

## Deforestation in Land Reform Settlements in the Amazon

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In the Amazon, 1,354 rural settlements had been created up to 2002, occupying more than 231 thousand square kilometers. Those settlements are vital for land distribution and have already benefited some 231,815 families. However, activities developed by the families, such as agriculture and logging, have great potential for generating deforestation and forest degradation in the region. In this *The State of the Amazon*, we assess the situation of deforestation in the Land Reform Settlements in the Legal Amazon. To do this, we combined deforestation data with the map of settlements created from 1970 to 2002 by the Brazilian Colonization and Land Reform Agency (*Instituto Nacional de Colonização e Reforma Agrária - Incra*). Around 106 thousand square kilometers (49% of the area of settlements mapped) were deforested up to 2004, representing 15% of Amazon deforestation. Additionally, from 1997 to 2004, the rate of deforestation in the settlements was 1.8% per year. Three measures may be able to harmonize the social demand for land reform with the urgent need to reduce deforestation and recover environmental losses in the settlements. First, create settlements in deforested/degraded areas. Second, recuperate deforested areas in the settlements, especially those situated in the Legal Reserve areas (RL) and Areas for Permanent Preservation (APPs). Finally, include the settlements in the government program for monitoring deforestation in the Amazon.

### Land Reform Settlements in the Amazon

The national colonization and integration projects, begun during the 1970s, laid the groundwork for implanting settlements in the Amazon. Most of the families who migrated to the region were motivated by the offer of lands and subsidized credit.<sup>1</sup> Those families were mostly distributed in Incra settlements, concentrated along the Transamazon highway in the State of Pará, and near the BR-364 highway in Rondônia.<sup>2</sup> The settlements have been very

important in land distribution and have already benefited more than 850 thousand families in all of Brazil.<sup>3</sup> On the other hand, activities developed in the settlements are connected to agriculture and to logging<sup>4</sup>, which have a high potential for generating deforestation and forest degradation in the Amazon.<sup>5,6</sup> Therefore, the challenge of the settlement policy is to assure access to land for small farmers and at the same time conserve Amazon forest resources.

### Geography of the Settlements

The 1,354 settlements created in the Amazon from 1970 to 2002, totaling an area of 230,858 square kilometers, are concentrated along the major highways and the *Arc of Deforestation* (Figure 1).<sup>7</sup> The State of Pará has the largest area of settlements (32%), followed by Rondônia (17%) and Mato Grosso (15%). The remainder of the settlement areas (36%) is distributed in the other States of the Legal Amazon. The great majority of the settlements (88%) were established beginning in 1995, while the oldest settlements (12%) were created during the period of 1970 to 1994. By 2002, 231,815 families had been settled –with an average of 171 families per settlement.

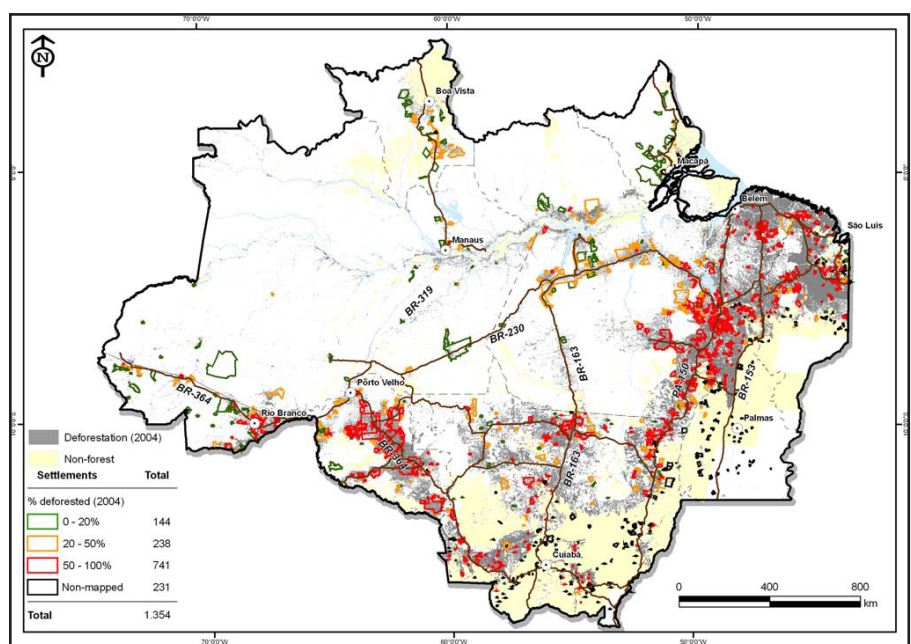


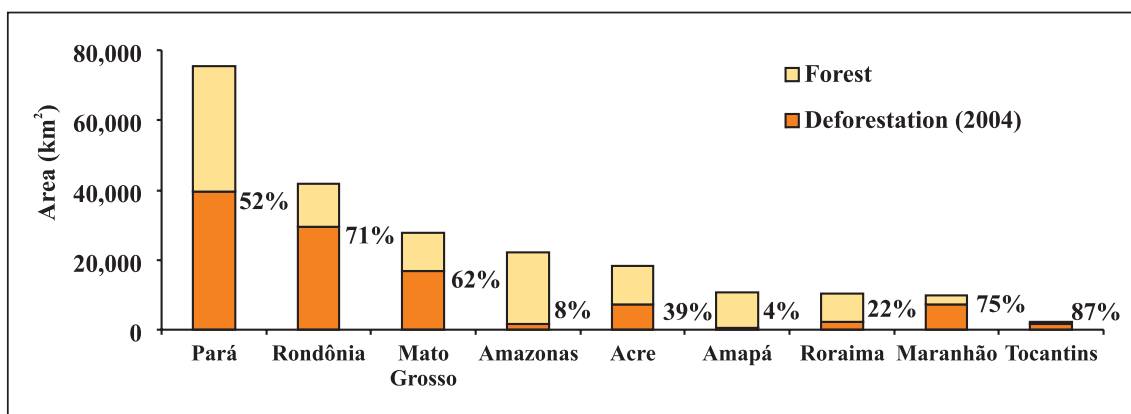
Figure 1. Deforestation up to 2004 (%) in the settlements created in the Amazon from 1970 to 2002.

**Deforestation in the Settlements**

Approximately 1,123 settlements were mapped by the Amazon Forest Monitoring Program (*Programa de Monitoramento da Floresta Amazônica - Prodes*) in 2004.<sup>8</sup> Of the total area of those settlements (217,801 square kilometers), around 106,580 square kilometers (49%)<sup>9</sup> had been deforested up to 2004. By far the greatest share of deforestation (81%) is concentrated in the settlements situated in the States of Pará, Rondônia and Mato Grosso, especially along the *Arc of Deforestation* (Figure 2). On the other hand, the least deforested settlements are located in Amapá, Roraima and Acre. The loss of forest in the settlements represented 15% of total deforestation in the Amazon up to 2004 (approximately 696 thousand square kilometers).

**Table 1. Percentage deforested in the settlements created from 1997 to 2002 mapped by Prodes during the years 1997 to 2004.**

Year of creation	Settlements		Deforestation (%)		
	Number	Area (km <sup>2</sup> )	Before creation	Between creation and 2004	Up to 2004
1997	139	18,729	15	17	32
2000	73	4,936	31	10	41
2001	82	7,127	18	9	27
2002	49	5,591	32	5	37
<b>Total</b>	<b>343</b>	<b>36,383</b>	<b>20</b>	<b>13</b>	<b>33</b>



**Figure 2. Area deforested up to 2004 (in km<sup>2</sup> and %) in the settlements mapped by State.**

**Do the Settlements Contribute to Deforestation?**

To answer that question, we analyzed 343 settlements (31% of the number of settlements studied) established during the period of 1997 to 2002<sup>10</sup>. The area of those settlements reached 36,383 square kilometers (17% of the total area of settlements mapped). Of that total, approximately 20% of the area had been deforested up to creation of the settlements, while 80% were native forests (Table 1). Between creation of the settlements and 2004 around 4,652 square kilometers were deforested, which corresponded to 13% of the settlement area 16% of the native forests in the year of creation. The deforestation rate in the settlements (1.8% per year) was four times greater if compared to the average rate of deforestation in the Amazon.<sup>11</sup> One of the reasons for this rapid advance in deforestation may be the access of small producers to resources made available by land reform (land ownership and subsidized credit).<sup>12</sup>

**Legality of Deforestation in the Settlements**

We detected that 43% of the settlements mapped (n= 485) had more than 75% of their area deforested. In these cases, there was irregular deforestation in RL areas and probably also in the APPs.<sup>13</sup> However, to precisely estimate the irregularity of deforestation in the settlements it would be necessary to have the maps showing the boundaries of the RL areas in the settlements. This type of data does not exist. In the case of the APPs, illegal deforestation may be estimated using satellite images<sup>14</sup>, combining the limits of those areas, extracted based on water bodies (rivers, streams, etc.) in the settlements, with deforestation data from Prodes. This is already being done on properties larger than 10 square kilometers in Mato Grosso.<sup>15</sup>

**Actions for Mitigating Deforestation**

Several governmental actions are seeking to reduce the environmental impacts of settlements:

1. *Creation of Sustainable Development Projects (PDS) in 1999.*<sup>16</sup> This settlement modality is geared toward populations who base their subsistence on extractivism, family agriculture and other activities with a low environmental impact. As of 2004, eight PDS has been created in the Amazon, totaling 2,871 square kilometers.<sup>17</sup>
2. *Establishment of guidelines for environmental licensing for land reform settlement projects, Conama resolution number 289/2001.*<sup>18</sup> The main guidelines are prohibition of settlements in forest areas and the requirement of environmental licenses for the new settlements (Prior, Installation and Operation), besides an operating license for settlements created before 2001. In this latter case, it was necessary to have a the signing of a Term for Commitment to Adjustment of Conduct (*Termo de Compromisso de Ajustamento de Conduta - TAC*) in 2003.<sup>19</sup> However, the report of the Ministry of the Environment on application of Conama 289/2001 notes that, in all of Brazil, only 718 settlements were in the licensing process from 2003 to 2005, indicating a low level of compliance with the TAC.<sup>20</sup>
3. *Creation of Settlement Projects (PAF) in 2003.*<sup>21</sup> Still in the implantation phase in the Amazon, this settlement modality emphasizes multiple forest management and agroforestry systems. However, as of April, 2006, only two PAFs (426 square kilometers) had been created (in 2003) in the State of Acre.<sup>22</sup>
4. *Creation of legal instruments for recovery of degraded areas.*<sup>23</sup> Since 1965, Brazilian legislation has presented guidelines for recuperation of RL and APP areas. Additionally, financial instruments such as Pronaf Florestal can contribute toward recuperation of degraded areas in the settlements.<sup>24</sup>

To assess the effectiveness of such actions on reducing environmental impacts and recuperating degraded areas in settlements, it is essential to integrate

into one data bank spatial information on the settlements and plans for use and recuperation of those areas. However, it was not possible to perform this evaluation in this study. Although there has been a significant advance in generating and making available data on deforestation in the settlements, it is still necessary to disseminate data on the boundaries of RL and APP areas, as well as publish data on environmental licensing for the settlements.

### Suggestions for Public Policies

We suggest three measures for improving environmental management in the Land Reform Settlements in the Amazon.

**Create new settlements for agricultural purposes in already deforested areas.** Land reform programs should prioritize creation of settlements for agricultural and ranching purposes in deforested and degraded regions. In this way, the new settlements would not contribute to advancing deforestation in the Amazon. Legal provisions have been created for this purpose.<sup>25</sup>

**Recuperate degraded areas, RL and APP areas.** This measure might be carried out through Pronaf Florestal, a subsidized credit program, geared towards the land reform public. Pronaf Florestal prioritizes activities in multiple management, reforestation and agroforestry systems. However, only 21% of the amount available from 2003 to 2005 (24 million USD) was contracted<sup>26</sup>, which indicates underutilization of the program's funds.

**Include monitoring of settlements in the government monitoring program for the Amazon.** This will make it possible to follow up the application of environmental law, plans for recuperating degraded areas and enforcement of TACs in the settlements. Deforestation data are generated and divulged annually by the National Space Research Agency (*Instituto Nacional de Pesquisas Espaciais - Inpe*), and it will be necessary only to overlay these maps with spatial data from the settlements to be supplied by Incra.

## References and Notes

- \* Corresponding author: [brandaotr@amazon.org.br](mailto:brandaotr@amazon.org.br)
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  - <sup>3</sup> Incra, Nead e Secretaria do Banco da Terra. A maior reforma agrária do mundo contemporâneo. Available at: [http://www.pdsb.org.br/biblioteca/era\\_do\\_real/07.pdf](http://www.pdsb.org.br/biblioteca/era_do_real/07.pdf).
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  - <sup>5</sup> Laurance, W. F. 2000. Mega-development trends in the Amazon: Implications for global change. *Environmental Monitoring and Assessment* 61: 113-122.
  - <sup>6</sup> Walker, R; Moran, E. & Anselin, L. 2000. Deforestation and cattle ranching in the Brazilian Amazon: External capital and household processes. *World Development* 28 (4): 683-699.
  - <sup>7</sup> The map of 1,354 settlements created by Incra between 1970 and 2002 was originated by the Information System for Land Reform Projects (*Sistema de Informações de Projetos de Reforma Agrária - Sípra*) and made available by the SDTT – Territorial Organization Division/Brasília.
  - <sup>8</sup> Prodes monitors deforestation of the Brazilian Amazon biome based on satellite images. Non-forested areas located mainly in the south/southeast of the States of Tocantins and Mato Grosso are not mapped. Settlements with more than 50% of their area under forest cover were mapped, totaling 1,123 settlements (an area of 217,801 square kilometers). As of 2004, around 105,613 square kilometers had been deforested in those settlements. The 231 settlements (13,057 square kilometers in area) with less than 50% made up of forest vegetation and/or located outside of the area mapped by Prodes were not mapped. However, in the unmapped settlements located on the boundary between forest and non-forest 967 square kilometers had been deforested up to 2004, totaling 106,580 square kilometers deforested in the settlements.
  - <sup>9</sup> The percentage deforested was calculated in relation to the settlements mapped.
  - <sup>10</sup> Due to the lack of deforestation maps prior to 1997 and to the annual variation of the area mapped by Prodes, we estimated the deforestation rate for 343 settlements created in 1997, 2000, 2001 e 2002, equivalent to 31% of settlements mapped.
  - <sup>11</sup> The annual rate of deforestation for the Amazon for the 1997-2004 period was 0.42 %.
  - <sup>12</sup> Wood, C.; Walker, R. & Toni, F. 2003. Os efeitos da posse da terra sobre o uso do solo e investimentos entre pequenos agricultores na Amazônia brasileira. In: J.F. Tourrand & J.B. Veiga (Eds.). *Viabilidade de sistemas agropecuários na agricultura familiar da Amazônia*. Belém: Embrapa Amazônia Oriental. pp. 427-436.
  - <sup>13</sup> Federal Law 4771 of 1965 and Provisional Measure 2166-67 of 2001 prohibit the removal of native forest in the RL and APP areas, except for deforestation authorized by the competent environmental agency.
  - <sup>14</sup> Firestone, L.A. & Souza Jr., C. 2002. The role of remote sensing and GIS in enforcement of areas of permanent preservation in the Brazilian Amazon. *Geocarto* 17 (2): 51-56.
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  - <sup>19</sup> In October, 2003, a Term for Commitment to Adjustment of Conduct (TAC) was signed between the Public Prosecution Service (MPF), Ministry for Agrarian Development (MDA), Ministry of the Environment (MMA), National Institute for Colonization and Land Reform (Incra) and the Brazilian Environmental Institute (Ibama). Available at: <http://www.mma.gov.br/port/conama/processos/EFFC0E7F/TACLicAmbProjAssentRefAgr.pdf>
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  - <sup>22</sup> Incra. 2004. Notícias 2004. Available at: [http://www.incra.gov.br/noticias/news/Ano/2004/mes/mar%E7o/semana4/25\\_Termina\\_sexta\\_feira\\_prazo\\_para\\_consulta\\_p%FAblica.htm](http://www.incra.gov.br/noticias/news/Ano/2004/mes/mar%E7o/semana4/25_Termina_sexta_feira_prazo_para_consulta_p%FAblica.htm).
  - <sup>23</sup> The Brazilian Forest Code of 1965 (Law 4771), Law n°. 9649 of 1998, Provisional Measure 2116-67 of 2001 and the Joint Administrative Rule (*Portaria Conjunta*) of Incra n°. 155 of 2002 present guidelines for reforesting and recuperating degraded RL and APP areas.
  - <sup>24</sup> Pronaf – Programa Nacional de Fortalecimento da Agricultura Familiar. Available at: <http://www.pronaf.gov.br>
  - <sup>25</sup> Administrative Rule n°. 88/1999 of the Ministry Extraordinary for Land Policy and Provisional Measure no. 166/2001 prohibit implantation of settlement projects in areas with primary forest cover, or secondary forest cover in an advanced stage of regeneration, with exceptions for agroextractivist settlement projects.
  - <sup>26</sup> Veríssimo, A. 2006. Estratégia e Mecanismos Financeiros para Florestas Nativas do Brasil. *Documento Técnico, FAO*. Brasília: Ministério do Meio Ambiente. 40 p.