

Antônio Victor, Heron Martins; Carlos Souza Jr.; Márcio Sales & Adalberto Veríssimo (Imazon)

ABSTRACT

In January 2014, the majority (58%) of the forest area of Brazilian Amazon was covered by clouds, a coverage lower than January 2013 (61%), which reduced the ability to detect deforestation and forest degradation in the region. The States with the largest cloud coverage were Amapá (86%), Pará (83%) and Rondônia (79%). During the period analyzed, and under these cloud conditions, were detected by SAD, 107 square kilometers of deforestation in the Brazilian Amazon. This represents an increase of 206% compared to January 2013 when the deforestation totaled 35 square kilometers.

The forest degradation accumulated in the period from August 2013 to January 2014, corresponding to the first six months of the current calendar of deforestation, totaling 531 square kilometers. There was a reduction of the

accumulated deforestation of 60% over the previous period (August 2012 to January 2013) when the deforestation totaled 1,326 square kilometers.

The degraded forests totaled 32 square kilometers in January 2014. Compared to January 2013 there was a reduction of 53% when the forest degradation totaled 69 square kilometers. The vast majority (97%) occurred in Mato Grosso, followed by Amazonas (2%) and Pará (1%).

The forest degradation accumulated from August 2013 to January 2014 totaled 212 square kilometers. Compared to the previous period (August 2012 to January 2013) was reduced by 80% when the forest degradation totaled 1,043 square kilometers.

Deforestation Statistics

According to SAD, deforestation (total suppression of the forest for other alternative land uses)

reached 107 square kilometers in January 2014 (Figure 1 and Figure 2).

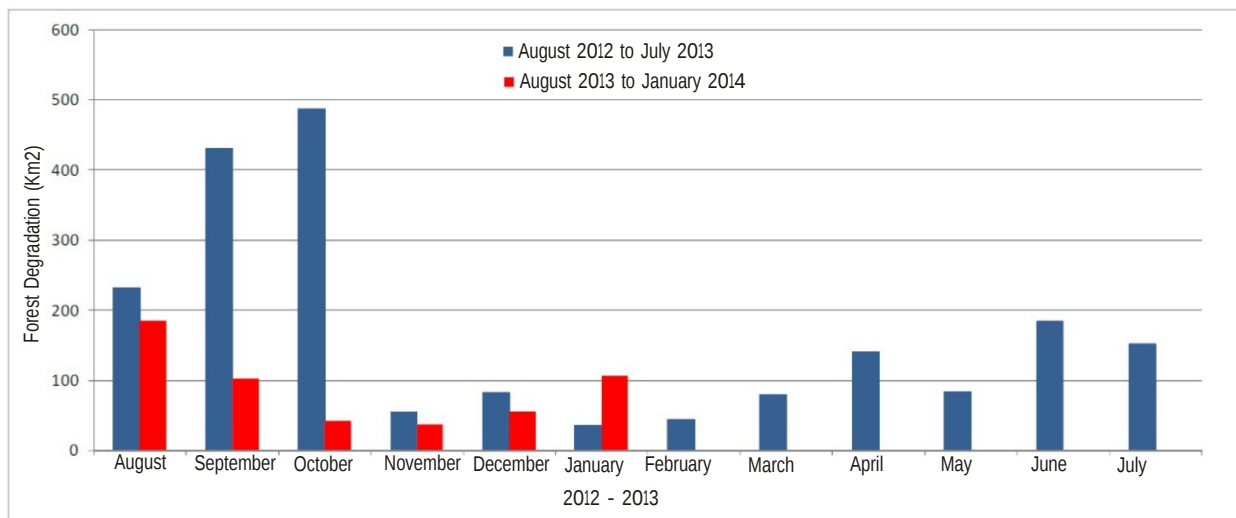


Figure 1. Deforestation from August 2012 to January 2014 in the Brazilian Amazon (Source: Imazon/SAD).

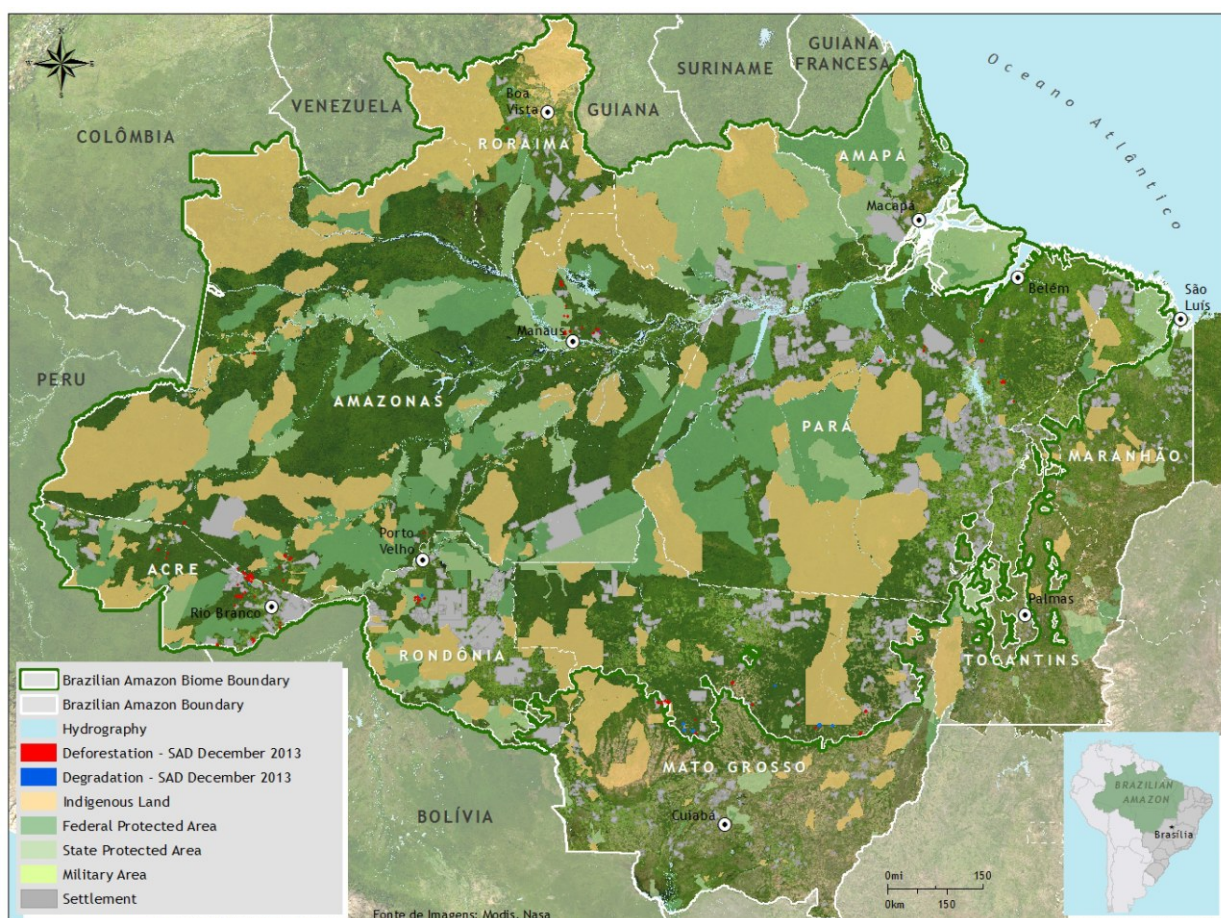


Figure 2. Deforestation and Forest Degradation in January 2014 in the Brazilian Amazon (Source: Imazon/ SAD).

Deforestation accumulated from August 2013 to January 2014, corresponding to the first six months of the official deforestation measurement calendar reached 531 square kilometers. There was a reduction of 60% of the deforestation over the previous period (august 2012 to january 2013) when it reached 1.326 square kilometers.

In January 2014, the deforestation occurred in Roraima (34%), followed by Mato Grosso (22%), Pará (22%), Tocantins (9%), Acre (8%), Amazonas (3%) and Rondônia (2%).

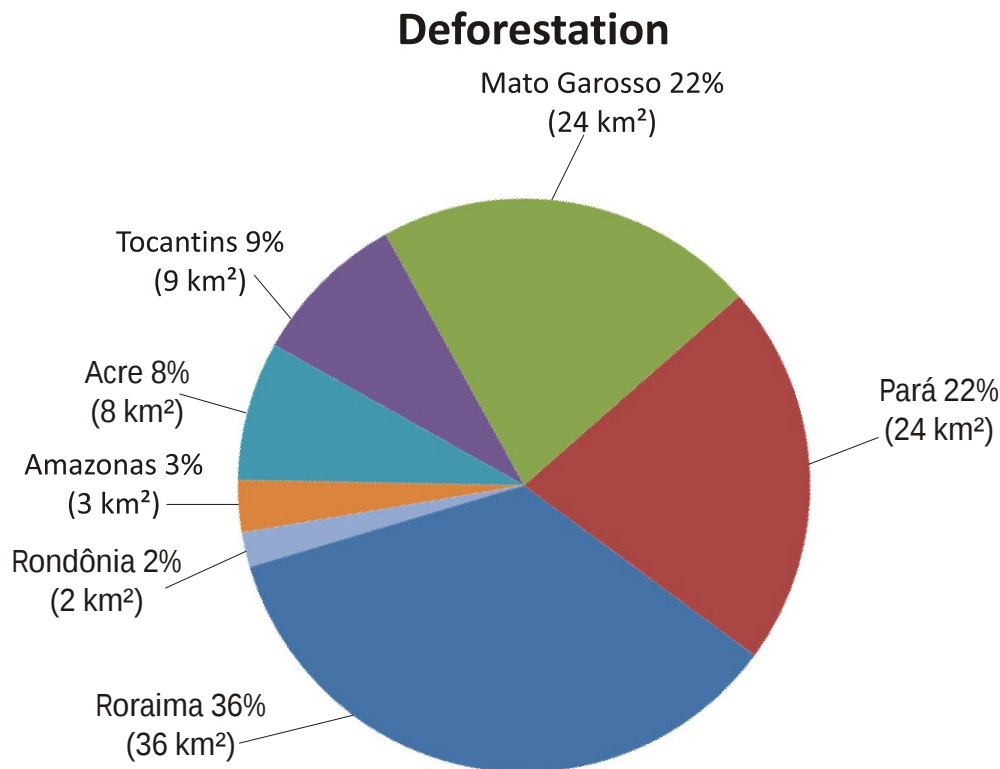


Figure 3. Percentage of deforestation in the States of the Brazilian Amazon in January 2014 (Source: Imazon/SAD).

Considering the period from August 2013 to January 2014, Pará tops the ranking with 24% of the total deforested in the period. Then, appears Amazonas with 22% and Rondônia with 21%. In relative terms, there was an increase of 348% in Roraima and 324% in Acre. On the other hand, there was a significant reduction in Pará (-80%) and Mato Grosso (-77%).

In absolute terms, Pará leads the ranking of accumulated deforestation with 125 square kilometers, followed by Amazonas (117 square kilometers) and Rondônia (112 square kilometers).

Table 1. Evolution of deforestation among the States of the Brazilian Amazon from August 2012 to January 2013 and from August 2013 to January 2014 (Source: Imazon/SAD).

State	August 2012 to January 2013	August 2013 to January 2014	Variation (%)
Pará	638	125	-80
Mato Grosso	323	76	-77
Rondônia	170	112	-34
Amazonas	155	117	-24
Roraima	10	46	+348
Acre	10	42	+324
Tocantins	20	12	-40
Amapá	-	-	-
Total	1.326	531	-60

*Data from Maranhão state has not been analyzed.

Forest Degradation

In January 2014, SAD reported 32 square kilometers of degraded forests (forests intensively exploited by logging activity and/or burning) (Figures 2 and 4). From this total, the large majority (97%)

occurred in Mato Grosso, followed by Amazonas (2%) and Pará (1%).

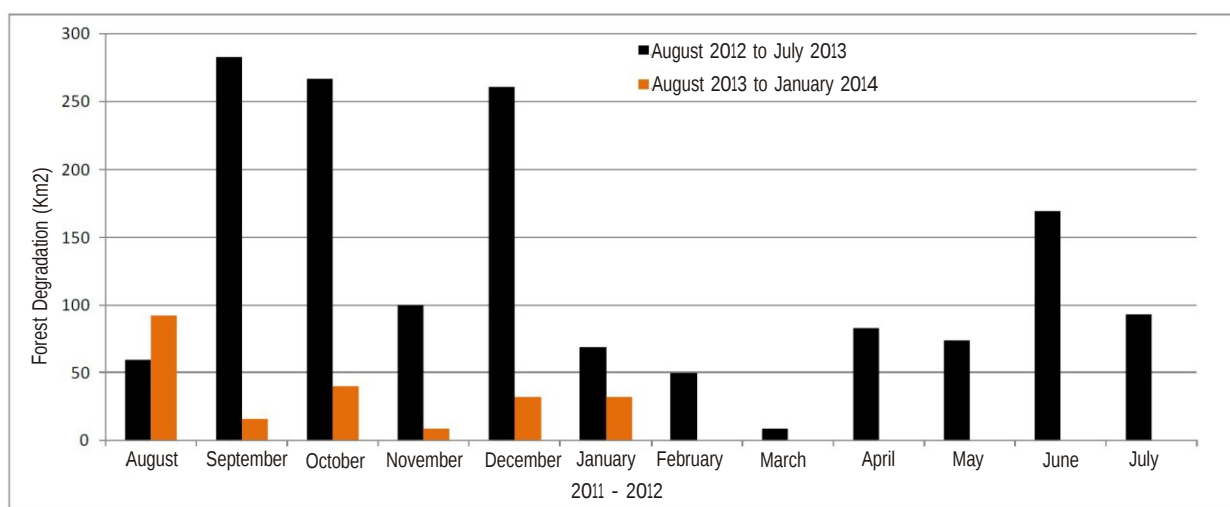


Figure 4. Forest degradation from August 2012 to January 2014 in the Brazilian Amazon (Source: Imazon/SAD).

The accumulated forest degradation from August 2013 to January 2014 (first six months of the official deforestation measurement calendar) reached 212 square kilometers. This represents a reduction of 80% in the forest degradation

accumulated over the same previous period (august 2012 to january 2013) when the forest degradation totaled 1.043 square kilometers (Table 2).

Table 2. Evolution of forest degradation among the States of the Brazilian Amazon from August 2012 to January 2013 and from August 2013 to January 2014 (Source: Imazon/SAD).

State	August 2012 to January 2013	August 2013 to January 2014	Variation (%)
Mato Grosso	571	154	-73
Pará	387	48	-88
Rondônia	49	7	-86
Amazonas	11	3	-72
Roraima	-	-	-
Acre	-	-	-
Tocantins	25	-	-100
Amapá	-	-	-
Total	1.043	212	-80

*Data from Maranhão has not been analyzed.

Geography of Deforestation

In January 2014, the vast majority (66%) of the deforestation occurred in private areas or under various stages of possession. The remaining deforestation was

registered in Land Reform Settlements (20%), Protected Areas (13%) and Indigenous Lands (1%) (Table 3).

Table 3. Deforestation by land category in January 2014 in the Brazilian Amazon (Source: Imazon/ SAD).

Category	January 2014	
	km ²	%
Land Reform Settlement	22	20
Protected Areas	13	13
Indigenous Lands	0,5	1
Private, Possession & Land in Abeyance	71	66
Total (km²)	107	100

¹ The official calendar for measuring deforestation has beginning in August and ends in July.

Land Reform Settlements

SAD recorded 22 square kilometers of deforestation in the Land Reform Settlements in January 2014 (Figure 5). The Settlements most affected by deforestation were PAD Anauá

(Rorainópolis, Roraima), PDS Serra Azul (Monte Alegre, Pará) and PA Cruzeirão (Óbidos, Pará).

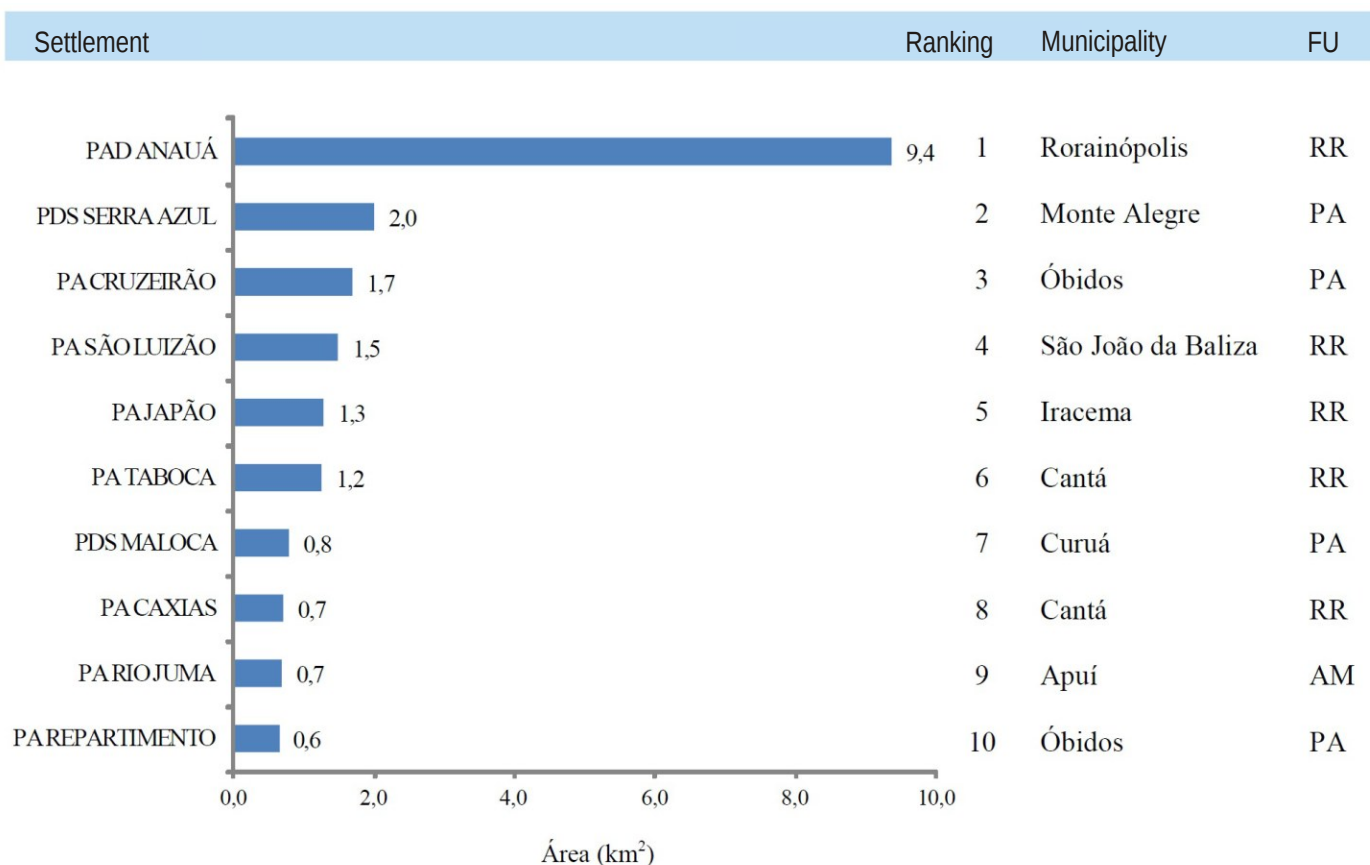


Figure 5. Land Reform Settlements in January 2014 in the Brazilian Amazon (Source: Imazon/SAD).

Protected Areas

In January 2014, SAD detected 13 square kilometers of deforestation in the Protected Areas (Figure 6). In the case of Indigenous Lands, in January 2014 were detected 0,5 square kilometers of

deforestation in Miratu (Amazonas) and Wai-Wai (Roraima) (Figure 7).

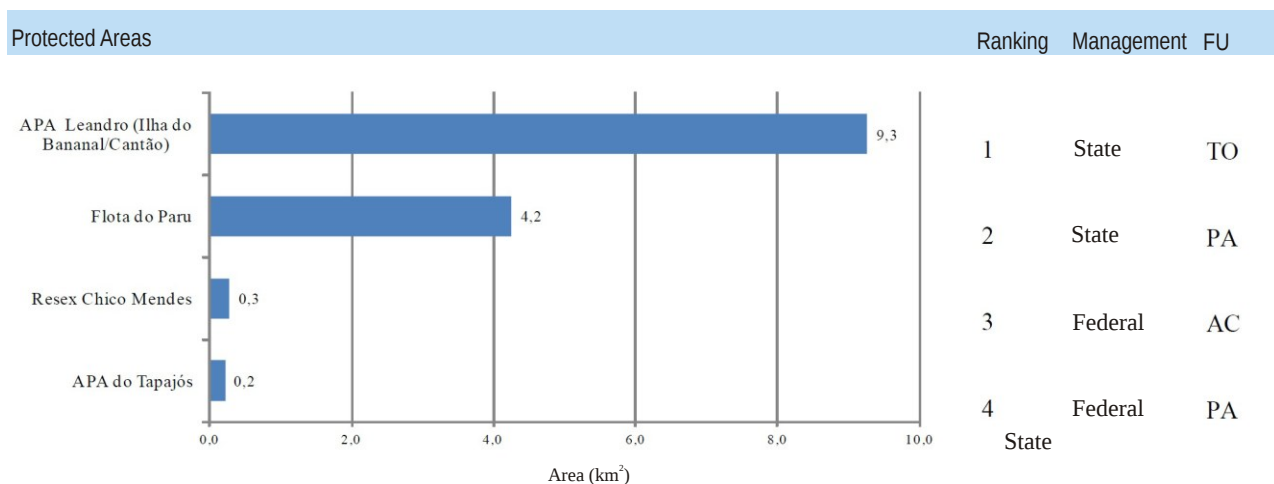


Figure 6. Protected Areas deforested in the Brazilian Amazon in January 2014 (Source: Imazon /SAD).

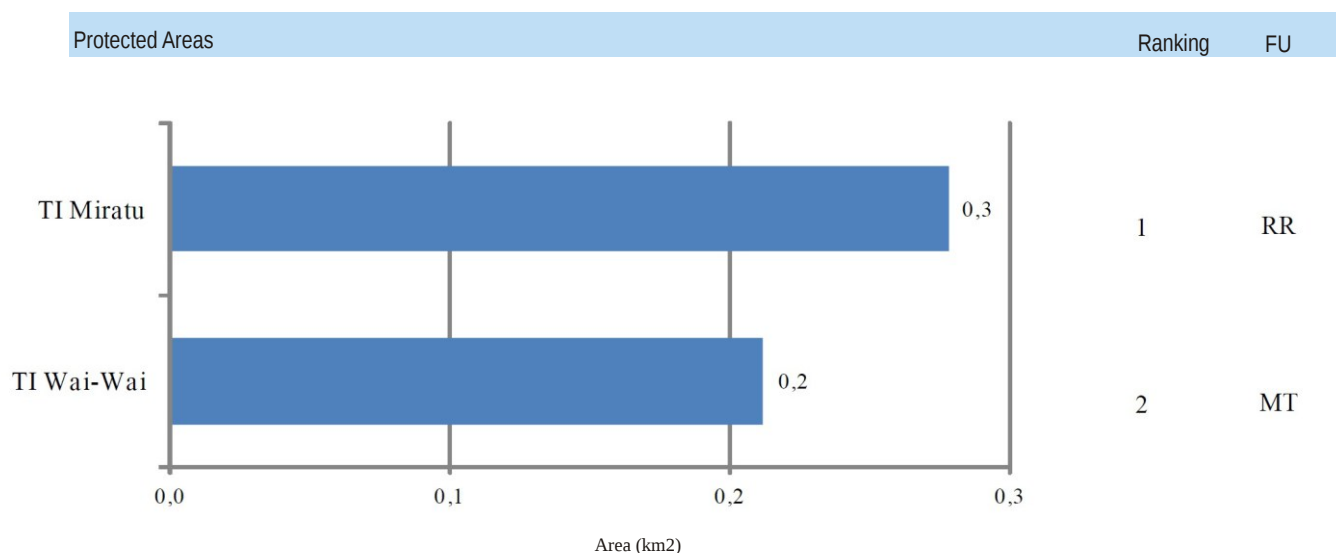


Figure 7. Indigenous Lands in Brazilian Amazon in January 2014 (Source: Imazon /SAD).

Critics Municipalities

In January 2013, the most deforested municipalities were Rorainópolis (Roraima) and

Prainha (Pará) (Figures 8 and 9).

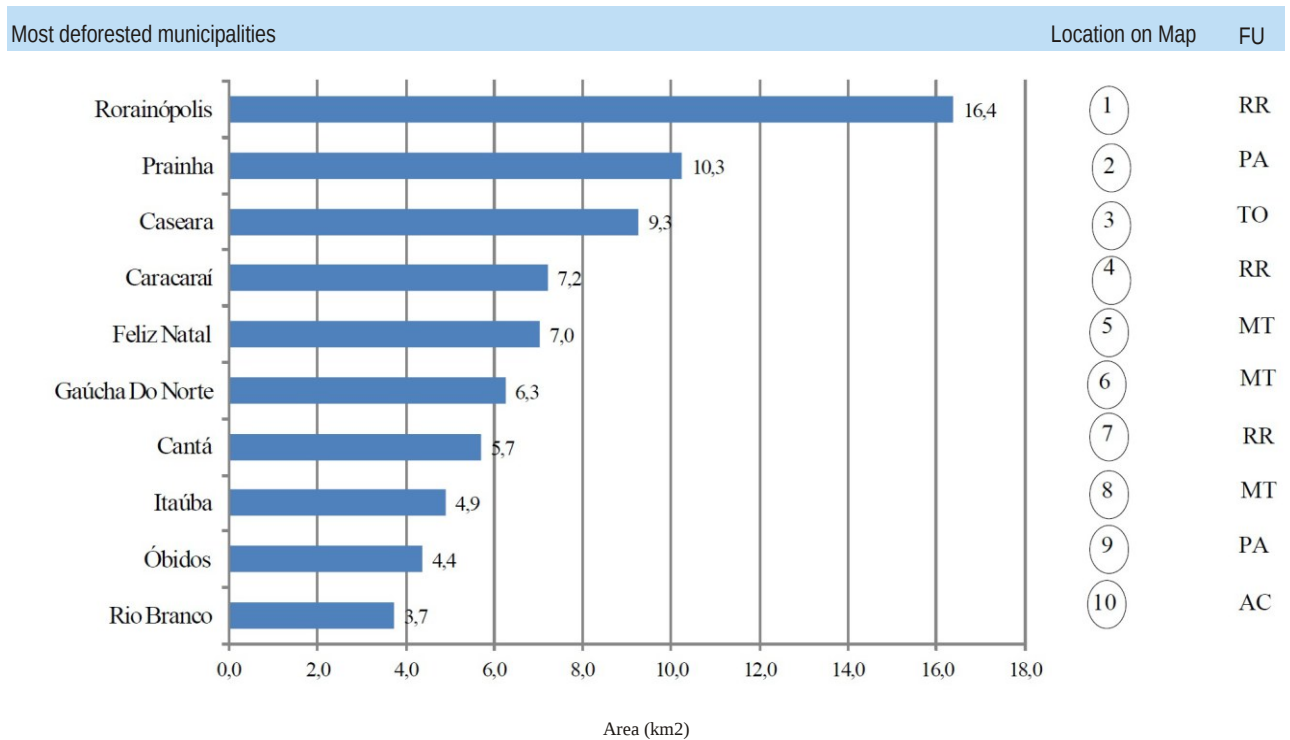


Figure 8. Municipalities most deforested in the Brazilian Amazon in January 2014 (Source: Imazon /SAD).

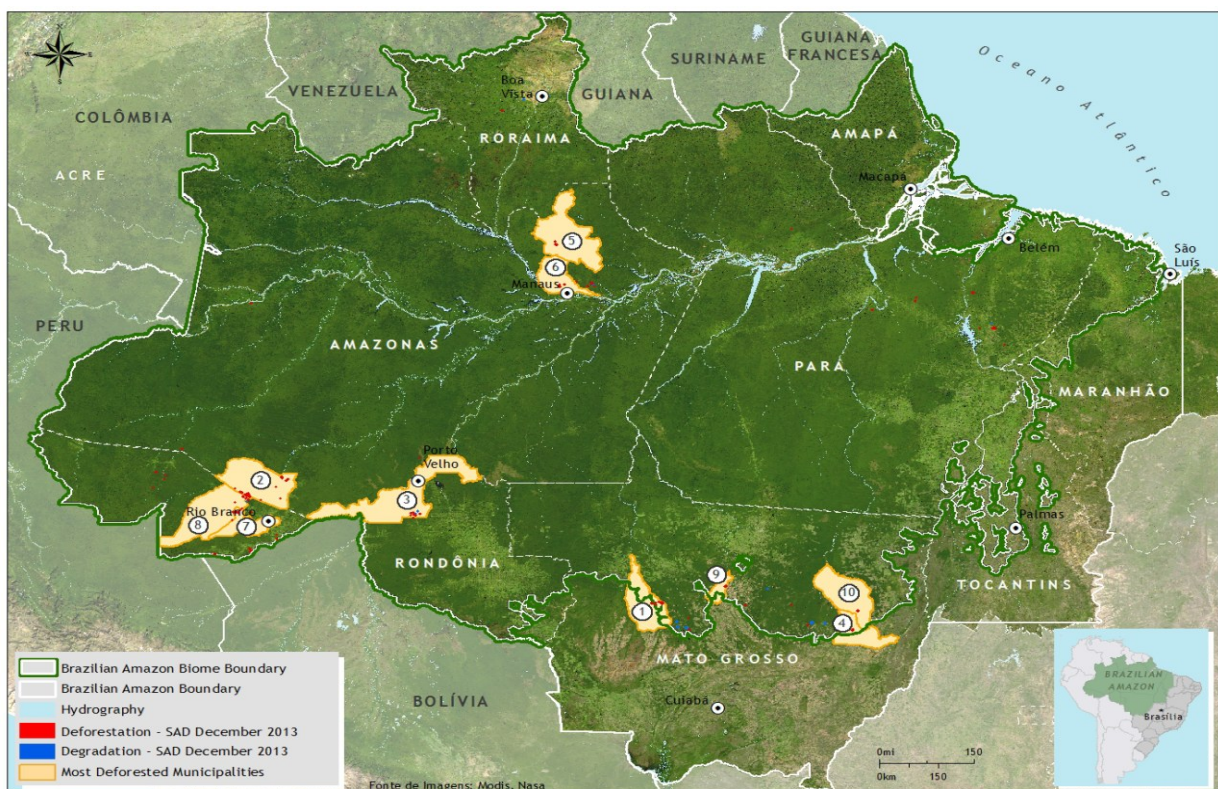


Figure 9. Municipalities with the largest deforested areas in January 2014 (Source: Imazon/SAD).

Cloud and Shadow Coverage

In January 2014, it was possible to monitor next to SAD only 42% of the forested area in the Brazilian Amazon compared to 39% in January 2013. The other 58% of the forest territory was covered by clouds, hindering detection of deforestation and forest degradation. The States with the largest cloud coverage

were Amapá (86%), Pará (83%) and Rondônia (79%). As a result, data from deforestation and forest degradation in January 2014 may be underestimated (Figure 10).

* The part of Maranhão integrating the Brazilian Amazon was not analyzed.

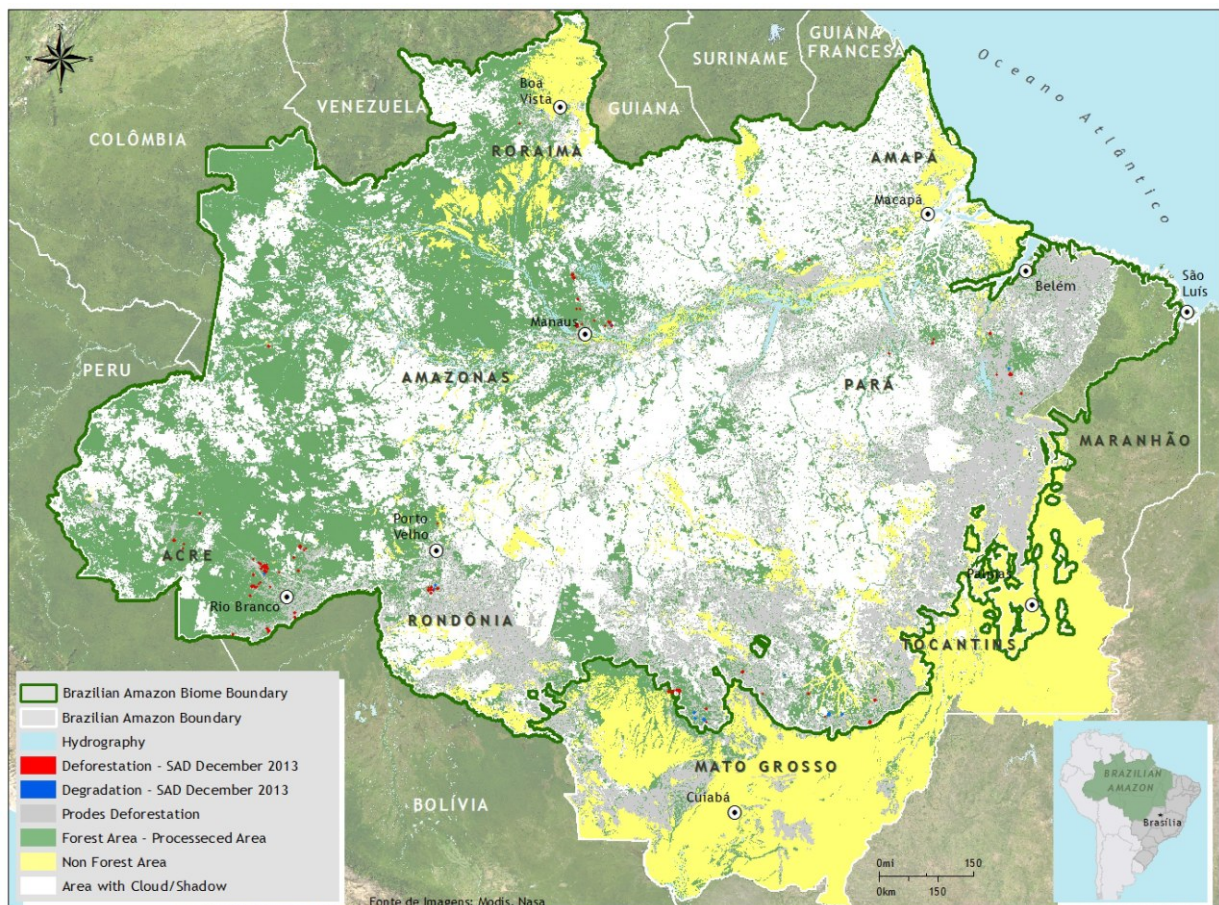


Figure 10. Area with cloud and shadow in January 2014 in the Brazilian Amazon.

SAD-EE

Since July 2012, SAD detection of deforestation and forest degradation alerts is being performed at Google Earth Engine (EE) platform with the new version SAD EE. This system was developed in collaboration with Google and use the

same procedure already used by SAD 3.0 (Table I), with reflectance images from MODIS in order to generate alerts from deforestation and forest degradation.

Table I: SAD 3.0

Since October 2009, the SAD had some news. First, we created a graphic interface in order to integrate all image processing programs used in SAD. Second, we begin to compute deforestation in areas that were covered by clouds in the previous months in a new class. Finally, deforestation and degradation are detected in pairs of NDFI images in a changes detection algorithm. The main method remains the same of SAD 2.0, as described below.

SAD generates temporal mosaic of daily MODIS images of the MOD09GQ and MOD09GA products in order to perform the clouds filtration. Then, we use a bands fusion technique of different spectral resolution, i.e. with different pixel sizes. In this case, we change the scale of the 5 bands with pixel from 500 meters of the MODIS to 250 meters. This allowed enhance the spectral model of pixel mixture, providing the ability to estimate the abundance of vegetation, soils and not photosynthetically active vegetation (NPV from English - Non-Photosynthetic components (vegetation, soil and Shadow) in order to calculate the NDFI, with equation below:

$$NDFI = \frac{(VGs - (NPV + Solo))}{(VGs + NPV + Solo)}$$

Wherein VGs is the component of normalized Vegetation for shadow given by:

$$VGs = \text{Vegetation} / (1 - \text{Shadow})$$

The NDFI ranges from -1 (pixel with 100% of exposed soil) to 1 (pixel with > 90% with forest vegetation). Thus, we now have a continuous image that shows the transition from deforested areas, passing through degraded forests until they reach the forest without signs of disturbance.

The detection of deforestation and degradation spent this month with the difference of NDFI images of consecutive months. Thus, a reduction of NDFI values between -200 and -50 indicates possibly deforested areas and between -49 and -20 with signs of degradation.

SAD 3.0 Beta is compatible with the previous versions (SAD 1.0, 2.0), because the detection threshold of deforestation was calibrated in order to generate the same type of response obtained by the previous method.

SAD is already operating in the State of Mato Grosso since October 2006 and in the Amazônia Legal since April 2008. In this report, we present the monthly data generated by SAD from August 2012 to January 2014.

Notes:

Responsible Staff:

General Coordination: Carlos Souza Jr. and Adalberto Veríssimo (Imazon)

Technical Coordination: Antônio Fonseca, Heron Martins

Staff: Marcio Sales (Modeling and Statistics), Rodney Salomão, Amintas Brandão Jr. (Geoprocessing), João Siqueira, Marcelo Justino and Wildson Queiroz (Image Interpretation), Kátia Pereira and Victor Lins (ImazonGeo), Bruno Oliveira and Stefânia Costa (Communication)

Data Sources:

The deforestation statistics are generated from the SAD data (Imazon);
INPE data - Deforestation (PRODES)
<http://www.obt.inpe.br/prodes/>

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Google Earth Engine Team
<http://earthengine.google.org/>

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Secretaria de Meio Ambiente do Mato Grosso (SEMA) (Environment Protection Agency of Mato Grosso)
Secretaria de Meio Ambiente do Pará (SEMA) (Environment Protection Agency of Pará)
Federal Public Prosecutor of Pará
State Public Prosecutor of Pará
State Public Prosecutor of Roraima
State Public Prosecutor of Amapá
State Public Prosecutor of Mato Grosso
Instituto Centro de Vida (ICV- Mato Grosso)