

# DAMS ON THE TAPAJÓS RIVER:

A CRITICAL ANALYSIS OF THE ENVIRONMENTAL IMPACT  
ASSESSMENT AND REPORT (EIA/RIMA) FOR THE  
SÃO LUIZ DO TAPAJÓS HYDROELECTRIC PROJECT\*



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\*Translation of the summary from the report "Barragens do rio Tapajós: uma avaliação crítica do Estudo e Relatório de Impacto Ambiental (EIA/RIMA) do Aproveitamento Hidrelétrico São Luiz do Tapajós". The full version can be found at: <http://greenpeace.org.br/tapajos/docs/analise-eia-rima.pdf>

A person in a small boat on a river with a forested background. The person is standing in the boat, holding a long pole. The background shows a dense forest of green trees under a clear sky. The water is calm with some ripples.

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# SUMMARY

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This report is the result of an independent critical analysis of the Environmental Impact Assessment and Report for the São Luiz do Tapajós Hydroelectric Project, which was submitted by the company CNEC Worley Parsons Engenharia S.A. In this report a series of issues are raised that compromise the use of the EIA/RIMA to determine the environmental viability of this project. The weaknesses detected result from:

- 1** lack or omission of important information needed to evaluate the impact of the project;
- 2** a sampling design that is only partially adequate, but poorly employed by the consultant;
- 3** inappropriate or obsolete sampling methods for the analysis of some taxonomic groups;
- 4** inadequate analysis and treatment of data for almost all of the groups;
- 5** generic and insufficient environmental programs suggested as mitigating and compensatory actions;
- 6** lack of regional contextualization of the results;
- 7** conclusions that lack scientific support.

The problems identified in the EIA are considered serious and make it impossible to evaluate the effects of the construction of the São Luiz do Tapajós Hydroelectric Plant will have. Furthermore, the Environmental Impact Report (RIMA) can be considered a marketing tool that fails to inform society, in an objective manner, about the consequences of the project and minimizes predicted impacts. The conclusion of the authors who took part in the critical analysis of the EIA/RIMA is that both of these documents should be rejected by the licensing agency, since they do not fulfill the role established in the licensing procedure for a project with the technical, political, economic, and environmental importance of the São Luiz do Tapajós Hydroelectric Project. This report highlights the need to integrate the environmental impact studies planned for other infrastructure projects slated for the Tapajós Basin (hydroelectric plants and industrial waterways) as a fundamental part of evaluating the effects of any of these projects on biodiversity.

## 1 Introduction

The present document is a society effort to evaluate in an independent manner the Environmental Impact Assessment and Report (EIA/RIMA) for the São Luiz do Tapajós Hydroelectric Project, drafted by the company CNEC Worley Parsons Engenharia S.A., and presented to the licensing agency (IBAMA) as part of the environmental licensing process. This process requires public participation through public hearings and, because they are both public documents, they can—and must—be analyzed and evaluated in an independent manner. As such, the aim of this work is to: 1) provide a critical assessment that will enable society to understand and measure the potential consequences of the construction of the São Luiz do Tapajós Hydroelectric Plant; and 2) provide technical information that will enable the government and licensing agencies to assess the material presented by the company from a technical standpoint.

This report was developed based on the assessments of nine renowned and experienced researchers, who are leaders in their respective fields, and members of important research and educational institutions, such as the National Institute of Amazonian Research (INPA), Emilio Goeldi Museum of Pará (MPEG), and the Federal University of Pernambuco (UFPE). Due to the vast amount of documents to be evaluated, the content of the EIA/RIMA was divided into the following components, which are presented in Chapters 1-9.

- Impacts on indigenous and traditional communities (Dr. Philip Fearnside; Chapter 1);
- Water quality: monitoring of mercury levels (Dr. Bruce Forsberg; Chapter 2);
- Impacts on flora: terrestrial vegetation (Dr. Leandro V. Ferreira; Chapter 3) and aquatic macrophytes (Dr. Maria T. P. Piedade; Chapter 4);
- Impacts on fauna: benthic invertebrates (Dr. Sheyla R. M. Couceiro; Chapter 5); fish (Jansen Zuanon; Chapter 6); amphibians and reptiles (Dr. Albertina Lima; Chapter 7); mammals (Dr. Enrico Bernard; Chapter 8); and birds (Dr. Luciano N. Naka; Chapter 9).

### The main objectives of this assessment were to:

- 1 assess the information and the objectiveness given to the social impacts in the EIA/RIMA;

- 2 assess the quality of the primary data (gathered in the field) and secondary data (obtained from the literature) used to characterize the biotic environment of the project area;

- 3 determine whether this characterization enables the identification, diagnosis and prevention of impacts on the biotic environment (flora and fauna), and whether these were duly considered and measured in the EIA;

- 4 determine whether the programs and projects proposed to minimize or prevent the impacts are appropriate and efficient;

- 5 compare the results and diagnosis found in the EIA with information provided to the public through the RIMA;

- 6 evaluate in an independent manner the socio-environmental viability of the São Luiz do Tapajós Hydroelectric Project.

The report is organized around a presentation of the socio-economic impacts, especially on traditional communities, like indigenous and riverside (ribeirinhos) communities. Next, we present a brief characterization of the biotic environment, which, despite some methodological problems, clearly shows that the region where the construction is planned contains extraordinary biodiversity. Next, a critical evaluation of the Environmental Impact Assessment (EIA) is performed, by analyzing the biological inventories and reporting problems regarding the sampling design and methodologies. Information that should have been included in the EIA. In this context, the opinions of each researcher were also highlighted regarding the area delimited by the study, which is restricted to a few kilometers above the São Luiz do Tapajós Hydroelectric Plant, since other large construction projects and an industrial waterway are being planned for the same river. This may potentially result in cumulative effects that cannot be evaluated individually. A clear manipulation of the data presented to society in the Environmental Impact Report (RIMA) was also noted. Finally, the authors conclude that the project will have extremely serious consequences for the biodiversity, including the cultural diversity of traditional communities. The authors also believe that many of the impacts will be permanent and impossible to minimize or compensate.



## Impacts of the Hydroelectric Project on Amazon biome

Historically, riparian habitats in the Amazon basin have suffered chronic—although relatively light—impacts by traditional human populations (indigenous people and riverside dwellers), whose livelihood is based on fishing and the limited use of land for subsistence agriculture. This panorama of apparent equilibrium between human populations and biodiversity is changing dramatically in the Amazon, as a result of the decision by the federal government to harness the hydroelectric potential of the rivers of this region, making the government one of the main threats to biodiversity (Laurance et al., 2015). Hydroelectric plants are being built at a heightened pace, at a rate unprecedented in the history of the region (Finer & Jenkins, 2012). Many of the major rivers of the Amazon basin (like the Madeira, Xingu, and Tocantins rivers) have already been or are currently being dammed, often through highly controversial licensing processes (Fearnside, 2014). Many other rivers are cited by the government with a view to establishing no fewer than 30 large plants (i.e. plant with an installed capacity of over 30 MW) by 2022, in the Brazilian Amazon alone (Brazil – Ministry of Mines and Energy, 2012).

Despite the pace of implementation of the hydroelectric projects on different rivers of the basin, most of the paradigms regarding the hydrologic modifications resulting from the construction projects, and their effects on biodiversity, are based on studies from temperate regions (Pringle et al., 2000). Generalizations about the effects of this type of infrastructure construction on biodiversity on a regional scale are constrained by the lack of data on the distribution of different plant and animal taxa, as well as the complete lack of understanding of the ecological needs of the species potentially affected by the hydroelectric plants.

In the Amazon, the flooded plains include a series of habitats, such as sandy beaches, river islands, floodplains and flooded forest, which have unique and irreplaceable characteristics (Junk et al., 2011). These environments play fundamental roles in the landscape and provide ecosystem services that go far beyond their geographic limits. They serve as nurseries for fish and other animals, including those of economic importance, and supply key resources for human and animal populations (Junk, 2002).

Although not all of the social and biological impacts related to the transformation of major free-flowing rivers into dammed rivers are understood (or in

chains of reservoirs and industrial waterways), it is known that the elimination of the natural flooding cycle can have various consequences on biota, both upstream and downstream from the dams. When a plant enters operation, the riparian forests and other environments associated with the rivers (beaches, rocky soils, river islands, alluvial forests) located upstream, are flooded by the reservoir, which can be larger or smaller depending on the physical characteristics of the terrain and the type of dam installed. Although plant species from riparian environments are adapted to living submerged part of the time, they are unable to survive in a permanently or semi-permanently flooded environment, and tend to die. Downstream from the dams, the flood pulse (patterns of flooding and droughts) is altered, permanently changing the original plant communities and all the fauna associated with them. The effects of a hydroelectric plant are therefore not restricted to a few kilometers above a dam, and can be detected hundreds of kilometers above and below the site. In addition, dams tend to impede the passage of a large part of the sediment, which plays a fundamental role in creating and maintaining riparian ecosystems, primarily in the formation of islands, which serve as special habitat for numerous species of animals (Rosenberg 1990, Robinson & Terborgh, 1997). However, the main obstacle to predicting the effect of this project is the lack of knowledge of the patterns of distribution of plants and animals in the areas surrounding the rivers of the Amazon, and the lack of inventories conducted on a macro-spatial scale. Actually, very little is known about the composition of species of any biological group on most rivers, and even less is understood how the characteristics of plants in the riparian environments define the patterns of fauna diversity.

Despite the uncertainties associated with the negative effects of the hydroelectric plants on biodiversity, many of their impacts are predictable (Keddy, 1992), and these are not random. Organisms that possess certain characteristics are filtered or disabled, and other species that can survive and propagate on this landscape are enabled, precipitating changes in biological communities, including local, regional and even global extinction (Diaz et al., 2007).

Despite the generous contributions of companies associated with the licensing of large infrastructure projects, like large hydroelectric plants, understanding how the construction of these projects will affect Amazon biota in the long term is still complex. To do so, more robust data are needed for the fauna and flora, obtained in a systematic and standardized manner, so as to

make these data comparable. However, knowing the distribution of the species is not enough to model the effect of the environmental changes resulting from human activities, since one would have to understand how the environmental variables affect the biological communities. This should be the function of the EIA/RIMA. With this type of data, it should be possible to predict more precisely the effects of the project on Amazon biota. Unfortunately, political decisions tend to overlook technical issues, thus compromising the biodiversity, and life on this planet.

### 3 Characterization of biotic environment

The study conducted for the licensing of the São Luiz do Tapajós Hydroelectric Project is the result of work by over 300 people, including coordinators, researchers and field assistants. These results were presented in 25 volumes totaling approximately 15,000 pages that compose the Environmental Impact Assessment (EIA), and, in a summarized version, the Environmental Impact Report (RIMA). Despite the technical and methodological criticisms presented in this document, the data of the EIA are impressive due to the large diversity of species recorded in the region. The inventories of the biotic environment include the recording, in the area of study, of 1,378 plant species, including trees, vines, palms, epiphytes, approximately 600 species of birds, 352 species of fish, 109 species of amphibians, 95 species of mammals, 75 species of reptiles, and others.

Many of the species recorded are endemic to the region, while others are threatened with extinction, and a significant portion of them inhabit environments that are directly impacted by the project (alluvial forests, rocky soils, beaches), which according to the analysis by the authors who participated in the drafting of this report were not adequately sampled. Not to mention the new taxa discovered during the fieldwork, which include possible new species of primates and birds, which run the risk of disappearing without ever having been described or formally recognized by science.

The results presented in the EIA show in an unequivocal manner that the Areas Directly Affected (ADA), under Direct Influence (AID) and Indirect Influence (AII) of the São Luiz do Tapajós Hydroelectric Project are located in a region endowed with extraordinary biological wealth, with unique and irreplaceable habitats and plant and animal species.

### 4 Critical analysis

The critical analysis of the researchers involved in this assessment detected serious problems in the EIA/RIMA, which compromise any analysis or decision made by the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA), as the licensing agency. The greatest weakness detected in the EIA is that although it performs a relatively complete diagnosis of biodiversity of the area, the report did not adequately evaluate the potential impacts of the project on traditional communities (indigenous and riverside), or on the fauna and flora.

#### The main weaknesses found in the EIA were:

- 1 absence or omission of information fundamental to the evaluation of environmental impacts;
- 2 a sampling design that is inadequate and insufficient for the sampling of biological groups that will be most impacted by the project;
- 3 use of inappropriate or outdated methodologies;
- 4 an inadequate analysis of data collected in the RAPELD sampling system;
- 5 lack of predictions of expected impacts;
- 6 superficial and/or inadequate proposals suggested to minimize the negative effects of the project on fauna, flora and traditional communities. These issues were evaluated specifically for each of the groups mentioned above and are presented in chapters 1 to 9. The RIMA on the other hand was clearly used as a marketing tool. In both cases, the final conclusions point to the socio-environmental viability of the project, but its impacts were not correctly assessed.

#### 4.1 Traditional and indigenous communities

The socio-economic component was treated in a tendentious and incomplete manner with regard to impacts on traditional populations, and illustrates the fragile nature of the protection the licensing system provides for the people of the forest who directly use the resources that will be most affected by the construction of a hydroelectric plant. As is common in the drafting of an EIA, there is a tendency to minimize or ignore significant impacts. The study presumes that the river and its resources, like fish, will remain essentially unaltered, and that the rates of deforestation will fall, indicating that the traditional and indigenous communities have no reason to worry about their means of subsistence. Reconstruction of the highway BR-163 was ignored by definition, because it is not considered a new highway, and the social impacts expected and common to large construction projects, such as prostitution, drugs, alcohol and crime, were not discussed in the manner they merit (Chapter 1).

It is known that Brazilian government's prioritization of hydroelectric projects on the São Luiz do Tapajós has resulted, not only in the decision to degazette large areas of federal conservation units, but also to block the creation of the Sawré Muybu Indigenous Land of the Munduruku, who live on part of the area to be flooded, and an sustainable use reserve for use by riverside communities. Surprisingly, the EIA emphasizes a law enacted under the military rule: *"It must be stressed that the federal government can intervene in indigenous areas to carry out public works of interest to national development,"* instead of emphasizing the legal protection of the indigenous peoples and other groups, provided for in the Federal Constitution of 1988, where: *"The removal of indigenous groups from their lands is prohibited, except ....in case of a catastrophe or epidemic that puts the population at risk, or in the interest of sovereignty of the country .... ensuring, regardless of the circumstances, immediate return as soon as the risk subsides"*.

The EIA also endorses one of the most notorious schemes of land grabbing in the Amazon, by presenting a map of the area known as the Montanha-Mangabal, showing the land claims of the company Madeiras L.B. Marochi Ltda., known as Indussolo, which usurped over one million hectares of public lands, over which the Federal Public Ministry lodged a Public Civil Action (MPF-PA, 2006), decided in favor of the riverside dwellers on June 16, 2006, indicating the invalidity of the claims made by Indussolo. The text emphasizes the predominance of large properties in the area

controlled by the company as an advantage, since it would reduce the number of properties that would be flooded and, therefore, avoid the need to relocate the communities present there.

In addition to being incomplete and tendentious, the document on the indigenous component was added to the EIA as an annex, a number of months after the rest of the report had been completed, suggesting the low priority given to this subject. Even the study itself stated that it, *"did not fully follow the methodological processes, as announced in the plan presented,"* since the team did not receive authorization from National Indigenous People Foundation (FUNAI-DF) and the *Munduruku* to enter the indigenous lands. In this manner, the study on the indigenous component was restricted to speaking with some *Munduruku* (apparently elementary school teachers) while the anthropology team remained in Itaituba city.

#### 4.2 Dynamics of mercury

The data presented in the EIA as a result of the sampling campaigns carried out in the field are of questionable quality and, in many cases, unusable. One of the biggest problems was related to the concentration of total mercury (Hg total) in the water, which was determined by four different companies and a university group, using different methodologies, in most cases making them completely inappropriate (see Chapter 3). Only the data from the group from the Federal University of Rio de Janeiro (UFRJ) were generated correctly and can be considered reliable. However, these data were not evaluated in a biogeochemical and epidemiological context, since the authors limited themselves to making comparisons with limits established by the National Environmental Council (CONAMA) for drinking water, which is not an appropriate parameter for this type of study.

In addition to the low quality of the data and the lack of appropriate analysis, mercury data was also not integrated with other components of the physical environment, essential for the analysis of its impact. The lack of information on the other hydroelectric plants planned for the Tapajós Basin (7 inventoried, 5 of which are planned), hampered an integrated analysis of impacts. Information about the current dynamic of total and methyl mercury in the system during the different phases of the flooding cycle was incomplete. New data collections will be needed to obtain information regarding the other dams planned upstream from the São Luiz do Tapajós Hydroelectric Plant.



### 4.3 Inventories of flora and fauna

The inventories of the components of flora and fauna appear very heterogeneous, varying in their efficiency, reliability and usefulness to evaluate and predict the impacts on biodiversity. This heterogeneity is associated with the quality of the study and possibly with the technical ability of the researchers in charge of each taxonomic group. The inventories can be divided into groups that were relatively well done, like terrestrial vertebrates in general (amphibians, reptiles, flightless mammals and birds) and others considered inadequate or weak (bats, fish, benthic invertebrates, and terrestrial and aquatic flora). The diversity of the latter groups was underestimated as a result of a variety of problems that include the use of inappropriate sampling or methodologies, insufficient sampling efforts, and lack of specialists capable of identifying species correctly. For the plants, the approaches were designed for forest management, and not for the evaluation of impacts on their diversity. Specific criticisms of the inventories for each taxonomic group can be found in Chapters 3-9.

## 5 Technical and methodological weaknesses

### 5.1 Sampling design

The Term of Reference (TdR) agreed and drafted by IBAMA for the biotic environment of the terrestrial ecosystems (amphibian, reptile, mammal, bird and insect bio-indicator species) stipulates a robust sampling design to evaluate the potential impacts of the project to be licensed, following the RAPELD methodology (Magnusson et al., 2013), which has shown itself to be effective in evaluating impacts in other projects, like on the Madeira River (Fraga et al., 2014; Dias-Terceiro et al., 2015).

The RAPELD modules use 2 lines of 5 km with at least 10 plots (5 per transect) as standard. An acceptable justification to reduce the number of transects per module, from 2 to 1, would be the need to increase the coverage for the same effort in the field. However, the sampling intensity was reduced from 10 sampling modules and 14 transects to only 11 transects (a decrease of over 20% in the sampling), without an offsetting increase in spatial coverage. The four unpaired sampling modules stipulated in the TdR should have 2 transects each, but did not.

One of the most serious flaws in the sampling design was the fact that all of the transects had been exclusively established upstream from the dam, resulting in a lack of standardized samples for these groups downstream from the project, which will also be directly and indirectly impacted by the project (see Section 7 - Delimitation of area covered by the EIA). A second serious flaw is the fact that the plots along the transects had been placed initially on dry land (km 0.5), and not along the riverbank (km 0), excluding riparian areas (precisely the areas that will be potentially affected by an increase in the level of the river as a result of the flooding caused by the São Luiz do Tapajós Hydroelectric Plant). Subsequent changes in the delimitation of the transects would have partially corrected this problem (Technical note no. 93/2012 - COHID/CGENE/DILIC/IBAMA), but, after having reduced the number of transects and plots, it is clear that the alluvial forests remain undersampled.

In contrast, the plots of communities present in riparian environments (river, flooded forest, river islands, rocky soils) were not as well sampled as the dry land forests. With a less robust design, shorter and poorly standardized sampling, the aquatic ecosystems were not investigated in an appropriate manner. Despite the inclusion of two plots per island, this standard was apparently not used by all the teams in the field. As such, due to the fact that some groups used different methodologies, it was not possible to compare the results from the islands and riverbanks.

Moreover, in the same way the transects downstream from the project were not sampled, no river island from the project was sampled downstream. However, the retention of sediment could directly affect the dynamic of the river islands. The specific problems in the sampling design that affect the different taxonomic groups in different ways were included in Chapters 2-9.

### 5.2 Analysis of the data

In analytical terms, various aspect of the transects were evaluated in a completely inappropriate manner, with the use of the RAPELD method, which allows the use of spatial replicas per quota of flooding. The components of the EIA that used this sampling system decided to combine the data collected to create a single unit sample: the transect. This type of analysis represents an enormous loss of information, as well as misinterpreting the methodology chosen by IBAMA. In summary, there is no advantage in using the RAPELD system if the

data collected in the plots established along the transects (flooding gradient) is transformed into a single value (the sampling unit in this system should have been the plot, and not the transect). This flaw is especially relevant since the use of the transect, and not the plot as the sample unit, hampers analysis of the impacts along the flooding gradient, which should have been the main reason for the use of this methodology. Without this information, it is not possible to determine which species inhabit the flooded areas that will be affected, and which occur exclusively on dry land, and possibly will not be directly affected by the flooding caused by the dam.

The usefulness of this system is based on the possibility of correlating biotic data with abiotic data. Although the need to collect a series of environmental variables (like elevation, distance from the river, canopy density, level of the water table) is included in the TdR for each plot along the transects, these were not used in the analysis for fauna. In this manner, it is unable to relate the biotic environment with the environmental characteristics of the landscape, making it even more difficult to predict how the environmental changes could affect the biotic communities.

### 5.3 Omission of information

The analysis presented here suggests that information fundamental to the evaluation of the environmental impact of the project in question was omitted. As a result of the flaws in the presentation of data, no list of the most potentially affected species of plants and animals was drawn up (exclusive species in the largest flooded areas). As such, the EIA does not define in a clear and objective manner which species live exclusively in the riparian environments. Furthermore, little quantitative information is presented in relation to the animals present along the river, whose habitats will disappear with the construction of the dam.

The most important omission of information is related to the identification, diagnosis and prediction of impacts on fauna and flora. In Vol. 23 (Tomo I) of the study the possible impacts of the enterprise are presented. They are divided according to the environment (physical or biotic) and according to a series of criteria and evaluation objectives. The content of the impacts on the biotic environment were classified as first-order impacts (impacts directly and immediately related to the generating factor), and second and third-order impacts (impacts indirectly correlated to

the generating factor, but that would be relevant to the formulation of mitigating or compensatory programs).

Unfortunately, the data presented in the EIA are of little use to evaluate the potential impacts of the project, since the species that could be affected by the hydroelectric project were not explicitly identified for the vast majority of the groups. The local populations, society, the public ministry and licensing agencies need to know how many and which species are likely to disappear locally and regionally in the different stages of the project. This information was not presented for most the biological groups, despite having been included in the term of reference (TdR) presented by IBAMA.

A lack of spatial dimensioning of the impacts is also evident. In the current version of the EIA, it is not possible to predict the local, regional and global effects of the project. The study needs to clearly determine the species that could disappear locally, and which could be affected more severely on a regional and global scale. Since the plans for the Tapajós River hydroelectric project are not restricted to the São Luiz do Tapajós Hydroelectric Plant, a complete analysis of the future scenario including other projects is necessary (see Section 7 - Delimitation of the All of the EIA).

The number of endemic and threatened species needs to be reviewed. It is fundamental that a revised version of the EIA include the most recent list of species of animals and plants threatened with extinction in Brazil (Administrative Order no. 444, of December 17, 2014). As a comparison, the number of taxa of birds endangered by some degree rose from 3 in the EIA/RIMA to 12 on the new Ministry of the Environment list. Especially worrisome is the presence of species not yet described, and apparently restricted to the Tapajós Basin. Among them are some mammals, including primates, a species of bird that is expected to be elevated to the level of species, and various specimens of frogs collected in the study area. How will the São Luiz do Tapajós Hydroelectric Project affect the species not yet described (and possibly rare and already endangered)? These taxa require quantitative analysis to evaluate the risk of them becoming extinct as a result of the construction of the São Luiz do Tapajós Hydroelectric Project and the other hydroelectric projects planned for the basin.

A detailed analysis of the EIA reveals that there is a large gap between the quality of the material presented in the inventories and the prediction of impacts of the project. It is suspected that those in charge of the themes were not asked to predict possible impacts, since there are no details of

species that could be affected. This is the most important part of the document, and the most incomplete. And as such, the study serves more as a biological inventory than as a report predicting environmental impact, to enable the development of mitigating measures.

With regard to the TdR signed by the parties, there are various questions that were not included in the EIA: a) areas not evaluated include alluvial forests, rocky soils and beaches that will not be affected by the project (TdR, 5.3. Biotic Environment, ponto 117); b) the environmental co-variables collected in the sample units were not associated with the biological groups (TdR, 5.3. Biotic Environment, ponto 118); c) the Jamanxim River was not evaluated as a geographic barrier for birds (TdR, 5.3.2 Terrestrial Ecosystems, ponto 127); d) current models of the occurrence of species were not presented in areas directly affected, and data for composition, abundance and environmental variables obtained in the sampling units were not used (TdR, 5.3.2 Terrestrial Ecosystems, ponto 129); e) the environmental bio-indicators selected for the purpose of monitoring are superficial and generic (TdR, 5.3.1.1 Fauna, ponto 133); f) potential areas for the purpose of relocation of recoverable fauna were not identified for any phase of the project (TdR, 5.3.1.1 Fauna, ponto 135); g) species that would be most impacted by the project were not presented, nor was the concept of irreplaceability of habitats incorporated (TdR, 7.3.1. Terrestrial Ecosystems, ponto 269); h) predictive models for the occurrence of species were not presented, considering the flooding of the reservoir (TdR, 7.3.1. Terrestrial Ecosystems, ponto 271). Specific details regarding fundamental data were not presented for any group in particular in Chapters 1-9.

## 6

## Mitigating or compensatory programs and measures

The specific actions for the biotic environment are contained in the Conservation Plan for Biodiversity and Natural Ecosystems. Under this plan, there are three Programs:

- 1** Program for Deforestation and Cleaning of the Intervention Areas (PDL) in the Directly Affected Areas (ADA);
- 2** Program for Integrated Management and Conservation of Terrestrial Flora and Fauna (PMICFF);
- 3** Program for Environmental Compensation.

The environmental measures and programs cannot be considered adequate. The specific actions for the terrestrial fauna, for example, can be found in the Conservation Plan for Biodiversity and Natural Ecosystems. Under this plan, there are three Programs: 1) Program for Deforestation and Cleaning of the Intervention Areas (PDL) in the Directly Affected Areas (ADA); 2) Program for Integrated Management and Conservation of Terrestrial Flora and Fauna (PMICFF); and 3) Program for Environmental Compensation. Within the Program for Deforestation and Cleaning of Intervention Areas in the Directly Affected Areas, two projects apply to fauna: 1) the Project for Deforestation and Removal of Terrestrial Fauna and 2) The Project for Rescuing and Scientific Utilization of Fauna. Although they are important, none of the projects have significant positive consequences for the fauna. The first project is designed to “reduce the need for rescuing fauna, by encouraging their spontaneous exit or driving them out by guided deforestation and monitored by surveillance and fauna rescue teams, reducing the stress caused by rescue, the costs of operation and expanding the success of the projects aimed at conserving fauna.” These are the plans to mitigate the effects of the project: driving away animals so that they can move to other areas, which are already saturated by existing populations, as explained in the EIA (Vol. 24, Tomo 1, pag. 210):

*“However, the adaptation to new habitats does not depend only on passive displacement to similar areas nearby. In the case of terrestrial species, a sudden increase in the density of population inside the surrounding areas is expected at first. Population will then tend to fall, due to a decrease in available resources, since the increase in the density of animals will lead to an increase in disease and competition for food resources and space, consequently shrinking populations and reducing the local diversity in the medium or long term (TOWSEND et al., 2006). Evidently this depends on the degree of saturation of the landscape.”*

In view of the low expectation for success of driving the fauna to other locations, the same program includes the Project for Rescuing and Scientific Utilization of Fauna, which is designed to promote monitoring, rescue and relocation operations for animals, in order to reduce mortality during the construction phase of the São Luiz do Tapajós Hydroelectric Project, and also use the specimens that cannot be rescued alive or that are severely injured to the point of compromising their survival to further science. In other words, rescuing them would be an active version of driving them away,



which as mentioned is not very successful in the long term. The scientific collection of individuals in nature is important and appropriate for this type of situation, but it cannot be included in programs whose objective is to minimize the negative effects of a project on fauna.

One of the projects of the Program for Integrated Management and Conservation of Terrestrial Flora and Fauna is the Monitoring of Terrestrial Fauna, which is designed to use bio-indicators to evaluate changes in the populations during the phases of construction, flooding and operation of the plant. This program is generic and superficial and has nothing to do with the data collected in the field by the technical teams. For example, the groups suggested for birds include, *“birds of the understory, restricted or not to the alluvial forest, large predators of the overstory, frugivores of the canopy and the forest floor, pollenizers and species that reproduce on beaches and sandbanks”* (Vol. 24, Tomo I, pag. 266).

In the case of the birds, the suggestion of the target groups leaves open the type of species that will be evaluated. The denomination *“birds of the understory, restricted or not to the alluvial forest”* is not particularly useful, and is not in keeping with the efforts of almost 3 years in the field to evaluate the potential consequences of one of the most controversial projects of the entire Growth Acceleration Program (PAC). This type of suggestion is repeated for the different groups, and shows a lack of commitment in the final development of these programs.

However, if monitoring is fundamental to understanding the effects of the construction of a hydroelectric plant on biota, it would be useful to take advantage of the lessons learned from other projects, such as the Jirau and Santo Antônio hydroelectric plants on the Madeira River (Lima et al., 2010-2014), and propose measures to minimize the damage that will be caused in the different groups. The EIA should serve as a guideline for the activities and programs that will be carried out over the next 12 years. But it certainly does not appear to fulfill its role of evaluating and providing information for future activities designed to minimize and monitor fauna.

The Environmental Compensation Program contains two associated projects: 1) Project to Support Implementation or Management Activities for Conservation Units; and 2) Project for Conservation of Threatened, Endemic and Priority Species. The first project is regulated by the Federal Constitution (Law no. 9.985, of July 18, 2000 which regulates art. 225, § 1, subparagraphs I, II, III and VII). The project agency must comply with pre-established rules. The Support for Implementation

or Management Activities for Conservation Units is fundamental and of vital importance if the project is carried out. The study and conservation projects for endemic and threatened species are important, but they should be adjusted to include new taxa that were not present on the threatened species list used in the EIA, but which are contained in the most recent list (MMA, 2014; Administrative Order no. 444, December 17, 2014). Some endemic and/or priority conservation species are listed or mentioned in the EIA in a superficial manner, and were not evaluated in detail. Specific analyses of each biological group evaluated were included in Chapters 3-9.

In general, expected impacts were minimized and relativized in the document, favoring programs whose benefits clearly would not be able to prevent the deleterious effects on fauna and flora (for example, the program for deforestation and cleaning of the reservoir as a measure to minimize the disappearance of key resources in the flooded forests). The cleaning of the reservoir is important before the flooding begins, but this activity has nothing to do with the disappearance of key resources in the region.

## 7 Delimitation of the area covered in the EIA

Although this is not an issue associated with the EIA/RIMA evaluated here, there are three serious problems in the current geographic coverage of the study:

- 1 the construction works planned for the Tapajós and Jamanxim rivers include other hydroelectric plants, which will have cumulative impacts.
- 2 the project to transform the river into an industrial waterway makes practically all of the mitigating measures of this hydroelectric facility in particular impracticable.
- 3 the effects of one hydroelectric plant are felt both downstream and upstream.

The EIA for the São Luiz do Tapajós Hydroelectric Plant Project cannot be evaluated on its own, since its effects will depend on other works planned for the basin. And the plans for the construction of the dams in the Tapajós Basin are extremely ambitious and worrisome from a socio-environmental standpoint, and will completely and definitively changed the landscape of one of the most biodiverse regions in the world. At

least 43 large plants (with over 30 MW of installed capacity) are being built or planned for this basin (Brazil, MME, 2013; Fearnside, 2015). Numerous small hydroelectric plants (with up to 30 MW of installed capacity) are also being planned, but these are exempt from EIA/RIMA, in accordance with Normative Resolution no. 343/2008 of the National Electric Energy Agency (ANEEL). In addition to the São Luiz do Tapajós Hydroelectric Plant, two large dams were inventoried on the river (Jatobá and Chacorão), and another 39 on their tributaries (4 on the Jamanxim River, 7 on Teles Pires and 28 on the Juruena River and tributaries).

Plans by the federal government for the Tapajós Basin go beyond the construction of these projects, since the overriding objective is to transform the river into an industrial waterway, and a key part of the “shipping hub” for the Growth Acceleration Program (Brazil, MT, 2010), whose ultimate objective is to ship soybeans produced in Mato Grosso to the Atlantic Ocean, where they can be sent to the main consumer markets, like China (Fearnside, 2014). As such, the official plans are to complete the chain of dams along the river and its main tributaries, including the São Luiz do Tapajós Hydroelectric Plant, which is being evaluated in this document, but which represents a necessary step for the passage of ships around the natural obstacles of the river (rapids and waterfalls). The construction of locks for the crossing of vessels is provided for in the EIA evaluated. In order to facilitate this project, the priorities and timetables presented in the 10 Year Energy Expansion Plan have continually changed.

In summary, it is not possible to evaluate the effects of the São Luiz do Tapajós Hydroelectric Plant without taking into consideration the official plans for transforming the Tapajós River into a series of lakes for navigation, where the flooding cycle and other natural characteristics of the river will be modified drastically. This situation is especially relevant in the context of the mitigating and compensatory measures present in the EIA/RIMA, since the natural environments suggested for preservation will be affected by the project as well as by other projects not included in this EIA. This situation is the same as promising to pay a debt with money that you already know will be spent on other things. In technical terms, for example, it is known that the concentrations of mercury are cumulative and cannot be evaluated independently.

The river permanently floods the lakes generated by the dams, resulting in the loss of habitats above the hydroelectric plants. While the panorama downstream from the dams is completely different and is related to the opposite effect:

lack of water and interruption of the flood pulse. Although the flooded forests and all of their associated habitats are adapted to remain below the water for a number of months every year, the vegetation of these forests dies when flooded permanently. Likewise, adaptations to flooding provide competitive advantages over plant species that cannot tolerate flooding (species typical of dry land), which would lead to a slow, but predictable, substitution of the biotic communities in the areas that no longer flood according to the flood pulse. For this reason, the lack of studies in the context of the EIA/RIMA downstream from the project is unacceptable. In its evaluation, there was no standardized sampling of fauna and flora below the dam. None of the transects carried out were inserted downstream from the São Luiz do Tapajós project site, and there are no predictions about the effects of the project for the stretch of river that will not be flooded, but will be impacted by the work in question.

## 8

### Omission of data presented to the public: EIA/RIMA

The RIMA is a document that plays an important role in decision-making for the construction of projects that may impact the environment and the human beings that inhabit it. The environmental licensing process must necessarily involve the participation of different parts of society, and the RIMA is the means of communication between those who draft the EIA (hired by the project company) and society and decision makers, who many times do not have the technical expertise that would allow them to understand and evaluate a technical document like the EIA. However, although it is in the company's interest to convince the public and other stakeholders of the benefits of the project in question, the RIMA cannot omit information.

In this case the document is extremely tendentious, summarizing in just a few lines results presented in various volumes. This is a manner of withholding fundamental information from decision makers, such as the presence of species that are endemic, threatened and restricted to the stretches of the Tapajós River that will be seriously impacted by the project.

For example, regarding species of amphibians and reptiles, the RIMA reports that “Most do not fit into any endangered category and only one species of toad is classified as vulnerable to extinction,” omitting the fact that 16 possible new species



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(still undescribed) were found, whose distribution may be restricted to the region of the project and whose respective endangered status has not been evaluated by the International Union for Conservation of Nature (IUCN), due to the fact that they have not been classified and named. Regarding turtles, in the RIMA it says that "... the entire area studied is considered of low relevance for the reproductive stage of these animals," but the EIA emphasizes that the reproductive season of the tracajá (*Podocnemis unifilis*), the most abundant turtle species of the area and regionally endangered, was not covered by the sampling period. In the report there is no detailed information on the potential impact of the project on the biota, nor any mention of new species discovered in the fauna sampling.

Therefore, in the opinion of all the researchers that reviewed the different themes, the RIMA presented by the project administrator does not comply with its function to correctly inform society about the impacts of the project and should be disqualified.

## 9 Conclusions

### The critical evaluation of the authors showed that:

- 1 The treatment of the impacts on indigenous and riverside communities is incomplete and tendentious, omitting or minimizing impacts and highlighting the supposed benefits of the project.
- 2 The characterization of the biotic environment of the project area was heterogeneous in relation to the different taxonomic groups, with some groups well sampled and others insufficiently evaluated. The fauna component (birds, amphibians, reptiles, and flightless mammals) was relatively well sampled with regard to its composition of species (inventories), but other groups (fish, bats,



bio-indicator insects and vectors of diseases, aquatic invertebrates, terrestrial and aquatic plants) will possibly need additional fieldwork.

- 3 The characterization made, even for the best sampled groups, enables the identification of the species present in the areas under the influence of the project, but the analyses presented were not sufficient to predict the potential impacts of the project on the fauna and flora (lists of species that will become extinct locally and regionally are not presented). In relation to the components of the biotic environment, the EIA presented is more an inventory of species than an actual impact study.
- 4 Due to the analytical and methodological flaws, the document presents an incomplete prediction of impacts, and lacks the appropriate dimensioning or technical basis to determine the real effects of the project. An analysis of the EIA does not allow for dimensioning of local, regional and global losses of species due to the project proposed.
- 5 As a result of the weaknesses mentioned, it is impossible to propose appropriate programs and projects to minimize or prevent the impacts in an effective manner. The programs presented are insufficient and in many cases, unrealistic. In addition, plans for other hydroelectric plants in the Tapajós Basin, in addition to an industrial waterway, makes many of the environmental programs proposed impracticable, especially those that rely on other stretches of the river to preserve part of the biodiversity lost as a result of the flooding and modifications of the natural environments.
- 6 It is not possible to evaluate the environmental impacts of the large projects planned along the river (including an industrial waterway) individually. The impacts will be cumulative and local losses in biodiversity in the area surrounding a project can mean regional and/or global losses. The negative effects on aquatic species, alluvial forests, rocky soils, and beaches need to be evaluated in a future context, including the other projects.
- 7 The RIMA appears to be marketing piece and not a tool to disseminate information. It omits important information, minimizes and ignores significant impacts, and concludes, without a sound technical basis, the socio-environmental viability of the project.

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