

Summary

SAD detected 195 square kilometers of deforestation in the Brazilian Amazon in November 2014. That represented a 427% increase in relation to November 2013 when deforestation totaled 37 square kilometers. It was possible to monitor 67% of the forest area in the Brazilian Amazon while in November 2013 monitoring covered a smaller area (42%) of the territory.

In November 2014, deforestation was concentrated in Pará (70%) and Mato Grosso (18%), with a lower occurrence in Roraima (5%), Amazonas (4%), Amapá (1%), Rondônia (1%) and Acre (1%).

Degraded forests in the Brazilian Amazon totaled 86 square kilometers in November 2014. In relation to November 2013, when forest degradation totaled 9 square kilometers, there was an 855% increase.

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Deforestation statistics

According to SAD, deforestation (total suppression of the forest for other alternative land uses) reached 195 square kilometers in November 2014 (Figure 1 and Figure 2).

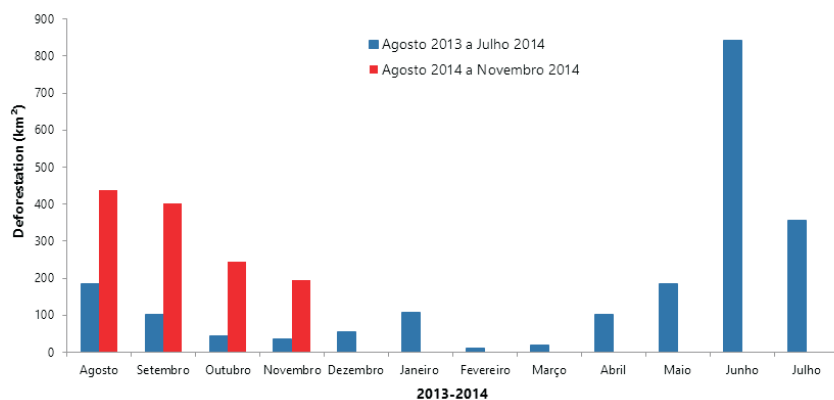


Figure 1. Deforestation from August 2013 to November 2014 in the Brazilian Amazon (Source: Imazon/SAD).

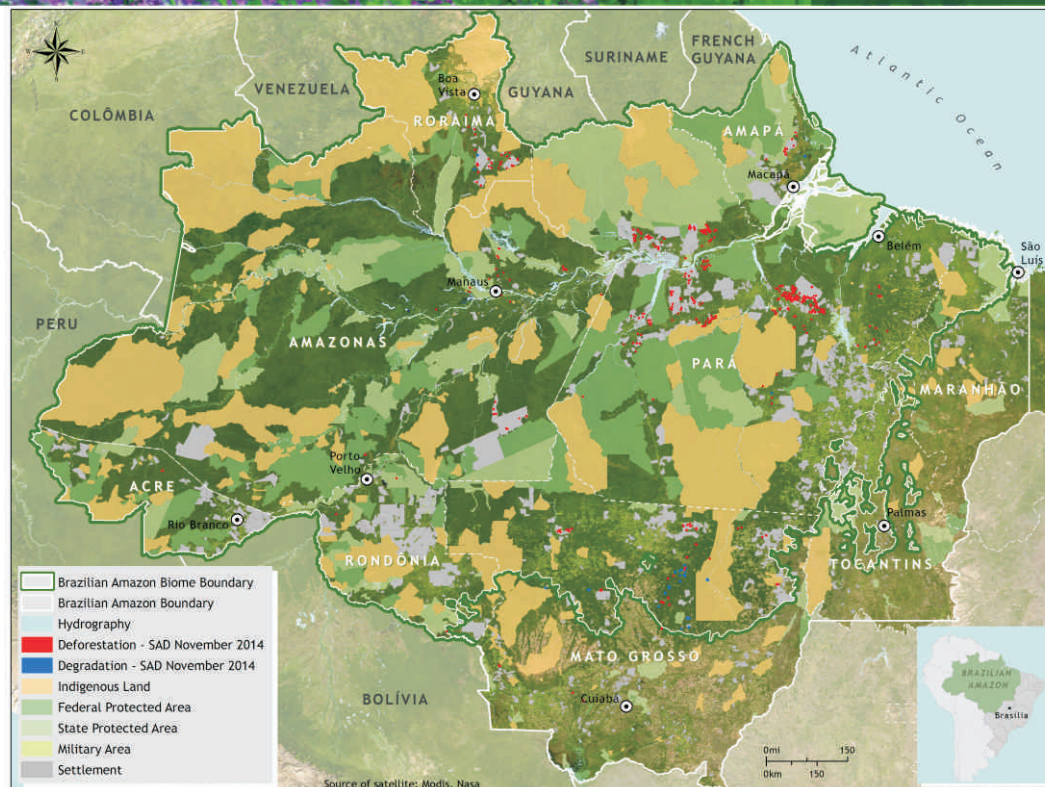


Figure 2. Deforestation and forest degradation in November 2014 in the Brazilian Amazon (Source: Imazon/ SAD).

In November 2014, deforestation was concentrated in Pará (70%) and Mato Grosso (18%), with a lower occurrence in Roraima (5%), Amazonas (4%), Amapá (1%), Rondônia (1%) and Acre (1%) (Figure 3).

The deforestation accumulated during the period of August to November 2014, corresponding to the first four months of the official calendar for measuring deforestation, reached 1,278 square kilometers. There was a 247% increase in deforestation in relation to the previous period (August 2013 to November 2013) when it reached 368 square kilometers.

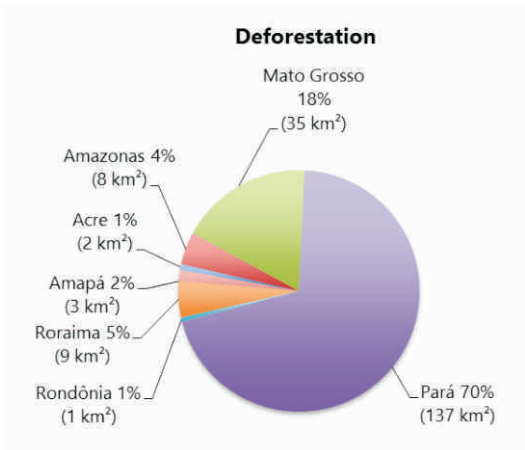


Figure 3. Percentage of deforestation in States of the Brazilian Amazon in November 2014 (Source: Imazon/SAD).

Considering the first four months of the current deforestation calendar (August 2014 to November 2014), Pará leads the ranking with 27% of the total deforested during the period. Next come Rondônia (26%) and Mato Grosso (24%). In relative terms, there was a significant increase of 940% in Mato Grosso and 495% in Roraima.

In absolute terms, Pará leads the ranking of accumulated deforestation with 343 square kilometers, followed by Rondônia (327 square kilometers) and Mato Grosso (312 square kilometers) (Table 1).

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

State	August to November 2013	August to November 2014	Variation (%)
Pará	98	343	+250
Mato Grosso	30	312	+940
Rondônia	106	327	+208
Amazonas	98	173	+76
Roraima	9	52	+477
Acre	24	66	+175
Tocantins	3	1	-200
Amapá	-	4	-
Total	368	1.278	+247

* Data from Maranhão were not analyzed.

Forest degradation

In November 2014, SAD recorded 86 square kilometers of degraded forests (forests intensely exploited through logging activity and/or burned) (Figures 2 and 4). Of that total, the great majority (93%) occurred in Mato Grosso, followed by Roraima (4%), Amapá (2%) and Pará (1%).

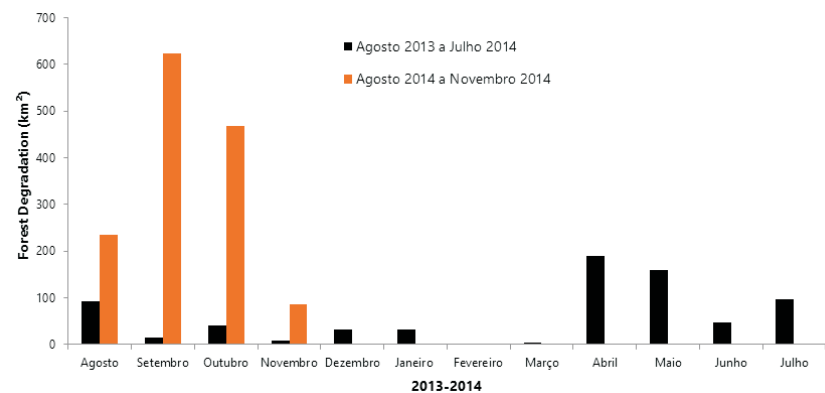


Figure 4. Forest Degradation from August 2013 to November 2014 in the Brazilian Amazon (Source: Imazon/SAD).

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

State	August to November 2013	August to November 2014	Variation (%)
Mato Grosso	99	1.153	+1,064
Pará	51	65	+2
Rondônia	6	35	+483
Amazonas	2	7	+250
Roraima	-	4	-
Acre	-	-	-
Tocantins	-	-	-
Amapá	-	2	-
Total	158	1,266	+701

* Data from Maranhão were not analyzed.

Geography of deforestation

In November 2014, the majority (64%) of deforestation occurred in areas that were private or at various stages of possession. The remaining deforestation was recorded in Land Reform Settlements (31%), Conservation Units (4%) and Indigenous Lands (1%) (Table 3).

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

Category	November 2014	
	km ²	%
Land Reform Settlements	61	31
Conservation Units	7	4
Indigenous Lands	2	1
Private, Possession & Untitled Public Lands	125	64
Total (km²)	195	100

Land Reform Settlements

SAD recorded 61 square kilometers of deforestation in the Land Reform Settlements in November 2014 (Figure 5). The Settlements most affected by deforestation were PDS Liberdade (Pacajá; Pará), PA Rio Aratau (Pacajá; Pará) and PA Cruzeiroã (Óbidos; Pará).

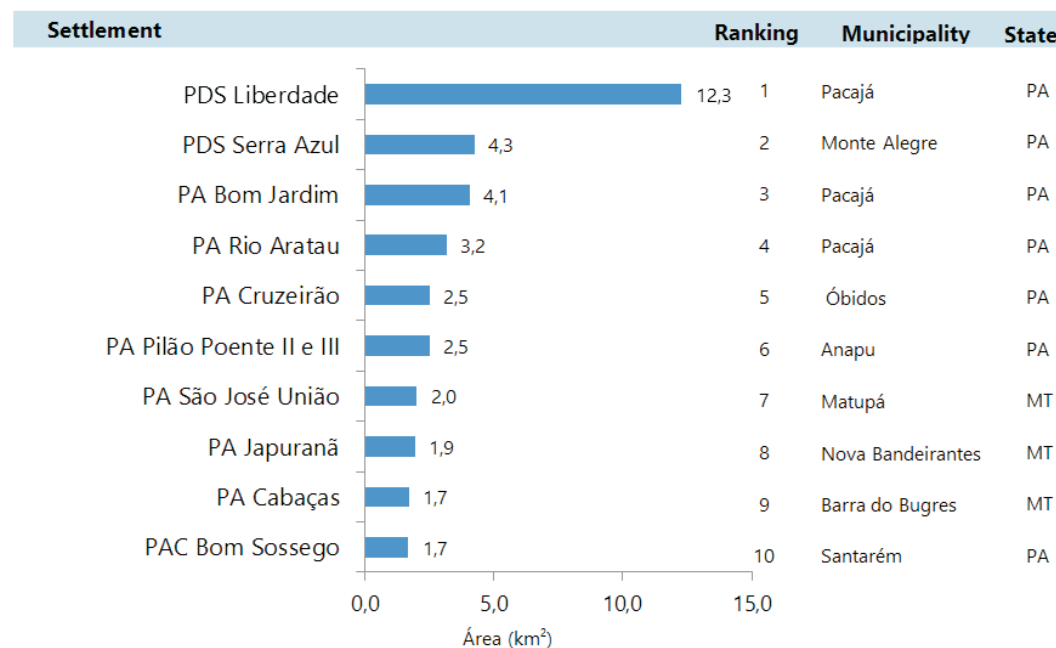


Figure 5. Land Reform Settlements deforested in November 2014 in the Brazilian Amazon (Source: Imazon/SAD).

Protected Areas

During the month of November 2014, SAD detected 7 square kilometers of deforestation in Conservation Units (Figure 6). In the case of Indigenous Lands, in November 2014, 2 square kilometers of deforestation were detected in TI Xingu (Mato Grosso), TI Andirá-Marau (Amazonas), TI Apyterewa (Pará) and TI Cachoeira Seca do Iriri (Pará).

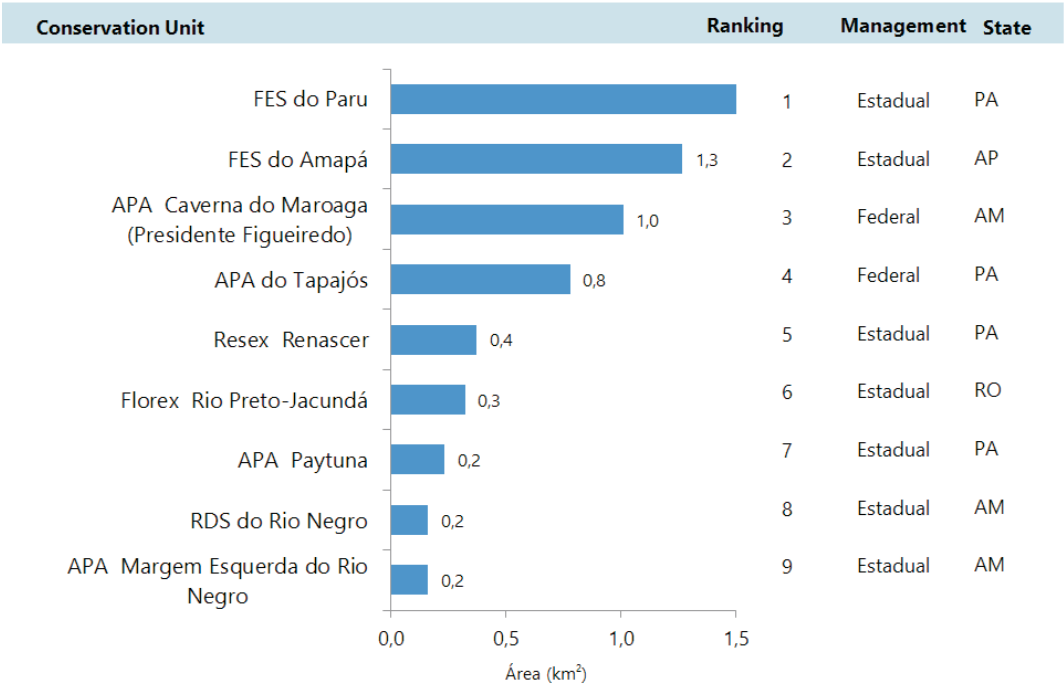


Figure 6. Conservation Units deforested in the Brazilian Amazon in November 2014 (Source: Imazon /SAD).

Critical municipalities

In November 2014, the most deforested municipalities were: Pacajá (Pará) and Portel (Pará) (Figure 7 and 8).

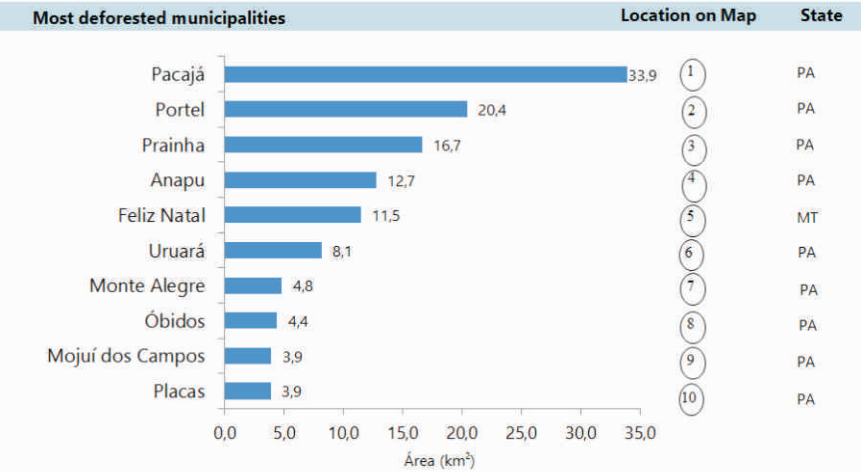


Figure 7. Most deforested municipalities in the Brazilian Amazon in November 2014 (Source: Imazon /SAD).

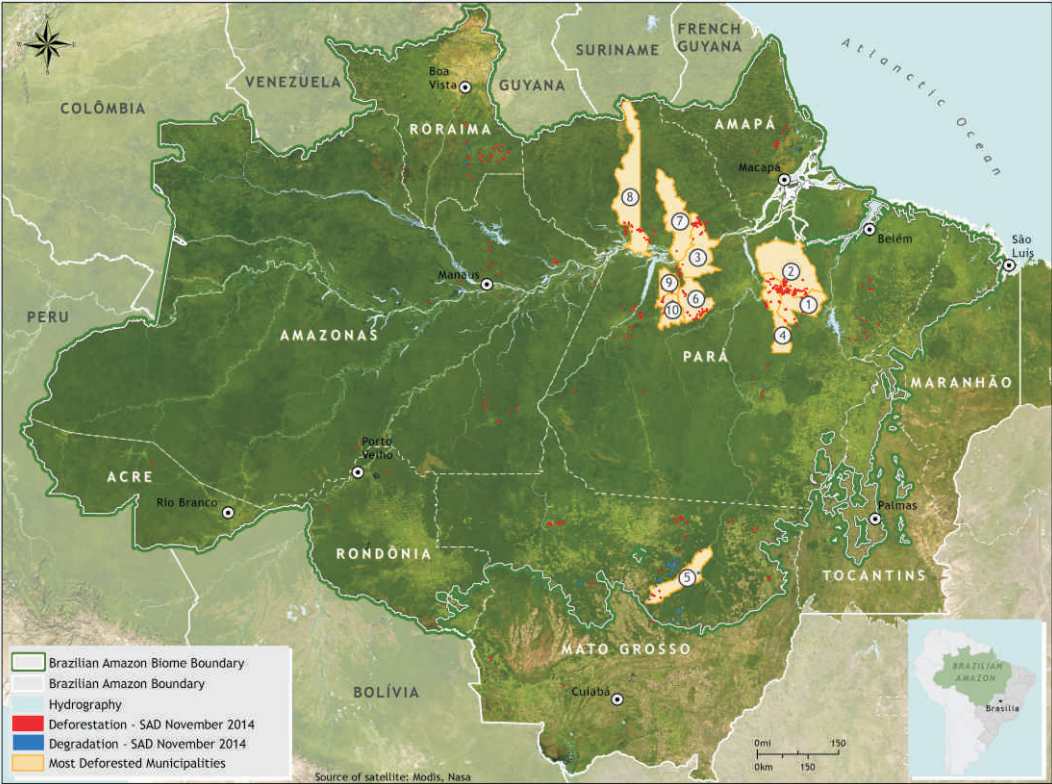


Figure 8. Municipalities with the largest areas deforested in November 2014 (Source: Imazon/SAD).

Cloud and shadow cover

In November 2014, with SAD it was possible to monitor 67% of the forest area in the Brazilian Amazon. The other 33% of the forest territory were covered by clouds, which made it difficult to detect deforestation and forest degradation. The States with the greatest cloud cover were Mato Grosso (53%) and Acre (50%). Because of that, data for deforestation and forest degradation in November 2014 may be underestimated (Figure 9).

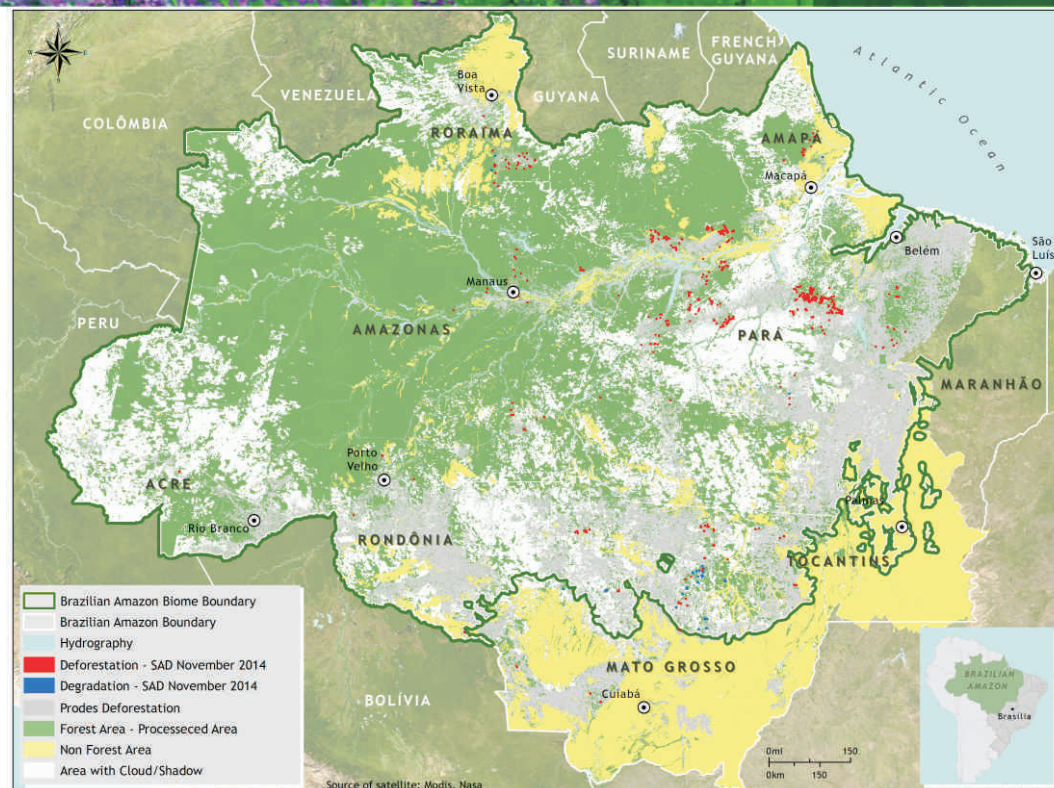


Figure 9. Area with cloud and shadow in November 2014 in the Brazilian Amazon.

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.

* The portion of Maranhão that is part of the Brazilian Amazon was not analyzed.

BOX I: SAD 3.0

Since August 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:

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

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 August 2006 and in the Legal Amazon since August 2008. In this bulletin, we present the monthly data generated by SAD from August 2013 to November 2014.

Team reasponsible

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Data source

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

Acknowledgements

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

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State Public Prosecution Service of Roraima
State Public Prosecution Service of Amapá
State Public Prosecution Service of Mato Grosso
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Support

