

# DEFORESTATION SCENARIOS IN THE AREA OF INFLUENCE OF THE TAPAJÓS HYDROPOWER COMPLEX<sup>1</sup>

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Hydropower projects can cause hydrological fragmentation of rivers and trigger deforestation, particularly in the Amazon, compromising the connectivity of freshwater and forest ecosystems. Therefore, it is important to assess the potential deforestation that these projects might cause. This assessment includes an analysis of the history, main drivers and future scenarios of deforestation, and was carried out by municipalities that will be directly or indirectly affected by the proposed Tapajós Hydropower Complex, by land tenure and

designation categories, by proximity to access roads, and by the existence of nature protected areas and indigenous territories in the region.

A total of 42 medium to large hydropower projects in the Brazilian states of Pará (PA), Mato Grosso (MT) and Amazonas (AM) are planned or under construction in the Tapajós river basin (including the Teles Pires, Juruena, Tapajós and Jamanxim rivers), representing the most important expansion and investment frontier of the electrical sector in the Brazilian Amazon. For this assessment, the area of influence of the Tapajós Hydropower Complex is defined as the boundaries of the municipalities that belong to the basin, covering about 940,000 km<sup>2</sup> (mostly in MT and PA states).

The two most important drivers of deforestation in this region (before the hydropower programme) are currently the northward expansion of soybean croplands in Mato Grosso state and the paving of the BR-163 road that links Cuiabá (MT) to Santarém (PA), crossing the as yet unpaved Trans-Amazon road (BR-230). The impacts of these drivers are likely to be compounded by the land speculation, in-migration, and higher cost of goods and services resulting from the expectation of future hydropower development in the region, particularly given the poor land-use planning and the lack of impact mitigation controls that prevail in this region. By 2013, 19 per cent of the area of influence had been deforested, mostly (76 per cent) in Mato Grosso.

Seven of the 42 projects are mega-hydro plants (>1,000MW). If all projects were to go ahead, they would generate almost 28,000MW of energy, three times the amount generated by the Amazon's largest plant, Tucuruí. Of the 42 projects, 10 are included in a recent 10-year plan (to 2022) of the Brazilian energy sector, the largest being São Luiz do Tapajós (6,133MW). One of these, Teles Pires (1,820MW), is already under construction and causing the kinds of impacts assessed by this analysis.<sup>2</sup>

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1 A summary of the assessment: Alencar, A. A. C. and Piontekowski, W. 2014. Cenários de desmatamento na Área de Influência do Complexo Hidroelétrico do Tapajós. WWF (Living Amazon Initiative – LAI) and WWF-Brazil) and IPAM – Amazon Environmental Research Institute. 63pp.

2 Updating note: The Brazilian 10-year plans ("Planos Decenais de Expansão de Energia – PDEs") usually are revised every year. The most recent PDE, from 2014 (which lists the dams due to be in operation by 2023), excluded some dams that had been formerly listed, such as Salto Augusto Baixo (1,461MW) and São Simão Alto (3,509MW), which had been strongly questioned by several social actors (including WWF), particularly due to their locations overlapping with nature protected areas and indigenous territories. Nevertheless, this assessment has considered these projects, as they could be reinstated in a future PDE.



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These projects will directly impact 28 of 73 municipalities that have all or part of their jurisdictions within the Tapajós river basin. The municipalities that currently have the largest converted area (Altamira-PA, Itaituba-PA, Colniza-MT and Novo Progresso-PA) are also those that have large forest cover and a high proportion of non-registered land, which leaves these areas vulnerable to deforestation allowed by lack of governance, including lands subject to speculation and land-grabbing, usually triggered by the opening of new access roads.

*Mining is one of the drivers of deforestation and freshwater pollution and degradation. Tapajós River Basin, Brazil.*

The analysis of deforestation dynamics over the past 10 years, by land designation category, considering the history of this specific sub-region,<sup>3</sup> revealed that non-registered public or private areas, land reform settlements and registered private properties were the categories with the highest converted areas, having lost respectively 48 per cent, 38.5 per cent and 38 per cent of their original forests, mostly to cattle ranching and agriculture. Together, these areas have lost 14.5 million ha in the past 10 years (an area the size of Nepal). Conversely, and not surprisingly, the land designation categories that had the least conversion to other land designation so far were indigenous territories (1.4 per cent) and state nature protected areas (1.7 per cent), but also state-owned public lands (1.3 per cent).

This assessment commissioned by WWF and developed by IPAM aimed to provide a better understanding of the occupation dynamics in this region, identifying the trends and most vulnerable areas to induced deforestation (either directly or indirectly), so as to inform decision-making related to dam construction and, in the event these projects go ahead, to guide preventive and/or mitigation measures to reduce the environmental and social impacts of the projects. The study is composed of four parts: (a) an analysis of the recent deforestation dynamics in the region by land designation category and by municipality; (b) a mapping of the drivers of deforestation in the area of influence of the complex (both (a) and (b) based on PRODES-INPE/2013 data from the past 10 years); (c) an analysis of the vulnerability of the region to deforestation; and (d) a total of six deforestation scenarios (to 2030) based on the construction (or not) of hydropower projects and associated infrastructure and on the maintenance (or not) of protected areas in the region.

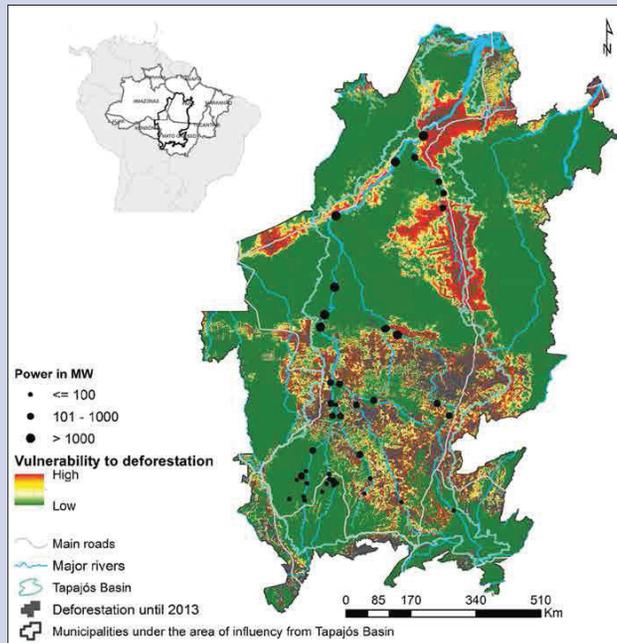
Although hydropower projects have not historically been associated with deforestation (as compared with roads), they produce significant indirect impacts on people and the forest. These indirect impacts are hard to measure, as compared with the direct impacts of the construction site and the reservoir. The main indirect impact of hydropower projects on the forest is the deforestation caused by the opening of new access roads, the migration of workers to the project site and the infrastructure needed to accommodate the workforce.

3 Trends identified in a particular study area are not necessarily easily extrapolated to other Amazon subregions.

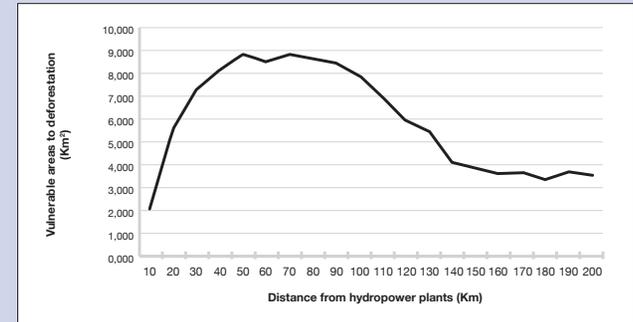
The vulnerability analysis revealed that the municipalities of Altamira (mainly Castelo dos Sonhos District), Novo Progresso and Itaituba in Pará state, and Apuí in Amazonas state have the highest degree of vulnerability to deforestation in the region, each municipality with more than 5,000 km<sup>2</sup> of forest under risk (Fig 1). Federal public lands are the land designation category that is most vulnerable to deforestation (45 per cent of the area they cover). At least 55 per cent of vulnerable areas are located less than 100km from planned hydropower plants and 86 per cent are less than 200km away (Fig 2). Hydropower projects, therefore, can act as a trigger of deforestation processes in high-vulnerability areas.

The projection of the pressures caused by the proposed hydropower complex was based on empirical observation data or on the interpretation of the in-migration processes that took place in similar and relatively recent situations in the Amazon, such as those related to the Santo Antônio, Jirau and Belo Monte dams in Rondônia and Pará states, and those occurring along the BR-163 highway in Mato Grosso and Pará states.

In order to support better decision-making, six deforestation scenarios through 2030 were defined using spatially explicit tools. They were based on three infrastructure scenarios: (i) no construction of hydropower projects and obviously no other



**Figure 1.** Vulnerability to deforestation – areas in red highly vulnerable (area of influence of the Tapajós Hydropower Complex). (Map: Valderli Piontekowski/Amazon Environmental Research Institute - IPAM)



**Figure 2.** Vulnerability to deforestation in terms of distance from hydropower plants.

associated infrastructure (e.g. roads); (ii) construction of hydropower projects without the associated infrastructure (e.g. roads); and (iii) construction of hydropower projects with the added influence of other infrastructure (e.g. roads). So as to check whether protected areas have an effect on holding back deforestation pressures, for each of these three infrastructure-focused options, the analysis considered two protected areas<sup>4</sup> scenarios: the maintenance of existing protected areas in the basin and the exclusion of these protected areas.



Teles Pires River being affected by dam construction, Mato Grosso state, Brazil.

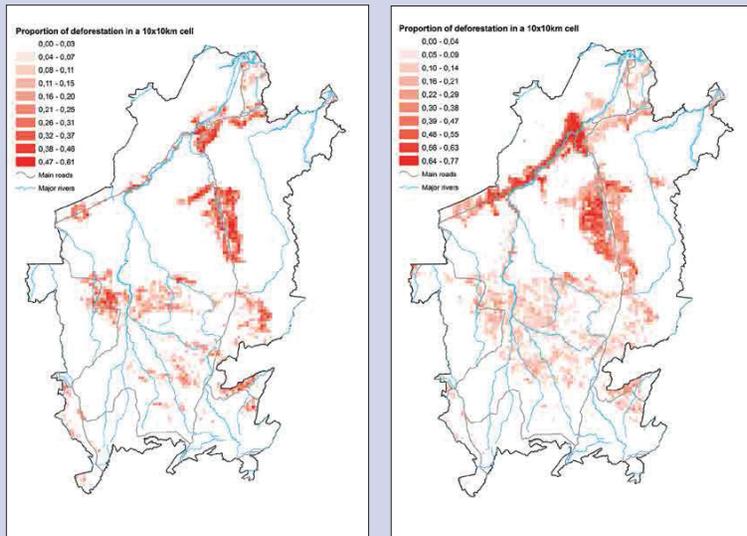
Following an analysis of historic deforestation rates for two periods (2006-2009 and 2010-2013), a decision was taken to base all six scenarios on data for the period 2010-2013, given that this more recent period better represents current trends.

The additional deforestation estimated for the “with hydropower plants” scenarios (as compared with the “no hydro plants” scenarios) corresponds to the deforestation induced

<sup>4</sup> For the exclusion of protected areas scenarios we assumed that only the conservation units could be formally excluded.

by hydropower development in the region. The results of the analysis for the next 17 years (from 2014 to 2030) produced an estimated area of additional deforestation (as compared with the "no hydro plant" scenario) of between 5,000 km<sup>2</sup> (for the scenario with hydropower plants only + maintenance of protected areas) and 11,000 km<sup>2</sup> (for the more pessimistic scenario, i.e. hydropower plant and road-influenced in-migration + elimination of protected areas). (Fig 3)

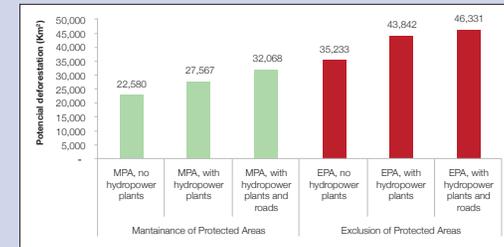
Besides the increase of deforestation pressure due to the direct and indirect impacts, hydropower projects and their associated infrastructure could also lead to the downsizing, downgrading or degazetting of existing protected areas (PADD). This would have the effect of further inducing deforestation, given that the scenarios analysis in this study has demonstrated the important role of protected areas in reducing the deforestation pressure.



**Figure 3.** Deforestation scenarios (at 2030): (i) without hydropower projects and with protected areas (left, "a") and (ii) with hydropower projects and associated infrastructure (roads) and without protected areas (right, "b") (area of influence of the Tapajós Hydropower Complex). (Maps: Valderli Piontekowski/Amazon Environmental Research Institute - IPAM).

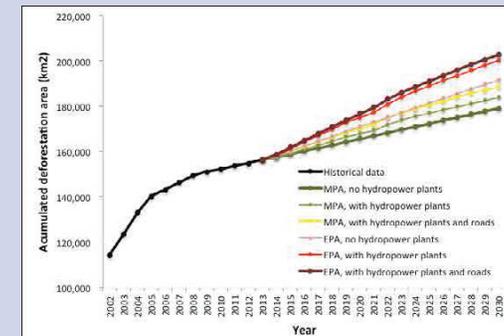
Up to 2013, approximately 19 per cent of the forests in the Tapajós basin had been deforested. The projection for 2030 of the more "optimistic" or "best-case" scenario (without hydropower plants and maintaining existing protected areas) is that the deforested area would increase to 22.56 per cent. This would increase to 25.56 per cent under the more "pessimistic" or "worst-case" scenario (with hydropower plants and their associated infrastructure, e.g. roads, and excluding protected areas). The worst-case scenario represents a 27.8 per cent increase from 2013 figures and a 117.2 per cent increase when compared with the deforested area under the best-case scenario (Fig 4).

The absence of protected areas would result in a 62.5 per cent increase in deforestation as compared with the best-case scenario, and the maintenance of protected areas would result in a 32.4 per cent reduction of the deforestation created by the worst-case scenario.



**Figure 4.** Area potentially deforested between 2014 and 2030 according to the projections of the six scenarios (area of influence of the Tapajós Hydropower Complex).

Up until 2002, the total deforested area in the region was less than 115,000 km<sup>2</sup>. From 2003 to 2013, there was a 37 per cent increase in relation to the total cumulative amount to 2002, reaching more than 156,000 km<sup>2</sup>. Based on the projected "with hydro plant" figures to 2030, even assuming maintenance of protected areas, the cumulative deforested area would reach 188,000 km<sup>2</sup> in the next 17 years, an increase of more than 20 per cent in relation to 2013 (Fig 5).



**Figure 5.** Accumulated deforestation recorded to 2013 and the projections in the six scenarios (MPA stands for maintenance of Protected Areas; EPA stands for exclusion of Protected Areas) to 2030 (area of influence of the Tapajós Hydropower Complex).

These impacts, though, will not affect the subregions of the Tapajós basin equally. It is important to consider that the history and the trends of deforestation and protection in the basin are different in each of its parts, with the southern half having suffered much more deforestation historically. There are well-conserved areas across the basin, mainly in its core and northern area; this is mostly due to the absence of access roads and better coverage by nature protected areas and indigenous territories. These are the parts of the basin that would potentially be more affected by the indirect impacts of hydropower projects, precisely because they have been less degraded until now. Furthermore, their degree of vulnerability also considers land tenure and designation. The two areas most vulnerable to deforestation induced by the establishment of the Tapajós Hydropower Complex are the stretch of the Trans-Amazon road between Jacareacanga and Itaituba, where the majority of the land is still not registered, and the un-registered lands north of Itaituba, which are susceptible to deforestation as a result of land speculation and land-grabbing induced by the construction of the São Luiz do Tapajós plant.

