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## Summary

In this bulletin *Transparency in Forest Management in Mato Grosso* we assess the logging situation in the State from August, 2010 to July, 2011. To do this we utilized information from the forest control systems at Sema (State Environmental Secretariat) in Mato Grosso: Simlam (Integrated System for Environmental Licensing and Monitoring) and Sisflora (System for Commercialization and Transportation of Forest Products). That information was also crossed with information generated by Simex (System for Monitoring Timber Harvesting), developed by Imazon.

Analysis of satellite images revealed that approximately 139,407 hectares of forests were logged from August, 2010 to July, 2011. Of that total, 73,953 hectares (53%) were authorized by Sema and 65,454 hectares (47%) were not authorized. Of the non-authorized total, the majority (64,852 or 99%) occurred in private, vacant or disputed areas and 602 hectares (1%) occurred in Protected Areas, land reform settlements and Conservation Units. When we compared logging numbers from the previous period (August, 2009 to July, 2010) with the recent one (August, 2010 to July, 2011),

we observed that there was a 41% reduction (52,294 hectares) in the occurrence of authorized logging and 34% (34,346 hectares) in non-authorized logging.

In the areas logged with authorization, we assessed the situation of the respective Autex (Authorization for Timber Harvesting) issued in 2011 and verified that the great majority (98%) were regular. The remainder (2%) presented some degree of inconsistency, such as management authorized in a deforested area.

We also assessed the quality of timber harvesting between the two periods analyzed by using satellite images. We verified that the areas with good quality logging were reduced from 7 thousand hectares to 2 thousand hectares; the area with medium quality logging held steady at 38 thousand hectares; and the areas with low quality logging showed a notable reduction, from 80 thousand hectares to 34 thousand hectares.

Finally, we verified from satellite images that in 99% of the areas logged under forest management assessed from August, 2007 to July, 2011 the forest was maintained, while there was deforestation in only 1%.

## Forest Control System

For forest management, Sema utilizes the Simlam and Sisflora forest control systems. Simlam is used for the entire process of environmental permitting and issuing of environmental licensing for performance of the timber harvesting activity: the LAU (Single Environmental Licensing) and Autex. With Sisflora, Sema performs control of the flow of entry and release of credits for logwood and forest products.

According to Simlam, 162 Autex were issued in 2010 of a total of 162 forest management plans

that covered an area of 146,793 hectares of forest. In terms of volume, that represented 3.3 million cubic meters of logwood. In 2011, approximately 186 Autex were issued of a total of 186 forest management plans that covered an area of 153,512 hectares of forest, which represented 3.6 million cubic meters of logwood derived from native forests (Table 1).

With Sisflora approximately 3.3 million cubic meters of logwood were recorded and authorized in 2010, and in 2011 the number was 2.1 million cubic meters

**Table 1.** Volume of timber authorized through Simlam and Sisflora in 2010 and 2011 in the State of Mato Grosso.

Year	Autex (Qt)	PMF (Qt)	Authorized area (ha)	Volume Simlam (m³)	Volume Sisflora (m³)	Difference in Volume between Simlam and Sisflora
2010	162	162	146,793	3,345,173	3,303,440	-41,733
2011	186	186	153,512	3,677,005	2,112,959	-1,564,046

## Legal Regularity for Authorized Areas

We evaluated the regularity or consistency of authorizations for logging and for timber credits issued from January to December in 2011 and made available in the Sema/MT forest control system.

Of the 186 Autex evaluated in 2011, 98% (183 Autex) were consistent, while 2% (3) presented irregularities, these being (Figures 1 and 2):

- Management authorized in deforested area.* Area under authorized forest management totally or partly degraded area or one lacking forest cover. We observed

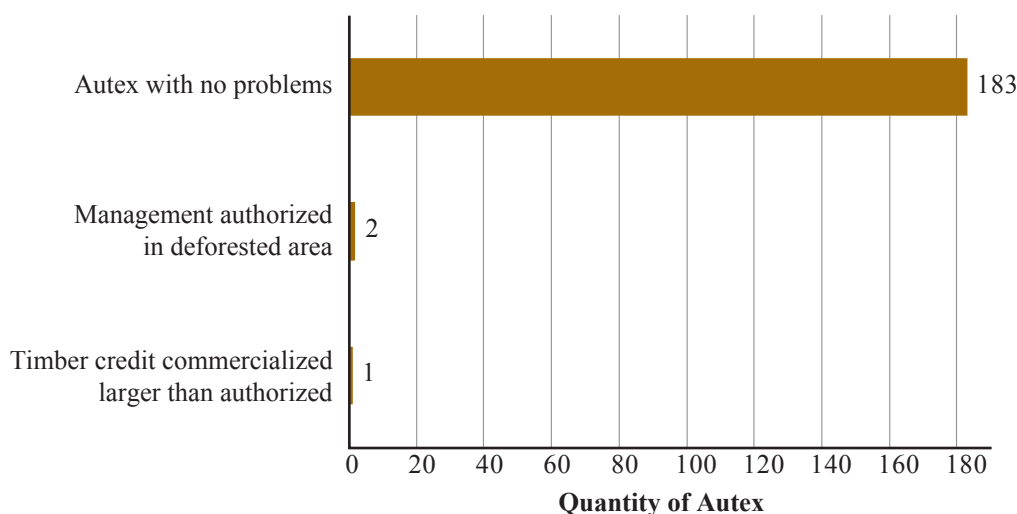
2 cases for a total of 1,086 hectares of authorized area<sup>1</sup>;

- Credit commercialized greater than authorized.*

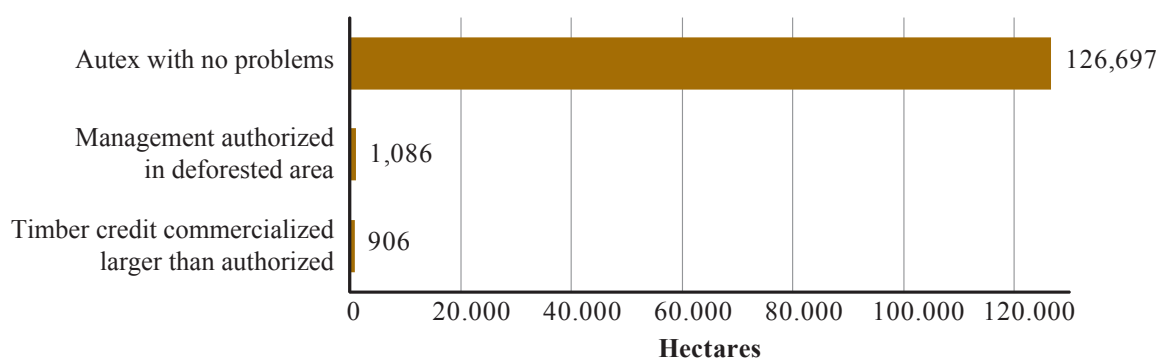
The credit for commercialized timber described in Sisflora does not correspond to the timber credit authorized in Simlam. One case was identified, which involved 906 hectares of authorized area.

When we compared the number of inconsistent Autex from 2010 and 2011, we observed that in the cases of management authorized in a deforested area there was a reduction from 3 to 2 cases, and in credit commercialized greater than authorized there was an increase from 0 to 1 in the most recent period (Figure 3).

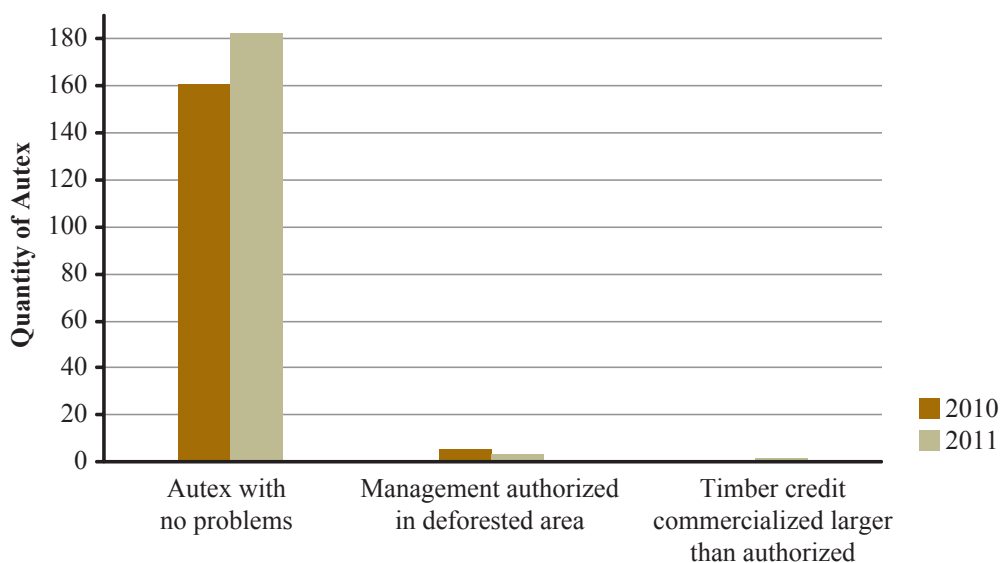
<sup>1</sup> According to Sema-MT, those projects met requirements and followed the procedures adopted by the secretariat for authorizing timber harvesting in areas with previous non-authorized logging.



**Figure 1.** Evaluation of the consistency of information of Autex and timber credits issued in 2011 (number of cases) in the forest control systems at Sema/MT (Source: Imazon/Simex based on data from Sema/MT).



**Figure 2.** Evaluation of the consistency of information from Autex and timber credits issued in 2011 (in hectares) in the forest control systems at Sema/MT (Source: Imazon/Simex based on data from Sema/MT).



**Figure 3.** Comparison of the consistency of information from the Autex and the timber credits issued in 2010 and 2011 in the forest control systems at Sema/MT (Source: Imazon/Simex based on data from Sema/MT).

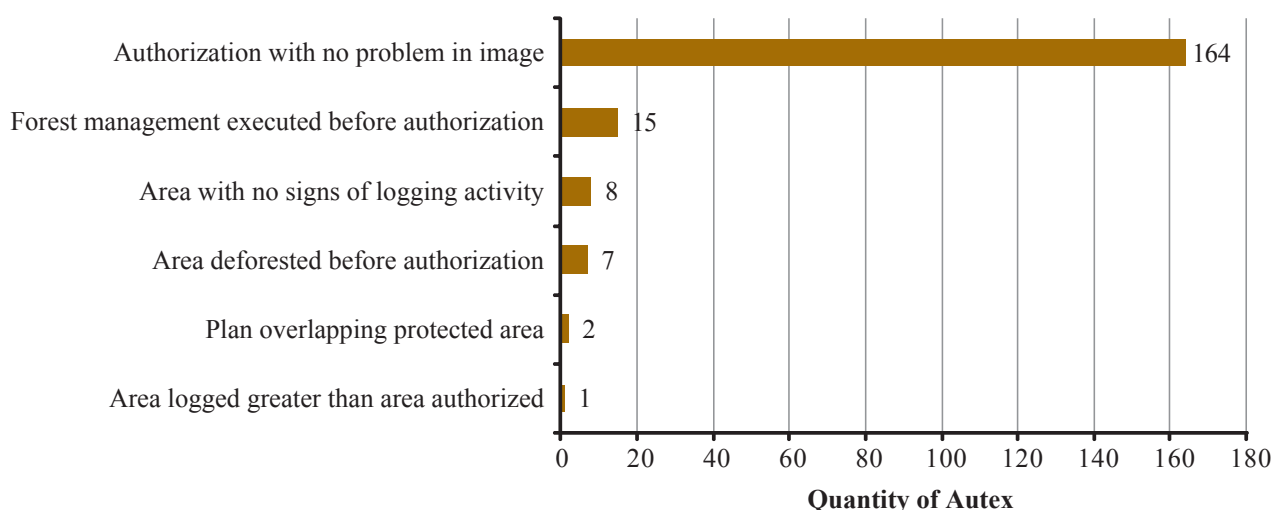
We analyzed 197 Autex<sup>2</sup> based on satellite images from 2011: 164 (120,796 hectares) did not present problems and 33 (51,527 hectares) revealed inconsistencies (Figures 4 and 5), which were:

- i. *Forest management executed before authorization.* In 15 cases logging was carried out before the forest authorization was issued, totaling 24,415 hectares of authorized area;
- ii. *Area with no signs of logging activity.* In the images we did not identify logging scars for the period in the authorization was valid. However, we identified the sale of timber related to this authorization. We identified 8 cases with this problem, covering an area of 10,563 hectares of authorized area.
- iii. *Area deforested before authorization.* In 7 cases the area licensed for forest management was deforested before issuance of the management authorization. Those cases totaled 11,360 hectares of authorized area.

iv. *Plan overlapping Protected Area.* In 2 cases three cases the licensed forest management area overlapped a Protected Area. The authorized area for those plans totaled 5,068 hectares;

v. *Area logged greater than area authorized.* In 1 case the area was logged above the authorized limit, totaling 121 hectares of authorized area;

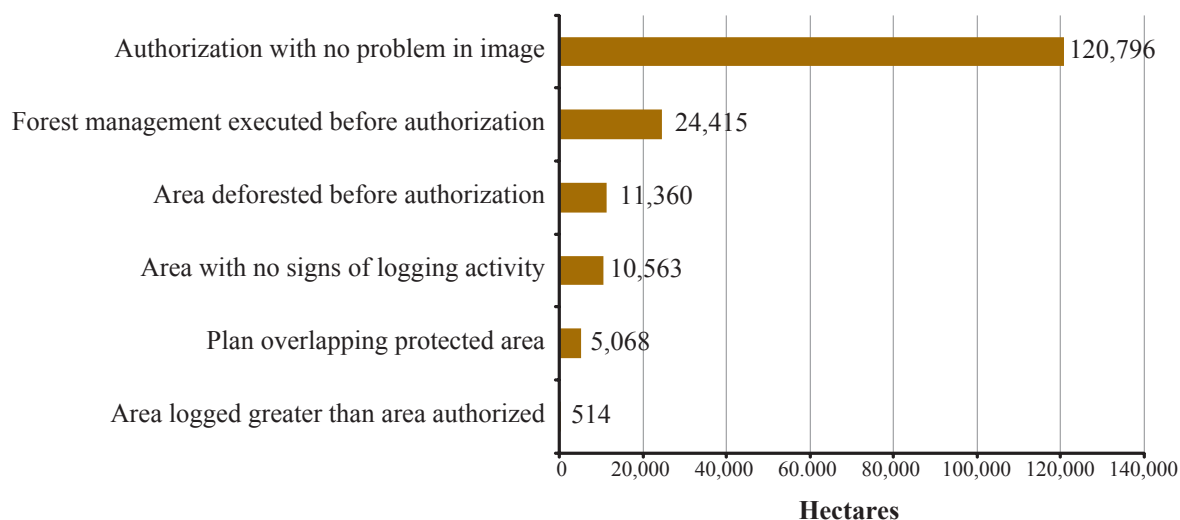
When we compared the recent period of analysis (August/2010 to July/2011) with the previous one (August/2009 to July/2010), we found an increase of from 1 to 7 for cases of areas deforested before authorization and from 1 to 15 for cases of management carried out before authorization. We also found a reduction of from 2 to 1 for cases logged above the authorized limit, from 9 to 8 for cases of area authorized without signs of logging, and from 3 to 2 for cases of plans overlapping a Protected Area (Figure 6).



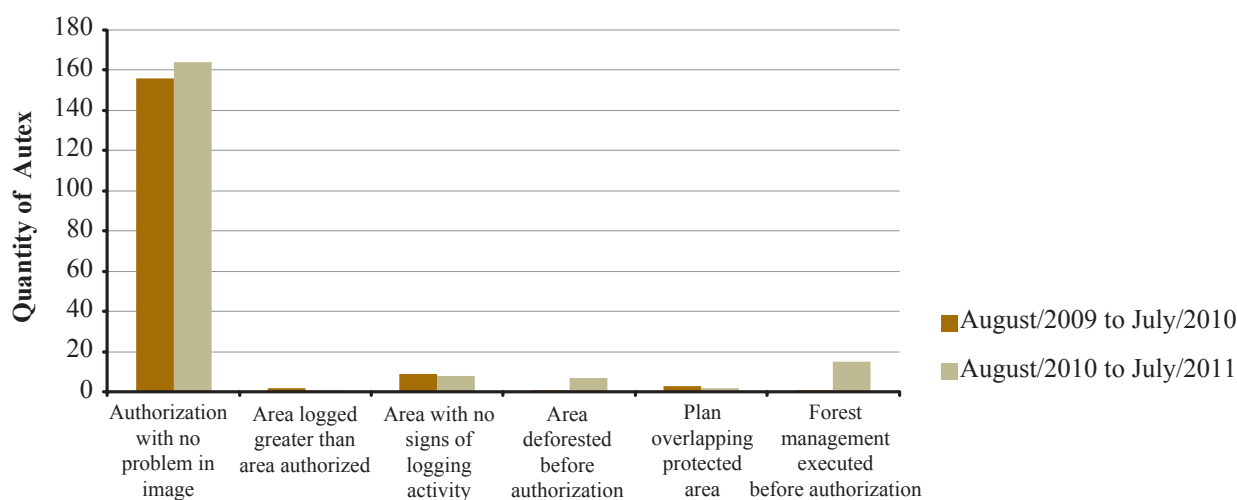
**Figure 4.** Forest management situation in the State of Mato Grosso from August/2010 to July/2011 (number of cases), obtained by integrating information from the control systems at Sema/MT with satellite images (Source: Imazon/Simex based on data from Sema/MT).

<sup>2</sup> Besides the Autex from 2011 we evaluated Autex from previous years that were still valid in 2011. That is because in Mato Grosso some Autex are valid for five years.

<sup>3</sup> According to Sema/MT one of those forest management plans was authorized by court order.



**Figure 5.** Forest management situation in the State of Mato Grosso from August/2010 to July/2011 (in hectares), obtained by integrating information from the control systems at Sema/MT with satellite images (Source: Imazon/Simex based on data from Sema/MT).



**Figure 6.** Comparison of the forest management situation in the State of Mato Grosso from August/ 2009 to July/2010 and August/2010 to July/2011, obtained by integrating information from the forest control systems at Sema/MT with satellite images (Source: Imazon/Simex based on data from Sema/MT).

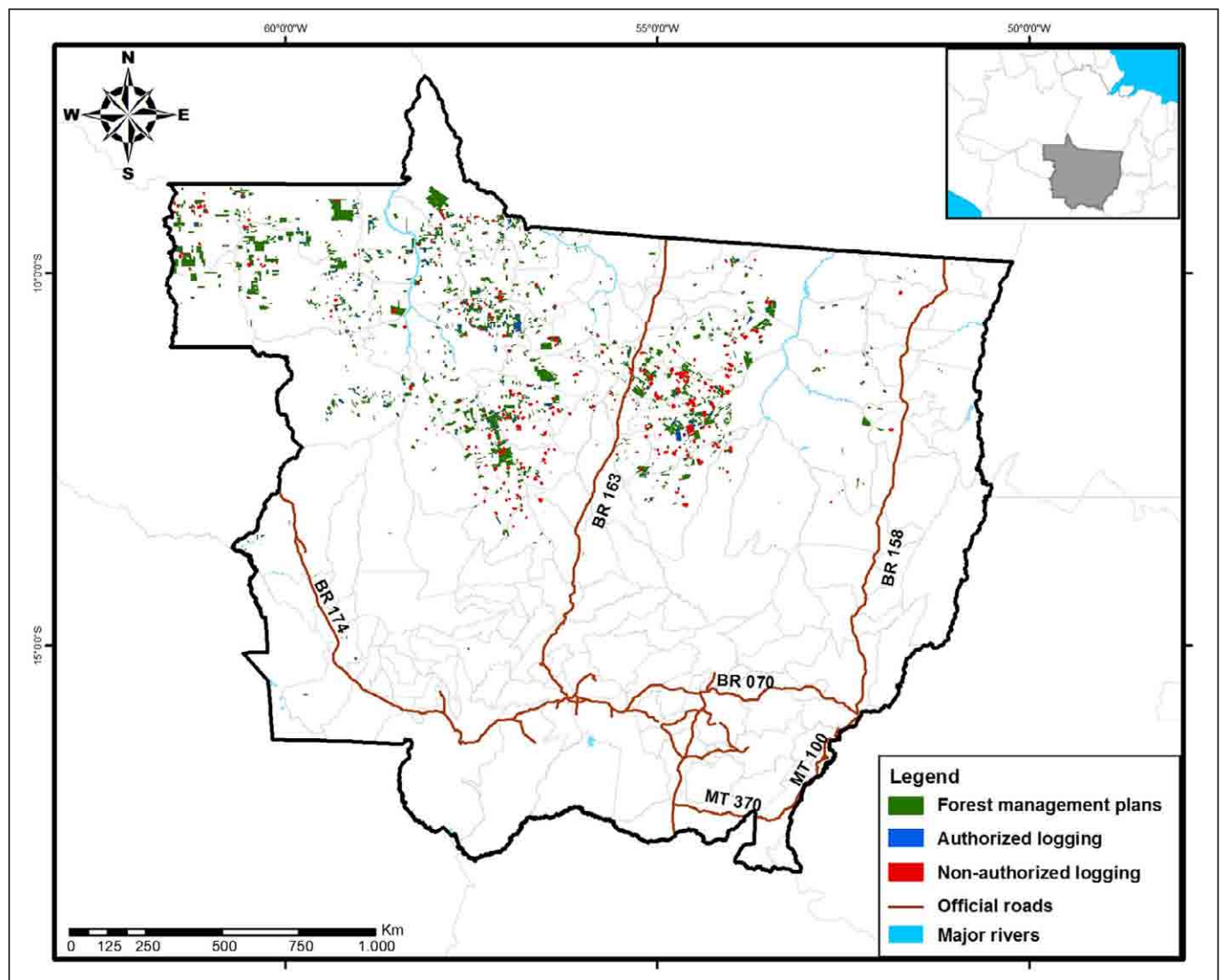


## Geography of Timber Harvesting in Mato Grosso

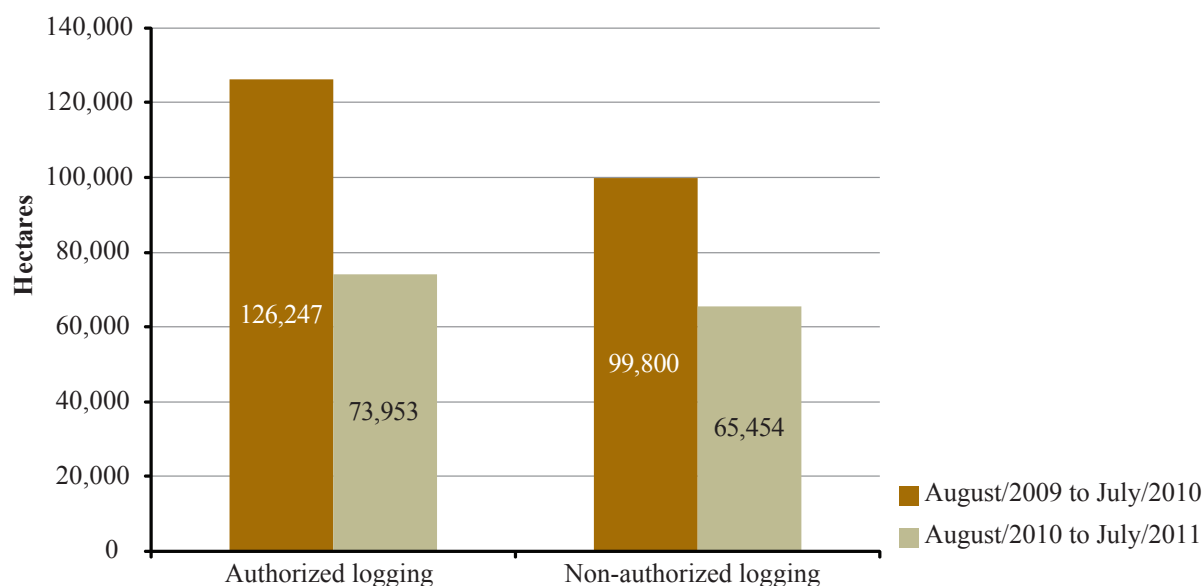
To identify authorized logging (forest management) and non-authorized (illegal and predatory) in the State from August, 2010 to July, 2011, we overlapped the boundaries of forest management plans with NDFI images (See Box 1 for methodology). We detected 139,407 hectares of harvested forests, of which 73,953 hectares (53%) had authorization and 65,454 hectares (47%) were not authorized for management (Figure 7).

Non-authorized logging (illegal) was detected in all regions of the Mato Grosso biome, with 77% being in the middle north, 12% in the northwest, 10% in the far north and 1% in the northeast.

When we compared the total area logged between the recent period of analysis and the previous one, we observed a reduction of 34% (34,346 hectares) in the areas logged without authorization and of 41% (52,294 hectares) in the authorized areas (Figure 8).



**Figure 7.** Spatial distribution of authorized (forest management) and non-authorized (predatory) logging in the State of Mato Grosso from August/2010 to July/2011 (Source: Imazon/Simex based on data from Sema/MT).



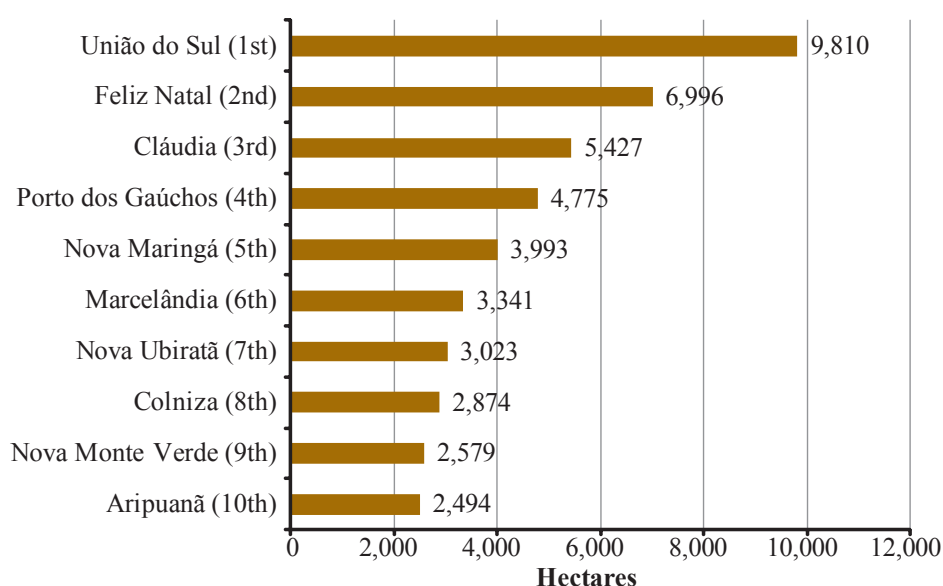
**Figure 8.** Comparison between authorized (forest management) and non-authorized (predatory) logging in the State of Mato Grosso from August/2009 to July/2010 and August/2010 to July/2011 (Source: Imazon/Simex based on data from Sema/MT).

## Critical Municipalities

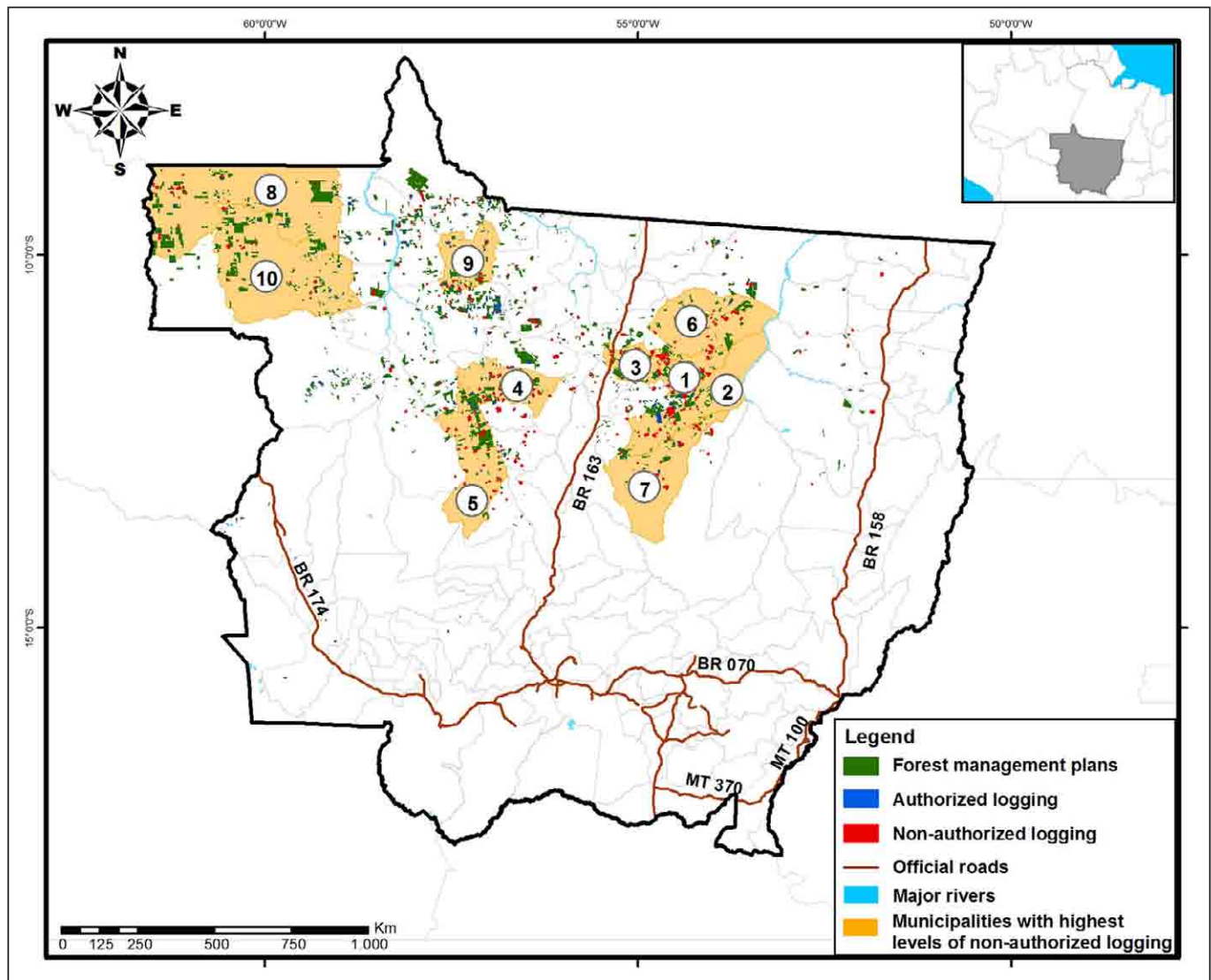
Of the 65,454 hectares of forest logged without authorization in Mato Grosso from August, 2010 and July, 2011, the majority (69%) occurred in 10 municipalities (Figures 9 and 10). The remaining

31% were distributed more sparsely among another 33 municipalities.

The five municipalities with the largest areas of non-authorized timber harvesting are, in decreasing order: União do Sul, Feliz Natal, Cláudia, Porto dos Gaúchos and Nova Maringá.



**Figure 9.** Municipalities with the largest areas logged without authorization in the State of Mato Grosso from August/2010 to July/2011 (Source: Imazon/Simex based on data from Sema/MT).

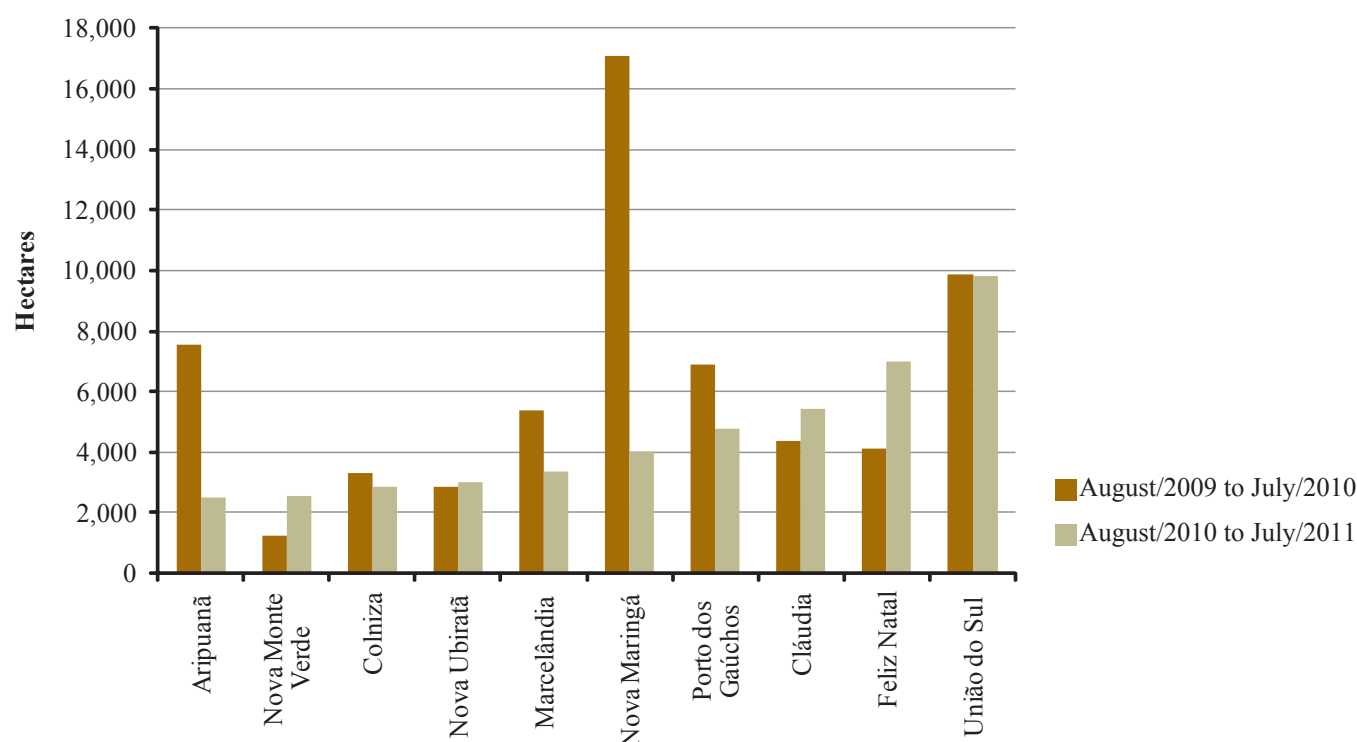


**Figure 10.** Location of the ten municipalities with the largest areas logged without authorization in the State of Mato Grosso from August/2010 to July/2011 (Source: Imazon/Simex based on data from Sema/MT).

When we compared the analysis of the previous period with the most recent one (August, 2009 to July, 2010 and August, 2010 to July, 2011) we found a reduction in non-authorized harvesting in Nova Maringá (13,801 hectares), Aripuanã (5,075 hectares), Porto dos Gaúchos (2,140 hectares),

Marcelândia (2,041 hectares), Colniza (444 hectares) and União do Sul (38 hectares). On the other hand, we perceived an increase in non-authorized logging in Feliz Natal (2,858 hectares), Nova Monte Verde (1,352 hectares), Cláudia (1,052 hectares) and Nova Ubiratã (170 hectares) (Figure 11).





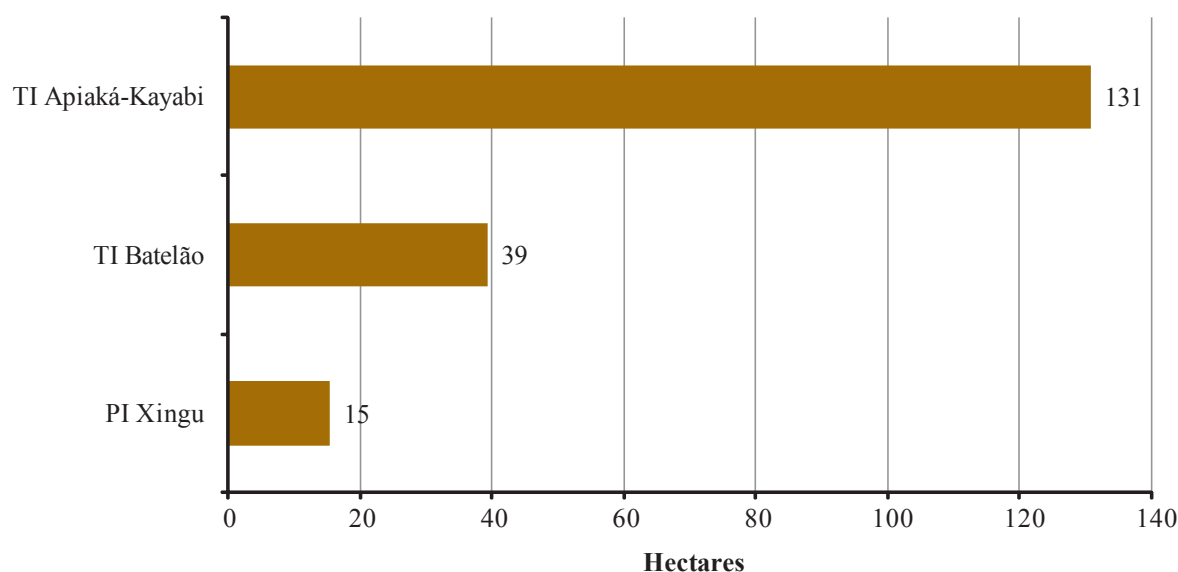
**Figure 11.** Comparison among the municipalities with as the largest areas logged without authorization in the State of Mato Grosso from August/2008 to July/2009 and August/2009 to July/2010 (Source: Imazon/Simex based on data from Sema/MT).

## Protected Areas

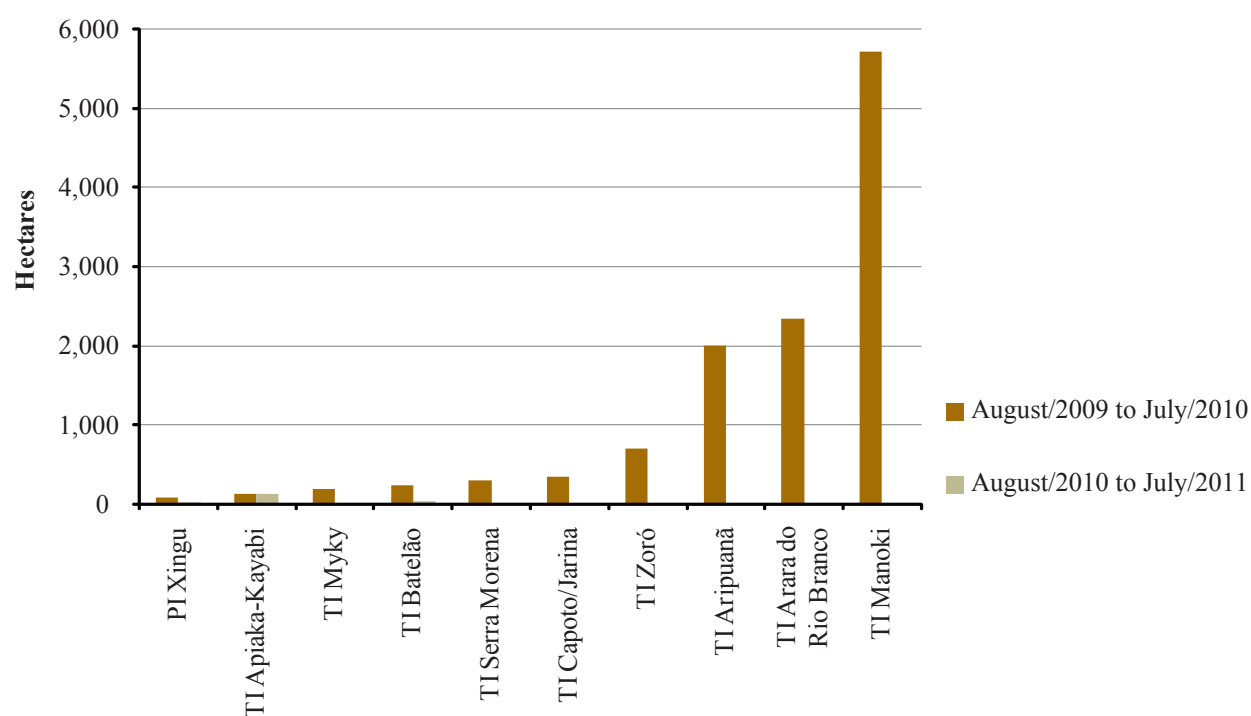
Illegal timber harvesting affected 186 hectares in TIs (Indigenous Lands), all of them located in the middle-west of the state. The TI presenting the largest logged area from August/2010 to July/2011 was Apiaká-Kayabi, (with 70% or 131 hectares) located in the municipality of Juruá. Following it are TI Batelão (21% or 39 hectares), located in the municipality of Tabaporã, and PI (Indigenous Park) Xingu (8% or 15 hectares) in the municipality of Paranatinga (Figure 12).

When we compared the analysis of the previous period with the recent one we verified that the illegally logged area reduced considerably in some TIs. That reduction was most significant in TI Batelão (from 239 hectares to 39 hectares) and in the PI Xingu (from 75 hectares to 15 hectares). The exception was TI Apiaká-Kayabi, where there was an increase 128 hectares to 131 hectares (Figure 13).

As for the occurrence of non-authorized logging in Conservation Units, this was observed only in Tucumã PES (State Park) (38.15 hectares).



**Figure 12.** Indigenous Lands with the largest areas logged without authorization in the State of Mato Grosso from August/2010 to July/2011 (Source: Imazon/Simex based on data from Sema/MT).



**Figure 13.** Comparison of Indigenous Lands with the largest areas logged without authorization in the State of Mato Grosso from August/2009 to July/2010 and August/2010 to July/2011 (Source: Imazon/Simex based on data from Sema/MT).

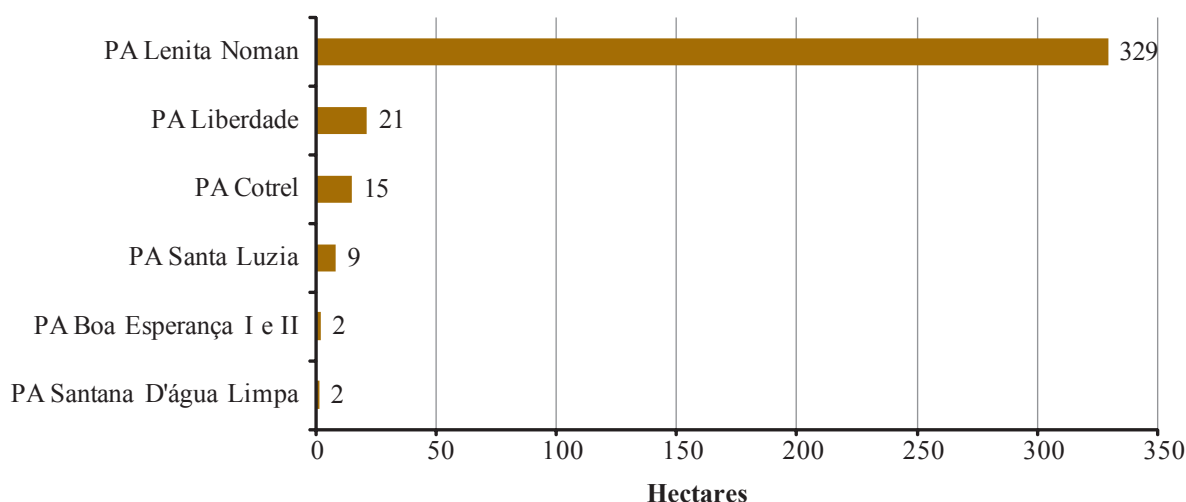


## Settlements

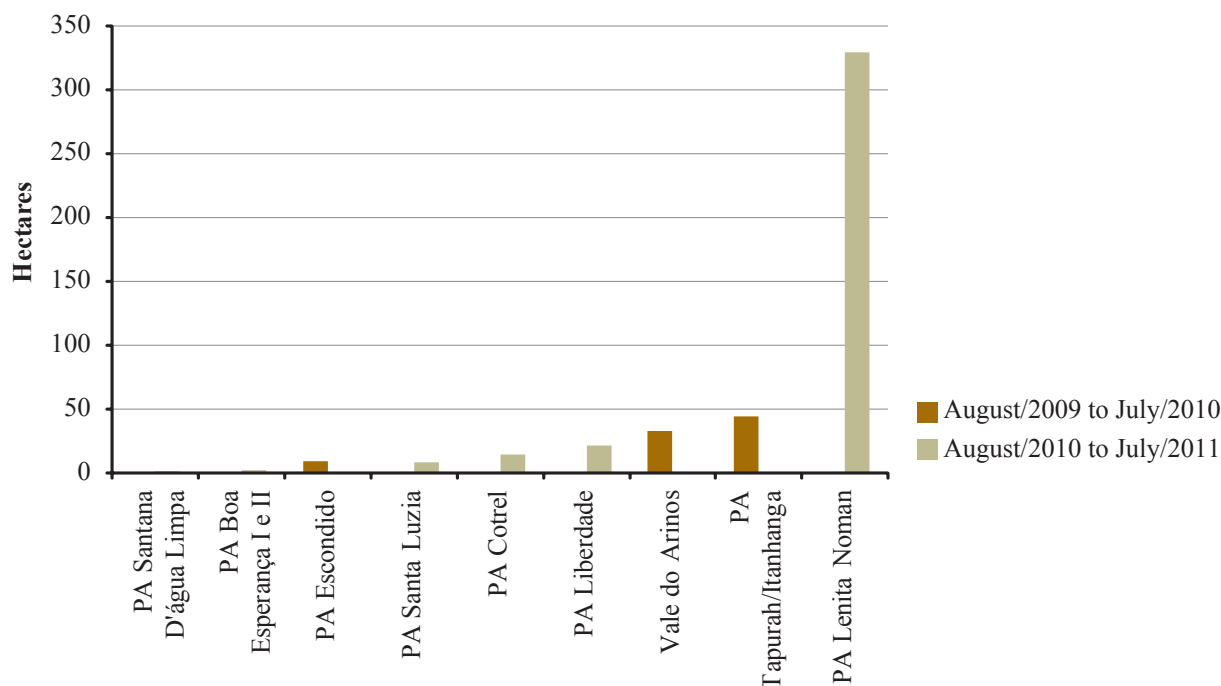
In the land reform settlements in Mato Grosso non-authorized timber harvesting affected an area of 378 hectares of forest. The most critical situation was in the Lenita Noman PA (Settlement

Project), with 86% of the total logged or 329 hectares (Figure 14).

When we compared the analyses for the periods of August/2009 to July/2010 with August/2010 to July/2011, we observed an increase of logging in settlements (Figure 15).



**Figure 14.** Land reform settlements with the largest areas logged without authorization in the State of Mato Grosso from August/2010 to July/2011 (Source: Imazon/Simex based on data from Sema/MT).



**Figure 15.** Comparison of the land reform settlements with the largest areas logged without authorization in the State of Mato Grosso from August/2009 to July/2010 and August/2010 to July/2011 (Source: Imazon/Simex based on data from Sema/MT).

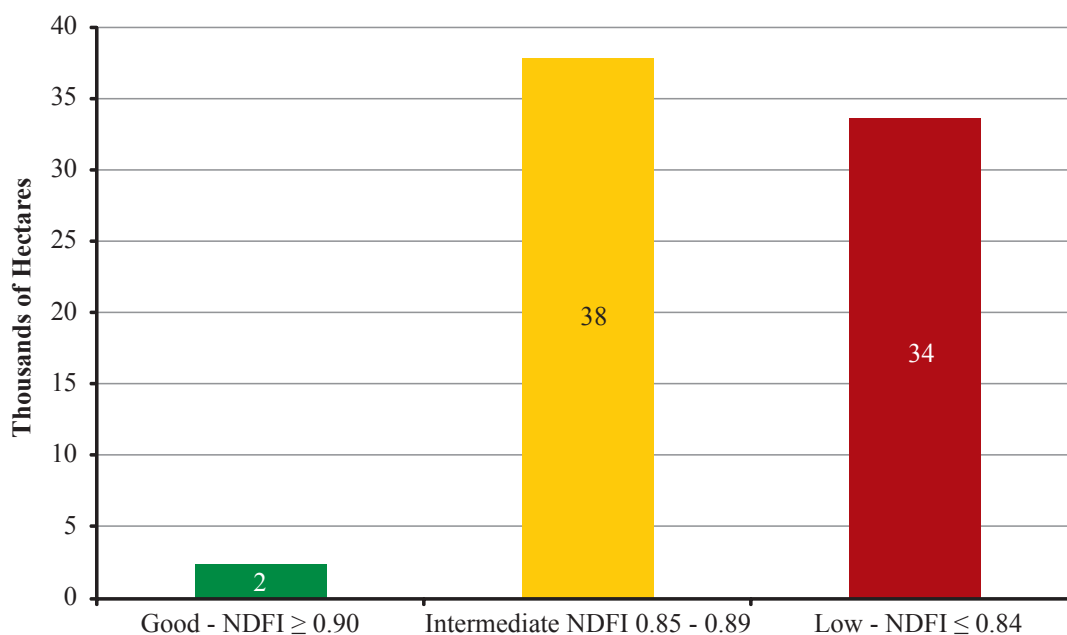
## Quality of Timber Harvesting

We evaluated timber harvesting in the NDFI images (Box 1), for which we determined quality thresholds<sup>4</sup>, so that:  $NDFI \leq 0,84$  represents low quality logging (predatory logging);  $NDFI = 0.85-0.89$ , medium quality logging (there was an attempt at adopting management, but the configuration of roads, log landings and clearings reveals serious problems with execution); and  $NDFI \geq 0.90$ , timber harvesting of good quality, meaning that the configuration of roads, log landings and clearings has the format found in planned logging.

Of the operational forest management plans for 2011, we analyzed 222 (73,953 hectares)<sup>5</sup> in

which it was possible to visualize the quality of logging in images from 2011. Of those, 3% (2,432 hectares) presented good quality harvesting, 51% (37,873 hectares) intermediate quality and 46% (33,649 hectares) were classified as low quality harvesting (predatory logging) (Figure 16).

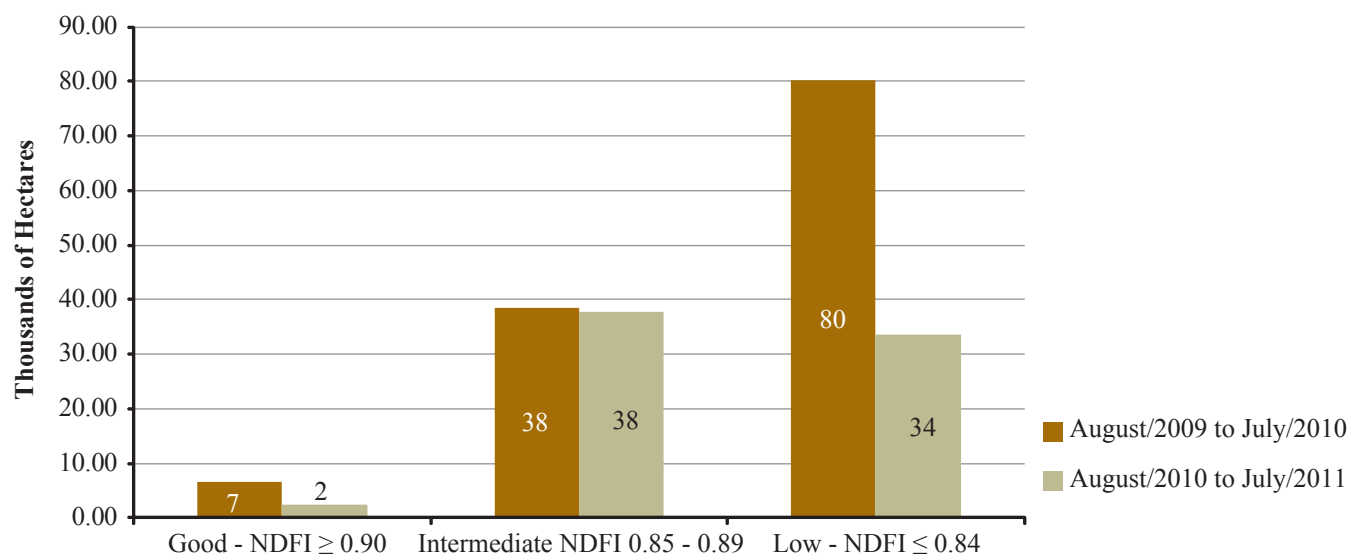
Comparing the quality of timber harvesting between the recent period analyzed and the earlier one, we observed a reduction in the areas with good quality logging (from 7 thousand to 2 thousand hectares) and low quality (from 80 thousand to 34 thousand hectares). The area with intermediate quality logging remained at 38 thousand hectares (Figure 17).



**Figure 16.** Quality (in hectares) of timber harvesting for 222 operational management plans in the State of Mato Grosso from August/2010 to July/2011 (Source: Imazon/Simex based on data from Sema/MT).

<sup>4</sup> Monteiro, A; Brandão Jr., A; Souza Jr., C; Ribeiro, J; Balieiro, C; Veríssimo, A. 2008. Identificação de áreas para a produção florestal sustentável no noroeste de Mato Grosso. Imazon: Belém-PA: ISBN: 978-85-86212-24-6. 68p.

<sup>5</sup> Some Autex evaluated in previous years were re-evaluated because of the five year validity.

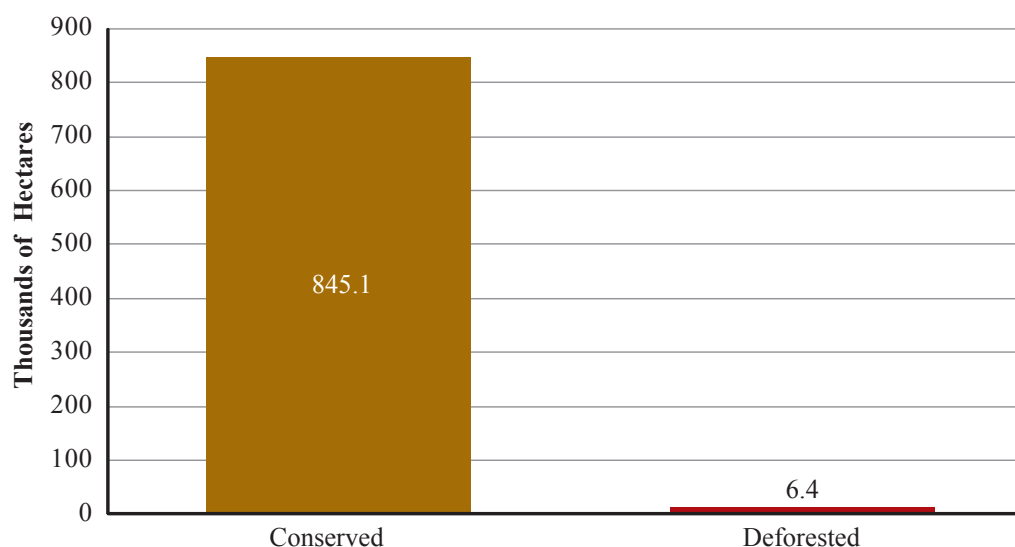


**Figure 17.** Comparison of the quality of timber harvesting (in hectares) carried out from August/2009 to July/2010 and August/2010 to July/2011 (Source: Imazon/Simex based on data from Sema/MT).

## Maintenance of the Forest Management Areas

We analyzed the satellite images from 2011 to see if the operational forest management plans from August, 2007 to July, 2011 are being maintained for the next cutting cycle. Of the 851,581 hectares

(1,057) of management areas evaluated for that period, 99% (845,131 hectares) continued to be conserved and 1% (6,450 hectares) were deforested (clear cutting) (Figure 18).



**Figure 18.** Conservation situation of the forest management areas logged from August/2007 to July/2011 evaluated in the images from 2011.



## Box 1. System for Monitoring Timber Harvesting Monitoring – Simex

Simex was developed by Imazon to monitor forest management and non-authorized logging. The system uses Landsat 5 images (with 30 meters of spatial resolution) to detect selective timber harvesting, but can also be applied to other optical sensors (SPOT, ASTER, ALOS-VNIR and RESOURCESAT).

The Landsat images are processed in order to generate the spectral mixture model (abundance of vegetation, soils, cloud shadow and NPV - Non-Photosynthetic Vegetation) and later to calculate the NDFI (Normalized Difference Fraction Index), defined by:

$$\text{NDFI} = \frac{(\text{VEGnorm} - (\text{NPV} + \text{Soils}))}{(\text{VEGnorm} + (\text{NPV} + \text{Soils}))}$$

Where VEGnorm is vegetation component normalized for cloud shadow, determined by:

$$\text{VEGnorm} = \text{VEG} / (1 - \text{Shadow})$$

The information extracted from satellite images is crossed with information from Simlam and from Sisflora to evaluate the situation of the licensed management plans.

First, the documentation available in the control systems is analyzed in order to identify possible inconsistencies. Next, forest management plans are evaluated by overlaying their boundaries on satellite images. Later on that information is associated with information from the forest control systems. Simex makes it possible to evaluate the occurrence of: i) area authorized in deforested area; ii) area authorized in an area already logged; iii) authorized area greater than the management area; iv) credit commercialized greater than authorized; v) area without signs of logging; vi) area logged above the authorized limit; vii) area deforested before authorization; viii) management performed before authorization; and ix) plan overlapping Protected Area. Simex makes it possible to identify evidences of irregularity in licensing and execution of forest management, meaning the consistency of licensing and the degree of forest management adoption. For example, plans with few inconsistencies and errors in licensing but with evidence of low implementation of management practices need to be verified in the field in order to identify problems with executing them.

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**Data Source:**

As estatísticas da exploração madeireira são geradas a  
partir dos dados do Imazon;

Dados da Sema/MT (Simlam e Sisflora)

<http://monitoramento.sema.mt.gov.br/simlam/>

<http://monitoramento.sema.mt.gov.br/sisflora/>

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