoto de Azevedo) that received animals for fattening. It is therefore apparent that many of the animals sold for fattening from the municipalities with a risk of deforestation remain in the same regions.

It should also be noted that most of the animals transported, both for fattening and for slaughter, which originate in Mato Grosso, remain in the state. In 2016, 95% of the animals sent to slaughter stayed in the state (3.1 million heads), while 96% of the animals transported for fattening (7.6 million heads) stayed in the state.

According to the IBGE’s Quarterly Slaughter Survey, 4.58 million head of cattle were slaughtered in Mato Grosso in 2016, 4.54 million in 2015 and 5.35 million in 2014. Considering that most of the animals transported for this purpose remain in the state, as seen above, it was found that in 2016 the animals transported for slaughter within Mato Grosso accounted for 68% of formally documented slaughter by the IBGE. In 2015 this figure was 99%, and in 2014, 92%. So, in 2016 Mato Grosso imported animals from other states to be slaughtered, compared with the other years when almost all of them came from the state.

In addition, the difference between 2016 and other years is because of the 31% fall in the number of animals slaughtered in Mato Grosso (declared on GTAs) compared with 2015, shadowing the 32% fall in the number of animals transported in the state. In that same period, the number of animals slaughtered legally grew by 1%.

This result may be related to different factors, among them: i) farmers or animal transport agents no longer using GTAs - that is, non-documentated transactions; or ii) fewer transactions, with fewer animals transported.
ANALYSIS OF THE ANIMAL TRANSPORT PERMITS FOR CATTLE IN MUNICIPALITIES AT RISK OF DEFORESTATION IN MATO GROSSO

Focusing more on the 21 municipalities with a risk of deforestation as regards the transport of animals, it was found that in 2016, 3.83 million head were traded there (30% of the total traded in the state), with 64% of the animals transported for fattening (2.46 million head), 23% for slaughter (893,000), 12% for breeding (451,000) and 1% for other purposes (24,000).

Of the total number of cattle traded in the municipalities with a risk of deforestation (3.83 million), a large part came from the locations with the largest herds, namely, Cáceres, Vila Bela da Santíssima Trindade, Juara, Alta Floresta, Juína, Vila Rica and Porto Esperidião - a total of 2.34 million head in 2016.

Graph 5: Number of animals transported in municipalities with a risk of deforestation in 2016

Source: INDEA. Prepared by: Agroicone.

6The analysis of GTAs for the 21 municipalities with a risk of deforestation was based on 2016, since it is the most recent period available and because, as observed in the previous section, the document issuance standard and number of animals transported is similar in the three years examined.
As for the cattle transported for fattening, which represent indirect suppliers, Cáceres, Vila Bela da Santíssima Trindade, Juara, Juína, Alta Floresta, Porto Esperidião, Vila Rica and Brasnorte were the major municipalities, with 1.6 million head, accounting for 65% of the cattle transported for fattening between the municipalities at sourcing risk, and 30% of the total transported for the same purpose in Mato Grosso.

In 15 of the 21 municipalities with risk of deforestation over 50% of the animals sent for fattening remain in the same municipality, as shown in the chart below.

**Graph 6: Transport of animals for fattening with origin and destination in municipalities with a risk of deforestation in 2016**

In addition, 98% of animals sent for fattening (2.46 million head) originating in municipalities with a risk of deforestation remain in Mato Grosso. Only 1% went to São Paulo (25,000 head in 2016) and another 28,000 head were sent to Goiás, Mato Grosso do Sul, Minas Gerais, Rondônia, Tocantins, Pará, Amazonas, Pernambuco, Alagoas and Paraná.

Analysis of the cattle transported for slaughter from municipalities with a risk of deforestation shows that 893,000 head were slaughtered in 2016, accounting for 27% of the total traded for this purpose in the state of Mato Grosso.
Vila Bela da Santíssima Trindade, Cáceres, Juara, Alta Floresta, Porto Esperidião, Vila Rica, Juína and Brasnorte were the municipalities that sent most animals for slaughter, totaling 683,000 head in 2016. In addition, 12 of the 21 municipalities with a risk of deforestation transported animals for slaughter within the same municipality. The others sent cattle to other regions.

Graph 7: Transport of animals for slaughter originating in municipalities with a risk of deforestation in 2016

Source: INDEA. Prepared by: Agroicone
CONCLUSIONS AND RECOMMENDATIONS

This study has sought to identify the municipalities in Mato Grosso that present the greatest uncertainty about the sourcing of cattle in breeding and/or rearing systems and their relationship with deforestation. To that end, the variables of deforestation rate, remaining vegetation, herd concentration and variation, the features of the properties and settlements in Mato Grosso, and data on Animal Transport Permits (GTAs) issued in the state between 2014 and 2016 were used. From analysis with different approaches it was possible to quantify them and to identify the main municipalities in the state in terms of risk regarding sustainable cattle sourced from indirect suppliers.

Twenty-one municipalities were selected through which the increased rate of deforestation, the number of animals in the herd and the animals in breeding and/or rearing systems were observed. These municipalities were characterized as being of a sourcing risk.

According to the data, of the 4.8 million heads slaughtered in 2014, 36% (or 1.7 million heads) may have been at some sourcing risk in coming from breeding and/or rearing systems in deforested areas. However, it is must be made clear that a causal relationship cannot be established between these variables, as econometric analysis showed that the indirect suppliers’ herds do not explain deforestation alone.

The investigation of GTAs separated cattle herd transport in Mato Grosso, with most animals transported for fattening, making them from breeding and/or rearing systems (indirect suppliers). This same context is observed in municipalities at sourcing risk, it being that in 14 of the 21 municipalities over 50% of the animals are sent for fattening in properties in the same region.

It should also be noted that over 95% of the animals sent for fattening and slaughter, originating in Mato Grosso, remain in the state, according to data from 2016. In that same year, the animals transported for slaughter within Mato Grosso accounted for 68% of formally documented slaughter by the IBGE.

It should also be remembered that non-documented slaughter exists, where there is no record of animal transport, involving slaughterhouses without proper sanitary inspection, and/or avoiding tax. There is also slaughter that occurs on the ranches themselves, part consumed there and another part sold without documentation. Efforts made in the main municipalities where cattle ranching is prominent could, then, achieve significant results regarding the sourcing of the animals and its relationship to deforestation.
It can be inferred from this study that the challenge of monitoring and halting animal production in deforested areas must consider objective criteria such as remaining vegetation, data on the herd and production systems, animal transport and pasture areas. The characterization of risk, demonstrated for the 21 municipalities, suggests that control of indirect suppliers should be analyzed on a case-by-case basis to target it.

The definition of sourcing risk indicators, as well as goals and initiatives for each of the municipalities, could achieve effective results. As for the slaughterhouses nearby these areas, exposure to the risk of deforestation could be identified for each one based on its economic radius, in addition to establishing a range of efforts to minimize sourcing uncertainty related to deforestation stemming from indirect suppliers.

For properties in the municipalities with pasture in rural settlements, with increasing rates of deforestation and the concentration of animals in breeding and/or rearing systems, specifically Colniza, Confresa, Cotriguaçu, Nova Bandeirantes, Peixoto de Azevedo, São Félix do Araguaia, Vila Bela da Santíssima Trindade and Vila Rica, efforts to improve productivity, technical assistance and agricultural extension for ranchers, which are important in raising awareness of and the adoption of sustainable practices, need to be implemented.

Public policies should also be focused on these locations, with an emphasis on land regularization and access to credit to implement low carbon practices, especially for the restoration of pasture.

Cáceres, Cocalinho and Porto Esperidião, municipalities with a lot of remaining vegetation and a high concentration of indirect suppliers but a low rate of deforestation must be observed. Those with a high concentration of deforestation and animals in the breeding and/or rearing systems need to be monitored through a voluntary protocol by slaughterhouses on the perimeter of the regions listed in the study by means of deforestation command and control efforts or by a combination of them. Alta Floresta, Aripuanã, Brasnorte, Colniza, Cotriguaçu, Juara and Juína should be the priorities, while Marcelândia and Querência should be less of a priority. For the municipalities with higher rates of deforestation and more rural settlements, such as Colniza, a set of actions to improve productivity and income (for the settlements) should be set up with command, control and monitoring of the slaughterhouses in the vicinity.
To guarantee sustainable sourcing of the herd, the following recommendations are made:

a) Improve the reliability of the Rural Environmental Registry (CAR).

b) Get ranchers to sign up to the states’ Environmental Regulation Program (PRA) in order to include suppliers (direct and indirect) who are not in compliance with social and environmental regulations (in particular the Forest Code) in the formal meat market and to prevent “cattle evasion.”

c) Promote environmental compliance by embargoed or non-embargoed areas through illegal deforestation occurring after July 22, 2008, as a way to align ranchers and legalize sourcing of animals.

d) Implement actions aimed at improving income and productivity on ranches, especially in areas with high rate of deforestation and a concentration of rural settlements.

e) Make the issuance of the Animal Transport Permit (GTA) conditional upon CAR registry in municipalities with a high rate of deforestation, as a way to create territorial and animal transport governance mechanisms.

f) Provide consumers with information about meat sourcing, as a conscientious consumer market is one way of demanding sustainable production (which can be a form of product differentiation).

g) Define deforestation risk areas, considering a radius of economic influence of the slaughterhouses, as a way of determining localized action. It is suggested a set of solutions be integrated into productive sustainable sourcing clusters in order to reduce deforestation, comply with the Forest Code, and improve territorial governance and management.

It is of the utmost importance that econometric analysis be done to expand and update the results obtained so far. In addition, it is essential more recent data be sought to improve the results obtained so far, which have been based on the best available information.

Finally, it should be made clear that this investigation seeks to further knowledge and suggest approaches that allow animal sourcing from indirect suppliers and its relation to deforestation to be dealt with. This is not an exhaustive study and should be seen as a step forward in sustainable cattle sourcing.
REFERENCES


