Illegal deforestation and Brazilian soy exports: the case of Mato Grosso

Methodological Note

1. Datasets

The study draws on a range of datasets, including spatial information on deforestation, land tenure datasets, official deforestation licenses, soy cropland maps and export flows. The georeferenced datasets were standardized in a unique system of coordinates with conical projection according to Lambert and datum SIRGAS 2000. These datasets are explained in detail below:

1.1 Deforestation

The deforestation data used includes deforestation that occurred between the years 2012 and 2017, produced by combining deforestation data mapped by the Project for Monitoring Deforestation in Brazilian Biomes by Satellite - Prodes Amazônia and Prodes Cerrado (Source: INPE) and Pantanal land-use mapping (Source: SOS Pantanal).

For the areas where the Prodes Amazônia and Prodes Cerrado deforestation mapping overlapped, the Amazon data was used. The Prodes Cerrado data that covered "non-forest" areas of Prodes Amazônia were preserved. For the Pantanal, where land-use maps showed native vegetation transitioning to other types of land-use, this was classified as deforestation. The deforestation identified in this study can be obtained here.

The resulting map showed 1,697,000 hectares of deforestation between 2012 and 2017 in Mato Grosso. Of this total, 1,439,710 hectares were identified as being part of rural properties (described below). This represents 85% of the total.

1.2 Rural properties

Rural properties were identified in the study by using a compilation of land tenure datasets, according to the methodology described in Sparovek et al. (2019). For this study, only the following land tenure categories were included: Land Tenure Management System (SIGEF - INCRA), Rural Environmental Registry (CAR), Titled Lands from Terra Legal Program and Rural Settlements (INCRA).

Table 1. Number of rural properties by biome.

Land tenure categories	Amazon	Cerrado	Pantanal	Total
Rural Settlements	204	171	25	400
Rural Environmental Registry (CAR)	40,005	21,979	3,463	65,447
Land Management System (SIGEF)	17,944	20.047	1,583	39,574
Titled Lands from Terra Legal Program	4,620	1,522	268	6,410
Total	62,773	43,719	5,339	111,831

The Rural Environmental Registry (CAR) relies on property owners to register their properties, with registration then validated by the relevant state environmental agencies. Most of the properties declared have not yet been validated, which suggests that there may be inconsistencies with the registrations. However, it has been used as a reference to analyse the impact of agricultural supply chains on the environment by a number of studies and scientific articles (Gibbs et al., 2015; Guidotti et al., 2017; L'Roe et al., 2016).

The 111,831 rural properties identified in the study cover a total of 65 million hectares, or approximately 72% of the territory of Mato Grosso. The remaining areas are made up of Protected Areas, Indigenous Lands or Undesignated Lands (for more details see Sparovek et al, 2019).

1.3. Deforestation licenses and deforestation

Details of licences were obtained from the website of the State Secretariat for the Environment (SEMA / MT), through its Transparency Portal. Only licences that were valid between August 2011 and July 2017 were considered. This matches the period over which deforestation was analysed for this study, using Prodes (Amazon and Cerrado biomes), and SOS Pantantal (Pantanal biome).

In addition to the licences, the analysis also considered the areas of vegetation cleared for four hydroelectric dams – Teles Pires, Colíder, São Manuel and Sinop. These data were obtained through environmental licensing documents from the IBAMA and SEMA.

1.4. Soy planting areas

These were identified using the 2017 soy cultivation area maps for the Amazon and Cerrado biomes, produced by Agrosatellite. These maps do not include details of the boundaries of rural properties, but only the areas used for soy cultivation. In Mato Grosso, these maps cover 9,327,384 ha of soy cultivation areas in total. The procedure used to identify rural properties that grow soy is described in Section 2.2 of this document.

1.5. Soy exports

This information is taken from the Trase platform database, which provides a comprehensive mapping of the Brazilian soy supply chain. Trase data systematically link export markets and soy exporting companies to the municipalities where the soy was produced. For more details on the methodology used by Trase, visit trase.earth. For the study, we considered soy export data for 2018 (soy grown in 2017).

2. Data processing and analysis

2.1. Deforestation and illegality:

By overlaying the deforestation layers and the details of deforestation licences, we were able to identify legal (authorized) and illegal (unauthorized) deforestation. According to the Forest Code, for deforestation to be classified as legal: i) the deforestation must have taken place in the area authorized by the deforestation licences; ii) deforestation must have occurred while the licence was valid. We also considered any deforestation identified within the boundaries of hydroelectric plants (see 1.3) as legal, based on the assumption that activities that have gone through an environmental licensing process will have a valid deforestation licence for clearing vegetation. Any deforestation that was not covered by a deforestation licence, or that took place when the licence was not valid, was classified as illegal.

2.2. Rural properties and soy mapping:

To identify the farms growing soy, we overlaid the soy maps for 2017 with the rural properties boundaries of registered farms (as described in the section 1.2). Of the total soy area in Mato Grosso, 8,763,539 ha (94%) was identified on farms registered in the land tenure datasets considered in the study, and described in 1.2. To reduce potential inconsistencies from overlaying these databases and reduce errors, we only included properties growing at least 5 ha of soy in 2017. This analysis identified 22,101 properties with more than 5 ha of soy in 2017, with a total of 8,756,035 ha, or 99.9% of the total area cultivated with soy within registered farms.

2.3. Soy and deforestation:

In order to identify the deforestation that took place on soy-growing farms, we overlaid the deforestation data for 2012 and 2017 with the registered farms that were growing soy in 2017 (as described in item 2.2).

To reduce inconsistencies between the two databases and to take a conservative approach, only polygons of deforestation of at least 5 hectares (ha) within each property in a given year were considered. For example, if two areas of deforestation of 2 ha each were identified as having taken place on a property in 2013 (totalling 4 ha) and 3 areas of 2 ha in 2014 (totalling 6 ha), only the deforestation that occurred in 2014 was included in the analysis. After applying this filter, we found 1,390,279 ha of deforestation (97% of the total) spread across 13,483 properties.

Deforestation was then classified as: i) on the soy-growing area - (legal and illegal) deforestation in areas that were used for soy cultivation in 2017; ii) on uncultivated land - (legal and illegal) deforestation on soy-growing farms, but in areas that had not been converted for soy by 2017.

Therefore, we analysed the dynamics of areas deforested between 2012 and 2017 on rural properties which were growing soy in 2017.

2.4. Export flows and illegal deforestation:

In order to assess the exposure of markets and of traders exporting soy grown on farms where illegal deforestation occurred, we took the following steps:

1. Using Trase data, we calculated the proportion of soy produced by each municipality that was exported to each market of interest in 2018 (China, European Union (EU)).

2. We calculated the area of soy for export in hectares by converting volume to land use area (hectares), based on soy yield per municipality.

3. We then multiplied the proportion of soy exported from each municipality to each destination country by the total area of soy grown on properties where illegal deforestation had exceeded 5 ha. This provided an estimate of the exposure of import markets to soy produced on properties where illegal deforestation occurred at a municipality level.

4. We then divided the total estimated area of soy cultivation from properties with illegal deforestation linked to China or to the EU by the total area of soy cultivation exported to each of these destinations (step 1).

5. Finally, using data from the Trase platform, we identified the companies that are likely responsible for most of the soy exports to China and the EU from the 15 municipalities with the largest area of soy on properties where illegal deforestation had taken place and which were likely to be exporting to China and the EU.

3. References

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