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ABSTRACT

In April 2014 the majority (59%) of the forest area of the Brazilian Amazon was covered by clouds, a cover superior to that of April 2013 (55%), which reduced the capacity for detecting deforestation and forest degradation in the region. The States with the greatest cloud cover were Amapá (91%), Roraima (80%) and Pará (76%). The State of Mato Grosso presented a low cloud cover (12%), making it possible to detect deforestation and forest degradation in areas that were under cloud cover in previous months.

During the period analyzed, and under those cloud conditions, 101 square kilometers of deforestation in the Legal Amazon were detected by SAD. That represents a 28% decrease in relation to April 2013 when deforestation totaled 140 square kilometers.

The deforestation accumulated during the period of August 2013 to April

2014, corresponding to the first nine months of the current deforestation calendar, totaled 662 square kilometers. There was a 58% reduction in accumulated deforestation in relation to the previous period (August 2012 to April 2013) when deforestation totaled 1,570 square kilometers.

Degraded forests totaled 189 square kilometers in April 2014. In relation to April 2013, when forest degradation totaled 9 square kilometers, there was an increase of 1980%. The great majority (92%) occurred in Mato Grosso, followed by Rondônia (7%) and Roraima (1%).

Forest degradation accumulated during the period of August 2013 to April 2014 totaled 407 square kilometers. There was a 67% reduction in relation to the previous period (August 2012 to April 2013) when forest degradation totaled 1,219 square kilometers.

Deforestation Statistics

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

uses) reached 101 square kilometers in April 2014 (Figure 1 and Figure 2).

Forest Transparency

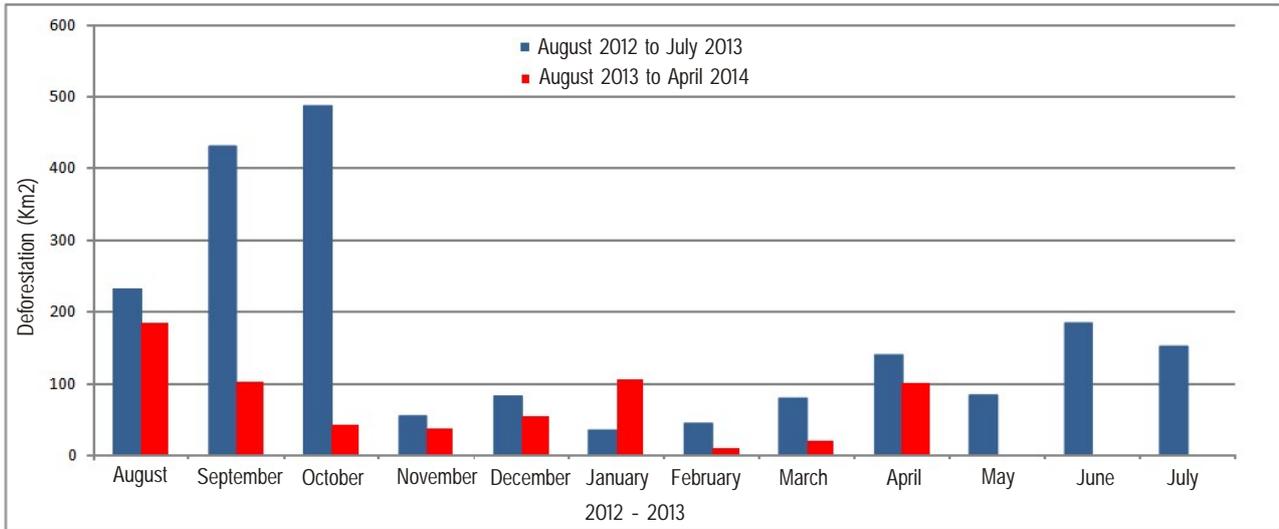


Figure 1. Deforestation from August 2012 to April 2014 in the Brazilian Amazon (Source: Imazon/SAD).

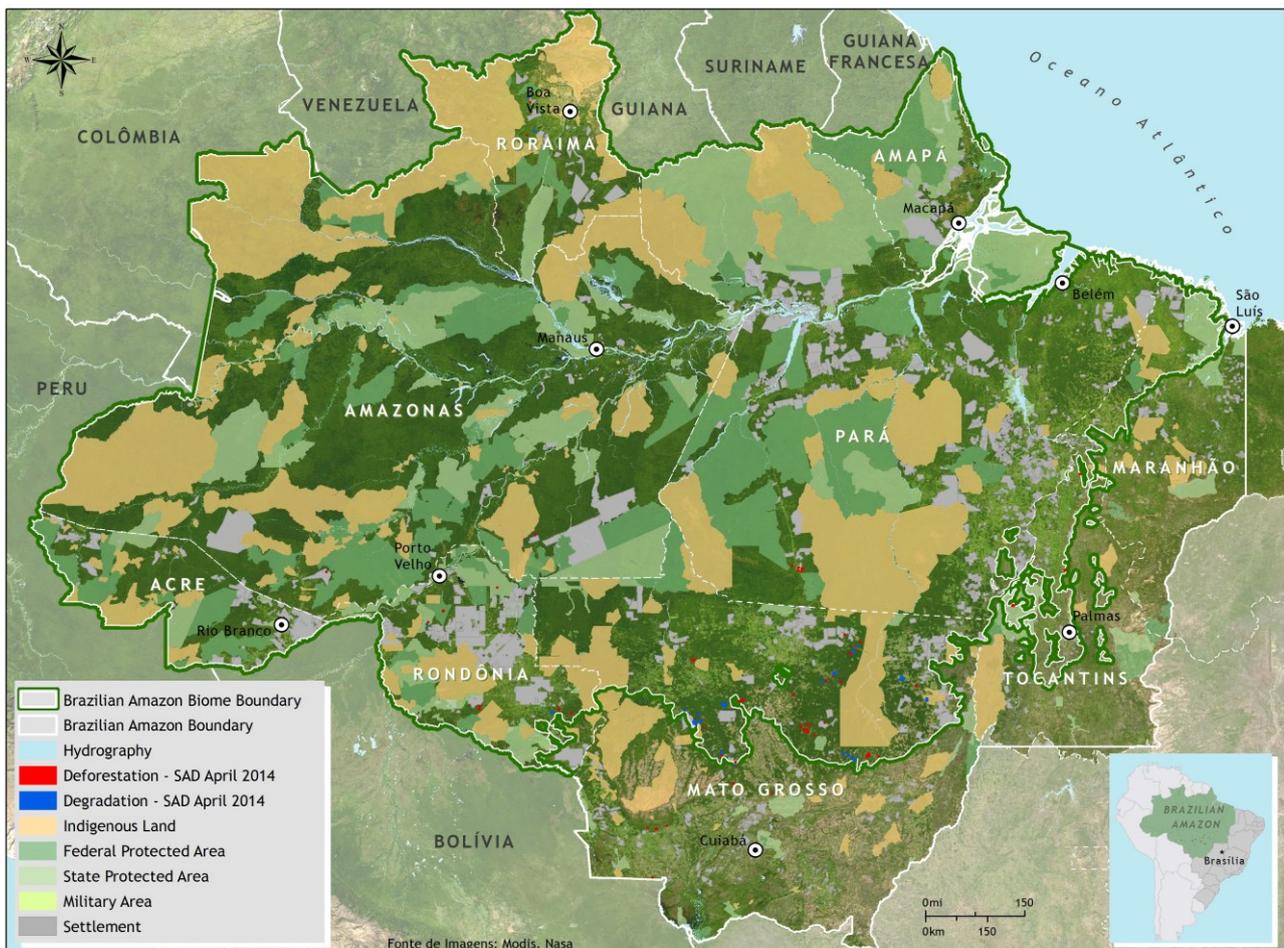


Figure 2. Deforestation and Forest Degradation in April 2014 in the Brazilian Amazon (Source: Imazon/ SAD).

The deforestation accumulated during the period of August 2013 to April 2014, corresponding to the first nine months of the official calendar for measuring deforestation, reached 662 square kilometers. There was a 58% reduction in deforestation in relation to the

previous period (August 2012 to April 2013) when it reached 1,570 square kilometers.

In January 2014, deforestation occurred in Mato Grosso (72%), followed by Tocantins (10%), Rondônia (9%), Pará (7%), Amazonas (1%) and Roraima (1%).

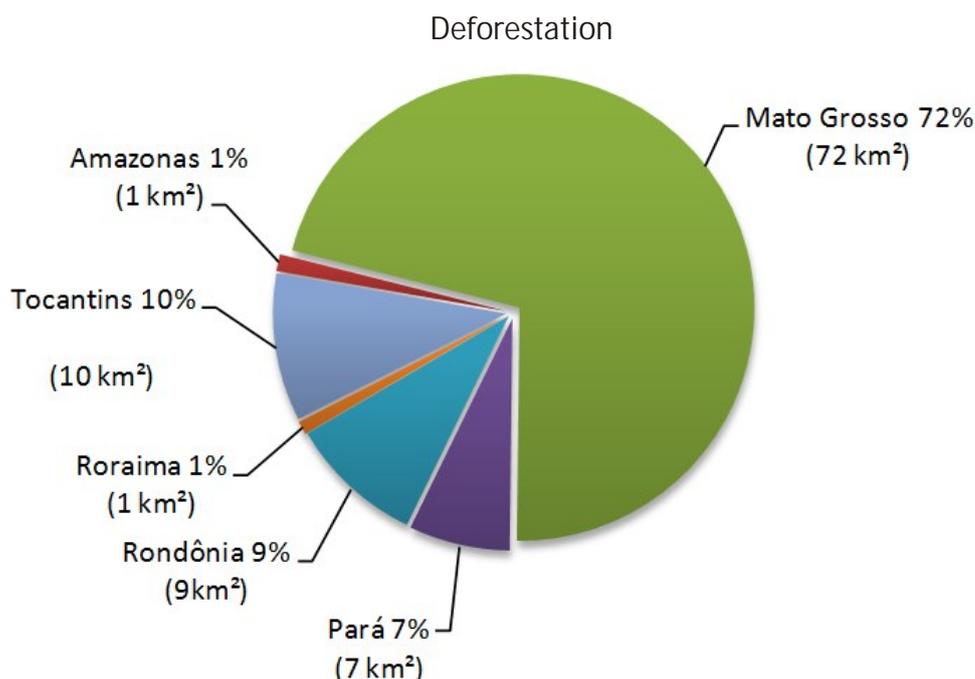


Figure 3. Percentage of deforestation in the States of the Brazilian Amazon in April 2014 (Source: Imazon/SAD).

Considering the period from August 2013 to April 2014, Mato Grosso leads the ranking with 24% of the total deforested area. Next is Pará with 24% and Amazonas and Rondônia with 21% each. In relative terms, there was an increase of 328% in Roraima and 234% in Acre. On the other hand, there was a significant reduction in Pará (-78%)

and Mato Grosso (-67%).

In absolute terms, Mato Grosso leads the ranking of accumulated deforestation with 158 square kilometers, followed by Pará (140 square kilometers) and Rondônia and Amazonas (112 square kilometers).

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

State	August 2012 to April 2013	August 2013 to April 2014	Variation (%)
Pará	651	140	-78
Mato Grosso	481	158	-67
Rondônia	220	122	-45
Amazonas	168	122	-28
Roraima	13	56	+328
Acre	13	42	+234
Tocantins	24	22	-7
Amapá	-	-	-
Total	1,570	662	-58

*Data from Maranhão state has not been analyzed.

Forest Degradation

In April 2014, SAD recorded 189 square kilometers of degraded forests (forests intensely exploited by logging activity and/or burned)

(Figures 2 and 4). Of that total, the great majority (92%) occurred in Mato Grosso, followed by Rondônia (7%) and Roraima (1%).

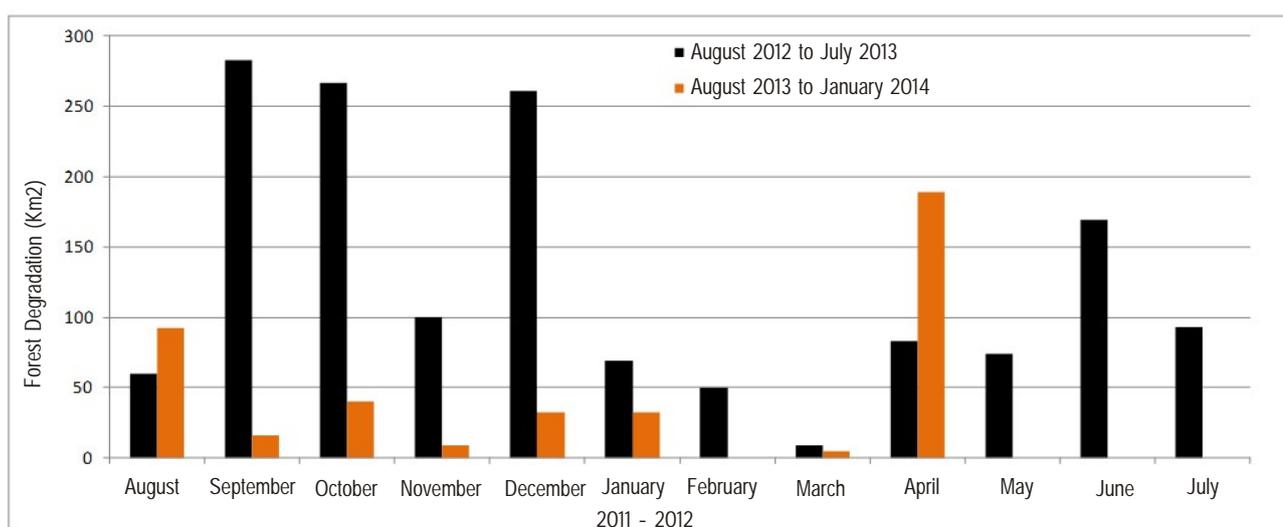


Figure 4. Forest Degradation from August 2012 to April 2014 in the Brazilian Amazon (Source: Imazon/SAD).

Forest degradation accumulated during the period of August 2013 to April 2014¹ (first nine months of the official calendar for measuring deforestation) reached 407 square kilometers. That represents a reduction of 67% in forest

degradation accumulated in relation to the same previous period (August 2012 to April 2013) when forest degradation totaled 1,219 square kilometers (Table 2).

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

State	August 2012 to April 2013	August 2013 to April 2014	Variation (%)
Mato Grosso	680	333	-72
Pará	398	48	-88
Rondônia	97	20	-79
Amazonas	11	3	-72
Roraima	5	3	-40
Acre	3	-	-100
Tocantins	25	-	-100
Amapá	-	-	-
Total	1,219	407	-67

*Data from Maranhão has not been analyzed.

Geography of Deforestation

In April 2014, the great majority (87%) of deforestation occurred in private areas under different stages of possession. The remainder of

deforestation was recorded in Land Reform Settlements (4%) and Conservation Units (9%) (Table 3).

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

Category	April 2014	
	km ²	%
Land Reform Settlement	4	4
Conservation Units	9	9
Indigenous Lands	-	-
Private, Possession & Untitled public lands	88	87
Total (km²)	101	100

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

Land Reform Settlements

SAD recorded 4 square kilometers in Land Reform Settlements in April 2014 (Figure 5). The Settlements most affected by deforestation were PDS Mãe Menininha

(Altamira, Pará), PA Monte (Boca do Acre, Amazonas) and PA Boa Esperança I, II and III (Nova Ubiratã, Mato Grosso).

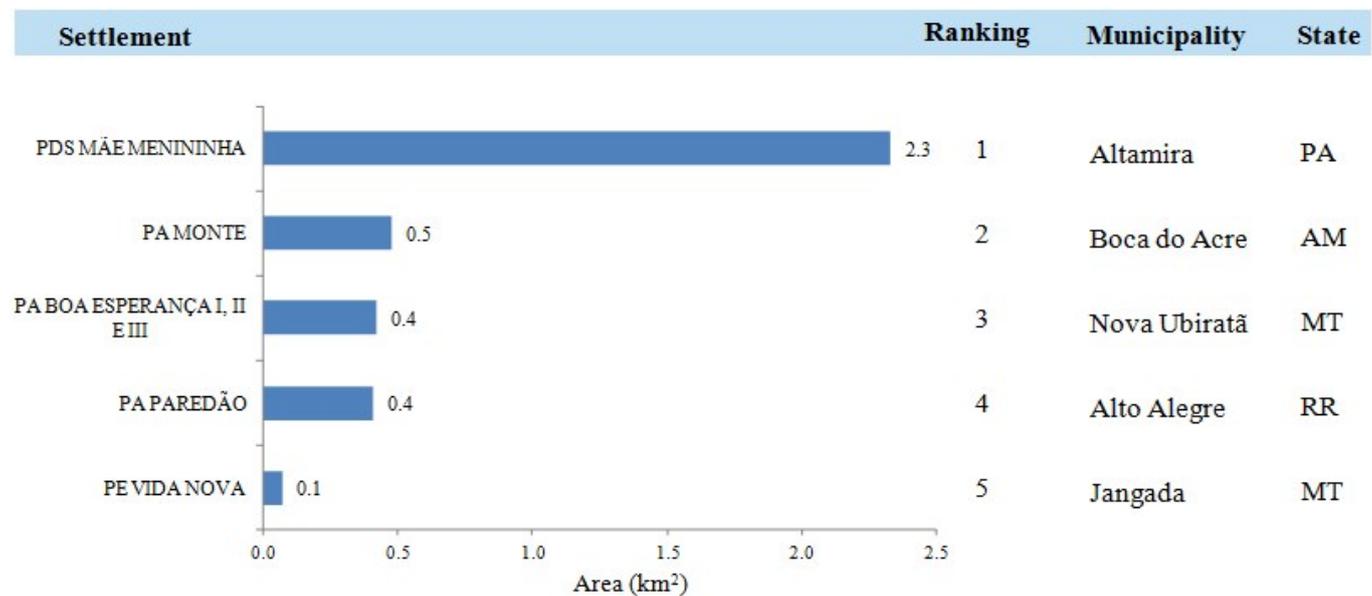


Figure 5. Land Reform Settlements deforested in April 2014 in the Brazilian Amazon (Source: Imazon/SAD).

Protected Areas

In April 2014, SAD detected 9 square kilometers of deforestation in Conservation Units

(Figure 6). In April 2014 no deforestation was detected in Indigenous Lands in the Brazilian Amazon.

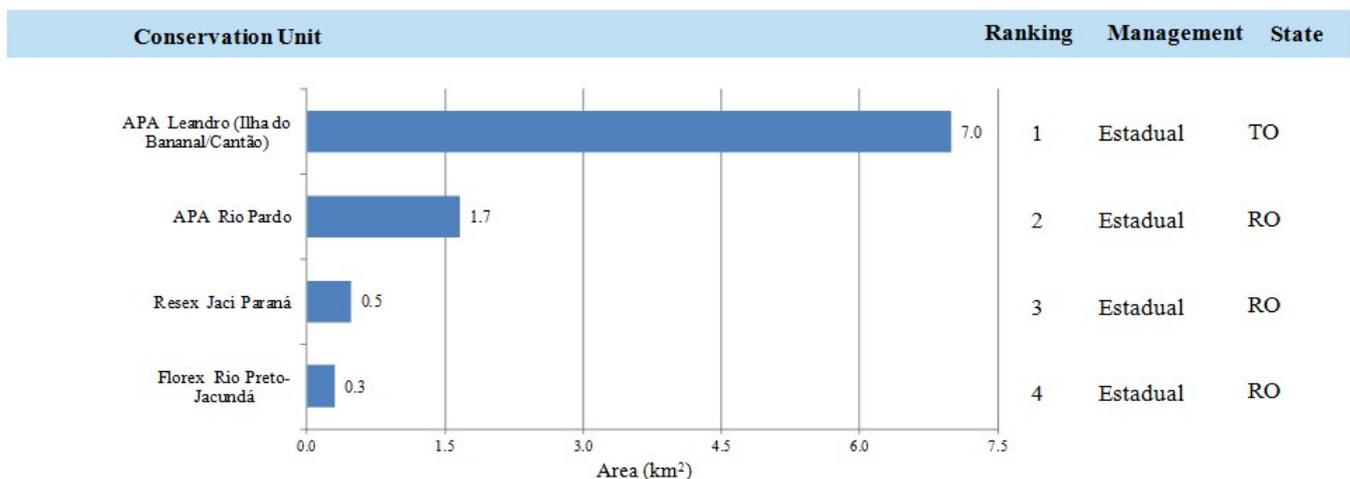


Figure 6. Conservation Units deforested in the Legal Amazon in April 2014 (Source: Imazon/SAD).

Critical Municipalities

In April 2014, the most deforested municipalities were Feliz Natal (Mato Grosso) and Nova

Maringá (Mato Grosso) (Figure 7 and 8).

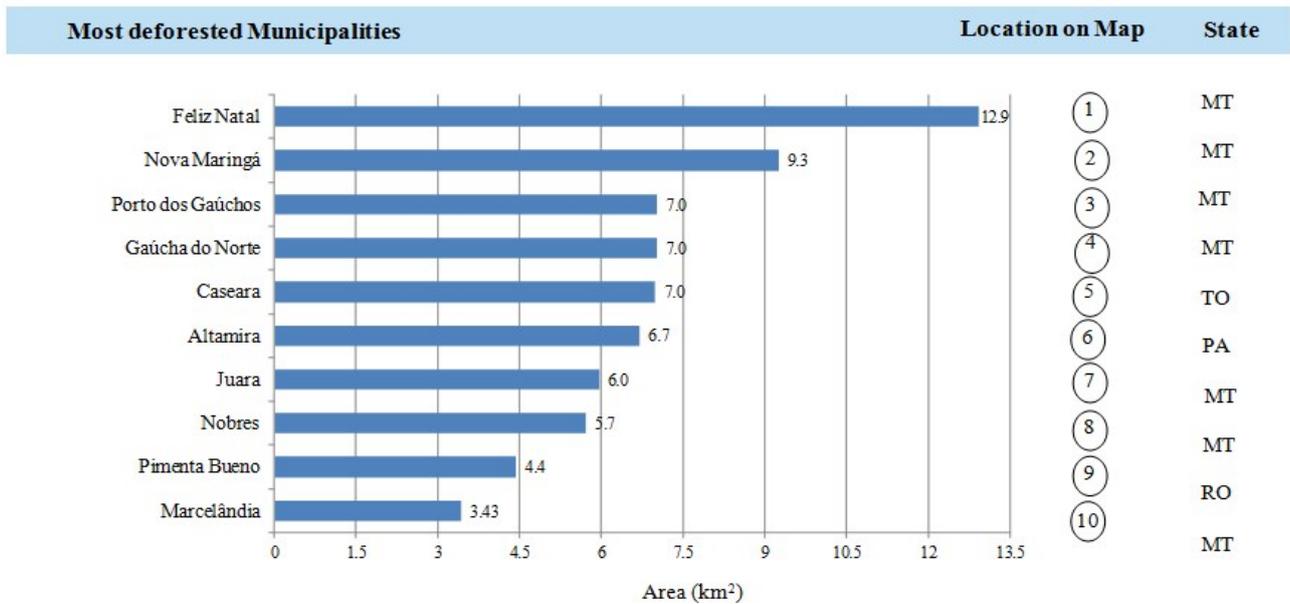


Figure 7. Most deforested municipalities in the Brazilian Amazon in April 2014 (Source: Imazon /SAD).

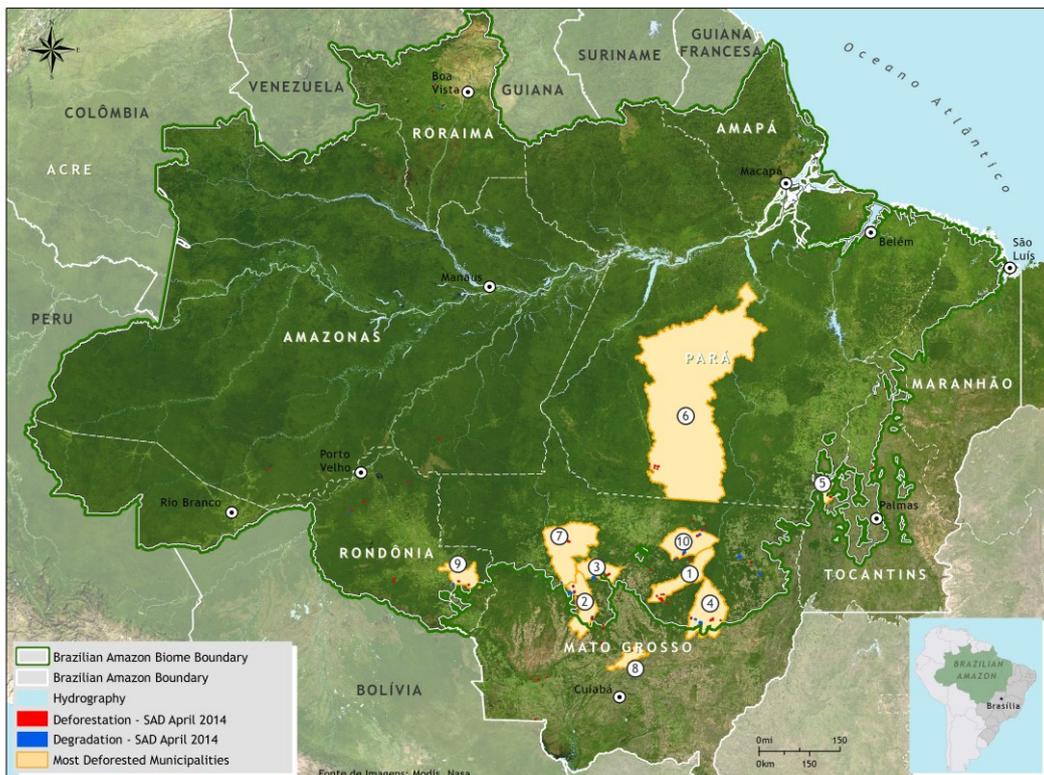


Figure 8. Municipalities with largest deforested areas in April 2014 (Source: Imazon/SAD).

Cloud and Shadow Coverage

In April 2014, it was possible with SAD to monitor only 41% of the forest area in the Brazilian Amazon, as opposed to 45% in April 2013. The other 59% of forest territory were covered by clouds, which made it difficult to detect

deforestation and forest degradation. The States with the highest cloud cover were Amapá (91%), Roraima (80%) and Pará (76%). Because of that, the data on deforestation and forest degradation for April 2014 may be underestimated (Figure 9).

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

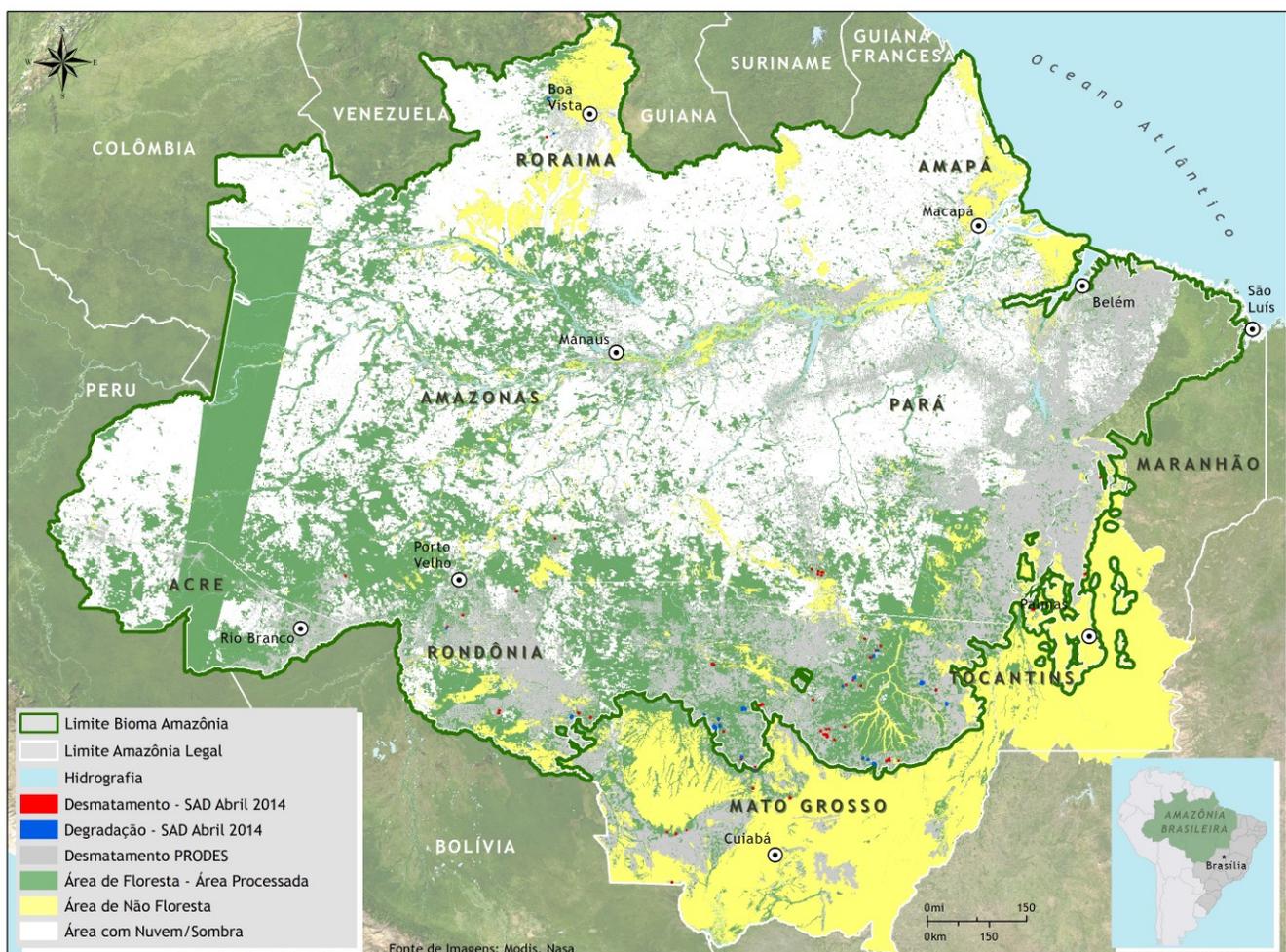


Figure 9. Area with cloud and shadow in April 2014 in the Brazilian Amazon.

SAD-EE

Since July 2012 deforestation and forest degradation detection alerts have been performed using the Google Earth Engine platform (EE), with the new SAD EE version. That system was developed in

collaboration with Google and uses the same process already employed by SAD 3.0 (Box I), with reflectance images from MODIS to generate the deforestation and forest degradation alerts.

Table I: SAD 3.0

Since October 2009, SAD has had some new features. First, we created a graphic interface to integrate all of the image processing programs used in SAD. Next, we began to compute deforestation in areas that were covered by clouds in the previous months in a new class. Finally, deforestation and degradation are detected with pairs of NDFI images using a change detection algorithm. The principal method continues to be the same as with SAD 2.0 as described below.

SAD generates a temporal mosaic of daily MODIS images from the MOD09GQ and MOD09GA products for filtering clouds. Next, we use a technique for fusing different spectral resolution bands, i.e. with pixels of different sizes. In this case, we made a change in scale from 5 bands with 500 meter pixels in MODIS to 250 meters. That allowed us to improve the spectral mixture model and provided the capacity for estimating the abundance of Vegetation, Soils and Non-Photosynthetic Vegetation (NPV) components (Vegetation, Soil and Shadow) to calculate the NDFI, with the following equation:

$$\text{NDFI} = \frac{\text{VGs} (\text{NPV} + \text{Soil})}{\text{VGs} + \text{NPV} + \text{Soil}}$$

Where VGs is the Vegetation component normalized for shadow given by:

$$\text{VGs} = \frac{\text{Vegetation}}{1 - \text{Shadow}}$$

The NDFI varies from -1 (pixel with 100% of exposed soil) to 1 (pixel with > 90% of forest vegetation). Thus, we have a continuous image that shows the transition from deforested areas, going through degraded forests, until reaching forest without signs of disturbances.

Detection of deforestation and degradation this month involved a difference in the NDFI images from consecutive months. Thus, a reduction in the NDFI values of from -200 to -50 indicates possible deforested areas and from -49 to -20 indicates signs of degradation.

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

SAD has been in operation in the State of Mato Grosso since October 2006 and in the Legal Amazon since April 2008. In this bulletin, we present the monthly data generated by SAD from August 2012 to April 2014.

Team Responsible

General Coordination: Carlos Souza Jr.
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Team

João Siqueira, Marcelo Justino and Wildson Queiroz (Image interpretation), Kátia Pereira and Victor Lins (ImazonGeo), Bruno Oliveira and Stefânia Costa (Communication)

Data Source

Statistics for deforestation are generated using data from SAD (Imazon);
Data from INPE - Deforestation (PRODES)
[Http://www.obt.inpe.br/prodes/](http://www.obt.inpe.br/prodes/)

Acknowledgement:

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

Partnerships:

Secretaria de Estado de Meio Ambiente do Pará (SEMA) (Environment Protection Agency of Pará)
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)

Support

