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Abstract

In this bulletin *Transparency in Forest Management in Pará* we assess the logging situation in the State from August, 2010 to July, 2011. To do this, we first verified the regularity or consistency of the information on management plans in the Timber Harvesting Authorizations (*Autorizações de Exploração Florestal - Autef*) and authorized credits from logging issued by the State Secretariat for the Environment in Pará (Sema), for the period. We found that in 2011 the great majority (89%) of Autef plans were legally compliant, while 11% had inconsistencies, such as: i) area authorized in already logged area; ii) area authorized greater than the forest management area.

The assessment also involved estimating the areas logged both legally (authorized) and illegally (not authorized) using NDFI images derived from Landsat satellite images. The results revealed that of the 81,092 hectares of forests logged in the period, 48,802 (60%) were not authorized by Sema as opposed to 32,290 hectares authorized (40%). Of the illegal logging, the great majority (72%) occurred in areas that were private, vacant or disputed; another 20% in land reform settlements; and only 8% in Protected Areas. Comparing the periods of August, 2009 to July, 2010 and August, 2010 to July, 2011 we observed a 38% reduction (30,139 hectares) in non-authorized logging and 22% (9,281 hectares) in authorized logging.

Finally, we evaluated the quality of forest management performance in the State from August, 2009 to July, 2010 and August, 2010 to July, 2011 using NDFI images. We observed that the area under forest management decreased during these periods; good quality logging fell by 25,185 hectares (81%); intermediate quality logging fell by 15,454 hectares (29%) and logging with quality fell by 7,557 hectares (31%).

For a general assessment of timber harvesting status in the State, we utilized information from Sema control systems: Simlam (Integrated System for Licensing and Environmental Monitoring - *Sistema Integrado de Licenciamento e Monitoramento Ambiental*) and Sisflora (System for Sale and Transportation of Forest Products - *Sistema de Comercialização e Transporte de Produtos Florestais*)-, which were overlapped with information generated by Simex (System for Monitoring Timber Harvesting - *Sistema de Monitoramento da Exploração Madeireira*), developed by Imazon (Box 1).

Forest Control System

According to Simlam at Sema/PA, in 2010 approximately 435 Autefs were issued out of a total of 433 forest management plans that covered an area of slightly over 282 thousand hectares of forest. That represented 8.8 million cubic meters of logwood and 4.4 million cubic meters of forest residues. In 2011 there were approximately 153 Autefs of a total of 148 forest management plans that covered an area of approximately 120 thousand hectares of forest, representing a volume of 3.5 million cubic meters of logwood and 1.6 million cubic meters of forest residues. In relation to 2010, the volumes for 2011 forest residues allowed in Simlam for 2010 represent significant decreases of 60% and 64%, respectively. The great majority (94%) of this wood came from native forest, as had been observed for previous periods, and the rest (6%) from planted forest.

In Sisflora, there was the registration and clearing[1] in 2010 of approximately 7.9 million cubic meters of logwood and 4.2 million cubic meters of forest residues. In 2011, around 3.3 million tons of logwood and 1.6 million tons of forest residues were cleared, representing considerable reductions of 59% and 63%, respectively in relation to 2010 (Table 1).

Geography of Timber Harvesting in Pará

To identify non-authorized (illegal and predatory) and authorized (legal, forest management) logging in the State from August, 2010 to July, 2011 we overlaid the boundaries of forest management plans on NDFI images for this period (Figure 1 and see Box 1 for methodology).

Non-authorized logging was detected in almost all of the regions and mesoregions of the State, with the greatest share concentrated southeast (36%) and southwest regions (30%), followed by the northeast (14%) Marajó (10%) and Lower Amazon (9%) (Figure 1).

Overall, 81,092 hectares of logged forests were detected, of which 48,802 (60%) were not authorized and 32,290 hectares (40%) were authorized for forest management. Compared with the logged areas detected during the previous period, we found a considerable reduction of 38% for non-authorized harvesting and 22% in authorized harvesting (Figures 1 and 2).

Table 1. Volumes of timber authorized by Simlam and by Sisflora for 2010 and 2011.

Year	Autef (Qt)	PMF (Qt)	Authorized area (ha)	Volume Simlam (m³)		Volume Sisflora (m³)		Difference in volume between Simlam and Sisflora (m³)	
				Log	Residue	Log	Residue	Log	Residue
2010	435	433	282,047	8,859,579	4,482,041	7,985,443	4,246,922	-874,135	-235,119
2011	153	148	120,017	3,526,542	1,621,686	3,295,150	1,566,071	-231,392	-55,616

[1] The timber credits are only cleared by Sisflora after approval in Simlam and Ceprof. That explains the differences of volumes among Simlam and Sisflora. Ceprof is an electronic registration system containing information on the owner, company, property, licensed activity, and person technically and legally responsible.
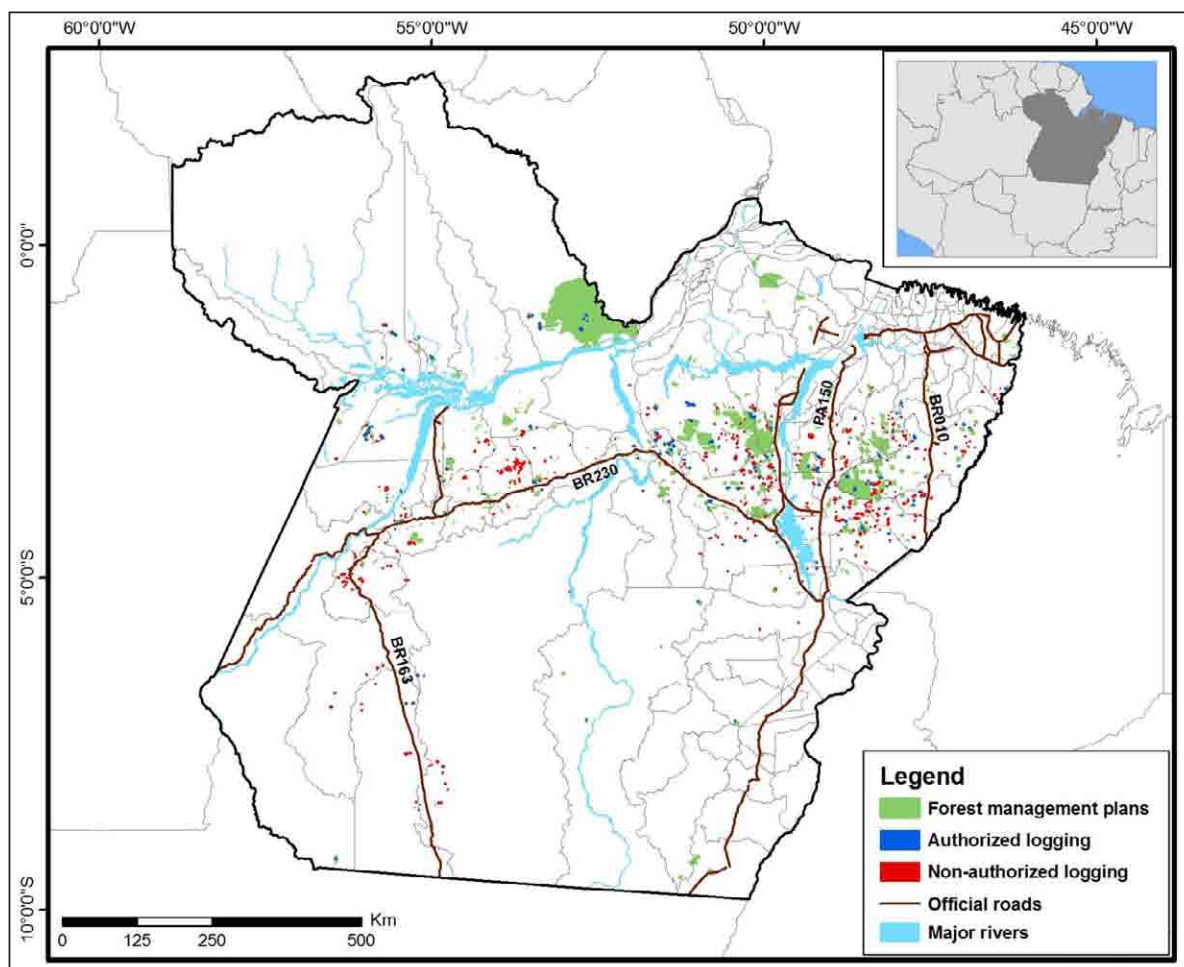
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Figure 1. Authorized harvesting (authorized management) and non-authorized harvesting (predatory) in the State of Pará from August/2010 to July/2011 (Source: Imazon/Simex).
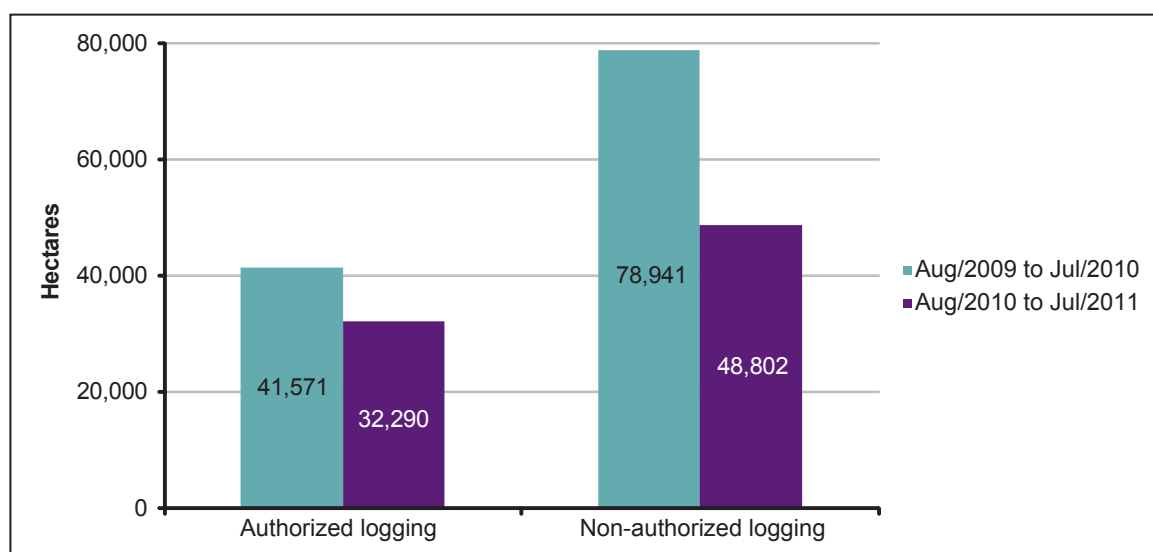

Figure 2: Comparison of areas logged with and without authorization in the State of Pará from August/2009 to July/2010 and August/2010 to July/2011.

Critical Municipalities

Of the 48,802 hectares of forest logged without authorization in Pará from August, 2010 to July, 2011, the majority (33,035 hectares or 68%) occurred in 10 municipalities (Figures 3 and 4). The first five were located in the following regions: Goianésia do Pará (PA- 150), Uruará (BR-230), Paragominas (BR-010), Portel (Amazon River) and Pacajá (BR-230). The remaining 15,767 hectares (32%) were more sparsely scattered among 32 other municipalities.
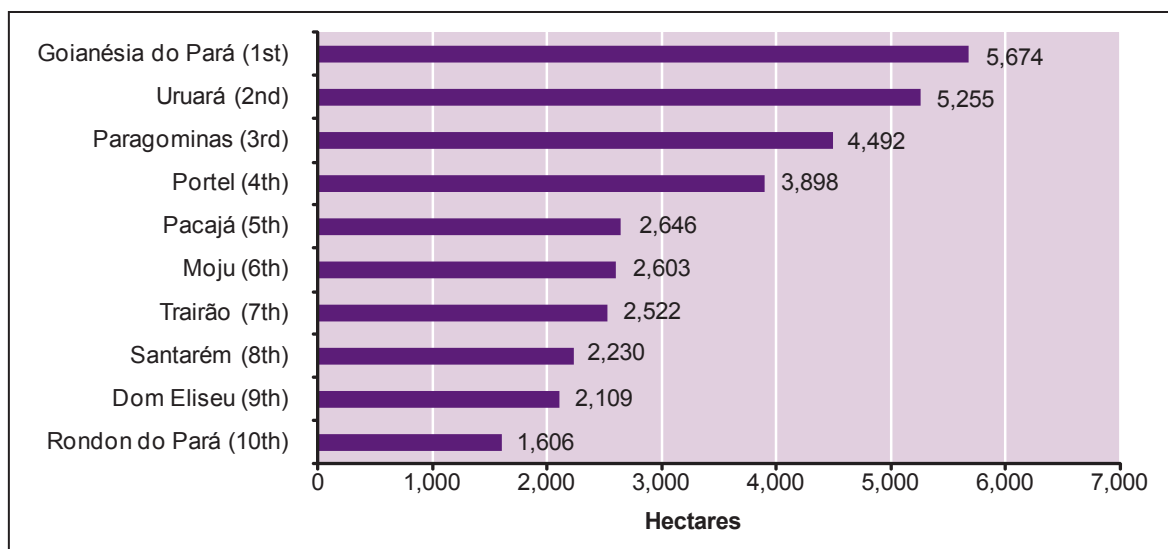
Figure 3. Municipalities with the largest areas logged without authorization in the State of Pará from August/2010 to July/2011. (Source: Imazon/Simex).
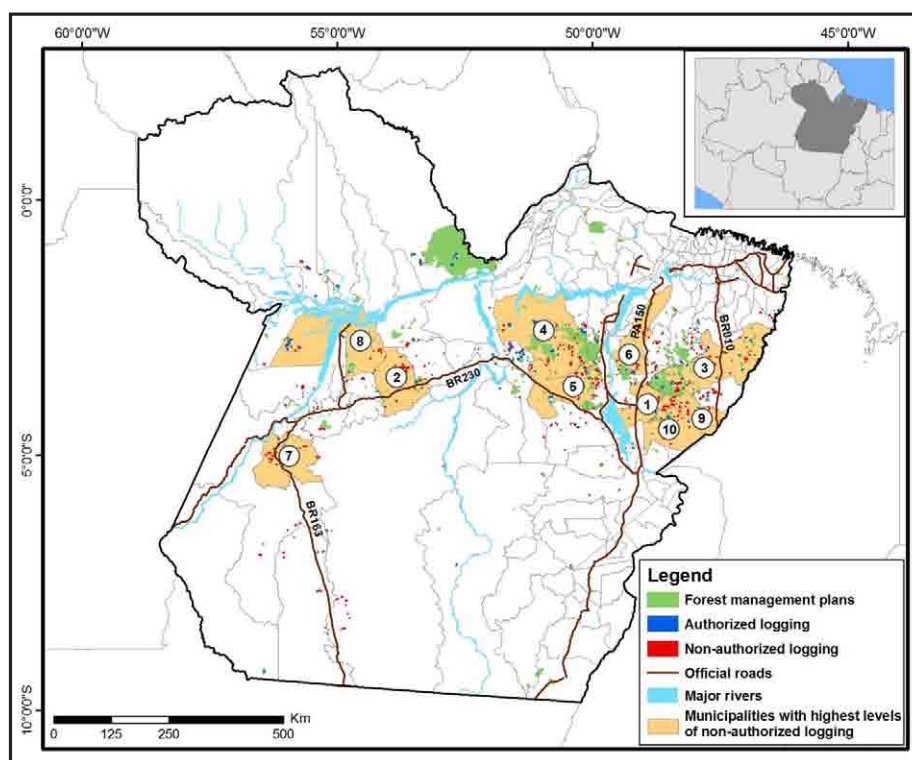
Figure 4. Location of the ten municipalities with the largest areas logged without authorization by the State of Pará between August/2010 and July/2011 (Source: Imazon/Simex).

When we made the comparison with the previous period analyzed (August, 2009 to July 2010) we found a significant reduction in illegal timber harvesting in the municipalities of Rondon do Pará (85%), Ipixuna do Pará (83%), Dom Eliseu (66%) and Paragominas (56%). On the other hand, we observed an impressive increase in that harvesting in the municipality of Trairão (3,170 %) (Figure 5).
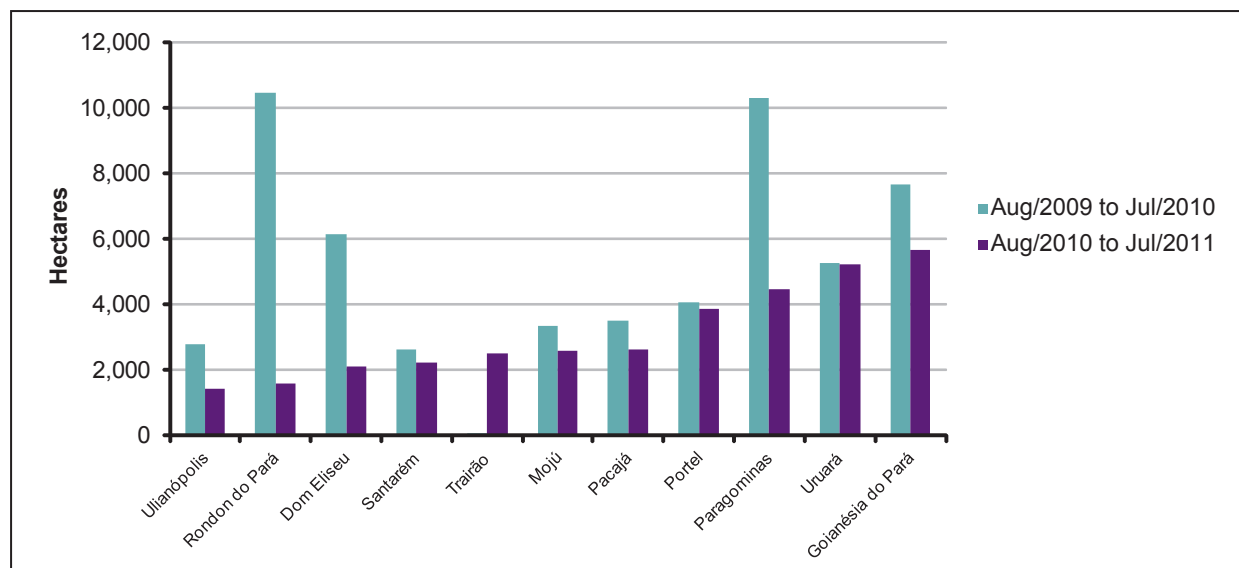

Figure 5. Comparison of municipalities with the largest area logged without authorization in the State of Pará from August/2009 and July/2010 and August/2010 to July/2011(Source: Imazon/Simex).

Protected Areas

In the Indigenous Lands (TIs), 1,552 hectares of illegal timber harvesting were detected from August, 2010 and to July, 2011. The Anambé TI, situated in the municipality of Moju presented the highest percentage of illegally logged area (76%). Next is the TI Alto Rio Guamá (Garrafão do Norte, Nova Esperança do Piriá, Paragominas and Santa Luzia do Pará) with the remaining 24% (Figure 6).
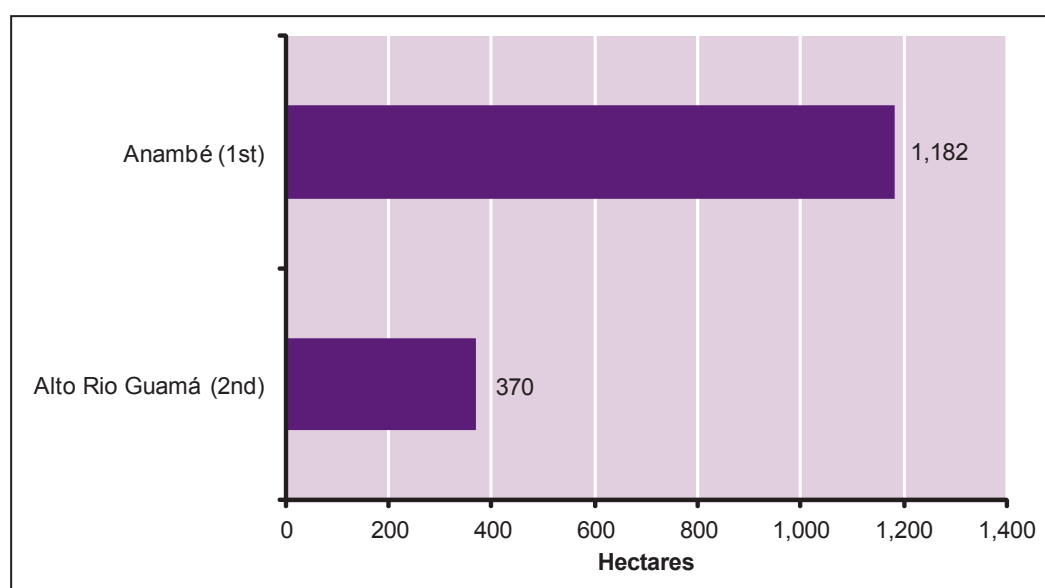

Figure 6. Indigenous lands with the largest areas logged without authorization in the State of Pará from August/2010 to July/2011 (Source: Imazon/Simex).

Illegal timber harvesting in the TIs in Pará for August, 2010 to July, 2011 presented considerable increases and reductions when compared with the previous period. The Alto Rio Guamá and Anambé TIs respectively presented significant increases of 564% (or 304 hectares) and 327% (or 820 hectares), while in other TIs such as Sarauá, which led the ranking in the previous period (with 484 hectares logged), there was no record of illegal harvesting in the most recent period (Figure 7).

In the UCs (Conservation Units) in Pará 2,402 hectares of illegally logged forest were detected from August, 2010 to July, 2011. The majority (54%) occurred in the Itaituba II Flona (National Forest), followed by the Trairão Flona with 23% and Jamanxim Parna (National Park) with 8%. The remaining 15% were distributed among five other UCs (Figure 8).
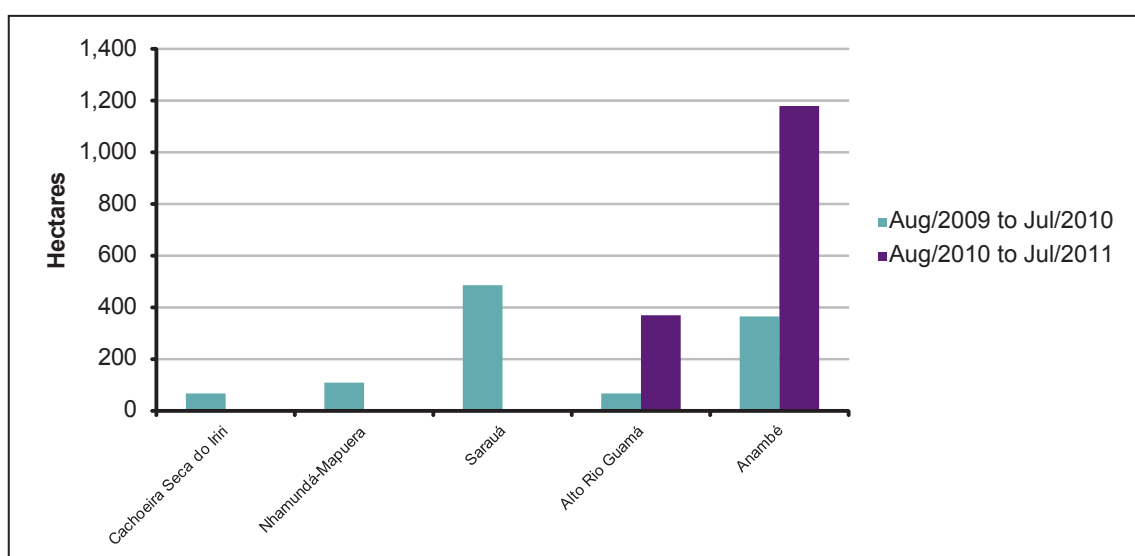

Figure 7. Comparison of Indigenous Lands with the largest areas logged without authorization in the State of Pará from August/2009 to July/2010 and August/2010 to July/2011(Source: Imazon/Simex).
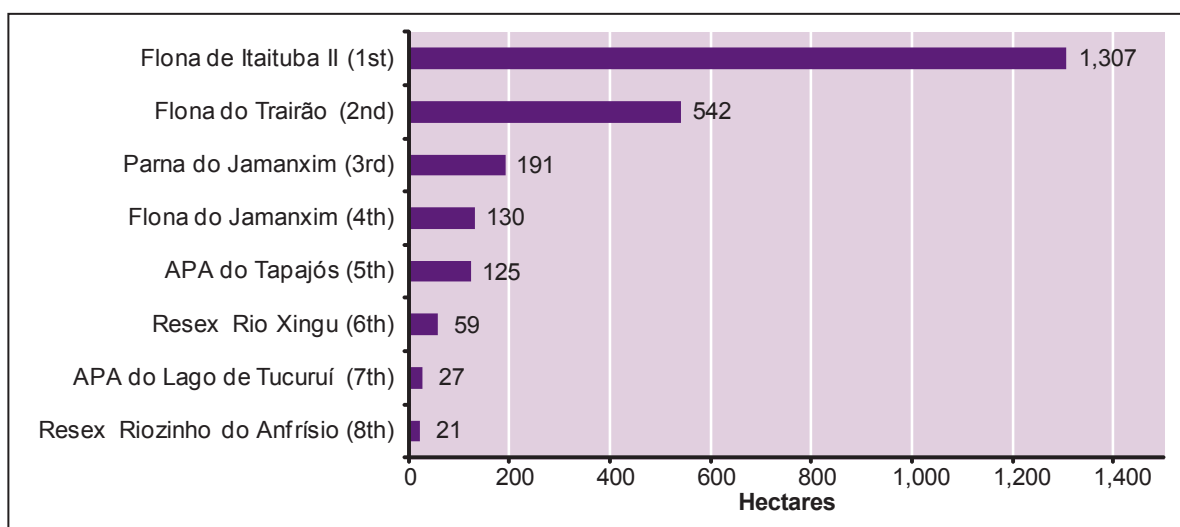

Figure 8. Conservation Units with the largest areas logged without authorization in the State of Pará from August/2010 to July/2011 (Source: Imazon/Simex).

Compared to the previous period (August, 2009 to July, 2010), illegal timber harvesting from August, 2010 to July, 2011 increased considerably in the National Forests of Itaituba II (in which had not presented logging before) and Trairão (3,315%). On the other hand, considerable reductions in such logging were observed in the Renascer Resex (from 732 hectares to no occurrence) and the Lago do Tucuruí APA (86% less) (Figure 9).

Settlements

Illegal timber harvesting affected 9,802 hectares of forest in land reform settlements in the State from August, 2010 to July, 2011. The most critical situation was found in the PDS (Sustainable Development Project) Ouro Branco (19% of the total harvested), the PAC (Collective Settlement Project)

Ouro Branco I (16%) and PDS Liberdade (15%) (Figure 10).

Among the 45 settlements identified as having illegal logging, PDS Cupari (176 hectares), PDS Água Azul (83 hectares), PA Del Rey (54 hectares), PA Paragominas/Faiscão (45 hectares), PA Cruzeirão (35 hectares), PDS Novo Mundo and PA Água (6 hectares) were placed on the list of the federal government's Green Settlements program (Administrative Ruling number 717, of November 27, 2012).

Comparing the two periods analyzed, we observed a significant increase in logging without authorization in a large number of the settlements. The most critical situations were observed in PDS Anta Curuá Una and Caracol, with increases of 525 and 424 hectares, respectively. On the other hand, considerable reductions in such logging were observed in other settlements such as PDS Renascer (49% less), PA Corta Corda (42% less) and in PDS Liberdade (23% less) (Figure 11).
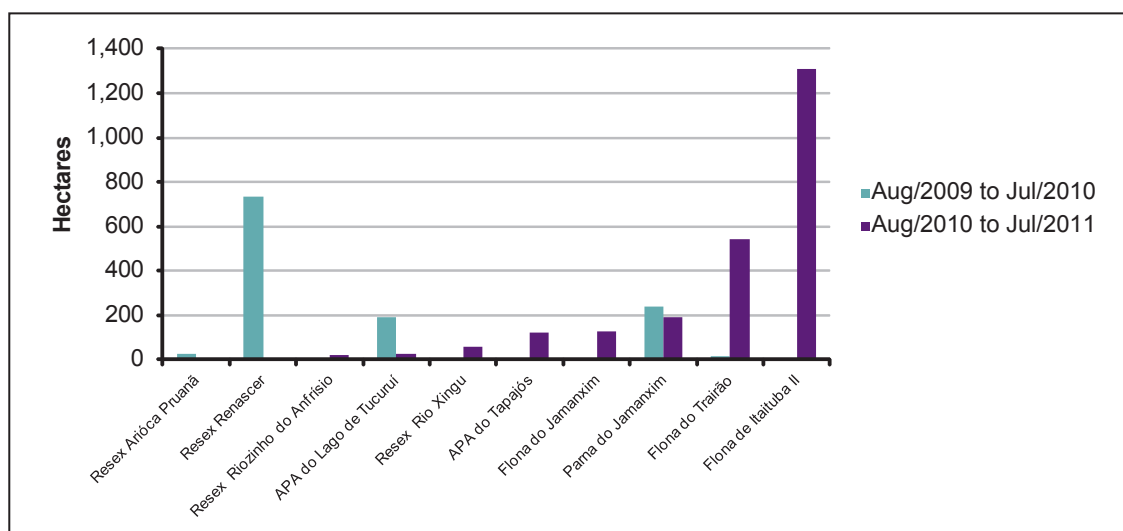

Figure 9. Comparison of Conservation Units with the largest areas logged without authorization in the State of Pará from August/2009 to July/2010 and August/2010 to July/2011 (Source: Imazon/Simex).
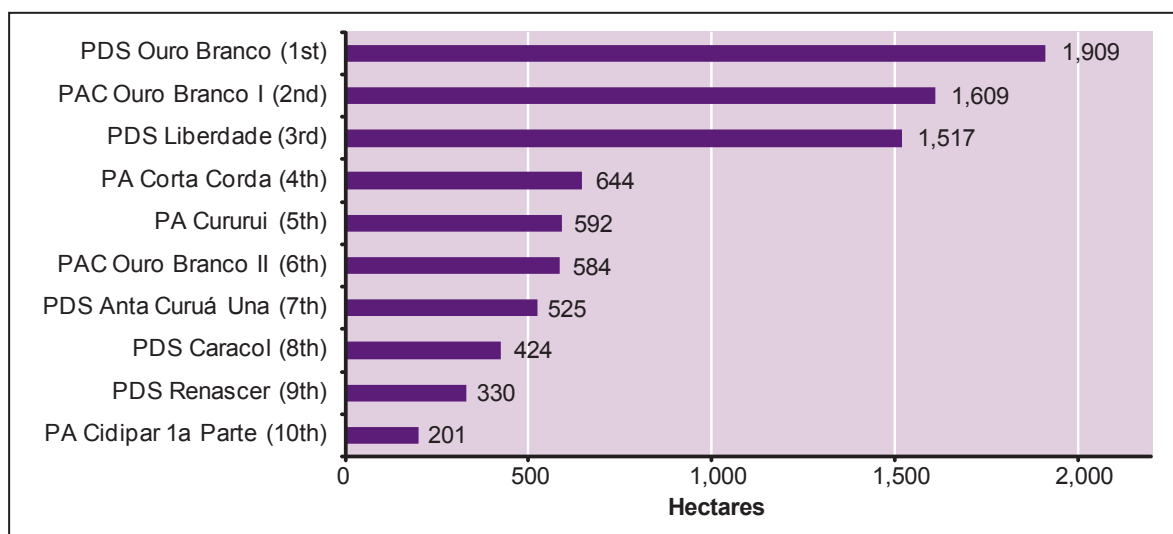
Figure 10. Land reform settlements with the largest areas logged without authorization in the State of Pará from August/2010 to July/2011 (Source: Imazon/Simex).
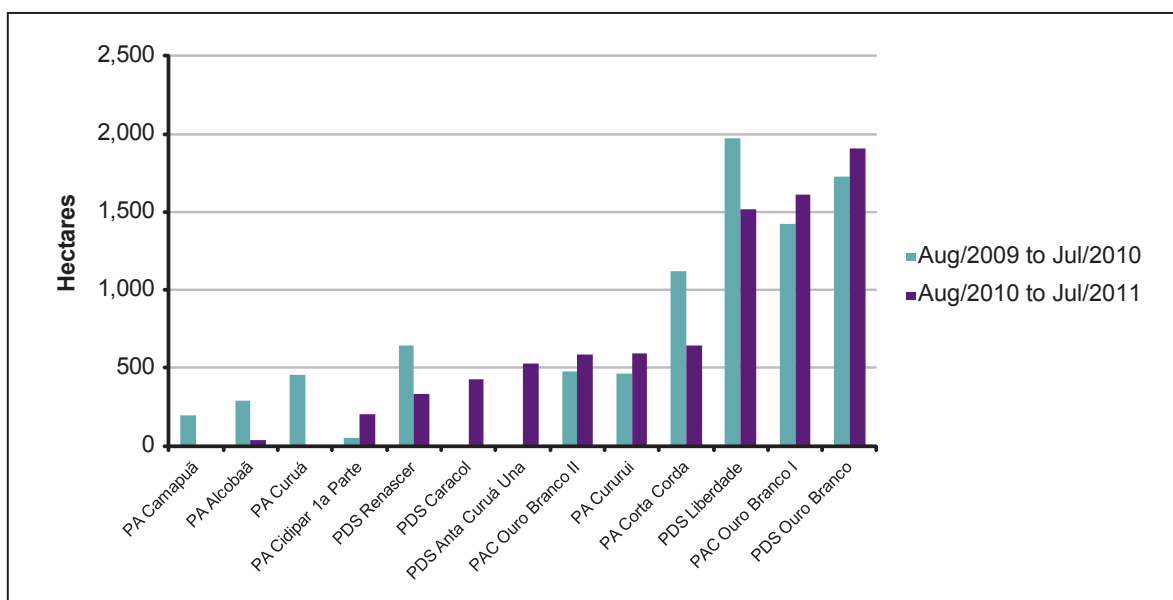

Figure 11. Comparison of land reform settlements with the largest areas logged without authorization in the State of Pará from August/2009 to July/2010 and August/ 2010 to July/2011 (Source: Imazon/Simex).

Legal Regularity for Authorized Areas

We assessed the consistency of information contained in the Autefs from Simlam and respective timber credits issued in Sisflora in 2011 so as to verify the regularity of the management areas authorized by Sema/PA.

In 2011, 153 Autefs were approved of a total of 148 forest management plans covering 120,017 hectares. Of that total, we analyzed only authorizations for harvesting timber in native forest areas, which totaled 133 Autefs (117,560 hectares), of a total of 132 forest management plans. We observed that the great majority (89% or 119 Autefs) were consistent, while 11% revealed inconsistencies[2], notably (Figures 12 and 13):

i) *Area authorized in already logged area.* Authorization for forest management in an area already totally or partially logged. We ob-

served 12 cases, for a total of 14,171 hectares of authorized area; and

ii) *Area authorized greater than the forest management area.* Area authorized for management greater than the total area for forest management. We observed 2 cases, for a total of 337 hectares of authorized area;

When we compared the number of inconsistent Autefs from 2010 to 2011 we observed a significant reduction for the majority of cases: area authorized greater than the forest management area dropped from 29 to 2 cases; area authorized in degraded or deforested area decreased from 19 cases to no occurrence; and timber credit commercialized greater than authorized fell from 5 to no occurrence. The exception was area authorized in already logged area, which presented a considerable increase of from one to twelve cases (Figure 14).
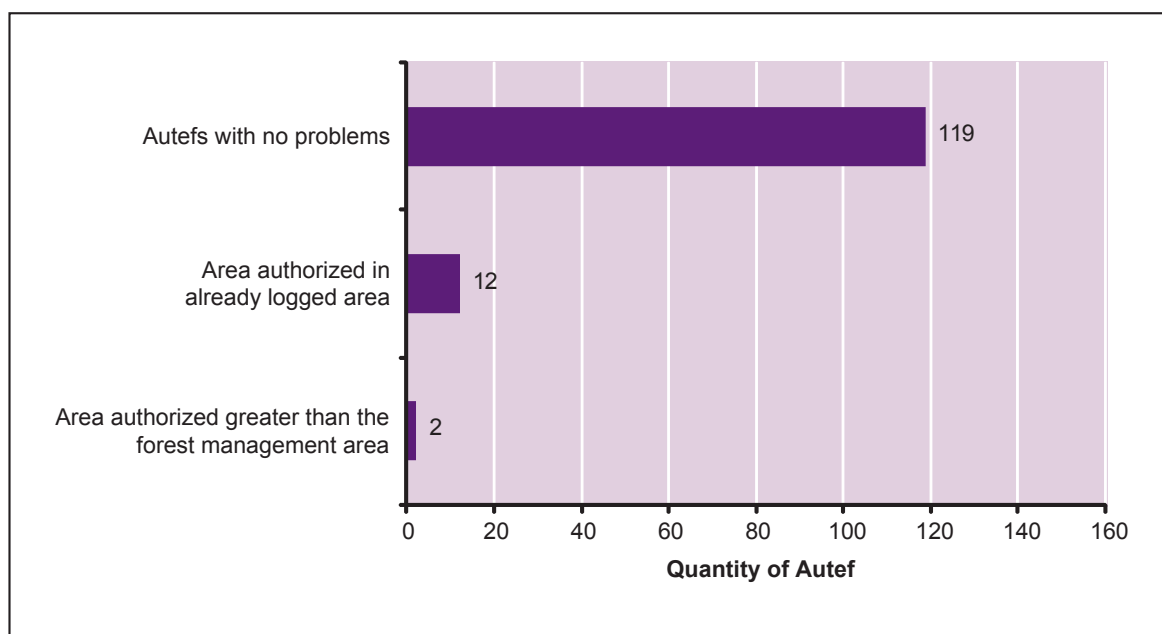

Figure 12. Assessment of consistency of information (number of cases) in the Autefs and in the Autefs with timber credits in 2011 in the forest control systems at Sema/PA (Source: Imazon/Simex).

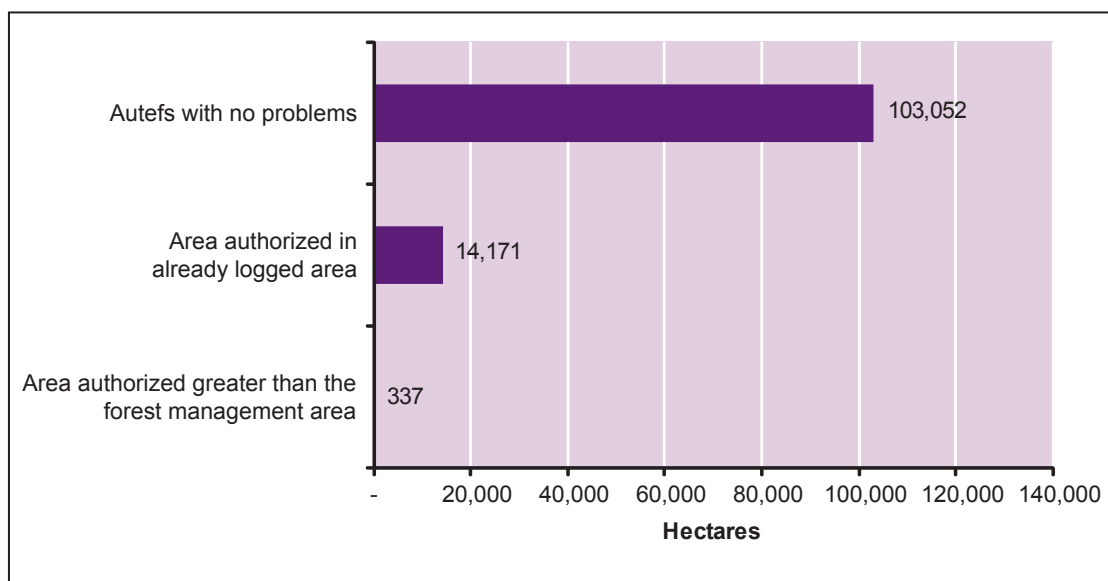[2] Sema/PA is evaluating those cases.

Figure 13. Assessment of consistency of information (in hectares) in the Autefs and in the Autefs with timber credits in 2011 in the forest control systems at Sema/PA (Source: Imazon/Simex).
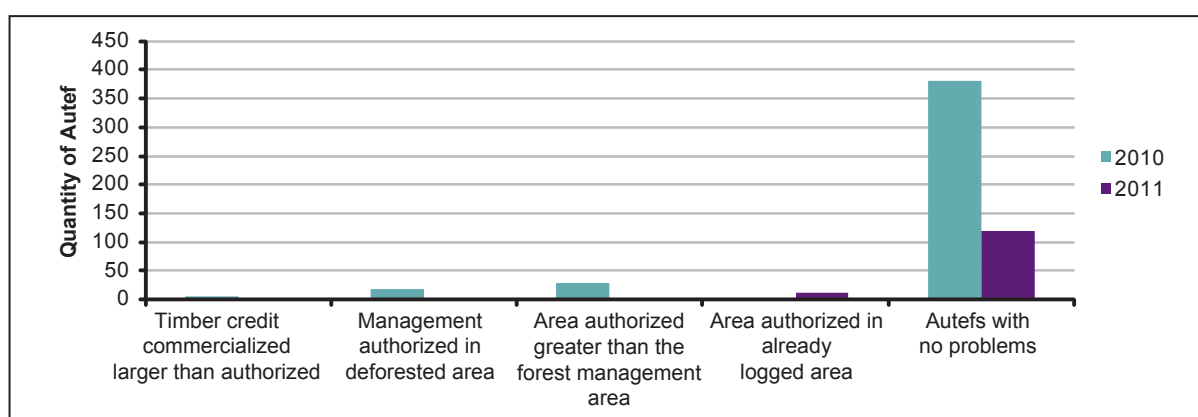

Figure 14. Comparison of the number of cases of inconsistencies with Autefs and timber credits in 2010 and 2011 in the forest control systems at Sema/PA (Source: Imazon/Simex).

For 2011, we also compared satellite images from of authorized areas with their respective authorizations, for a total of 143 Autefs. Of the total of images, 42% (78,197 hectares) could not be analyzed because they presented cloud cover; 56% (132 cases on 105,489 hectares) did not present any irregularity in the comparison; and 2% (11 cases on 3,396) revealed inconsistencies[3] (Figure 15 and 16), such as:

i) *Area with no signs of logging activity.* No logging scars were identified in the images for the period in which the Autef was valid. How-

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[3] Sema/PA is evaluating those cases

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ever, timber being sold related to that authorization was identified. We identified nine cases with this problem, covering an area of 1,558 hectares;

ii) Forest management executed before authorization. In two cases logging was done before issuance of the Autef. Those cases totaled 1,838 hectares of authorized area;
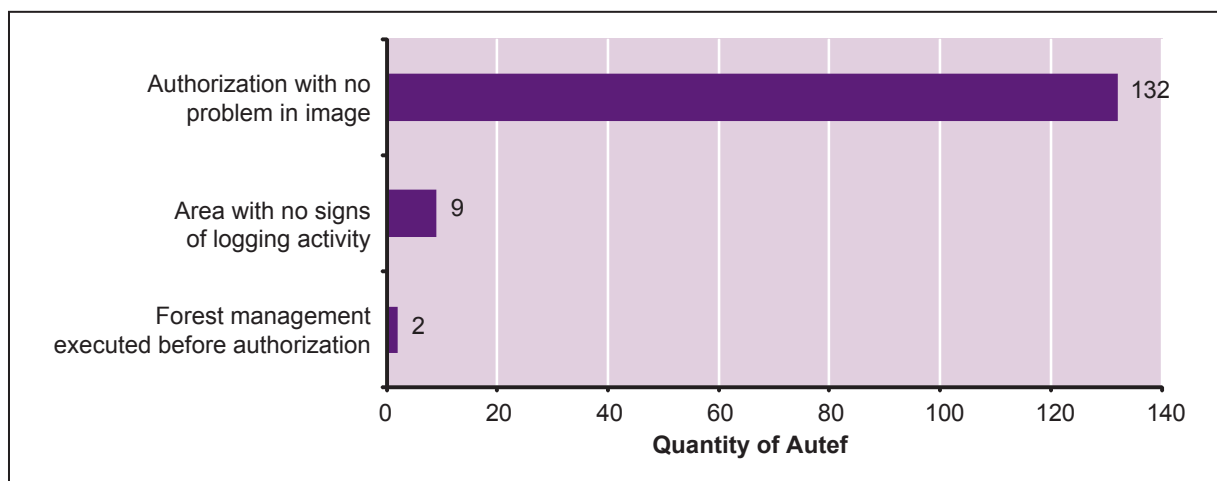

Figure 15. Forest management situation (number of cases) in the State of Pará from August/2010 to July/2011, obtained through integrating of information from the control systems at Sema/PA with satellite images (Source: Imazon/Simex).
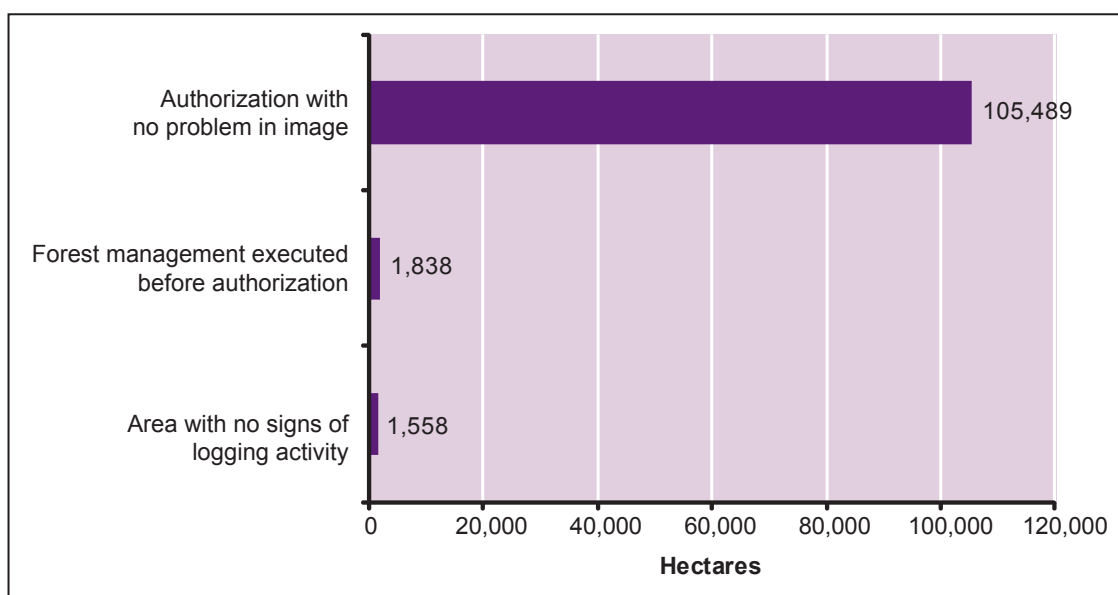

Figure 16. Forest management situation (in hectares) in the State of Pará from August/2010 to July/2011, obtained through integrating of information from the control systems at Sema/PA with satellite images (Source: Imazon/Simex).

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The comparison between the forest management analyzed in the previous period with the current one shows that there was an increment in the legally compliant cases and in the cases of area with no signs of logging activity. However, we observed a drop in cases of forest management executed before authorization (Figure 17).
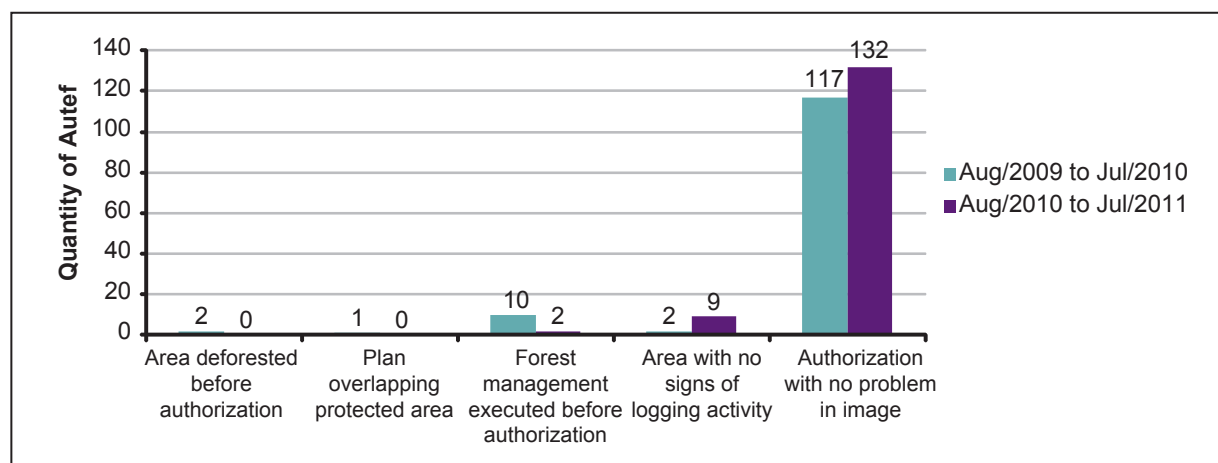

Figure 17. Comparison of the forest management situation in the State of Pará from August/2009 to July/2010 and August/2010 to July/2011, obtained through integrating information from the control systems at Sema/PA with satellite images (Source: Imazon/Simex).

Quality of Timber Harvesting

We assessed the quality of timber harvesting in the NDFI images (see methodology in Box 1) for which we determined thresholds[4], so that: NDFI ≤ 0.84 represents low quality logging (predatory logging); NDFI = 0.85-0.89, intermediate logging quality (there was an attempt at adopting management, but the layout of roads, log landings and clearings reveals serious problems with execution); and NDFI ≥ 0.90, good quality logging, meaning that the layout of roads, log landings and clearings is in conformity with accepted forest management techniques.

Of the operational management plans, we selected 55 (60,800 hectares) in whose images from 2011 it was possible to visualize logging scars and assess their quality. Of the logging detected in those images, only 10% (5,966 hectares) was of good quality, 62% (37,617 hectares) presented intermediate quality, and 28% (17,217 hectares) was classified as low quality (predatory logging) (Figure 18).

In comparison with the previous period, all of the quality classes showed a decline. However, the most significant reduction was found in good quality logging: 25 thousand hectares (Figure 19).

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[4] 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. ISBN: 978-85-86212-24-6. 68p.
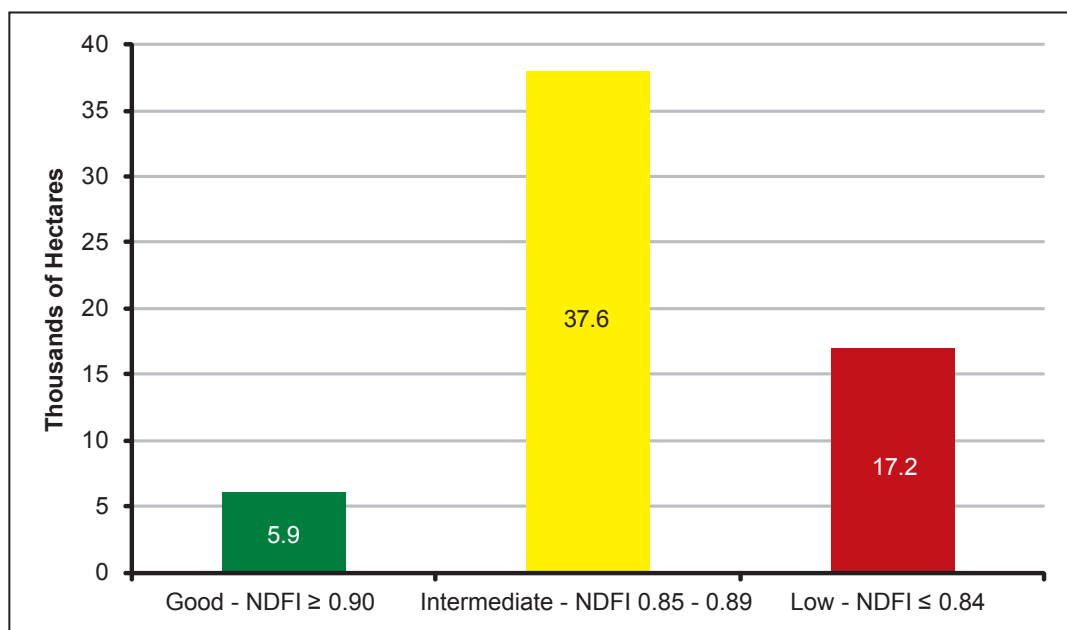
Figure 18. Quality of logging (in hectares) in 55 management plans in the State of Pará from August/2010 to July/2011 (Source: Imazon/Simex).
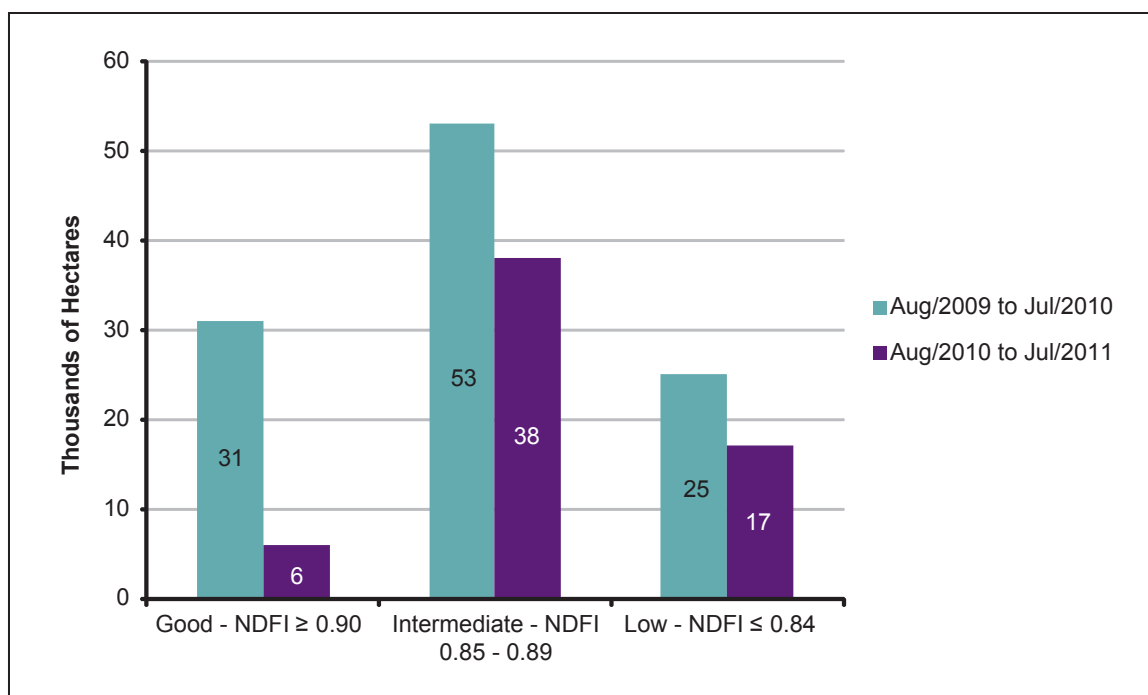

Figure 19. Comparison of logging quality, in a forest management area in the State of Pará from August/2009 to July/2010 and August/2010 to July/2011(Source: Imazon/Simex).

Maintenance of Forest Management Areas

We analyzed the satellite images from 2011 to see if the forest management plans in operation from 2007 to 2011 are being maintained for the next cutting cycle. Of the 665 forest management plans evaluated for this period (445,759 hectares), the great majority (99% or 443,281) remain conserved, and small part (1% or 2,478 hectares) was deforested (clear cutting) (Figure 20).
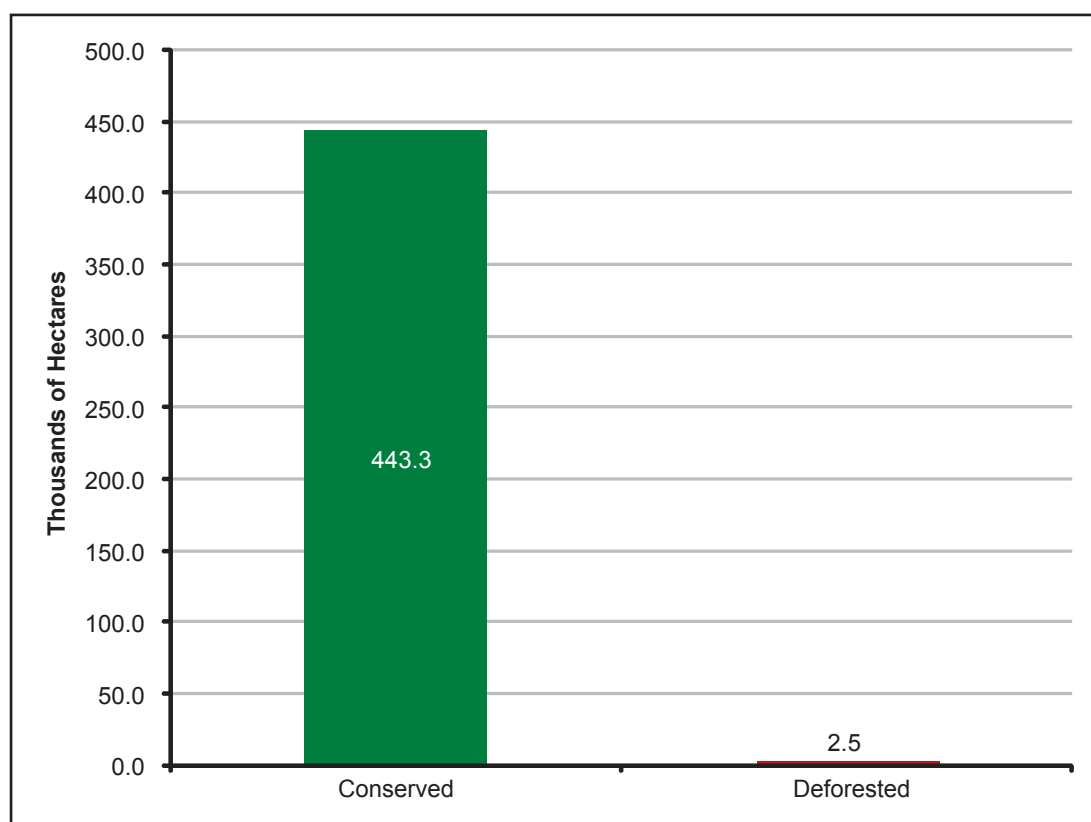

Figure 20. Situation of forest management areas from August/2007 to July/ 2011 evaluated in images from 2011.

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Box 1. System for Monitoring Timber Harvesting *(Sistema de Monitoramento da Exploração Madeireira – Simex)*

Simex was developed by Imazon to monitor forest management and non-authorized timber harvesting. The system utilizes Landsat 5 images (with 30 meters of spatial resolution) to detect selective timber harvesting; however, it can be applied to other optical sectors (SPOT, ASTER and ALOS-VNIR).

The Landsat images are processed to generate the spectral mixture model (abundance of vegetation, soils, shadow and NPV - Non-Photosynthetic Vegetation*)* and later for calculating the NDFI (Normalized Difference Fraction Index), defined as:

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

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

$$VEGnorm = VEG / (1-Shadow)$$

The information extracted from the satellite images is crossed with information from Simlam and Sisflora to assess the situation of licensed management plans. First, the document available in the control systems is analyzed in order to identify possible inconsistencies. Next, the forest management plans are assessed by overlaying their boundaries with the satellite images. Later on, that information is associated with information from forest control systems. Simex enables one to assess the occurrence of: i) area authorized in degraded or deforested area; ii) area authorized in already logged area; iii) area authorized greater than the forest management area; iv) timber credit commercialized greater than authorized; v) area with no signs of logging activity; vi) area logged greater than area authorized; vii) area deforested before authorization; viii) forest management executed before authorization; and ix) plan overlapping Protected Area. Simex makes it possible to identify evidence of irregularity in forest management licensing and execution, meaning the inconsistency between 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 should or need to be verified in the field in order to identify the problems with execution.

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