



OBSERVATÓRIO  
**BR-319**



## TECHNICAL NOTE

No. 05 | August 2023

# Facing challenges of rebuilding the highway that crosses the heart of Brazilian Amazon

Scenario analysis and conservation  
mechanisms for mitigating the impacts  
around BR-319 Highway

## TECHNICAL NOTE

No. 05 | August 2023

# Facing challenges of rebuilding the highway that crosses the heart of Brazilian Amazon

Scenario analysis and conservation mechanisms for mitigating the impacts around BR-319 Highway

## Introduction

BR-319 (or Manaus-Porto Velho Highway) is the only terrestrial link between the state capitals of Amazonas and Rondônia (Manaus and Porto Velho, respectively). With its 885.9 kilometers, this road is the only way to connect Amazonas capital with South and Southeast regions by land. It was opened in 1970 but, due to difficult soil conditions (unstable clay, recurrent landslides), low economic importance, and high rainfall, the road quickly degraded and was abandoned in 1988 (P. Fearnside & de Alencastro Graça, 2006). Since then, only short sections of its southern and northern ends were reconstructed and paved until a “maintenance” program made it marginally passable just in 2015 (Scherer, 2021).

This road’s reconstruction and paving have been justified on the “rational” expectation that Rondônia would be able to reduce transport costs for its fish farming and agricultural chains because it would guarantee access to the markets of various municipalities along the road,

and to the Manaus metropolitan area. Currently, a large part of the meat exported by the state goes by land to the ports of Brazilian southeast (Meirelles et al., 2018), through the BR-319, the cargo coming from Rondonia could flow through the port of Manaus, lowering costs, and also supply the local market. It is worth mentioning that the producers in Rondônia have a competitive advantage in relation to those



Figure 1 - Topological model of BR-319 Highway.

in Amazonas due to their greater access to economic incentives. In a broader sense, the main idea is enhancing the insertion of remote areas in the region into national, regional and global markets and the promise of generating employment and growth.



***“Opening up highways is the main factor driving habitat loss in the Amazon.”***

*Wildlife Conservation Society*

Some academics, environmentalists, and a broad sector of civil society agree that this situation is perhaps Brazil's most significant conservation issue today. The problem is due to negative impacts already evident because of land speculation and deforestation for establishing and defending land tenure (P. Fearnside, 2015) but mostly to potential impacts<sup>2</sup> (P. M. Fearnside & de Alencastro Graça, 2006) that would result from the connection between these development poles through one of the best preserved areas of the Amazon forest.

Alarcon (2018) & Meirelles et al. (2018) documented the chronology of BR-319. It reveals the historical relationship between initiatives for reopening this highway, including dynamics of deforestation and establishment of socio-environmental conflicts. The historical review shows the tensions caused by environmental impacts and the rise of conflicts and irregularities around the studies that must be carried out to determine the feasibility of the project.

Since 2004, the Federal Government has promoted concrete actions to reconstruct the road (P. Fearnside & de Alencastro Graça, 2006). Since then, there have been all kinds of disagreements, even on the very conception of the type of intervention that will be carried out on the road, and therefore on the studies and licensing required. These debates have triggered an enormous institutional conflict and have left to date many public audits and conciliation meetings between all levels of the government (Alarcon, 2018).

Controversies were extended to the rigor of these studies and their efficiency in suggesting mitigating environmental impacts and ensure a sustainable development. Experts suggest that the current environmental licensing system in Brazil is very generic and imprecise in its requirements especially for the Amazon region (Ritter et al., 2017). The environmental impact studies (EIA) required in the licensing process are mainly descriptive and very little objective in identifying potential impacts and suggesting concrete mitigation strategies to guarantee the environmental conservation and to prevent or minimize social impacts of infrastructure enterprises, mainly on indigenous and traditional populations (Ferrante et al., 2020; Bernard et al., 2014; IBAMA, 2009, among others).

On July 28, 2022 – in pre-electoral times, it should be noted –, the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) issued to the National Department for Transport Infrastructure (DNIT) the Preliminary



License (LP)<sup>3</sup> for work in “Trecho do Meio”<sup>4</sup>. On the other hand, the BR-319 Observatory has expressed concern due to serious management problems regarding environmental licensing process. According to a Position Statement published on August 1, 2022, about the release of the Prior License for the Middle Section (Trecho de Meio) of BR-319, the Observatory manifested: *“the management of this process that explains that highway BR-319 has not been paved to date”*. In this statement, the organizations forum alerts that the licensing is being conducted in an *“irresponsible, wrong way and omitting stages”*, warns how the delay and lack of diligence is already detonating *“social conflicts, rights violations and environmental degradation in the Purus–Madeira interfluve region”*, and also an *“increase in all kinds of violence and illegalities”*.<sup>5</sup>

Fearnside & de Alencastro Graça (2006) warn that BR-319 would also significantly increase deforestation. Its planned side road gives access to a large rainforest area that can be cut down in the western part

of the state of Amazonas, far beyond the highway route. Carvalho Ribeiro (2021) highlights the paving of BR-319 Highway:

- provides greater access to untouched lands by both settlers and commercial interests;
- promotes extractive industries, such as logging and mining, thus influencing deforestation rates;
- contributes to the development of economic enterprises associated with deforestation, such as soybean cropping and cattle raising, which were previously not viable;
- increases risk of land speculation and activities such as illegal mining and fishing;
- contributes to forest fragmentation, increased fire risk, and spatial patterns of biodiversity loss;
- rises criminality impacts on traditional local livelihoods<sup>6</sup>.

Currently, while this document is being prepared, DNIT teams have “started the earthworks services of the paving and reconstruction works of the 32-mile segment in Lot C of BR-319, also called Charlie Lot, which goes from KM 198 to KM 250” (Mongabay, 2022).

Further paving improvements on BR-319 would facilitate migration from “Arc of Deforestation”, in the southern part of the Amazon region, to new frontiers farther north (Fearnside & de Alencastro Graça, 2006). In addition, the road upgrade can generate synergistic and cumulative socio-environmental impacts that will undoubtedly be represented outside the banks of the road. Therefore, it is highly relevant to fight against those impacts mentioned above to reduce their consequences.

In a context in which the precautionary principle has been ignored, and in which accelerated and unplanned transformations are occurring in the territory, WCS recognizes its role as part in this problem, beyond the mere irregularity reporting. As a member organization of BR-319 Observatory, WCS has proposed to carry out its own territorial and situational analysis and put on the table proposals for binding action to different society actors.



**“Roads play a key role in economic development, yet are among the major driving forces behind the destruction of ecosystems”.**  
(Sánchez, 2015)

### **What is the problem behind BR-319 Highway?**

Approximately 90% of BR-319 Highway direct influence zone is composed of pristine vegetation still exceptionally well preserved (Mataveli *et al.*, 2021). Repaving BR-319 middle section would bring deforestation to vast areas of what remains of the Amazon forest (Scherer, 2021)<sup>7</sup>.

### **What is the current situation?**

BR-319 is already a vector of deforestation and occupation of Amazonia without being completely paved (Lima *et al.*, 2022).<sup>8</sup> To date, the total paving resumption of the highway that connects Manaus to Porto Velho caused deforestation alerts to go up in the region<sup>9</sup>.

### **What can be expected with the construction of this road if impact mitigation actions are not carried out?**

Recent modeling performed by Soares-Filho Britaldo; Leroy Davis, Juliana; Raoni R. (2020) showed that this road repaving project will drive accumulated deforestation of 170,000 km<sup>2</sup> by 2050, a value four times higher than the one modeled considering the historical average deforestation rate of this region.

In the context of the BR-319, the risk of changing, identified as PADDD (Protected Areas Downgrading, Downsizing and Degazettement<sup>10</sup>), in the Conservation Units around it is especially worrying due to impacts of public lands illegal occupation and subsequent legitimization (FGVces, 2021). The main area affected by BR-319 is the Madeira-Purus interfluve. The area has one of the highest levels of species richness in the entire Amazonia (Py-Daniel *et al.*, 2007).

Along this technical note, the reader will find the progress made by WCS in its efforts to analyze scenarios and conservation mechanisms for conserving prioritized areas around BR-319 Highway. This document comprises five sections, and develops: 1) methodology and results of identifying and prioritizing intervention areas around BR-319; 2) mitigation and intervention strategy outline; 3) overview of public policies and related conservation initiatives present around BR-319; 4) analysis of conservation scenarios in areas identified as a priority according to BR-319 Highway background; and finally, 5) some recommendations.

# 1. Methodology and results of identifying and prioritizing intervention areas around BR-319

## Definition of study area

For this analysis, methodology by proximity was selected to define the study area (BR-319 influence area), and was carried out according to the following steps and conditions:

1. Sub-basins level 7<sup>11</sup> polygons were selected as analysis units, according to Amazon Aquatic Ecosystem Spatial Framework, produced by Science for Nature and People Partnership (SNAPP) and Amazon Waters Initiative (AWI) (Venticinque *et al.*, 2016). All sub-basins level 7 that present intersection with the BR-319 main route or its primary connections with current and planned secondary roads, present in Purus and Madeira rivers interfluve region, were selected for this study. A total of 442 sub-basins were used as functional units for the analysis.
2. Since the WCS work area is limited to the state of Amazonas, in Brazil, from the previous selection of sub-basins level 7, all the areas outside the state were deleted.

## The challenge: invest effort in strategy

The study area can be understood as an indirect outlining project area (it has approximately 235,000 km<sup>2</sup>). Within the bigger area, there are 14 protected areas (6 of them are federal<sup>12</sup> and 8 are in state of Amazonas charge<sup>13</sup>), 62 prioritized environmental areas to be protected<sup>14</sup>, and 51 – officially recognized – indigenous territories.<sup>15</sup>

Forty-nine percent of the total study area is under some form of environmental protection<sup>16</sup>. In addition, it is essential to

mention that the study area includes 10 municipalities (6 of them in the central Meso-Amazon region<sup>17</sup> and another 4 in Brazil's southern Amazon<sup>18</sup>). According to this data, the analysis submitted here aims to offer an extensive territorial/ regional approach stamp.

Figure 2 gives a quick look at the study area and the particular interest areas in BR-319 surroundings (state-protected areas, federally protected areas, and indigenous lands) considered in this analysis.

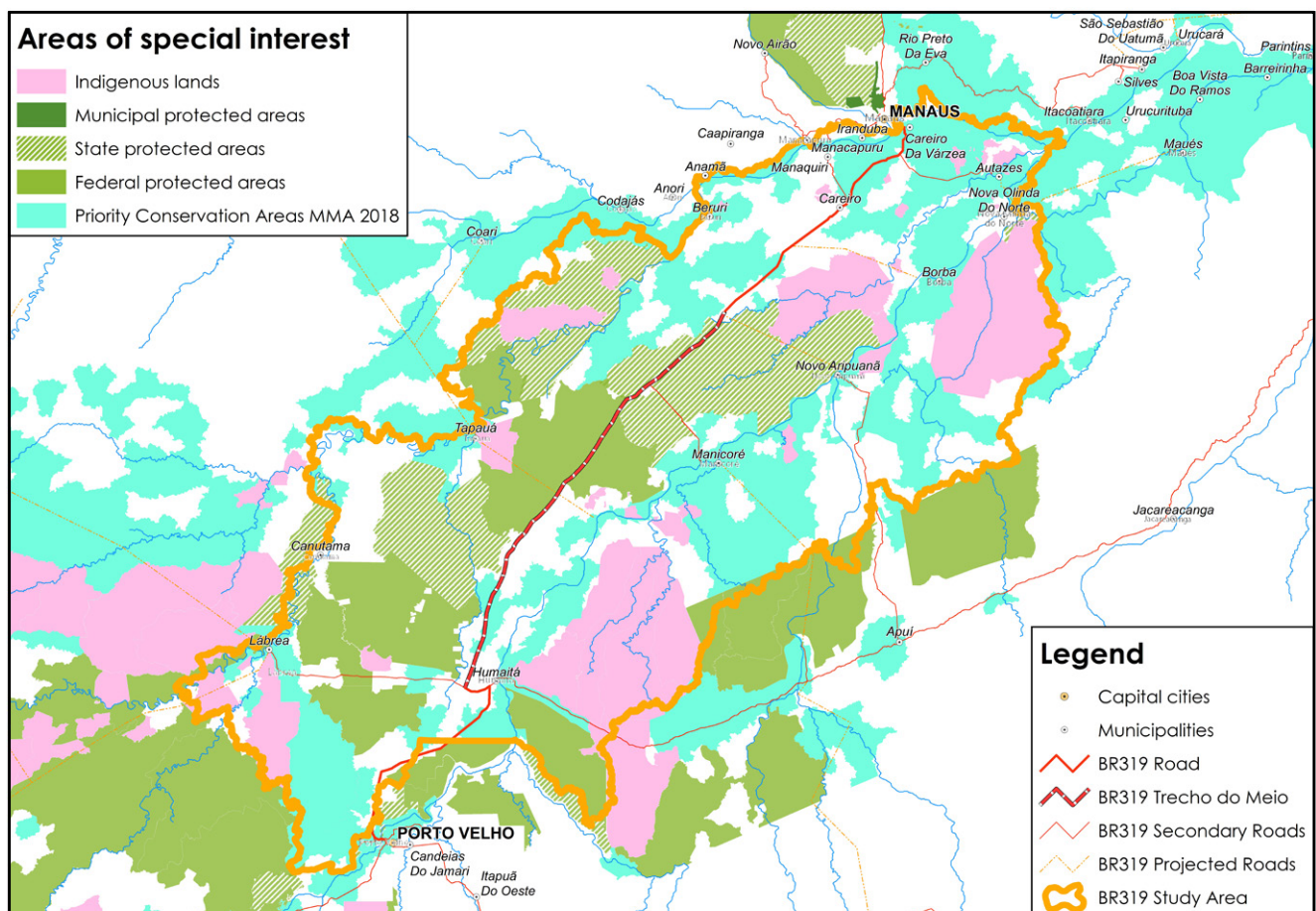


Figure 2. Areas of special interest

The figure above references the environmental and cultural importance sustaining the socio-environmental significance of this territory. It also illustrates the challenge magnitude for decision-makers which must guarantee adequate management of these territories and protection of their socio-environmental values.

Now, it is a fact that the entire study area has a high environmental importance, but due to its magnitude, strategic areas must be prioritized.

## Interest areas prioritization

For mapping priority interest areas, WCS team relied on a simple conceptual model composed of the following elements: Importance, Urgency, and Relevance.

In summary, what is expressed in the previous box means in defining priority interest areas the following criteria were taken into consideration: i) environmental characterization criterion to identify what is essential among what is important, ii) urgency criterion to detect the imminence of unwanted impacts occurrence in a particular area and iii) relevance criterion, obtained from overlapping importance and urgency criteria, which seeks to map priority areas to carry out intervention actions.

## Multi-criteria analysis scheme

Following the above, the relevance measure of a specific area<sup>19</sup> depends on importance and urgency criteria. Therefore, the multi-criteria scheme recognizes two large variable groups.

**Importance:** a measure representing the set of socio-environmental characteristics that reflects an area value or interest for its conservation.

In practical terms, Importance is constituted by variables representing species, ecosystem diversity, and some ecosystem services (carbon density or annualized fishing biomass) or ecological processes important for the long-term maintenance of basin biodiversity and species representation, including aquatic, wetland, and terrestrial indicators of biodiversity.

**Urgency:** a measure representing the set of situational characteristics that shows how urgent an action is needed in a specific area under the pressures and threats to which it is exposed. In other words, it shows the imminence of potential impacts occurrence due to BR-319 paving.

In practical terms, Urgency is constituted by variables representing all the impacts present on terrestrial, aquatic biodiversity and ecosystems directly related to BR-319 road.

**Relevance:** a measure that, for the purposes of this analysis, represents the product between what is important and, at the same time, urgent. Which, in turn, is equivalent to what is priority.

**Importance criteria** include variables of three thematic groups: i) forest and carbon, ii) ecological network, and iii) biological data; on the other hand, **Urgency criteria** took into consideration variables related to: a) deforestation and land use, b) land use and capability, c) conditioning anthropic factors in the territory, land tenure, pressures and threats (see Figure 3).

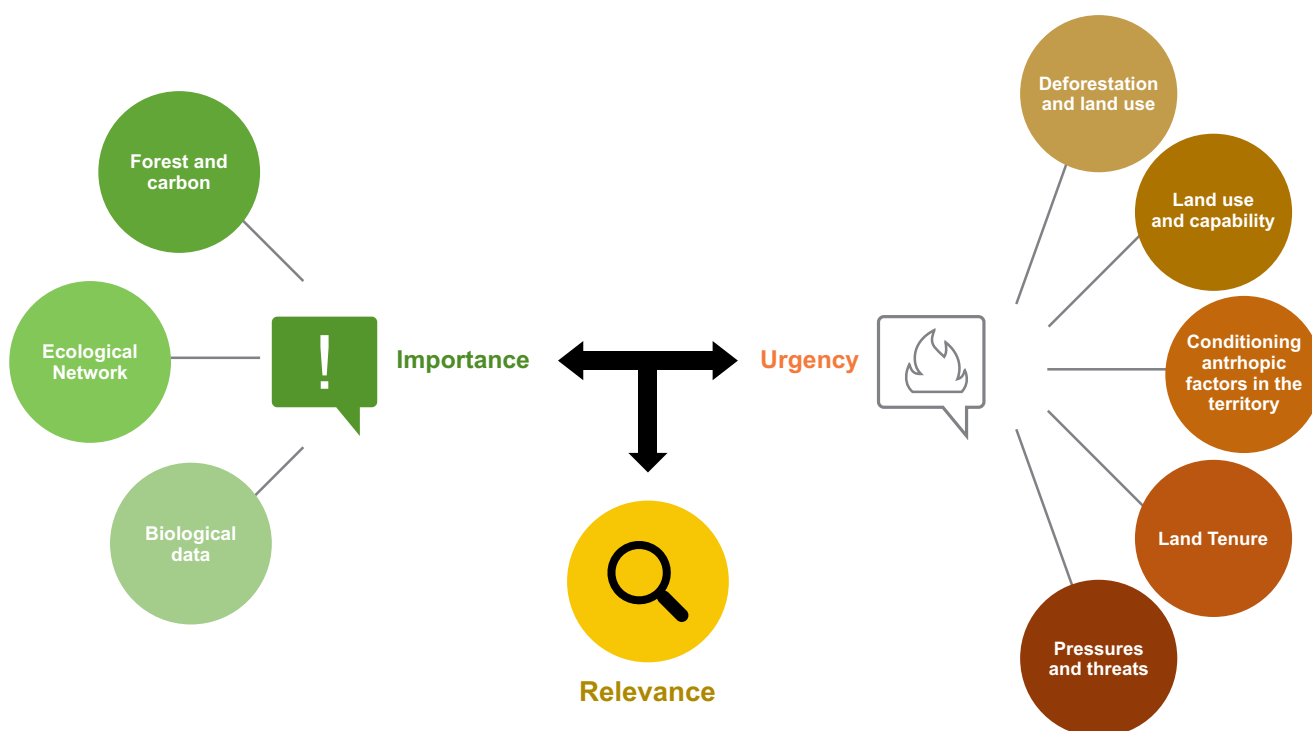
Once the representative variables of each criterion or group of variables are selected, a geographic database is created, and data processing is carried out in GIS environment. Synthetically, procedures used were: i) assigning weights to model variables using the Delphi method and ii) quantification of qualitative variables on a common rating scale.

The Delphi method was used to distinguish the representation level from each variable considered (in this case, the sub-basins

within the influence zone). For this analysis, five experts (WCS technical team members) assigned weights to the selected variables, using values from 1 to 3 according to their valuation of the variable representativeness of Importance and Urgency criteria. In the used rating scale, 3 represents the rating for a highly representative variable, and 1 illustrates not very representative (the weights assigned to each variable are referred to at the Tables 1 and 2).

Likewise, quantification of qualitative variables on a common rating scale is used to organize, read, code, and interpret data more practically. For this analysis, the assessment scale was homogenized<sup>20</sup> and five categories were established as follows:

- 1 = very low;**
- 2 = low;**
- 3 = medium;**
- 4 = high;**
- 5 = very high (Urgency/Importance)**



**Figure 3.** Schematic identification of interest areas. Importance, Urgency, and Relevance criteria.

For each of the 442 analysis units (sub-basins level 7) inside interest areas, a category was assigned according to its Importance and Urgency valuation. Thus, data integration on a common scale was possible, and the information was standardized in the same measurement unit.

## Model variables

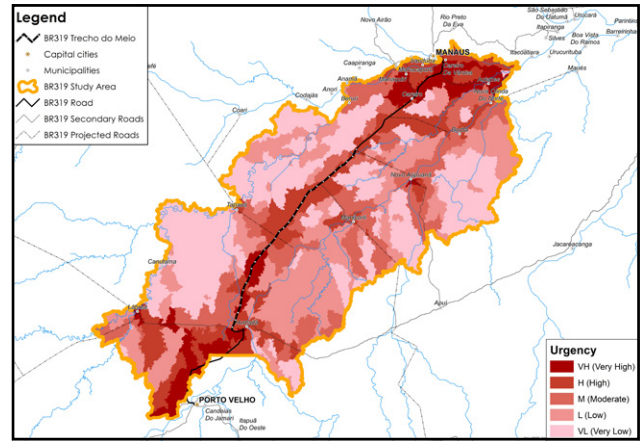
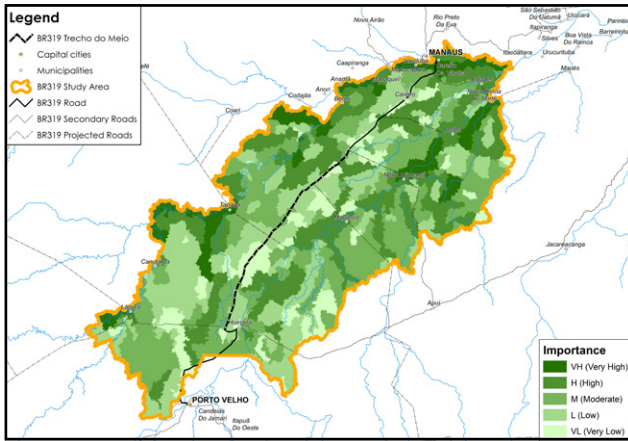
Variables selected as representative of Importance and Urgency criteria are listed at Table 1 below:

**Table 1.** Importance model variables.

VARIABLE TYPE	SECTION	GEOGRAPHIC DATA	AUTOR(S) / SOURCE(S)	YEAR	W
Forest and Carbon	Integral forest coverage (%)	Deforestation (2000-2019)	PRODES	2019	3
	Carbon density	Pantropical Biomass Map (National dataset of Aboveground Live Woody Biomass)	WHRC <sup>21</sup>	2012	3
Ecological network	Conservation priority areas	Conservation priority areas	MMA <sup>22</sup>	2018	3
	Ecologically important areas (river confluences)	Amazon aquatic ecosystem spatial framework / General nodes	SNAPP <sup>23</sup>	2013	3
	Strategic ecological connections	The potential for large-scale wildlife corridors between protected areas in Brazil using the jaguar as a model species.	JCF <sup>24</sup>	2014	3
Biological data	Endemism of natural ecosystems	Land ecosystems of South America	CAF <sup>25</sup>	2008	3
	Diversity of natural ecosystems	Land ecosystems of South America	CAF	2008	1
	Terrestrial fauna richness	Species distribution models	IUNC	2020	2
	Terrestrial threatened fauna richness	Threatened species distribution models	IUCN	2020	2
	Wetland diversity	Dual season mapping of wetland flooding and vegetation	Hess <i>et al.</i>	2019	1
	Aquatic species richness	Freshwater groups	IUCN	2020	2
	Reproductive female turtles	Giant South American river turtle <i>Podocnemis expansa</i>	Forero-Medina Germán <i>et al.</i>	2019	1

**Table 2.** Urgency model variables.

VARIABLE TYPE	SECTION	GEOGRAPHIC DATA	AUTOR(S) / SOURCE(S)	YEAR	W
Deforestation and land use change	Deforestation (%)	Deforestation (2021)	PRODES	2019	3
	Cumulative deforestation (%) (last ten years)	Deforestation (2000-2021)	PRODES	2019	2
	Projected deforestation (%) (2030)	Modeling conservation in the Amazon basin / projection business-as-usual (BAU)	Soares-Filho et al.	2006	2
Land use and land capability	Land use	Monitoring land use and cover in Brazil: 2016-2018	IBGE	2018	3
	Land capability	Monitoring land use and cover in Brazil: 2016-2018	IBGE	2018	1
Conditioning anthropic factors in the territory	Growth poles	WCS own information layer	WCS	2022	2
	Road infrastructure network	Road infrastructure	DNIT <sup>26</sup>	2020	3
	Urban Areas	Municipalities seats	IBGE	2020	1
	Road intersections with water network	WCS own information layer	WCS <sup>27</sup>	2013	2
Land tenure	Land tenure	Land network in Brazil, v. 1812	Freitas, F. L., et al.	2018	3
Pressures and threats	Mining concessions (#)	Mining concessions	RAISG <sup>28</sup>	2020	1
	Length of disconnected freshwater ecosystems	WCS own information layer	WCS	2022	2
	Wildlife run-over	WCS own information layer	WCS	2022	1
	Fires	Fires	RAISG	2020	3



**Figure 4.** Valuation of Importance and Urgency Criteria.

Figures 4, 5 and 6 have all the information above gathered in resulting maps where it is easier to look for important, urgent, and relevant areas to consider and then prioritize them as the project demands.

### What are the priority sites to act?

Once the attributes of the selected variables have been quantified on standard scales and weights, Importance and Urgency are mapped using map algebra operations and an additive algorithm. That is how the selected variables were summarized for each analysis unit (sub-basin level 7), generating a single result<sup>29</sup> for Importance and Urgency:

$$\begin{aligned}
 & \text{Urgency} \\
 & = \\
 & [(SW V1) * (Vurg 1) + (SW V2) * (Vurg2) + (... ) + (SW Vn) * (Vurg)] \\
 & \text{Importance} \\
 & = \\
 & [(SW V1) * (Vimp1) + (SW V2) * (Vimp2) + (... ) + (SW Vn) * (Vimpn)]
 \end{aligned}$$

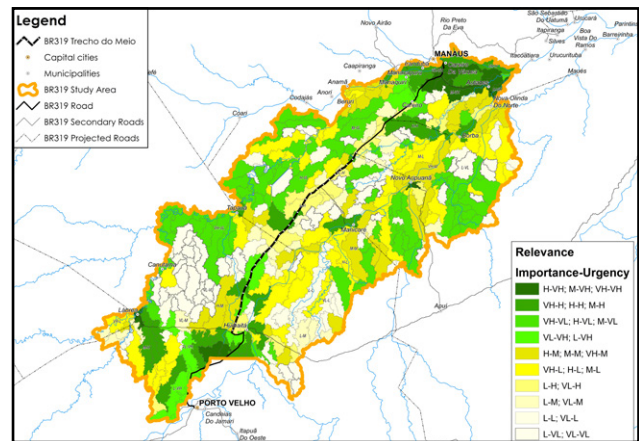
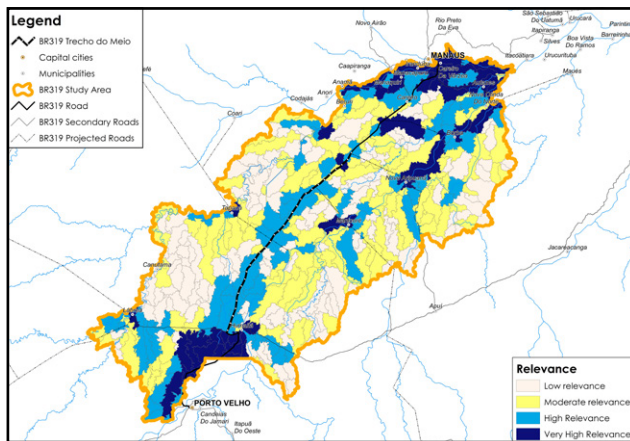
Subsequently, an estimate of Relevance is obtained by crossing Urgency and Importance layers. Then, two valuation systems are used:

$$\begin{aligned}
 & \text{Relevance} \\
 & = \\
 & (0.7) \sum_{(k=0)}^n (\text{Urgency}) + (0.3) \sum_{(k=0)}^n (\text{Importance})
 \end{aligned}$$

Finally, the above calculation resulted in the maps shown in Figure 4. The left-sided map presents the aggregated results of valuation for Importance criterion, and the right-sided shows the aggregated results of valuation for Urgency criterion.

The most critical areas (dark green) shown on the Importance criterion map (Green) point out the high or very high density of carbon, wetland or natural ecosystems diversity, and wetland cover percentage overlaps with other conservation priority areas, among other variables. Likewise, the overall outcome of the urgency criterion can be linked as an indicator of human pressure and a reference to potential negative environmental impacts. In this case, spots in heavy red are more likely to be affected by BR-319 pavement.

Subsequently, Figure 5 presents the Relevance mapping results using quantitative and qualitative representation criteria.



**Figure 5.** Valuation of Relevance Criterion (quantitative and qualitative approaches).

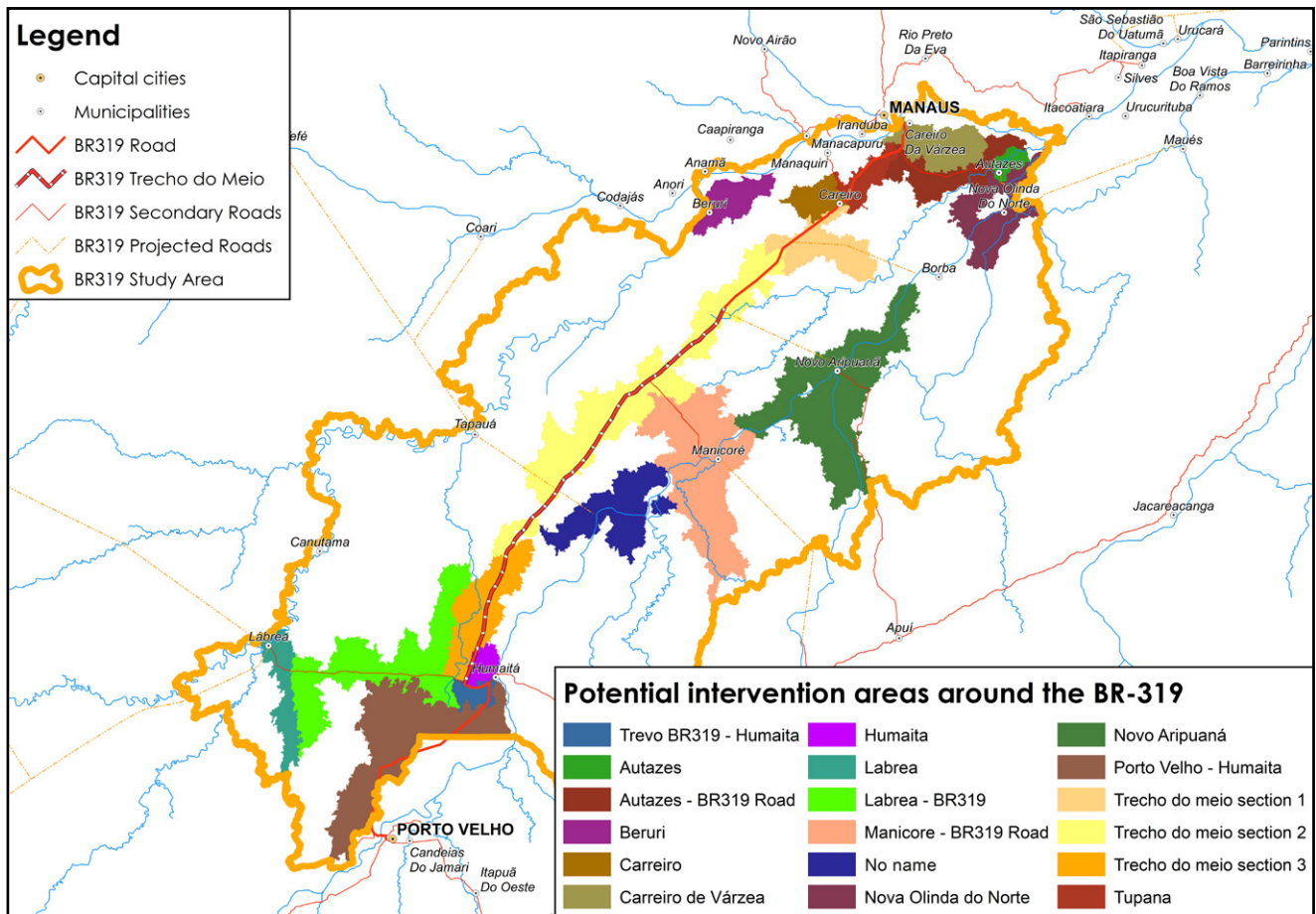
On the left side is a hotspot analysis of the quantitative intersection between Importance and Urgency criteria. The figure above clearly shows that highly and very highly relevant sub-basins gravitate around BR-319, where very highly relevant sub-basins concentrate in Manaus and Porto Velho surroundings, and highly relevant sub-basins are located across the “Trecho do Meio” Section. These results reflect the axes and vectors of current and latent territorial transformation.

On the right side, the map shows a qualitative representation of categorical criteria crossing. It combines qualitative valuations (Very Low, Low, Moderate, High, Very High) of Importance and Urgency, and assigns a valuation category to each sub-basin given by the arrangement of both estimates (e.g., Very High Importance – Moderate Urgency).

## 2. Mitigation and intervention strategy outline

Previous results allow obtaining an excellent quantitative approximation of the most relevant areas of intervention. However, as usual in multi-criteria methodologies, it is essential to ground the results to the context-specific reality of the analysis to identify: i) the intervention priority areas, and ii) the best conservation mechanisms to apply according to each area context.

With the above in mind, a zoning map was carried out based on i) the quantitative results of Importance, Urgency, and Relevance criteria; and ii) a grouping criterion according to the deforestation pattern identified (linear, nuclear, fishbone, etc.) and the focus or pressure vector (population centers, rivers main/secondary roads).



**Figure 6.** Potential intervention areas around BR-319 Highway.

As a result of the zoning process, **the WCS team identified 18 potential intervention areas** around BR-319 Highway that require immediate development of conservation mechanisms (see Figure 6).

To assess the priority of the proposed intervention areas, WCS team applied an impact mitigation logic in which roads are understood as the most representative disturbance factor.

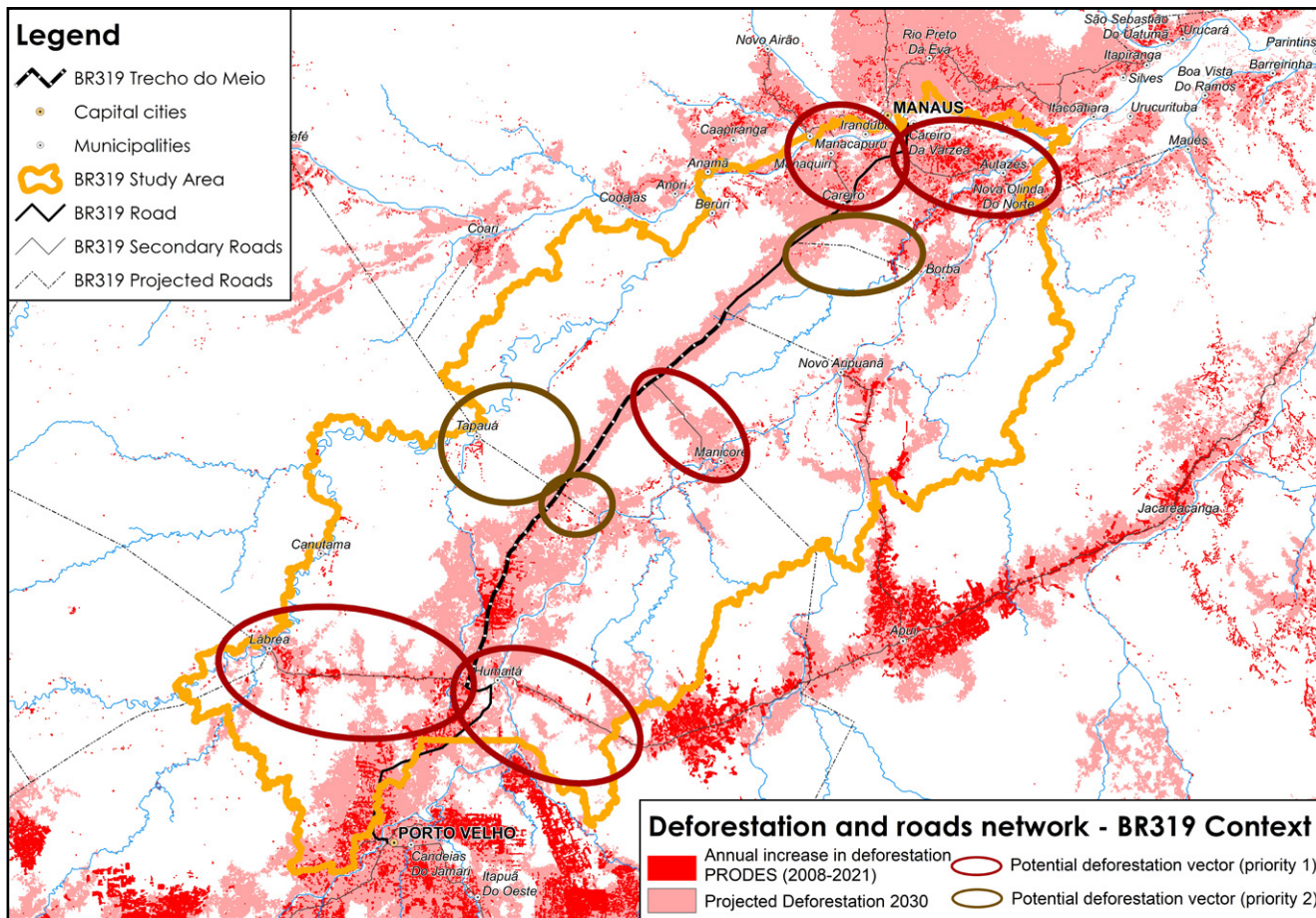
Figure 7 shows existing roads stamped in red, and the brown color indicates projected roads that will be activated with the BR-319 paving. Both can cause unwanted environmental effects and have

a current or potential relationship with the propagation of anthropic pressures around the area of interest.

**“The reconstruction of BR-319 and the building of planned connecting roads would act as spearheads for deforestation and forest degradation in the western portion of the Brazilian Amazon.”**

*Andrade et al. (2021)*





**Figure 7.** Deforestation and roads network in the BR-319 context.

The paving of BR-319/AM middle section will bring major social and economic changes to the region, because of (...) the consequent expansion of the road network, AM-366 and AM-364 (...). This road network will enable (...) traffic between the cities of Porto Velho/RO, Manaus/AM, Manicoré/AM, Humaitá/AM and Tapauá/AM (DNIT, 2021).

Thus, the effects of BR-319 paving are not restricted to the area directly accessed by the highway but also to a series of planned side roads connecting BR-319 to the municipalities center on the interfluvio between Madeira and Purus rivers. This area includes Manicoré, Borba, Novo Aripuanã, and Tapauá.<sup>30</sup>



**“Roads intensify migration, considerably increase land values and the profitability of agriculture and ranching.”**

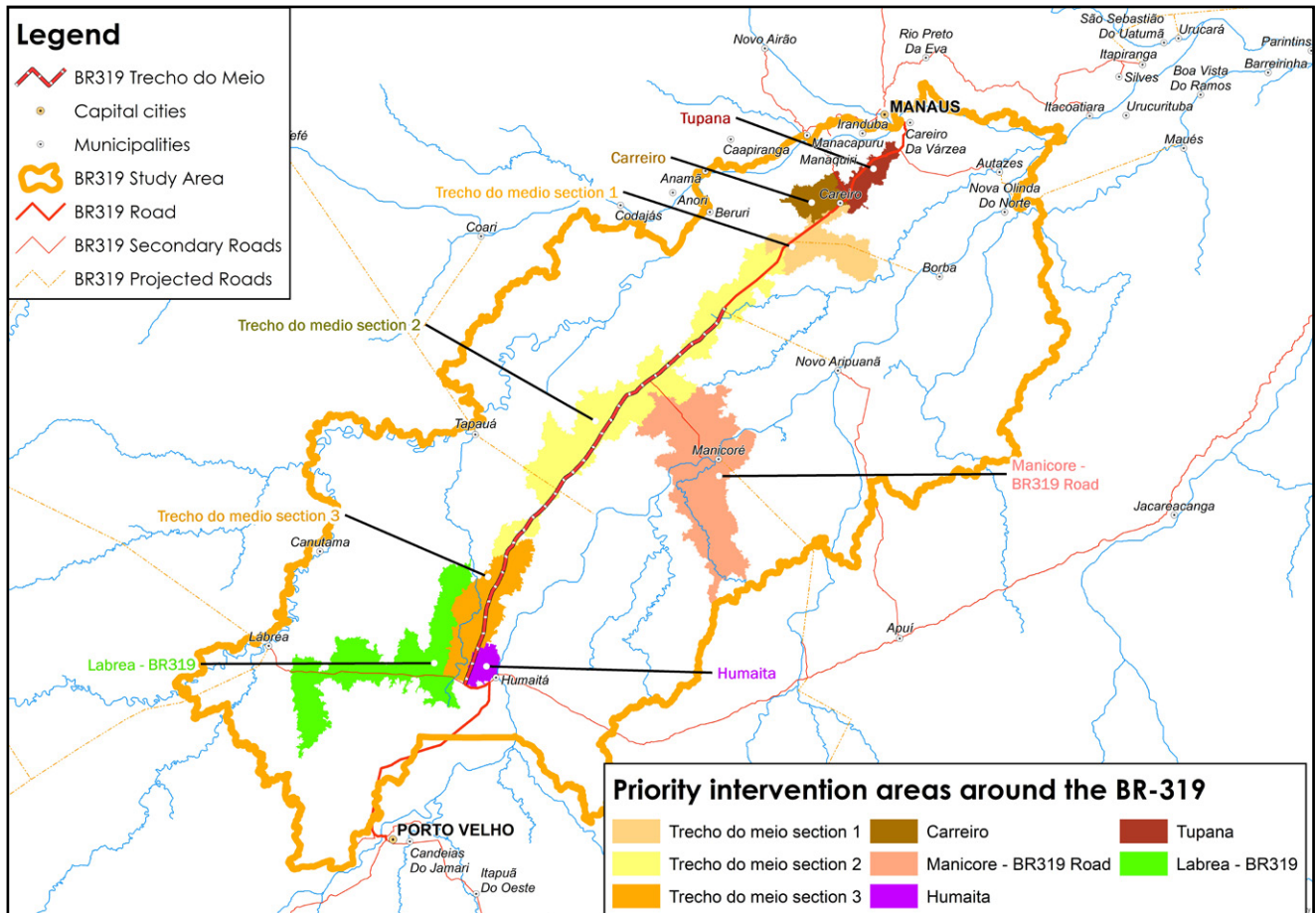
*P. Fearnside (2017)*

The **mitigation strategy** proposed here is oriented toward: preventing and reducing unwanted environmental impacts; containing deforestation advance vectors on both sides of the highway; and avoiding unsustainable growth of new development poles and accelerated expansion of tertiary network roads and illegal road branches.

Following this impact mitigation strategy, **WCS team prioritized 8 potential intervention areas** (see Figure 8).

Each of these eight prioritized areas selected by the team mentioned before is showed with more detailed important information at Table 4 in Section 5<sup>31</sup>.

**“The presence of roads is a strongest predictor of deforestation.”**  
Kirby et al., (2006)



**Figure 8.** BR-319 Intervention Priority Areas.

**“This road’s reconstruction and paving is perhaps Brazil’s most significant conservation issue today, facilitating migration from the ‘Arc of Deforestation’ in the southern part of the Amazon region to new frontiers.”**

*P. Fearnside & de Alencastro Graça (2006)*

**How to conserve prioritized areas in the BR-319 Highway context?**

**The action-reaction scheme: public policies, relevant conservation mechanisms and Nature-based Solutions for the Purus-Madeira interfluvio region.**

# 3. Overview of public policies and related conservation initiatives present around BR-319

While advancing legal and political tensions surrounding BR-319 reconstruction/repaving, speculation and the same inertia of this initiative advances at their own pace and continues to shape transformations of the Purus-Madeira interfluve region.

It is necessary to think about new alternatives and action schemes that allow the use of all the political tools and action mechanisms available in this context to face the challenges that the paving of this road will bring. The Federal Government attributes little importance to environmental impacts of this infrastructure project and little attention to warnings given by the academy, NGOs and civil society which aimed to apply the precautionary principle and to study rigorously the environmental impacts that this project could cause in the short, medium and long term.

The first proposal for this scheme is presented below. It has been called “action-reaction scheme” in honor of Newton’s third law and the principle of doing in front of the interaction with which the unwanted transformations in Purus-Madeira interfluve region advance.

The action-reaction scheme (see Figure 10) adapt the conceptual framework proposed by Moura (2016). Then, it associates a battery of conservation mechanisms, action fronts and Nature-based Solutions (NBS)<sup>32</sup> applicable to the case or that have a vocation for applicability in short or medium term in the BR-319 context.

The proposed scheme is represented by four reference levels: i) Legal Framework, ii) Strategic Conservation Mechanism, iii) Action Front, iv) Critical Window (usual tools and existing projects and initiatives founded on Nature Based Solutions):

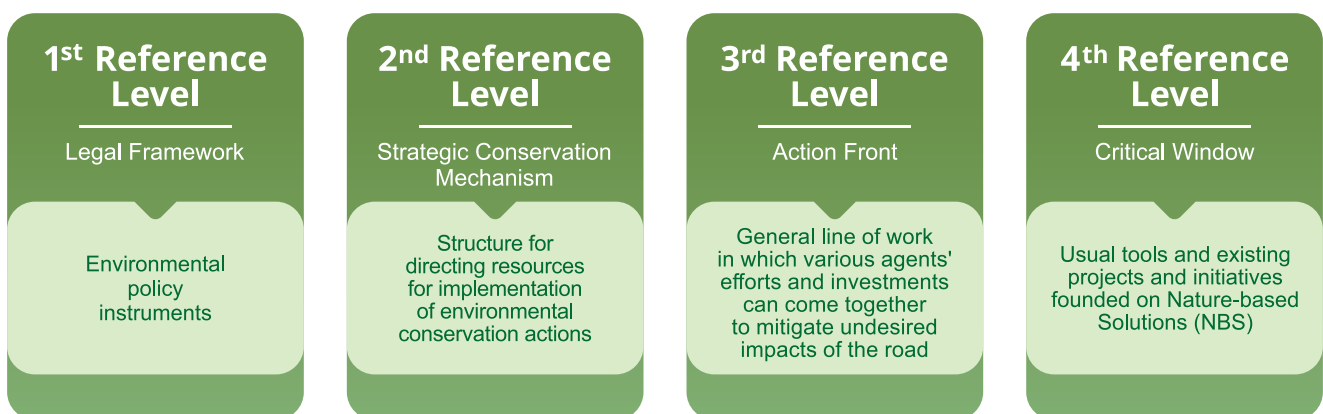


Figure 9. Action-reaction scheme. Conceptual framework.

# 4. Analysis of conservation scenarios in areas identified as a priority according to BR-319 Highway background

Once the intervention priority intervention areas have been selected, those characteristics that are considered determinant to establish the type of conservation mechanisms and actions to be implemented are evaluated. The ones considered most relevant are listed below:

- I. Is it on the axis of BR-319 road?
- II. Does it have federal protected areas?
- III. Does it have state protected areas?

IV. Does it have priority conservation area proposed by the Ministry of the Environment (MMA, 2018)?

V. Have existing complementary roads been identified?

VI. Have planned complementary roads been identified?

VII. Is there evidence of agricultural frontier expansion processes?

VIII. Is there proximity to population centers?

IX. Has a high/very high deforestation rate been identified?

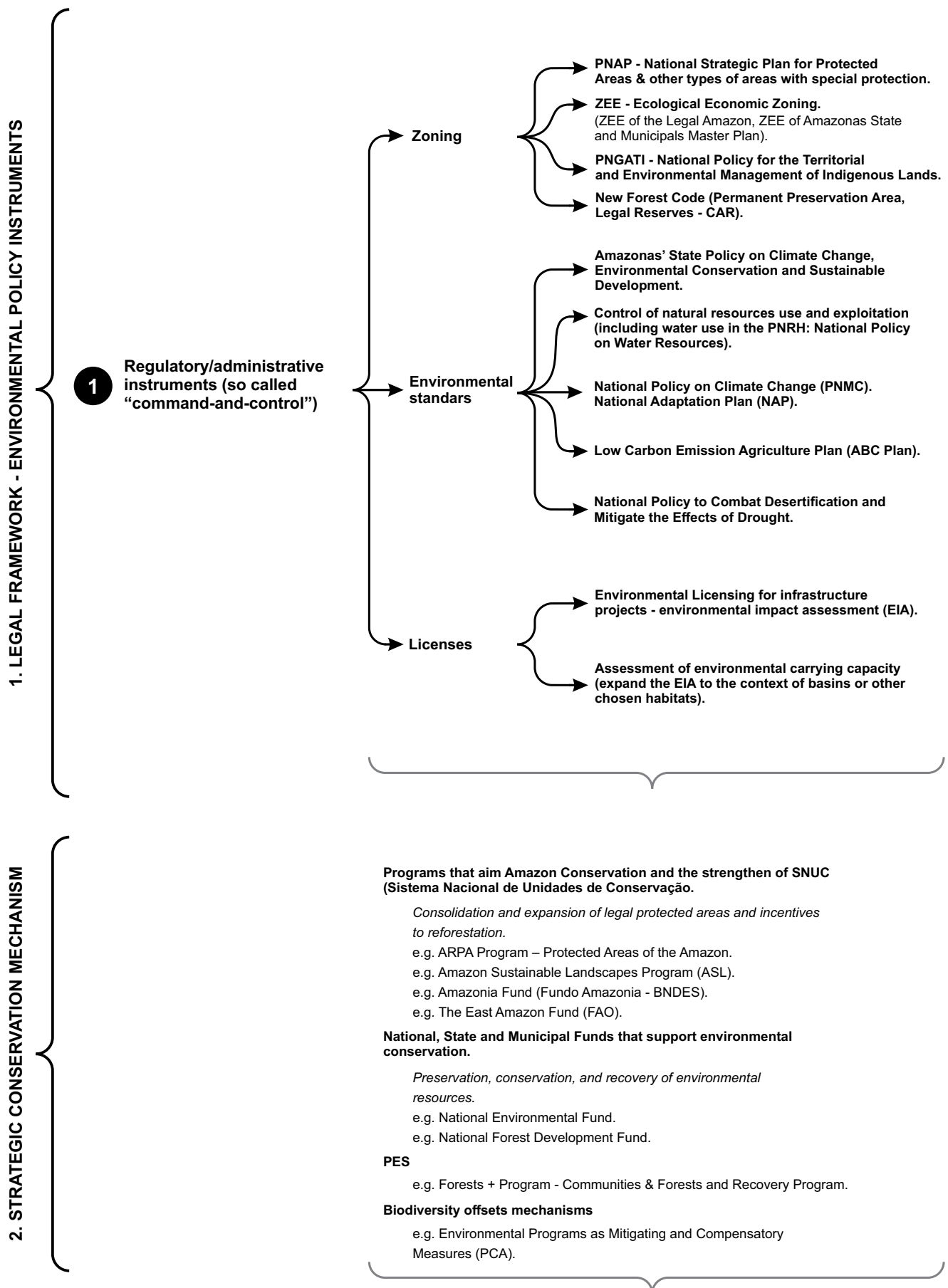
Table 3 collects the criteria evaluation of intervention priority areas. The boxes marked with x represent conditions described above which met the prioritized intervention areas.

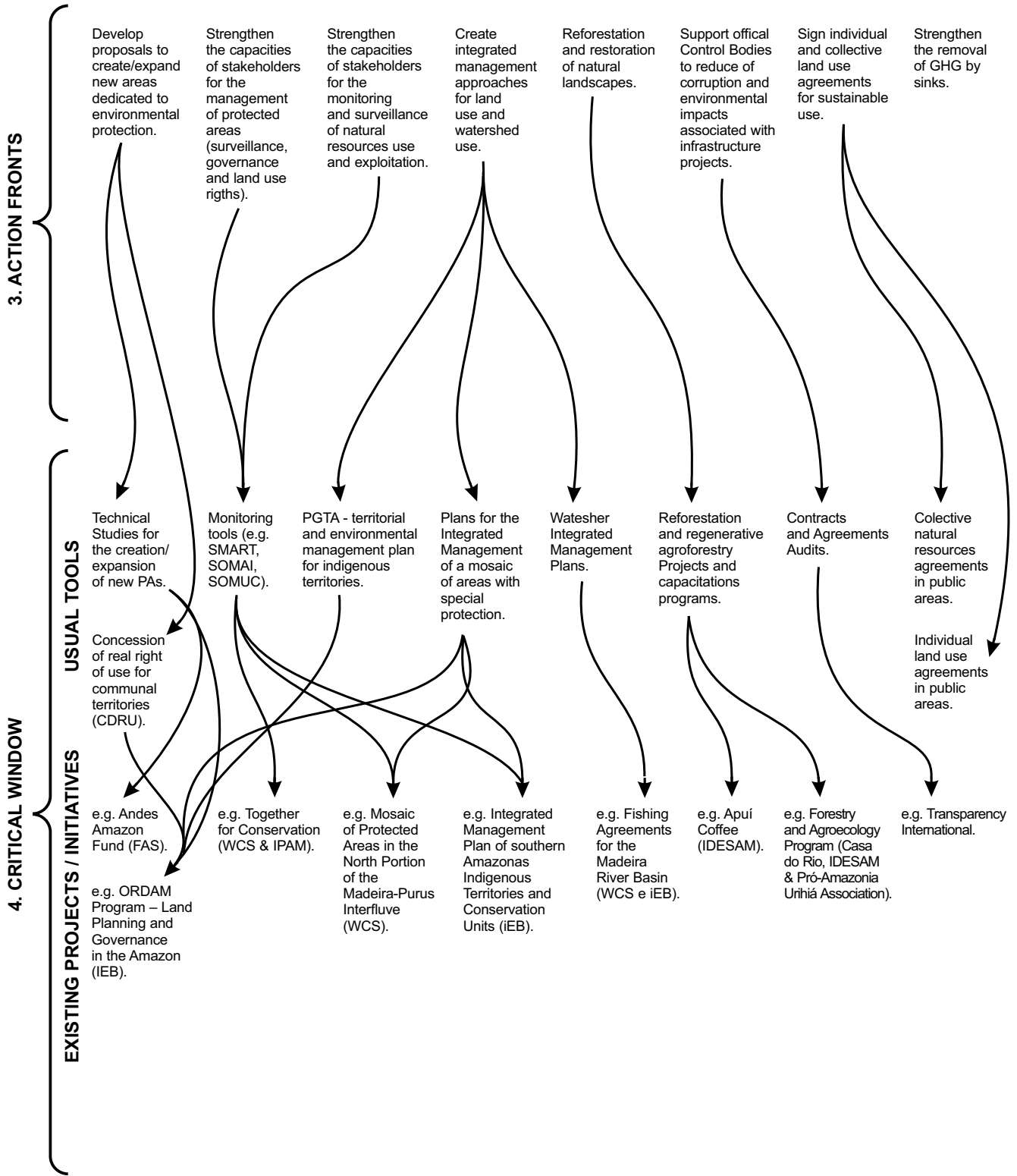
It is essential to acknowledge that each prioritized area will have a set of associated conservation mechanisms, varying depending on their usefulness and applicability, and given a specific funding desirable scenario.

**Table 3.** Prioritization Criteria.

LOCAL	I	II	III	IV	V	VI	VII	VIII	IX
Trecho do Meio Section 1	X			X		X			X
Trecho do Meio Section 2	X	X	X	X	X	X			
Trecho do Meio Section 3	X	X	X	X					X
Tupana	X			X			X		X
Careiro					X		X	X	X
Humaitá							X	X	
Lábrea - BR-319		X	X	X	X				X
Manicoré - BR-319	X	X	X	X		X		X	X

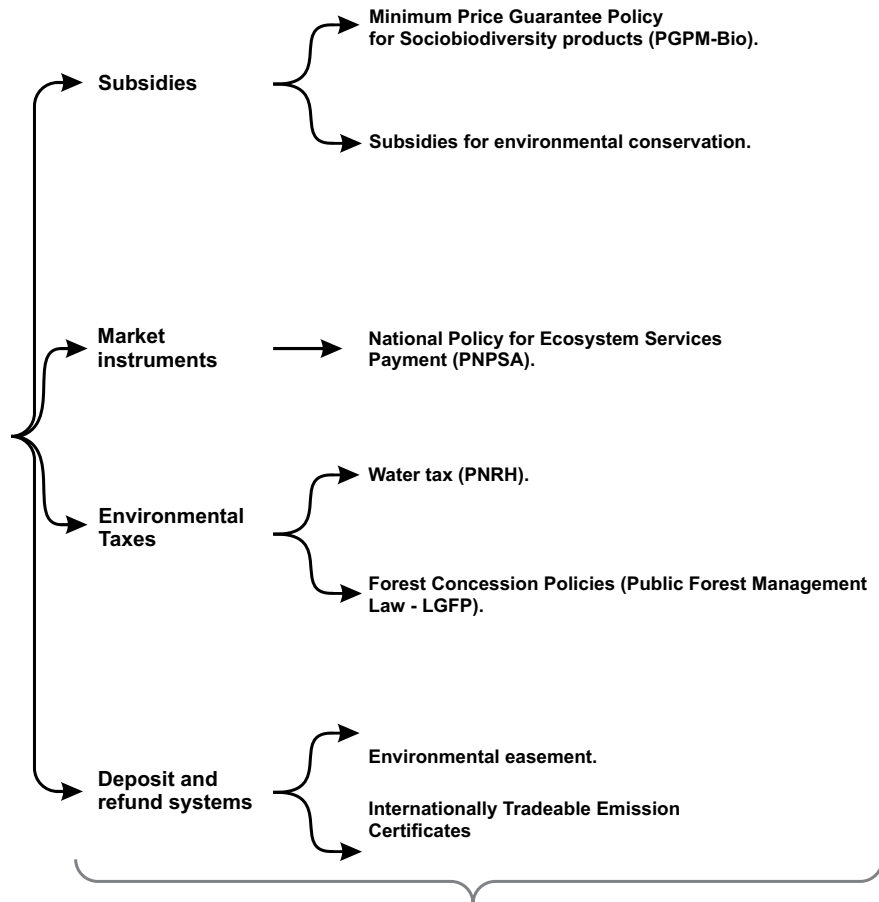
# The action-reaction scheme





1. LEGAL FRAMEWORK - ENVIRONMENTAL POLICY INSTRUMENTS

2 Economic Instruments



2. STRATEGIC CONSERVATION MECHANISM

**Credit Lines to boost investments in agricultural activities with low environmental impact.**

Pronaf - National Program to Strengthen Family Agriculture.  
SITAWI

**Internationally Tradeable Emission Certificates.**

**Payment for ecosystem services (PES).**

**Voluntary carbon markets.**

*e.g. AFOLU projects (Agriculture, Forestry and Other Land Use).*

**Voluntary carbon markets.aVoluntary biodiversity markets.**

*a future opportunity is foreseen...*

**Payments for results / Direct Transfers.**

*e.g. Floresta + Program Conservation & Innovation, Floresta em Pé Program (previous Bolsa Floresta Program) and Bolsa Verde Program.*

**Forest banks for legal reserve compensation (CAR).**

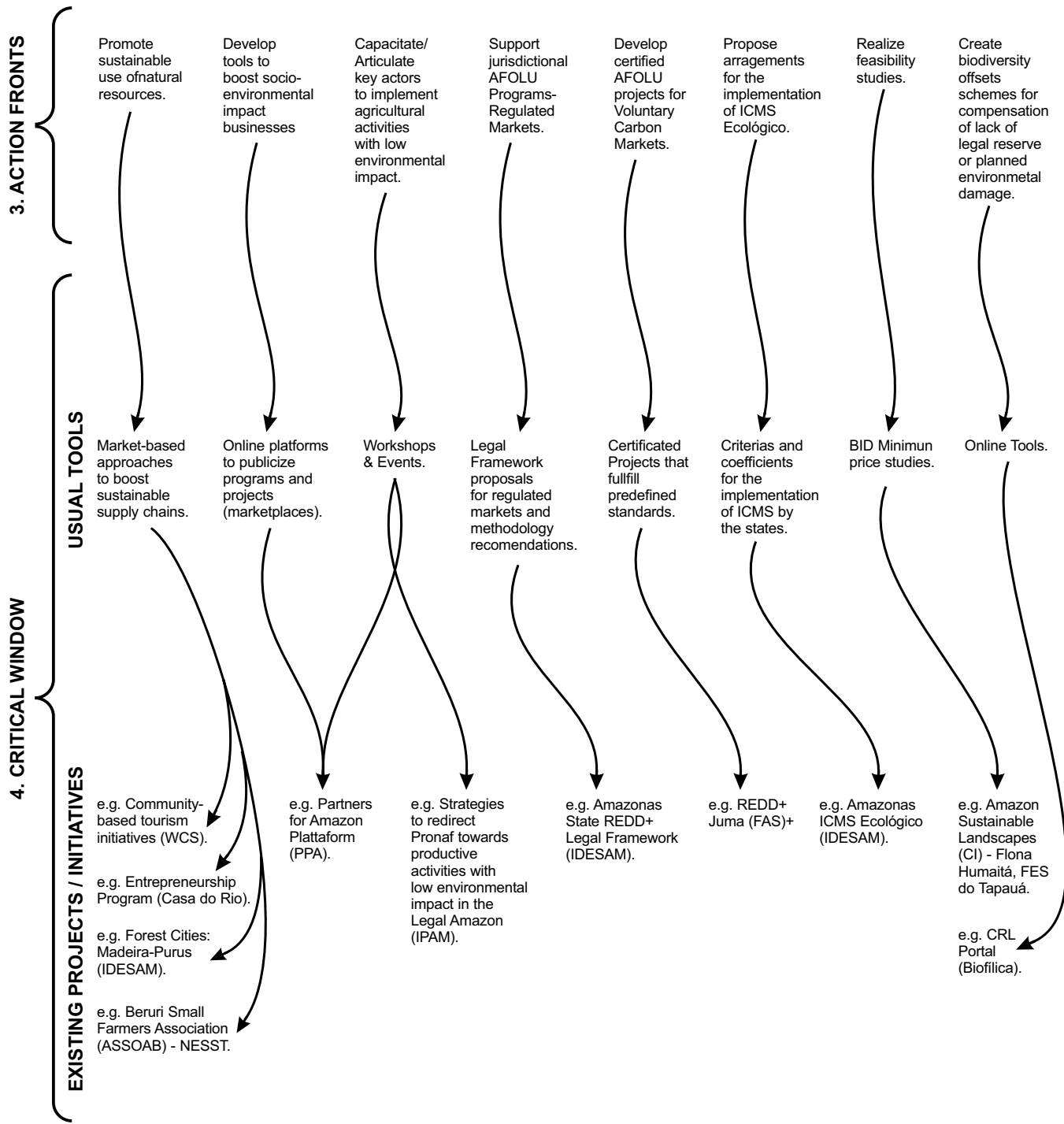
*a future opportunity is foreseen...*

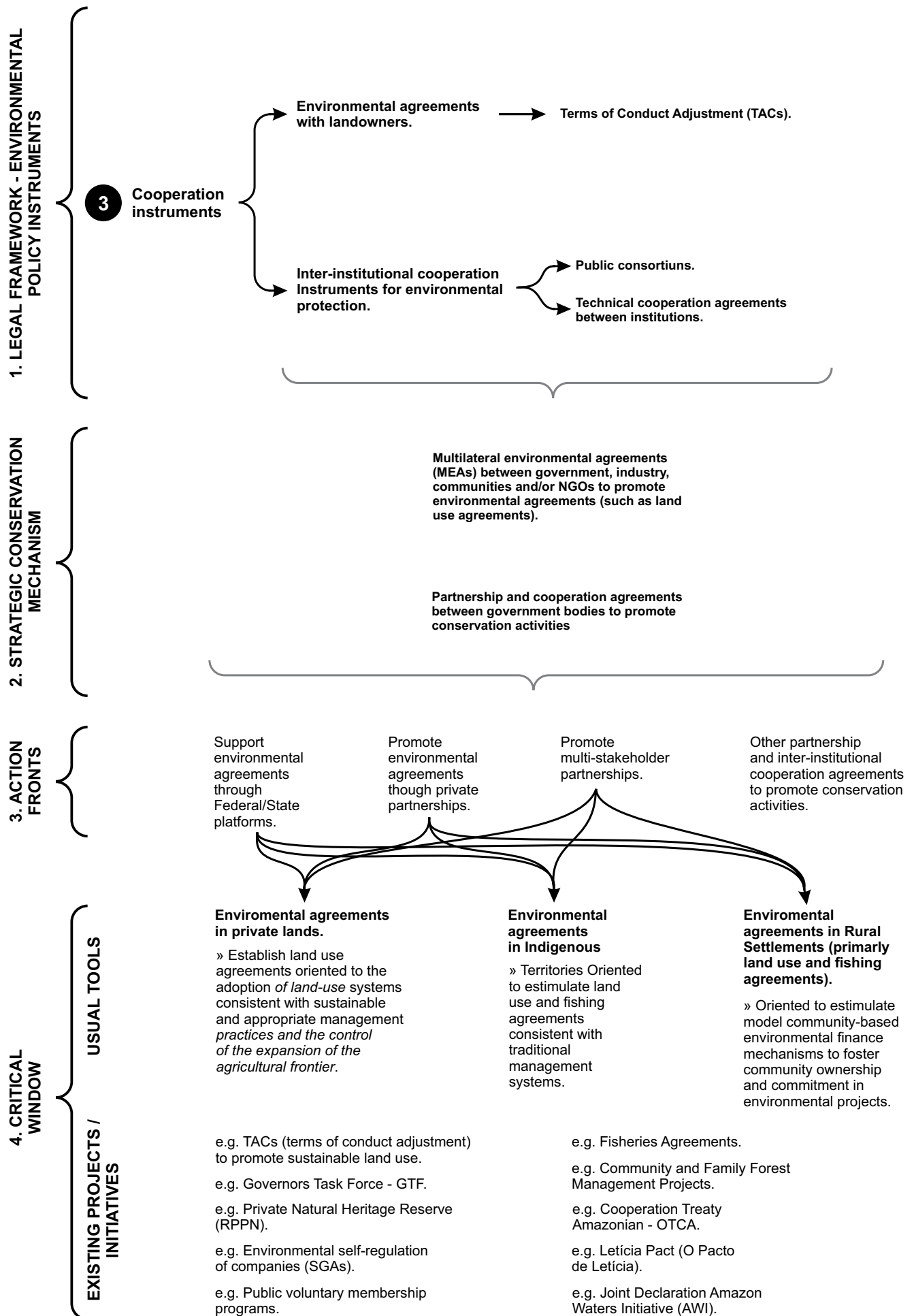
**BIDS Brazilian Forest Service (SFB).**

*Concession of public use for the sustainable exploitation of public forests or UCs visitation services.*

**ICMS Ecológico (Tax on Circulation of Goods and Services).**

**Tax and feesConversion of Environmental Fines.**





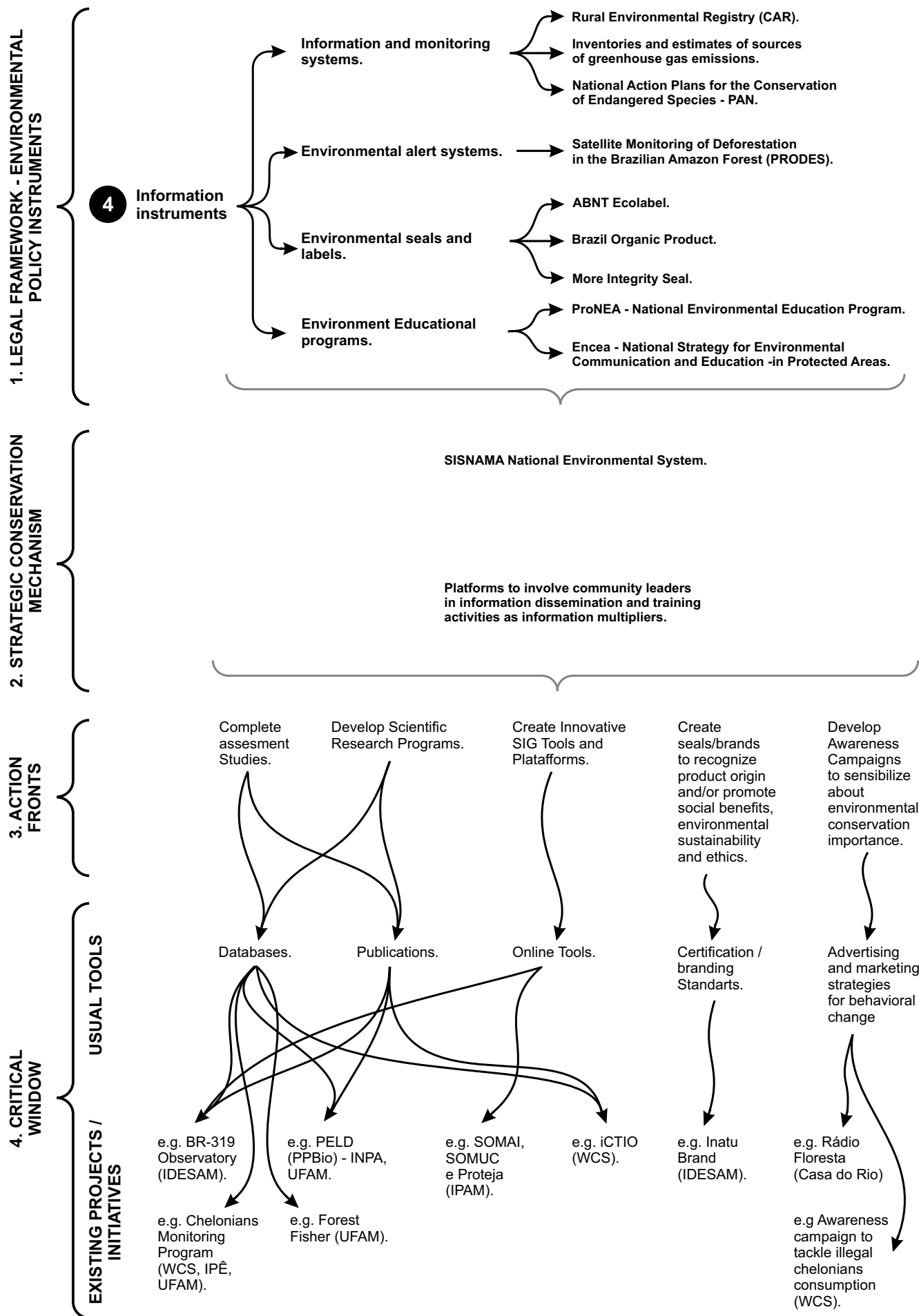


Figure 10. The action-reaction scheme.

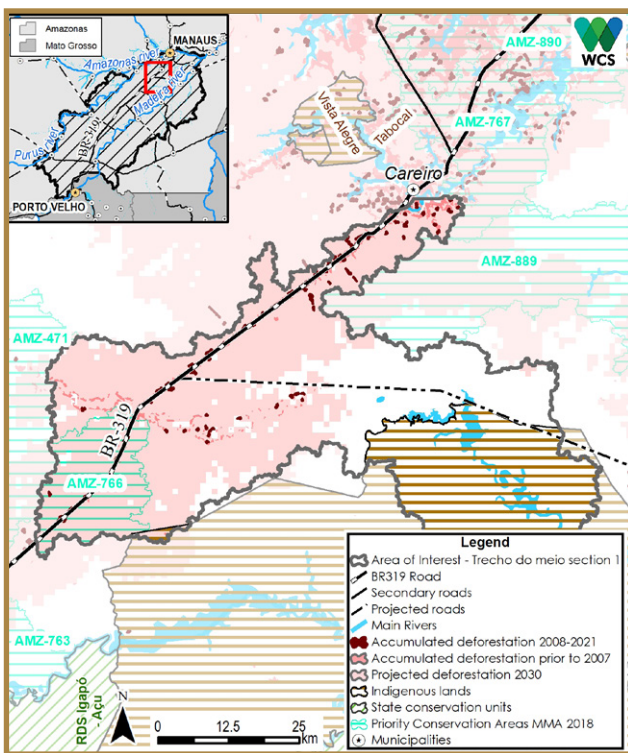
# Suggested conservation mechanisms for intervention priority areas

Characterization sheets below summarize:  
 i) general features, ii) prioritization criteria, iii) land tenure and property rights brief, iv) main applicable conservation mechanisms, v) action fronts suggested, vi) some

Nature-based Solutions applicable in each prioritized area and vii) some of EIA (Environmental Impact Assessment)<sup>33</sup> mitigation strategies that should be specially considered.

## Characterization sheets fronts for all 8 Prioritized Areas

### Trecho do meio section 1



#### General Features

##### Main Land Cover

Dense forest (94.9%)

##### Main Land Use

Less than 10% of agricultural areas.

##### Deforestation Rate

Moderate deforestation rate – expected high deforestation rate if no preventive action is taken.

##### Protected Areas

No protected areas identified in this prioritized area.

Nonetheless 2 priority areas for biodiversity conservation were identified by MMA (2018) - (AMZ-766/AMZ-889).

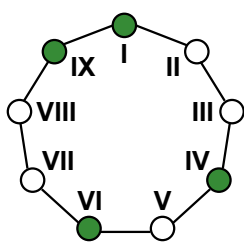
##### Indigenous Territories

Cunhã-Sapucaia

##### Mitigation Strategy

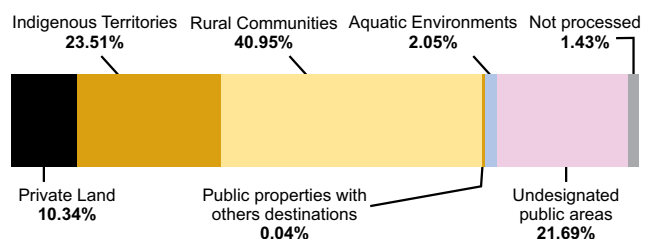
1. Preservation
2. Sustainable use

#### Prioritization Criteria



- I. Crossed by a BR-319 section
- IV. Priority Conservation Areas within
- VI. BR-319 planned complementary roads identified within
- IX. High/very high deforestation rate

#### Land Tenure and Property Rights Brief



## Main Applicable Conservation Mechanisms

- Strengthen of SNUC (National System of Conservation Units) through the establishment of new protected areas.
- Foster credit lines to boost investments in agricultural activities with low environmental impact (e.g., Sitawi, e.g., PRONAF Agroecologia, Floresta, Eco e Orientado).
- Stimulate and create a momentum for future development of Payment for ecosystem services (PES) schemes.
- Promote Multilateral Environmental Agreements (MEAs) between government, industry, communities and/or NGOs to promote environmental agreements (such as land use agreements).
- Boost partnership and cooperation agreements between government bodies to promote conservation activities.

## Featured Nature-based Solutions (NBS)

- Mosaic of Protected Areas in the North Portion of the Purus-Madeira Interfluve (WCS).
- Forestry and Agroecology Program (Idesam).
- Forestry and Agroecology Project (Pró-Amazônia Urihiá Association).
- SOMAI.
- ORDAM Program – Land Planning and Governance in the Amazon (IEB).
- Bolsa Verde (in rural settlements).
- Partners for Amazon Platform (PPA).
- Bioeconomy Project (INPA, USP, FAPEAM & FAPESP).

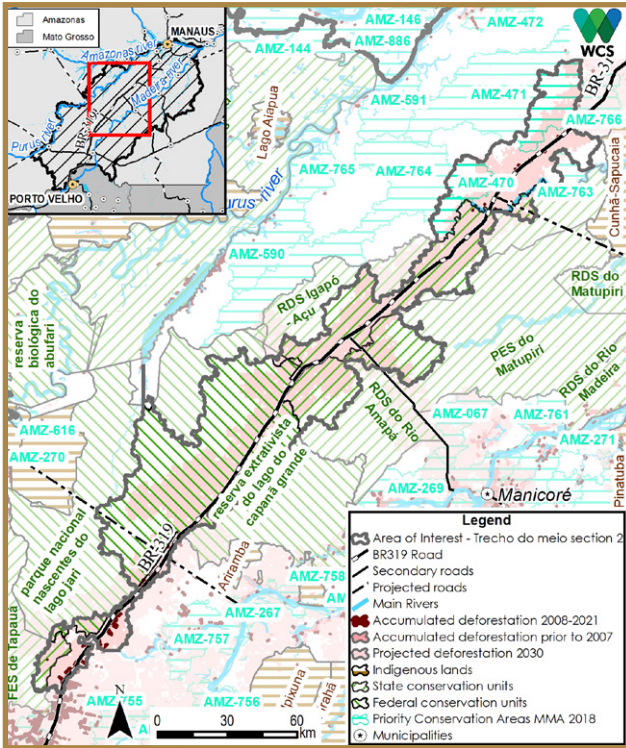
## Action Fronts Suggested

- Drive efforts to the establishment of new protected areas, such as priority areas for biodiversity conservation like AMZ-766 and AMZ-889 where the promotion of actions is suggested to regularize and mitigate impacts caused by illegal activities and biodiversity degradation.
- Foster the establishment of voluntary land use agreements with a) indigenous peoples from Cunchã-Sapucaia, b) rural communities and c) private landowners located at the bank of BR-319 Highway and on the projected road from BR-319 to Borba.
- Strengthen stakeholders capacities to manage protected areas (surveillance, governance and land use rights).
- Promote strategies to redirect PRONAF towards productive activities with low environmental impact in Legal Amazon (IPAM).
- Promote capacity building in local organizations for the implementation of strategic projects.
- Articulate key actors to implement agricultural activities with low environmental impact.
- Create biodiversity offset schemes to compensate the lack of legal reserve or planned environmental damage.
- Oversight and support for the implementation of environmental impact mitigation strategies proposed in EIA.

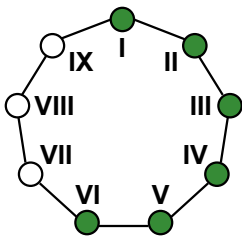
## Featured EIA Mitigation Strategies

- Environmental Management Program (PGA).
- Environmental Education Program.
- Flora Protection Program.
- Degraded Area Recovery Program.
- Forest Fire Fighting Subprogram.

## Trecho do meio section 2



### Prioritization Criteria



- I. Crossed by a BR-319 section
- II. Federal Protected Areas within
- III. State Protected Areas within
- IV. Priority Conservation Areas within
- V. BR-319 existing complementary roads within
- VI. BR-319 planned complementary roads identified within



### General Features

#### Main Land Cover

Dense forest (90.0%).

#### Main Land Use

Less than 10% of agricultural areas.

#### Deforestation Rate

Moderate deforestation rate – expected high deforestation rate if no preventive action is taken.

#### Protected Areas

- Parque Nacional Nascentes do Lago Jari.
- FES de Tapauá, PES do Matupiri, RDS do Rio Amapá and RDS Igapó-Açu.

In addition, 3 priority areas for biodiversity conservation were identified by MMA (2018) - (AMZ-470/AMZ-471/AMZ-764).

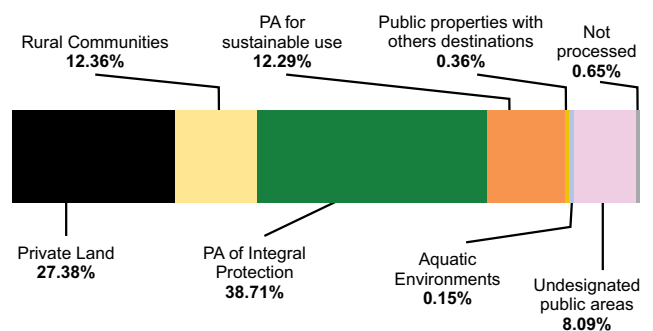
#### Indigenous Territories

No records of formalized indigenous territories in this intervention unit.

#### Mitigation Strategy

1. Preservation (strengthening capacities for current protected areas management).
2. Mitigate environmental impacts of BR-319 Highway paving.

### Land Tenure and Property Rights Brief



## Main Applicable Conservation Mechanisms

- Strengthen of SNUC (National System of Conservation Units) through the establishment of new protected areas and reinforcing management of existing ones.
- Stimulate and create a momentum for the future development of Payment for ecosystem services (PES) schemes.
- Promote multilateral environmental agreements (MEAs) between government, industry, communities and/or NGOs (such as land use agreements), e.g. Arpa Program.
- Boost partnership and cooperation agreements between government bodies to promote conservation activities.
- Reinforce tax incentives for biodiversity conservation.
- Implement and ensure the enforcement of the ICMS in Amazonas state.

## Featured Nature-based Solutions (NBS)

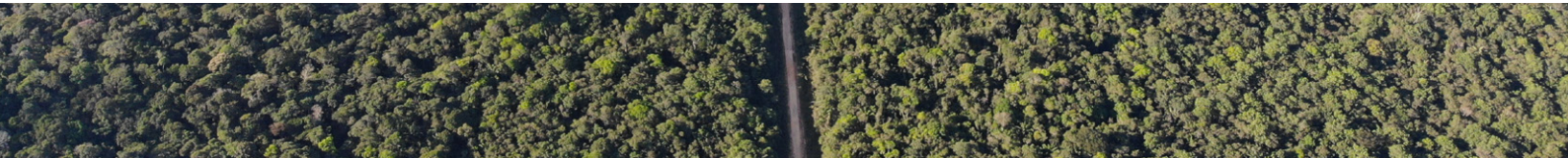
- Mosaic of Protected Areas in the North Portion of the Madeira-Purus Interfluvium (WCS).
- Amazonas ICMS Ecológico (Idesam).
- Amazonas State REDD+ Legal Framework (Idesam).
- PELD do Sudoeste do Amazonas (PSAM) – INPA, UFAM.
- Chelonians Monitoring Program (WCS, IPÊ, UFAM) – RESEX do Lago Capanã Grande.
- Beruri Small Farmers Association (ASSOAB) – NESsT – IT Itixi Mitari & RDS Piagaçu-Purus.
- Bolsa Verde (in rural settlements)
- Community-based tourism initiatives (WCS) – RDS Igapó-Açu
- Fishing Agreements for the Madeira River Basin (WCS e IEB) – TUC de Manicoré.
- SOMUC e SMART.
- Amazon Taste (Pirarucu Collective).
- CRL Portal (Biofílica).

## Action Fronts Suggested

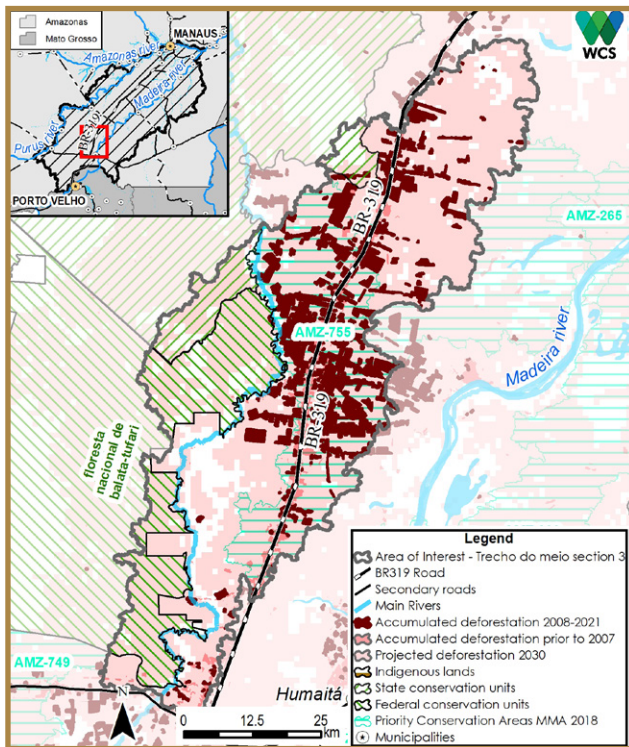
- Drive efforts to the establishment of new protected areas, such as priority areas for biodiversity conservation like AMZ-470, AMZ-471 and AMZ-764, where is suggested promoting actions such as the regularization of degradant activity, supervision/control of illegal activities, conserving connectivity through ecological corridors and traditional people territories, integrated and participatory management of protected areas, among others.
- Foster the establishment of voluntary land use agreements with private landowners and rural communities located: a) on the BR-319 Highway, b) on the road between BR-319 to Madeira River (nearby Manicoré), c) on the projected road from BR-319 to Madeira River upstream, and d) on the projected road to Tapaúa.
- Strengthening management capacities of Nascentes do Lago Jari National Park and other four state protected areas (FES de Tapauá, PES do Matupiri, RDS do Rio Amapá, and RDS Igapó-Açu) located in this intervention unit.
- Foster the establishment of collective land use agreements in communal lands.
- Promote sustainable use of natural resources.
- Support jurisdictional AFOLU Programs – Regulated Markets.
- Propose arrangements for the implementation of Ecological ICMS.
- Create biodiversity offset schemes for compensation of lack of legal reserve or planned environmental damage.
- Oversight and support for implementation of the environmental impact mitigation strategies proposed in the EIA.

## Featured EIA Mitigation Strategies

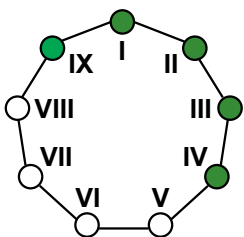
- Environmental Management Program (PGA).
- Construction Environmental Plan (PAC).
- Environmental Education Program.
- Environmental Liabilities Recovery Program.
- Degraded Area Recovery Program.
- Flora Protection Program.
- Erosive Process Monitoring and Control Program.
- Forest Fire Fighting Subprogram.
- Compensatory Planting and Forest Replacement Subprogram.



## Trecho do meio section 3



## Prioritization Criteria



- I. Crossed by a BR-319 section
- II. Federal Protected Areas within
- III. State Protected Areas within
- IV. Priority Conservation Areas within
- IX. High/very high deforestation rate

## General Features

### Main Land Cover

Dense forest (90.0%).

### Main Land Use

Less than 10% of agricultural areas.

### Deforestation Rate

High deforestation rate.

### Protected Areas

- Floresta Nacional de Balata-Tufari.
- FES de Tapauá.

In addition, 1 priority area for biodiversity conservation was identified by MMA (2018) (AMZ-755).

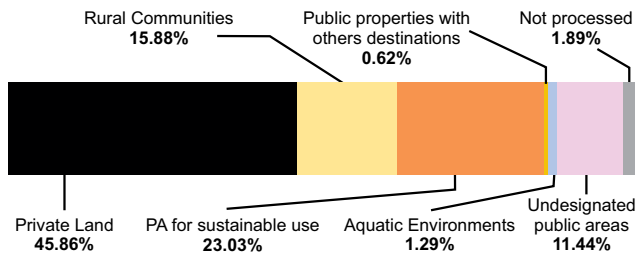
### Indigenous Territories

No records of formalized indigenous territories in this intervention unit.

### Mitigation Strategy

1. Mitigate environmental impacts of BR-319 Highway paving.
2. Sustainable use.
3. Restoration.
4. Preservation.

## Land Tenure and Property Rights Brief



## Main Applicable Conservation Mechanisms

- Encourage natural resources conservation through Payments for Ecosystem Services (PES) schemes.
- Foster credit lines to boost investments in agricultural activities with low environmental impact (e.g. Sitawi, PRONAF agroecologia, Floresta, Eco e Orientado).
- Empower local people with the necessary technical skills and means to access credit lines such as PRONAF (National Program for Strengthening Family Farming).
- Promoting sustainable use and expansion of forest cover through the concession of public use for the sustainable exploitation of public forests or protected areas visitation services (BIDS Brazilian Forest Service – SFB).
- Strengthen of SNUC (National System of Conservation Units) through the establishment of new protected areas and reinforcing management of existing ones.
- Explore forest conservation tools such as Forest Banks for legal reserve compensation.
- Reinforce tax incentives for biodiversity conservation. Expansion and optimization of the ICMS Ecológico.
- Promote multilateral environmental agreements (MEAs) between government, industry, communities and/or NGOs (such as land use agreements).
- Boost partnership and cooperation agreements between government bodies to promote conservation activities.

## Action Fronts Suggested

- Strengthening capacity for the management of Floresta Nacional de Balata-Tufari and FES de Tapauá.
- Promoting the expansion of protected areas within this intervention unit.
- Drive efforts to the establishment of new protected areas such as priority areas for biodiversity conservation AMZ-755 where is suggested promoting actions for the regularization of degradant activity and supervision and control of illegal activities.
- Foster the establishment of voluntary land use agreements with a) private landowners and b) rural communities located at the bank of BR-319 Highway.
- Develop certified AFOLU projects for Voluntary Carbon Markets.
- Reforestation and restoration of natural landscapes.
- Promote sustainable use of natural resources.
- Develop tools to boost socio-environmental impact businesses.
- Capacitate/Articulate key actors to implement agricultural activities with low environmental impact.
- Create biodiversity offset schemes for compensation of lack of legal reserve or planned environmental damage.
- Develop awareness campaigns to sensitize about environmental conservation importance.
- Oversight and support for the implementation of environmental impact mitigation strategies proposed in the EIA.

## Featured Nature-based Solutions (NBS)

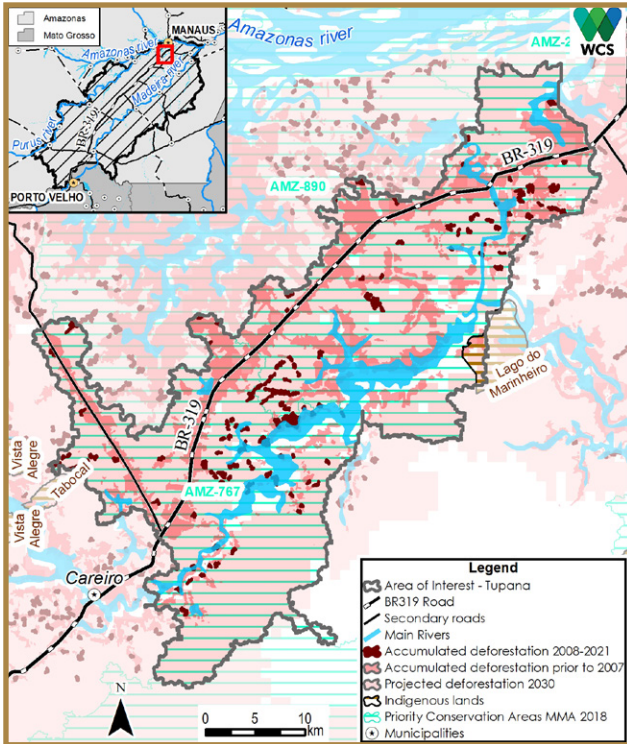
- Mosaic of Protected Areas in the North Portion of the Madeira-Purus Interfluve (WCS).
- Strategies to redirect PRONAF towards productive activities with low environmental impact in Legal Amazon (IPAM).
- Bioeconomy Project (INPA, USP, FAPEAM & FAPESP).
- Partners for Amazon Platform (PPA).
- Community and Family Forest Management Projects.
- Transdisciplinary Amazon Network (RETA) – FGVces.
- Amazon Sustainable Landscapes (CI) - BIDs FLONA Humaitá.
- Young Communicators Network (Alliance for Southern Amazonas Sustainable Development – WWF Brazil).
- CRL Portal (Biofílica).
- REDD + Juma (FAS).

## Featured EIA Mitigation Strategies

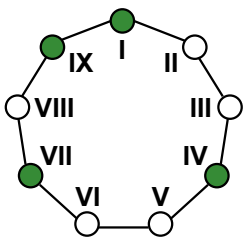
- Environmental Management Program (PGA).
- Construction Environmental Plan (PAC).
- Environmental Education Program.
- Environmental Liabilities Recovery Program.
- Degraded Area Recovery Program.
- Flora Protection Program.
- Erosive Process Monitoring and Control Program.
- Forest Fire Fighting Subprogram.
- Compensatory Planting and Forest Replacement Subprogram.



# Tupana



## Prioritization Criteria



- I. Crossed by a BR-319 section
- II. Priority Conservation Areas within
- III. Evidence of agricultural frontier expansion processes
- IV. High/very high deforestation rate
- V.
- VI.
- VII.
- VIII.
- IX.

## Main Applicable Conservation Mechanisms

- Encourage natural resources conservation through Payments for Ecosystem Services (PES) schemes.
- Credit lines to boost investments in agricultural activities with low environmental impact (e.g. Sitawi, PRONAF agroecologia, Floresta, Eco e Orientado).
- Empower local people with the necessary technical skills and means to access credit

## General Features

### Main Land Cover

Dense forest (60.5%).

### Main Land Use

This intervention unit has significative consolidated agricultural areas clustered along BR-319 road.

### Deforestation Rate

High deforestation rate.

### Protected Areas

■ No records identified in this prioritized area.

Nonetheless 2 priority areas for biodiversity conservation were identified by MMA (2018) - (AMZ-767 / AMZ-890).

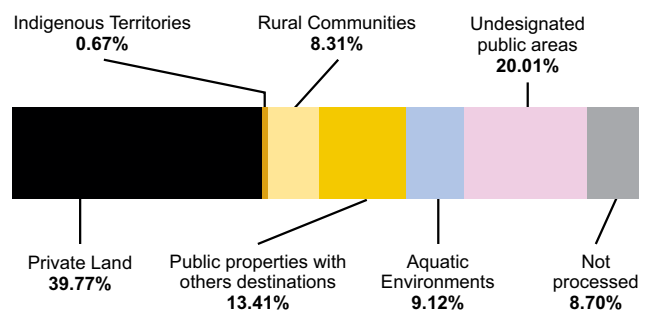
### Indigenous Territories

No records of formalized indigenous territories in this intervention unit.

### Mitigation Strategy

1. Sustainable use.
2. Mitigate environmental impacts of BR-319 Highway paving.
3. Preservation (establishment of new protected areas).

## Land Tenure and Property Rights Brief



lines such as PRONAF (National Program for Strengthening Family Farming).

- Promote multilateral environmental agreements (MEAs) between government, industry, communities and/or NGOs (such as land use agreements).
- Boost partnership and cooperation agreements between government bodies to promote conservation activities.

### Featured Nature-based Solutions (NBS)

- Strategies to redirect PRONAF towards productive activities with low environmental impact in Legal Amazon (IPAM).
- Partners for Amazon Platform (PPA).
- Community and Family Forest Management Projects.
- Forestry and Agroecology Program (Idesam).
- Awareness campaign to tackle illegal chelonians consumption (WCS) - Manacapuru e Manaus.
- ORDAM Program – Land Planning and Governance in the Amazon (IEB).
- TUC TUPANA (possible APA Tupana).

### Action Fronts Suggested

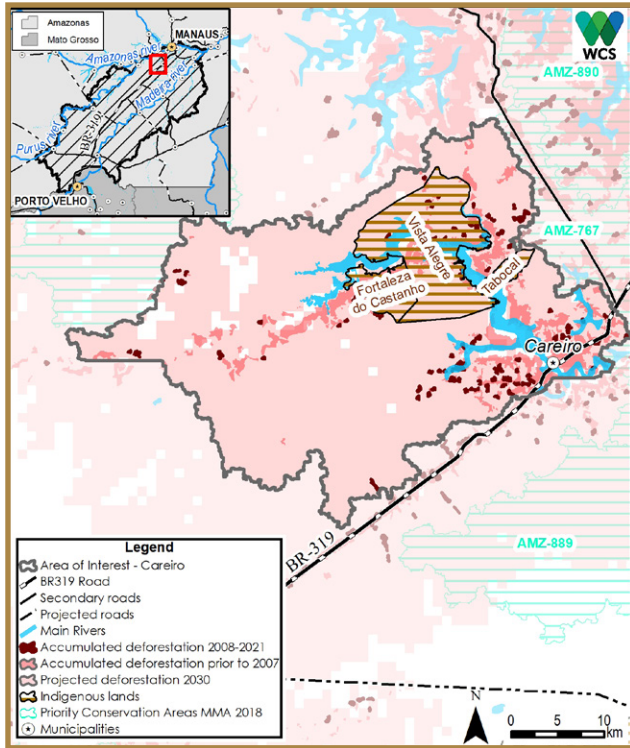
- Foster the establishment of voluntary land use agreements with a) indigenous peoples from Jacareúba/Katawixi, Caititu, and Juma indigenous territories, b) rural communities and c) private landowners located at the bank of BR-319 Highway and on the road from Careiro to Lábrea.
- Promote sustainable use of natural resources.
- Create integrated management approaches for land use and watershed use.

- Capacitate/Articulate key actors to implement agricultural activities with low environmental impact.
- Support the establishment of a PA in the Tupana communal land.
- Promotion of conservation actions in public areas related to the sustainable development of water resources.
- Create seals/brands to recognize product origin and/or Promote social benefits, environmental sustainability and ethics.
- Oversight and support for the implementation of the environmental impact mitigation strategies proposed in the EIA.
- Drive efforts to the establishment of new protected areas such as priority areas for biodiversity conservation like AMZ-767 and AMZ-890 where is suggested to promote actions of regularization and mitigation of impacts caused by illegal activities and biodiversity degradation.
- Promote reforestation and restoration of natural landscapes projects.
- Direct subsidiary programs for environmental and biodiversity conservation.
- Create biodiversity offset schemes for compensation of lack of legal reserve or planned environmental damage.
- Develop awareness campaigns to sensitize about environmental conservation importance.

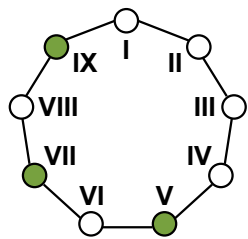
### Featured EIA Mitigation Strategies

- Environmental Management Program (PGA).
- Environmental Education Program.
- Forest Fire Fighting Subprogram.

# Careiro



## Prioritization Criteria



- V. BR-319 complementary roads existing within
- VII. Evidence of agricultural frontier expansion processes
- IX. High/very high deforestation rate

## General Features

### Main Land Cover

Dense forest (73.1%).

### Main Land Use

This intervention unit has some consolidated agricultural areas clustered along Lago do Castanho and its tributaries.

### Deforestation Rate

High deforestation rate.

### Protected Areas

■ No records in this intervention unit.

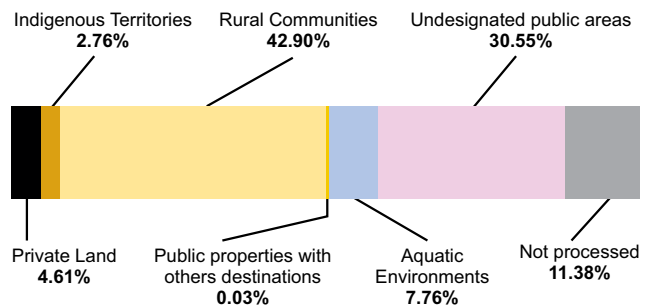
### Indigenous Territories

Vista Alegre, Fortaleza do Castanho, Tabocal.

### Mitigation Strategy

1. Sustainable use.
2. Preservation.
3. Contributing with the Vista Alegre indigenous territory regularization (currently, it is only delimited).

## Land Tenure and Property Rights Brief



## Main Applicable Conservation Mechanisms

- Encourage the conservation of natural resources through Payments for Ecosystem Services (PES) schemes.
- Foster credit lines to boost investments in agricultural activities with low environmental impact (e.g. Sitawi, PRONAF agroecologia, Floresta, Eco e Orientado).
- Empower local people with the necessary technical skills and means to access credit lines such as PRONAF (National Program for Strengthening Family Farming).
- Promote multilateral environmental agreements (MEAs) between government, industry, communities and/or NGOs (such as land use agreements).
- Boost partnership and cooperation agreements between government bodies to promote conservation activities.

## Featured Nature-based Solutions (NBS)

- Bioeconomy Project (INPA, USP, FAPEAM & FAPESP).
- Partners for Amazon Platform (PPA) – Idesam.
- Community and Family Forest Management Projects.
- Transdisciplinary Amazon Network (RETA).
- Forestry and Agroecology Program (Idesam).
- Melipoliculture extension project (IFAM - Amazonas Federal Institute).

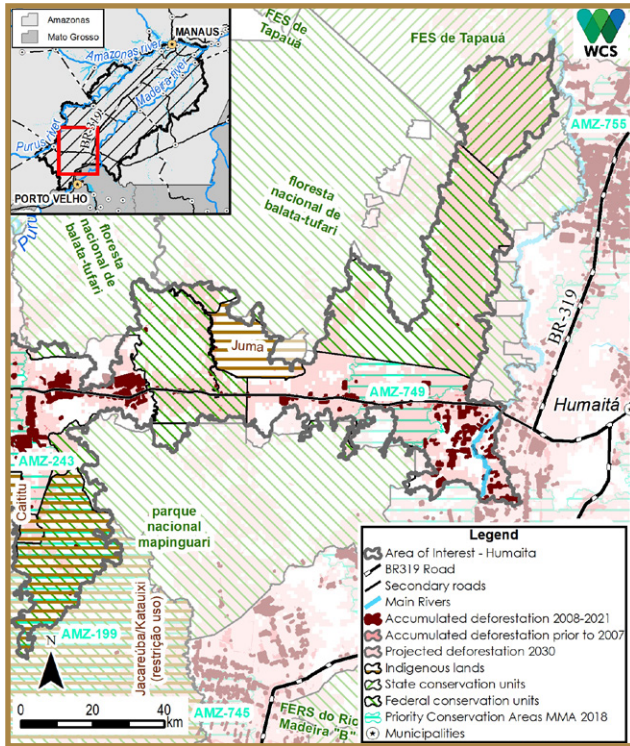
## Featured EIA Mitigation Strategies

- Environmental Management Program (PGA).
- Environmental Education Program.
- Forest Fire Fighting Subprogram.

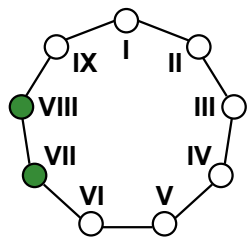
## Action Fronts Suggested

- Foster the establishment of voluntary land use agreements with a) private landowners, b) rural communities located at the bank of BR-319 Highway and along Lago do Castanho and c) on collective territories with indigenous peoples from Fortaleza do Castanho and Tabocal indigenous territories.
- Promote sustainable use of natural resources.
- Create integrated management approaches for land use and watershed use.
- Capacitate/ Articulate key actors to implement agricultural activities with low environmental impact.
- Enlarge subsidies for environmental conservation. e.g. Bolsa Verde.
- Develop awareness campaigns to sensitize about environmental conservation importance.
- Promote conservation action in public areas related to the sustainable development of water resources in Lago do Castanho and its tributaries.
- Develop proposals to create/expand new areas dedicated to environmental protection.
- Promote reforestation and restoration of natural landscapes projects.
- Foster collective natural resources agreements in public areas.
- Foster individual land use agreements in public areas.
- Develop tools to boost socio-environmental impact businesses.
- Create biodiversity offset schemes for compensation of lack of legal reserve or planned environmental damage.
- Contribute with the regularization of Vista Alegre indigenous territory (currently, it is only delimited).

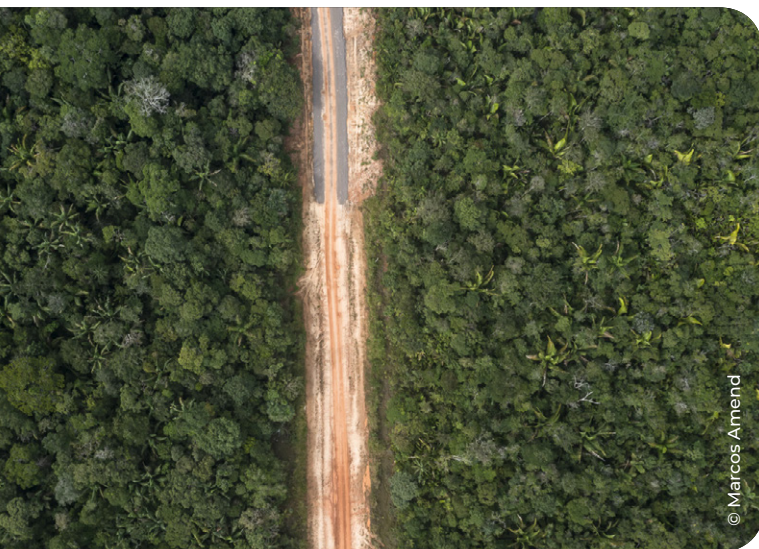
# Humaitá



## Prioritization Criteria



- VII. Evidence of agricultural frontier expansion processes
- VIII. Proximity to population centers



© Marcos Amend

## General Features

### Main Land Cover

Dense forest (69,3%).

### Main Land Use

This intervention unit has some consolidated agricultural areas clustered along the BR-319 road and along the Madeira River and its tributaries.

### Deforestation Rate

Moderate deforestation rate.

### Protected Areas

No records in this intervention unit.

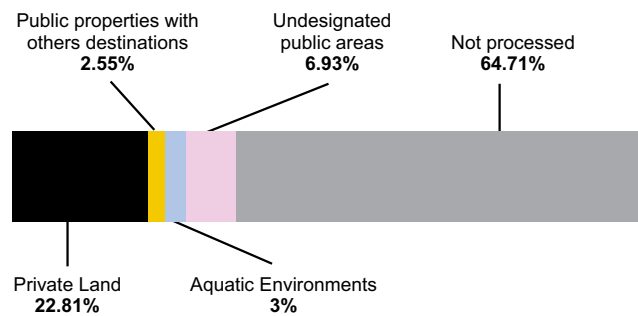
### Indigenous Territories

No records of formalized indigenous territories in this intervention unit.

### Mitigation Strategy

1. Sustainable Use.
2. Preservation (establishment of new protected areas).

## Land Tenure and Property Rights Brief



## Main Applicable Conservation Mechanisms

- Encourage natural resources conservation through Payments for Ecosystem Services (PES) schemes.
- Foster credit lines to boost investments in agricultural activities with low environmental impact (e.g. Sitawi, PRONAF agroecologia, Floresta, Eco e Orientado).
- Promote multilateral environmental agreements (MEAs) between government, industry, communities and/or (such as land use agreements).
- Boost partnership and cooperation agreements between government bodies to promote conservation activities.

## Featured Nature-based Solutions (NBS)

- Strategies to redirect PRONAF towards productive activities with low environmental impact in Legal Amazon (IPAM).
- Partners for Amazon Platform (PPA) – Idesam.
- Private Natural Heritage Reserve (RPPN).
- Transdisciplinary Amazon Network (RETA) – FGVces.
- Forest Fisher (UFAM) – Humaitá.
- Young Communicators Network (Alliance for Southern Amazonas Sustainable Development – WWF Brazil).

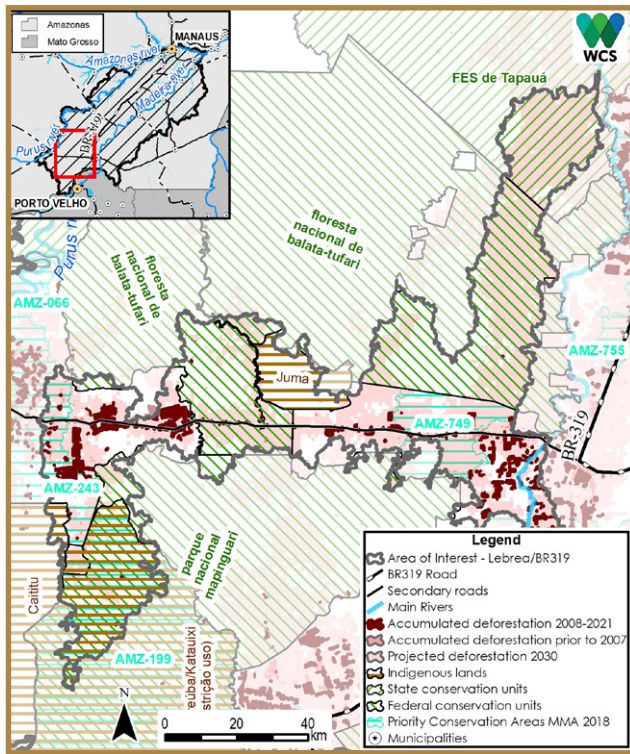
## Featured EIA Mitigation Strategies

- Environmental Management Program (PGA).
- Environmental Education Program.
- Forest Fire Fighting Subprogram.

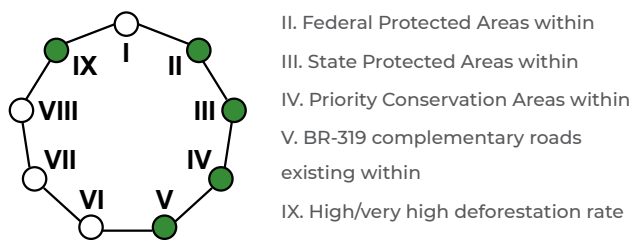
## Action Fronts Suggested

- Foster the establishment of voluntary land use agreements with landowners located along the BR-319 Highway through: a) Voluntary Carbon Markets (e.g. AFOLU projects) or b) payments by results programs (e.g. Floresta + or Floresta em Pé programs).
- Promote sustainable use of natural resources.
- Create integrated management approaches for land use and watershed use.
- Capacitate/Articulate key actors to implement agricultural activities with low environmental impact.
- Promote direct subsidiary programs for environmental and biodiversity conservation.
- Develop awareness campaigns to sensitize about environmental conservation importance.
- Stimulate private agents to carry out voluntary actions for environmental and biodiversity conservation such as the constitution of RPPN.
- Promote reforestation and restoration of natural landscapes projects.
- Foster collective natural resources agreements in public areas.
- Foster individual land use agreements in public areas.
- Create biodiversity offset schemes for compensation of lack of legal reserve or planned environmental damage.

# Lábrea – BR-319



## Prioritization Criteria



## Main Applicable Conservation Mechanisms

- Strengthen of SNUC (National System of Conservation Units) through the establishment of new protected areas and reinforcing management of existing ones.
- Collective agreements to promote conservation activities in communal properties.
- Foster the establishment of voluntary land use agreements with a) indigenous peoples

## General Features

### Main Land Cover

Dense forest (96.4%).

### Main Land Use

Most of this intervention unit have less than 10% of agricultural areas.

### Deforestation Rate

Very high deforestation rate.

### Protected Areas

- Floresta Nacional de Balata-Tufari.
- FES de Tapauá.

In addition, 3 priority areas for biodiversity conservation were identified by MMA (2018) - (AMZ-243 / AMZ-749).

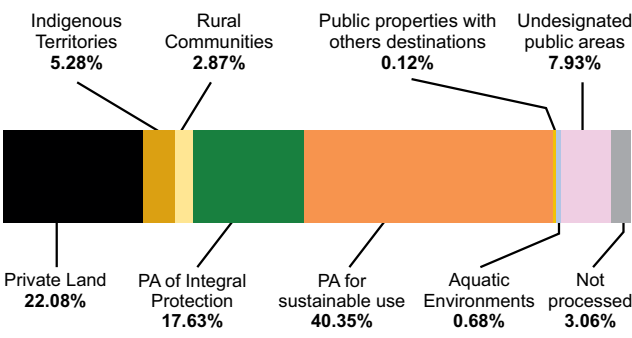
### Indigenous Territories

Juma

### Mitigation Strategy

1. Preservation (strengthening capacities for current protected areas management).
2. Mitigate environmental impacts of the secondary roads associated with BR-319 Highway.

## Land Tenure and Property Rights Brief



from Juma indigenous territory, b) private landowners located at the bank of BR-319 Highway.

- Encourage the conservation of natural resources through Payments for Ecosystem Services (PES) schemes.
- Reinforce tax incentives for biodiversity conservation. Promote the implementation and ensure the enforcement of the ICMS in Amazonas state.

### Featured Nature-based Solutions (NBS)

- Mosaic of Protected Areas in the North Portion of the Madeira-Purus Interfluve (WCS).
- Bioeconomy Project (INPA, USP, FAPEAM & FAPESP).
- PELD do Sudoeste do Amazonas (PSAM) – INPA, UFAM.
- Transdisciplinary Amazon Network (RETA) – FGVces.
- Integrated Management Plan for southern Amazonas Indigenous Territories and Conservation Units (IEB).
- Forest Cities: Madeira-Purus (Idesam) - Lábrea.
- Amazon Taste (Pirarucu Collective, ASPROC).
- Young Communicators Network (Alliance for Southern Amazonas Sustainable Development – WWF Brazil).
- Inatu Brand (Idesam).

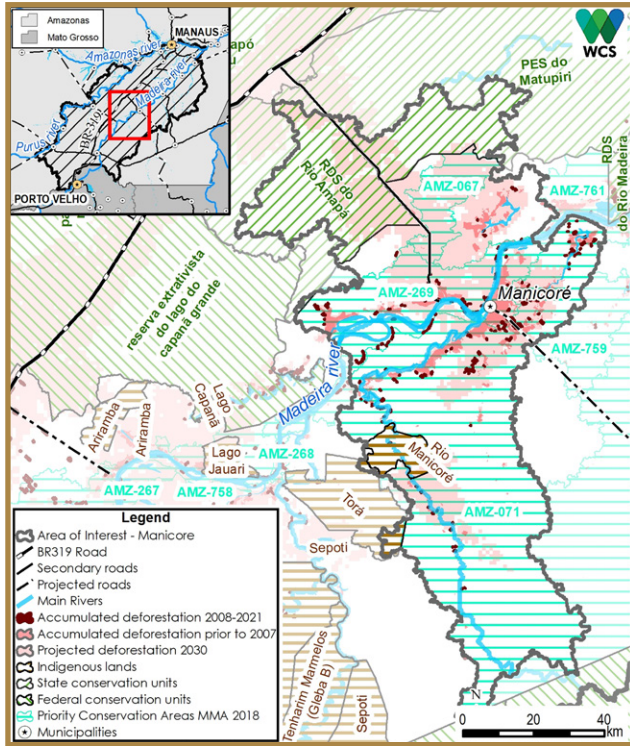
### Featured EIA Mitigation Strategies

- Environmental Management Program (PGA).
- Environmental Education Program.
- Forest Fire Fighting Subprogram.

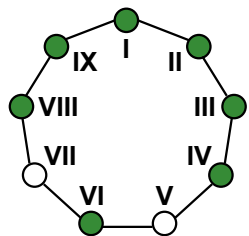
### Action Fronts Suggested

- Encourage integrated management of ITs and protected areas in southern Amazonas through programs that aim Amazon conservation and the strengthen of SNUC such as: i) Arpa Program – Protected Areas of the Amazon, ii) Amazon Sustainable Landscapes Program (ASL), iii) Amazonia Fund – BNDES, Pará's Eastern Amazon Fund (FAO), among others.
- Strengthening capacity for Balata-Tufari National Forest and FES de Tapauá management.
- Drive efforts to the establishment of new protected areas such as priority areas for biodiversity conservation like AMZ-243 and AMZ-749, where it is suggested to promote actions such as the regularization of degradant activity, and supervision and control of illegal activities.
- Strengthen stakeholders capacities to manage protected areas (surveillance, governance and land use rights)
- Create integrated management approaches for land use and watershed use.
- Develop tools to boost socio-environmental impact businesses.
- Propose arrangements for the implementation of ecological ICMS.
- Create biodiversity offset schemes for compensation of lack of legal reserve or planned environmental damage.
- Develop scientific research programs.

# Manicoré – BR-319



## Prioritization Criteria



- I. Crossed by a BR-319 section
- II. Federal Protected Areas within
- III. State Protected Areas within
- IV. Priority Conservation Areas within
- VI. BR-319 planned complementary roads existing within
- VIII. Proximity to population centers
- IX. High/very high deforestation rate



## General Features

### Main Land Cover

Dense forest (90.2%).

### Main Land Use

Most of this intervention unit have less than 10% of agricultural areas.

### Deforestation Rate

High deforestation rate.

### Protected Areas

- Área de Proteção Ambiental dos Campos de Manicoré.
- PES do Matupiri, RDS do Rio Amapá.

In addition, 2 priority areas for biodiversity conservation were identified by MMA (2018) - (AMZ-269).

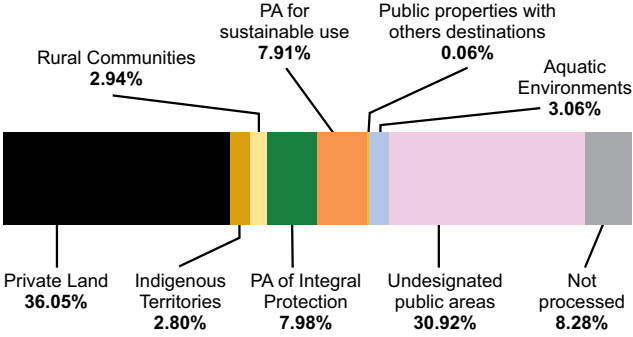
### Indigenous Territories

Rio Manicoré

### Mitigation Strategy

1. Sustainable Use.
2. Preservation.

## Land Tenure and Property Rights Brief



## Featured Nature-based™ Solutions (NBS)

- Bioeconomy Project (INPA, USP, FAPEAM & FAPESP)
- PELD do Sudoeste do Amazonas (PSAM) – INPA, UFAM.
- Transdisciplinary Amazon Network (RETA) – FGVces.
- Strategies to redirect PRONAF towards productive activities with low environmental impact in Legal Amazon (IPAM).
- Partners for Amazon Platform (PPA) – Idesam.
- Community and Family Forest Management Projects.
- TUC MANICORÉ (possible RDS) Manicoré/ Expansion of RDS do Rio Amapá.
- Forest Cities: Madeira-Purus (Idesam) – Apuí.
- Fishing Agreements for the Madeira River Basin (WCS e IEB).

## Main Applicable Conservation Mechanisms

- Strengthen of SNUC (National System of Conservation Units) through the establishment of new protected areas and reinforcing management of existing ones
- Foster credit lines to boost investments in agricultural activities with low environmental impact (e.g. Sitawi, PRONAF agroecologia, Floresta, Eco e Orientado).

## Featured EIA Mitigation Strategies

- Environmental Management Program (PGA).
- Environmental Education Program.
- Flora Protection Program.
- Degraded Area Recovery Program.
- Forest Fire Fighting Subprogram.

## Action Fronts Suggested

- Promote the expansion of protected areas, such as Área de Proteção Ambiental dos Campos de Manicoré and others like PES do Matupiri and RDS do Rio Amapá; would tend to order the occupation process in the region, especially the construction of the neighborhood link between the district of Santo Antônio do Matupi and the seat of the Municipality of Manicoré (decree published in the official gazette no 89-A, May 11, 2016).
- Establishment of new protected areas, such as priority areas for biodiversity conservation like AMZ-269 where is suggested to promote actions for the degraded areas recovery.
- Foster the establishment of voluntary land use agreements with a) indigenous peoples from Rio Manicoré Indigenous Territory, b) private landowners located on the BR-319 Highway and of the projected road from Manicoré to BR-230, and also collective natural resources agreements in public areas.
- Promote collective natural resources agreements in public areas.
- Promote integrated management approaches for land use and watershed use.
- Capacitate/Articulate key actors to implement agricultural activities with low environmental impact.
- Develop certified AFOLU projects for Voluntary Carbon Markets.

# 5. Recommendations

Through the different stages and steps taken in this study, it is vital to acknowledge the significant contributions made, especially the ones mentioned on the following points:

- Multi-criteria analysis based on representative variables of Importance and Urgency of environmental conservation around BR-319 Highway in state of Amazonas, Brazil;
- Identification of 18 potential intervention areas for the development of conservation mechanisms around BR-319 Highway in state of Amazonas, Brazil;
- Characterization of 8 intervention priority areas for the development of conservation mechanisms;
- Design of action-reaction scheme with 4 reference levels: i) Legal Framework, ii) Strategic Conservation Mechanism, iii) Action Front, iv) Critical Window (usual tools and existing projects and initiatives founded on Nature-based Solutions)
- Recommendations for the implementation of conservation action fronts, Nature-based Solutions examples and environmental management programs (PGA) where they could be applied for each of the intervention priority areas. PGAs are

foreseen in the Environmental Impact Assessment (EIA) carried out by the entrepreneur agency (DNIT – National Department of Transport Infrastructure) and their implementation is mandatory for next stage of the environmental licensing process approval, which will be the re-paving setup of the highway middle section.

Below are highlighted insights about the potential of some conservation mechanisms applicable for most of the intervention priority areas, according to the findings presented in the previous section. These general recommendations as well as the suggestions presented in the sheets for each specific intervention area aim to contribute to debates on conservation strategies and territorial intervention forms that must be taken in BR-319 area of influence. These actions can mitigate impacts, curb deforestation, and provide an additional perspective to other studies carried out by BR-319 Observatory member organizations.

## **5.1 Investing efforts in SNUC (National System of Conservation Units) enforcement is key to slowing down deforestation advance and meeting long-term climate change prevention goals**

In contexts such as the BR-319 interest area, establishing and expanding new Protected Areas as well as strengthening

management of the already established ones could become a key to preventing unwanted interventions in areas of environmental importance.

There is a deficiency in the effective management of existing protected areas due to institutional fragility of environmental agencies responsible for their surveillance. Despite that, the mere existence of protected areas of various types can significantly slow deforestation advance, and reduce the probability that any given hectare will transform the forest into another land use (Ferreira and others 2005).

Alarcon (2018) emphasizes the establishment of PAs has been one of the most effective strategies against deforestation in the Amazon region. Specifically, PAs near roads have been shown to have approximately 11% lower deforestation rates than unprotected areas near roads (Barber et al. 2014).

“*As mentioned by Fearnside and Lima de Alencastro Graça*  
**“Sometimes the mere rumor that a reserve will be created can discourage invasion.”**

BR-319 Observatory member organizations should promote, as soon as possible, the discussion on the feasibility of establishing new protected areas in the Arpa agenda. In 6 of the 8 intervention areas prioritized,<sup>35</sup> this mechanism was recognized as a priority due to the presence of 4 Federal Protected Areas,<sup>36</sup> 6 State Protected Areas, and 11 Priority Areas for Biodiversity Conservation.<sup>37</sup>

The Mosaic of Protected Areas in the north portion of the Purus-Madeira interfluvium initiative (lead by WCS) can contribute as an integrated management platform that can help coordinate and align strategic efforts of various stakeholders involved and dedicated in the region conservation.

## **5.2 Foster the establishment of voluntary land use agreements and encourage natural resources conservation through Payments for Ecosystem Services (PES) schemes**

### **a) Promoting land use voluntary agreements on collective territories is key, extending the responsibility for mitigating BR-319 impacts, and providing tools and resources to its natural custodians**

As previously noted, a good portion of prioritized intervention areas is under collective land rights or collective management statutes. Therefore, promoting voluntary conservation agreements on collective territories is a tremendous environmental conservation opportunity. As a result, it becomes possible to intervene in large tracts of land with only a few decision-makers involved while fostering conservation schemes consistent with the traditional livelihoods of indigenous people and rural settlements.

It may be possible to achieve meaningful conservation goals in strategic regions and effective interference in the use and management of land areas and waters where it would be very challenging

otherwise. This goal can be accomplished through the establishment of voluntary land use agreements between representative authorities of collective land rights and public or private parties interested in financing conservation initiatives in these territories.

Regarding this conservation mechanism, it is key to advance in the design and structuring of agreements with indigenous communities, such as Rio Manicoré, Cunha-Sapucaia, Vista Alegre, Fortaleza do Castanho, Tabocal, and Juma, following provisions of their existing or future Territorial and Environmental Management Plans (PGTAs).

Making agreements on communal territories land use may well be one of the most useful biodiversity conservation strategies in contexts such as BR-319. However, in the Brazilian context, it is not often that these agreements are binding, which makes them legally fragile and highly susceptible to breaches. It is, therefore, essential that land use agreements be designed in line with traditional communities demands, aligned with the vision of PGTAs, and that interested parties in signing this type

of agreement promote good practices to formalize their terms (specificity and clarity about the parties responsibilities, schedule of implementation actions, specified implementation areas, conditions in case of non-compliance, among others).

### **b) Foster the establishment of voluntary land use agreements with private landowners**

Voluntary land use agreements with individual landowners or groups are an alternative environmental enforcement tool that may be used to mitigate BR-319 undesired environmental impacts where private interests already rule an active land market.

Under voluntary land use agreement schemes such as Payments for Ecosystem Services (PES), landowners (either with formal or informal property rights) engage with biodiversity conservation and water production in exchange for a substantial and tangible financial benefit. These agreements must meet strategic environmental protection goals by distributing part of the land management conservation responsibilities to different landowners.



In addition, they must consider various incentives to effectively bolster landowner motivation in conserve and promote economic sustainable activities compatible with the road mitigation strategy.

### **c) Encourage conservation of natural resources through Payments for Ecosystem Services (PES) schemes**

Designing adequate Payments for Ecosystem Services schemes (PES) to reward ecosystem conservation services in the Purus-Madeira region is crucial to mitigate the undesirable effects of BR-319 paving via i) carbon markets (voluntary or cap and trade markets), ii) direct private payments or even iii) tax incentives.

In Brazil, PES were initiated in the early 2000s by NGOs. Currently, the Bolsa Floresta Program (launched in 2007) is one of the most representative initiatives applicable to the context of BR-319. Proof of this stands out in the Juma Sustainable Development Reserve, located in Novo Aripuanã (AM), which currently has 404 of program beneficiaries and almost 24 years of accumulated successful experience and learned lessons from setbacks.

Strengthening and extending PES initiatives to prioritized intervention areas is essential and urgent. Still, it is also important to stimulate and support the development of green investments aimed at offering benefits for ecosystem services care and helping to reduce greenhouse gases emission through other platforms, primarily through carbon markets and cap and trade markets. A pro-market strategic

direction of PES initiatives and an excellent financial planning model could become a funding vehicle for a comprehensive impact mitigation plan.

**“Over the course of the next decade, Brazil’s voluntary carbon market is predicted to grow up to 20 times and has the potential to help different actors achieve their mitigation goals – but the new decrees will need to overcome a series of technical issues as well as legal gaps in order for any potential benefits to come to fruition.”**  
(Ribeiro, 2022)

Implementing this conservation mechanism in the BR-319 context must consider agricultural frontier expansion areas with high and very high deforestation rates. Therefore, it is estimated that the intervention areas in which resources for this mechanism should be prioritized are areas in the BR-319, such as Tupana, Careiro, Lábrea – BR-319, Manicoré – BR-319 and Trecho do meio Section 3.

### **5.3 It is fundamental to encourage biodiversity offset mechanisms towards the prioritized intervention units and in coordination with other public and private interventions that may take place**

Biodiversity Offsets Schemes (BOs)<sup>41</sup> are actions that provide environmental benefits which counterbalance the significant residual environmental impacts or risks of a project or activity remaining after mitigation. BOs are increasingly used in a wide range of sectors as a mechanism to help

compensate adverse effects caused by development projects. They are generally undertaken with an overall objective of no net biodiversity loss (OECD, 2014).

The goal of biodiversity offset mechanisms<sup>42</sup> is to achieve no net loss and preferably a net gain of biodiversity on the ground concerning species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity (BBOP, 2022).<sup>43</sup>

Presently, biodiversity offsets tend towards a target-based ecological compensation approach, so they usually aim for net jurisdictional outcomes aligned with specific biodiversity targets. This approach helps connect project-level responses to these broad biodiversity targets to achieve desirable outcomes for stakeholders and biodiversity. It should be implemented synergistically with other conservation and sustainable development considerations: trading up, landscape-level planning, and impacts on people (Simmonds et al., 2019, p. 7).

#### **5.4 Foster multilateral environmental agreements (MEAs) between government, industry, communities and/or NGOs and contribute to the strengthening of cooperation agreements between government bodies in order to promote conservation activities aligned to the proposed mitigation strategy**

As has been warned, BR-319 repaving will trigger and accelerate unwanted impacts that undoubtedly demand urgent and

immediate attention. Therefore, is the BR-319 Observatory member organizations have a key role and must align efforts around a common impact mitigation strategy in order to promote the development of a public programs/policies to foster conservation actions in the most vulnerable territories. These actions are especially important in the intervention units nearby the primary sources of pressure such as Lábrea, Humaitá, Trecho do Meio Section 3, Careiro, Tupana and Trecho do Meio Section 1. Currently, national and state efforts to develop public projects of PES and OECMs stand out.

#### **5.5 Promotion of conservation actions in public areas related to the sustainable development of water resources as a strategy to mitigate pressure derived from unregulated commercial fishing. Implementing fishing agreements with local communities could help to promote sustainable fishing and establish regulations for sport and commercial fishing**

As mentioned, planned road branching constitutes a vector of pressure and threats for BR-319, and also will impact the aquatic environments in the BR-319 influence area. It is necessary that the state and federal government make efforts to guarantee this region governance, strengthening institutions such as INCRA, ICMBio, FUNAI and SEMA-AM, as well as land regularization.

Many of these threats are related to predatory fishing and alluvial mining and can be found in public areas where deficiencies in natural resources regulation and management have been evidenced.

As referred to in the Environmental Impact Study (EIA, 2021), in the Purus River, the lack of fisheries management in certain areas added to the lack of supervision by the competent bodies, and the consequent invasion of lakes by predatory fishing are frequent. Meanwhile, alluvial mining is one of Madeira River's most representative human pressures.

***“In general, a large part of the communities located in the BR-319 area of interest use the rivers as their means of life, relating to the headquarters of the municipalities in which they are located (...) their livelihoods are based on fishing, transporting goods and people and extracting of forest resources, in the case of communities present in Conservation Units “***  
*(EIA BR-319/AM, 2021)*

Consequently, it is essential to direct efforts toward the mitigation of pressures derived from these activities through mechanisms such as agreements and regulatory schemes for the sustainable use of water resources. These actions are especially recommended in interventions such as Tupana and Careiro, but also extending to areas where illegal, unreported and unregulated fishing already exists or may begin to occur due to the road's resurfacing. This scenario calls for new and more effective arrangements based on participatory management (or co-management) of fisheries in the region.

### **5.6 Capacity-building of local actors is key for establishing agricultural activities with low environmental**

### **impact and strengthening socio-bioeconomy initiatives**

There are subsidiary platforms to finance investments in the implementation, expansion or modernization of production, processing, industrialization and services structure in rural establishments aimed at the income generation and improving the use of family labor such as PRONAF. However, currently these subsidies are not reaching the places where they are most needed, mainly due to the lack of knowledge many of the possible beneficiaries have about the procedures to access these programs and on the technical requirements applicable.

Strengthening family agriculture programs and boosting investments in rural sustainable development activities could have a positive and large-scale impact on the slowdown of deforestation drivers associated with the most vulnerable deforestation agents such as family farmers who have been on the sidelines of public policies.

It is essential to work on capacity building to connect these programs with the territories and people who need them most.<sup>44</sup>

Vulnerability conditions of people settled in agricultural frontier expansion areas are well known and it is there where these training and capacity-building efforts should be directed as a priority. On the other hand, it is fundamental working on redirecting PRONAF guidelines towards productive activities with low environmental impact in Legal Amazon (IPAM).

# References

1. A recent sign of the government's institutional position regarding the road's reconstruction can be seen in the DNIT report: Relatório de Impacto Ambiental, Pavimentação e Melhoramentos, incluindo Obras de Artes Especiais, na BR-319/AM, Trecho do Meio (2021).
2. According to Meirelles et al. (2018): "Land occupation in the BR-319 region follows the same occupation practices in Rondônia: illegal removal of timber, deforestation, establishment of pastures for livestock, among other environmentally impactful activities."
3. The environmental impact assessment (EIA) document, submitted in June, 2022 to the licensing agency (IBAMA, Brazil's environmental agency) by the consulting company Engespro Engenharia Ltda.
4. The stretch studied by the EIA is between km 250,7 and km 656,4 and is known as "Trecho do Meio" and crosses the municipalities of Borba/AM, Beruri/AM, Manicoré/AM, Tapauá/AM, Canutama/AM and Humaitá /AM. The objective of the highway is to integrate the capitals of Amazonas (Manaus) and Rondônia (Porto Velho) states, as well as two municipalities located in the highway area (DNIT, 2021).
5. The entire statement at: [https://www.observatoriobr319.org.br/wp-content/uploads/2022/08/Nota-de-posicionamento\\_OBR319\\_01Agosto2022.pdf](https://www.observatoriobr319.org.br/wp-content/uploads/2022/08/Nota-de-posicionamento_OBR319_01Agosto2022.pdf).
6. As warned for Meirelles et al. (2018): "(...) given the absence of public power in the region, or that the expansion of these illegal businesses is guaranteed."
7. The forest areas in western Amazonia that would be opened by planned roads connecting to the BR-319 are vital to maintaining rainfall that supplies water to São Paulo and other major urban and agricultural areas outside the Amazon region (Scherer, 2021).
8. The highest deforestation and fire focus were observed near the capital cities of Manaus and Porto Velho, particularly following the road paved sections in its northern and southern extremes. Its middle section experienced a rapid increase in deforestation after a government plan to repave the road in 2015, still not done.
9. For the entire BR-319 Highway, 89,328 ha were deforested between 1988 and 2020, within a 40 km buffer, and 300,116 ha were deforested when considering a buffer of 150 km. After the highway "repaving" program began in 2015, PRODES data show highly significant increases in deforestation (...), indicating that the increase in deforestation is linked to the "repaving" program and to the political promise of total paving of the highway (Ferrante et al., 2021).
10. Refers to legal changes that ease restrictions on the use of a protected area, shrink a protected area's boundaries or eliminate legal protections entirely.
11. In this study the scientists divided the river basin into a number of sub-basins defined by 11 different stream orders ranging from tiny streams to the Amazon River itself. Seven distinct levels of basins were defined, with the main Amazon Basin as level 1. Sub-basin level 7 are minor drainage subunits with threshold sizes of 300 km<sup>2</sup>.
12. APA dos Campos de Manicoré, REBIO do Abufari, RESEX do Lago do Capanã Grande, FLONA de Humaitá, Parque Nacional Nascentes do Lago Jari, and FLONA de Balata-Tufari.
13. FES de Tapauá, PES do Matupiri, RDS Canumã, RDS do Matupiri, RDS do Rio Amapá, RDS do Rio Madeira, RDS Igapó-Açu and RDS Piagaçu-Purus.
14. Áreas Prioritárias para Conservação da Biodiversidade (MMA, 2018).

**15.** Belonging to ethnic groups such as Mura, Pirahã, Paumari, Tenharim, Tikuna, Torá, and Apurinã.

**16.** Both indigenous territories and state and federal protected areas are taken into account.

**17.** Anori, Beruri, Manaquiri, Careiro, Autazes, Careiro da Várzea.

**18.** Canutama, Humaitá, Manicoré, Borba.

**19.** In this case, as noted in the methodology, sub-basin level 7 is composed of analysis units and minimum spatial unit of observation.

**20.** Homogenization of layers for discrete data treatment consists of statistical-spatial operations that allow assigning a single value per variable to each sub-basin. This procedure enables point, line, and polygon and can take even raster-type spatial data to the same standard area unit-in this case, the sub-basin.

**21.** Woods Hole Research Center.

**22.** Ministry of the Environment (MMA).

**23.** Science for Nature and People Partnership.

**24.** Leandro Silveira – Jaguar Conservation Fund.

**25.** Andean Development Corporation.

**26.** National Department of Transport Infrastructure (DNIT).

**27.** Layer resulting from the superposition of the layer of the hydrological network (SNAPP Amazon Aquatic Ecosystem Spatial Framework / Rivers level 4-11) and the road network infrastructure (BR-319 Observatory, 2020).

**28.** Amazonian Network of Georeferenced Socio-Environmental Information (RAISG).

**29.** The results summarized above of Importance and Urgency criteria were standardized in categories from 1 to 5 (applying the same standardization method described

previously), generating a single result for each (Importance and Urgency). Correspondingly, the summarized quantitative result of the Relevance criterion is also represented on a scale of 1 to 5.

**30.** BR-319: Brazil's Manaus-Porto Velho Highway and the Potential Impact of Linking the Arc of Deforestation to Central Amazonia. (Fearnside, P. & de Alencastro Graça, P. M. 2006).

**31.** The shape files from this exercise are available for download in: [https://drive.google.com/drive/folders/1BhD8w5uyrqDTQ7nths\\_dejnYv7TV11GU?usp=share\\_link](https://drive.google.com/drive/folders/1BhD8w5uyrqDTQ7nths_dejnYv7TV11GU?usp=share_link)

**32.** According to IUCN, Nature-based Solutions are actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously benefiting people and nature. See more: <https://www.iucn.org/our-work/nature-based-solutions>.

**33.** Proposals arranged correspond to a selection made by the author based on what is described in the chapter 9 of the Environmental Impact Assessment (ENGESPRO, 2022).

**34.** Currently, half of the road axis crosses areas that do not have any type of strict environmental protection.

**35.** Trecho do meio Sections 1, 2 and 3, Tupana, Lábrea – BR-319, Manicoré – BR-319 and, Lebreá-BR-319.

**36.** Floresta Nacional de Balata-Tufari, Parque Nacional Nascentes do Lago Jari, Área de Proteção Ambiental dos Campos de Manicoré.

**37.** PES do Matupiri, RDS do Rio Amapá, RDS Igapó-Açu and FES de Tapauá.

**38.** AMZ243, AMZ269, AMZ470, AMZ471, AMZ749, AMZ755, AMZ764, AMZ766, AMZ767, AMZ889, AMZ890.

**39.** Recently, other countries in the Amazon region, such as Colombia, have made progress

in the design and implementation of this type of agreement. Land use agreements have been established in the neighboring country, in the lower basin of the Caquetá and Apaporis rivers, in a context very similar to that BR-319. This was possible as part of Multilateral Environmental Agreements (MEAs), in which Conservation International participates. These agreements promote the protection of some 250,000 ha of strategic ecosystems) where fishing agreements have also been signed and have resulted in an increase in fish species population such as the pirarucu and the arawana, and tangible benefits have been achieved for the community. Further information: <https://www.conservation.org.co/programas/Conservacion-para-el-desarrollo/Lista-Articulos/acuerdos-de-conservacion-la-cuenca-baja-de-los-r-os-caquet-y-apaporis>.

**40.** [https://www.ids.ac.uk/download.php?file=files/dmfile/LHcasestudy12\\_REDDBrazil.pdf](https://www.ids.ac.uk/download.php?file=files/dmfile/LHcasestudy12_REDDBrazil.pdf)

**41.** As the term “compensation” is somewhat vaguely used and does not always include the idea of no net loss, the term biodiversity offsetting is often used instead.

**42.** According to the Organization for Economic Co-operation and Development (OECD), three different mechanisms are used to implement biodiversity offsets: i) One-off approach: once adverse impacts have been evaluated, biodiversity offsets are carried out by the developer or by a subcontractor; ii) In-lieu arrangement: a government agency stipulates a fee that a developer must pay to a third party, to compensate for residual biodiversity impacts; iii) Habitat Banking/Biobanking (HB): once adverse impacts are evaluated, the developer can purchase offsets directly from already existing public or private habitat banks. The credits price is often determined in the market. (OECD, 2016, p. 5).

**43.** Biodiversity Offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from development plans or projects after appropriate prevention and mitigation

measures have been taken. The explanation has been derived from the Business and Biodiversity Offsets Program (BBOP, 2012). Available on: [https://www.forest-trends.org/wp-content/uploads/imported/bbop\\_updated\\_glossary\\_6-july-12\\_v1-pdf.pdf](https://www.forest-trends.org/wp-content/uploads/imported/bbop_updated_glossary_6-july-12_v1-pdf.pdf).

**44.** It is recommended to give adequate technical assistance in these settlements, given the large amount of land destined for environmentally differentiated settlements along BR-319 highway. This assistance needs to develop a strong social organized work within the settlements, as well as production systems suited to the local reality, added to the possibility of regularizing timber forest management and non-timber forest products within these areas, in order to generate income and life quality. (Meirelles et al., 2018).

# Bibliographic References

**Alarcon, C. U. (2018).** Land-use allocation on the Amazon Frontier: evidence from the Manaus - Porto Velho road (BR-319) in Amazonas, Brazil. Technische Universität Dresden.

**Andrade, M. B. T., Ferrante, L., & Fearnside, P. M. (2021).** Brazil's Highway BR-319 demonstrates a crucial lack of environmental governance in Amazonia. In *Environmental Conservation* (Vol. 48, Issue 3). <https://doi.org/10.1017/S0376892921000084>

**Bernard, E., Penna, L. A. O., & Araújo, E. (2014).** Downgrading, downsizing, degazettement, and reclassification of protected areas in Brazil. *Conservation Biology*, 28(4). <https://doi.org/10.1111/cobi.12298>

**DNIT. (2021).** Relatório de Impacto Ambiental. In Pavimentação e Melhoramentos, incluindo Obras de Artes Especiais, na BR-319/AM, Trecho do Meio, entre os Km 250,7 e 656,4, com extensão de 405,7 km.

**Fearnside, P. (2015).** Highway construction as a force in destruction of the Amazon forest (pp. 414–424). <https://doi.org/10.1002/9781118568170.ch51>

**Fearnside, P. (2017).** Deforestation of the Brazilian Amazon. Oxford University Press. <https://doi.org/10.1093/acrefore/9780199389414.013.102>

**Fearnside, P., & de Alencastro Graça, P. M. (2006).** BR-319: Brazil's Manaus-Porto Velho Highway and the Potential Impact of Linking the Arc of Deforestation to Central Amazonia. *Environmental Management*, 38, 705–716. <https://doi.org/10.1007/s00267-005-0295-y>

**IBAMA. (2009).** Parecer No 078/2009 - COTRA/CGTMO/DILIC/IBAMA.

**Fearnside, P. M., & de Alencastro Graça, P. M. L. (2006).** BR-319: Brazil's Manaus-Porto Velho Highway and the potential impact of linking the Arc of Deforestation to Central Amazonia. In *Environmental Management* (Vol. 38, Issue 5). <https://doi.org/10.1007/s00267-005-0295-y>

**Ferrante, L., Andrade, M. B. T., & Fearnside, P. M. (2021).** Land grabbing on Brazil's Highway BR-319 as a spearhead for Amazonian deforestation. *Land Use Policy*, 108. <https://doi.org/10.1016/j.landusepol.2021.105559>

**Ferrante, L., Gomes, M., & Fearnside, P. M. (2020).** Amazonian indigenous peoples are threatened by Brazil's Highway BR-319. *Land Use Policy*, 94. <https://doi.org/10.1016/j.landusepol.2020.104548>

**Kirby, K. R., Laurance, W. F., Albernaz, A. K., Schroth, G., Fearnside, P. M., Bergen, S., Venticinque, E. M., & da Costa, C. (2006).** The future of deforestation in the Brazilian Amazon. *Futures*, 38(4). <https://doi.org/10.1016/j.futures.2005.07.011>

**Lima, M., Santana, D. C., Maciel Junior, I. C., da Costa, P. M. C., de Oliveira, P. P. G., de Azevedo, R. P., Silva, R. de S., Marinho, U. de F., da Silva, V., de Souza, J. A. A., Rossi, F. S., Delgado, R. C., Teodoro, L. P. R., Teodoro, P. E., & da Silva Junior, C. A. (2022).** The “New Transamazonian Highway”: BR-319 and Its Current Environmental Degradation. *Sustainability (Switzerland)*, 14(2). <https://doi.org/10.3390/su14020823>

**Mataveli, G. A. v, Chaves, M. E. D., Brunzell, N. A., & Aragão, L. E. O. C. (2021).** The emergence of a new deforestation hotspot in Amazonia. *Perspectives in Ecology and Conservation*, 19(1), 33–36. <https://doi.org/https://doi.org/10.1016/j.pecon.2021.01.002>

**FGVces. (2021).** Fortalecendo governança e transparência na região da BR-319 - Debatendo Capacidades públicas no entorno da BR-319.

**Meirelles, F.A., Cardoso, G., Fernandes, J. G., Colini, M., & Paes, P. C. (2018).** Análise Ambiental e Socioeconômica dos Municípios sob Influência da Rodovia BR-319.

**Moura, A. M. M. de. (2016).** Aplicação dos Instrumentos de Política Ambiental no Brasil: Avanços e Desafios. In Governança Ambiental no Brasil: instituições, atores e políticas públicas.

**Py-Daniel, L. R., Pereira de Deus, C., Loureiro Henriques, A., Pimpão, D. M., & Marinho Ribeiro, O. (2007).** Biodiversidade do Médio Madeira - Bases Científicas para Propostas de Conservação. Inpa.

**Ritter, C. D., McCrate, G., Nilsson, R. H., Fearnside, P. M., Palme, U., & Antonelli, A. (2017).** Environmental impact assessment in Brazilian Amazonia: Challenges and prospects to assess biodiversity. In Biological Conservation (Vol. 206). <https://doi.org/10.1016/j.biocon.2016.12.031>

**Sánchez, L. E. (2015).** The impact of the IIRSA Road Infrastructure Programme on Amazonia. Impact Assessment and Project Appraisal, 33(3), 234–235. <https://doi.org/10.1080/14615517.2015.1051426>

**Scherer, G. (2021, October).** BR-319 highway hearings: An attack on Brazil's interests and Amazonia's future (commentary). Mongabay.

**Soares-Filho Britaldo; Leroy Davis, Juliana; Raoni, R. (2020).** Pavimentação da BR-319, a Rodovia do Desmatamento.

**Venticinque, E., Forsberg, B., Barthem, R., Petry, P., Hess, L., Mercado, A., Cañas, C., Montoya, M., Durigan, C., & Goulding, M. (2016).** An explicit GIS-based river basin framework for aquatic ecosystem conservation in the Amazon. Earth System Science Data, 8(2). <https://doi.org/10.5194/essd-8-651-2016>.

**WCS. (n.d.).** Monitoring BR 319. Retrieved February 5, 2023, from <https://brasil.wcs.org/en-us/Wild-Places/Monitoring-BR-319.aspx>.

# Attachment

## Indigenous Territories

INDIGENOUS LAND	INDIGENOUS PEOPLE	AREA	STATUS	MODALITY	FUNAI REGIONAL COORDINATION	BORDER
Apurinã do Igarapé São João	Apurinã	18232,4	Regularized	Traditionally occupied	Coordenação Regional Médio Purus	Not
Apurinã Igarapé Tauamirim	Apurinã	96456,5	Regularized	Traditionally occupied	Coordenação Regional Médio Purus	Not
Caititu	Apurinã, Jamamadi e Paumari	308062,6	Regularized	Traditionally occupied	Coordenação Regional Médio Purus	Not
Paumari do Lago Marahã	Apurinã	118766,9	Regularized	Traditionally occupied	Coordenação Regional Médio Purus	Not
Itixi Mitari	Apurinã	182134,8	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Diahui	Jiahui	47354,6	Regularized	Traditionally occupied	Coordenação Regional do Madeira	Not
Ipixuna	Parintintin	215362,1	Regularized	Traditionally occupied	Coordenação Regional do Madeira	Not
Nove de Janeiro	Parintintin	228777,1	Regularized	Traditionally occupied	Coordenação Regional do Madeira	Not
Jacareúba-Katauíxi	Isolated	647386,0	In study	Interdicted	Coordenação Regional Médio Purus	Yes
Juma	Juma	38351,1	Regularized	Traditionally occupied	Coordenação Regional do Madeira	Not
Apípica	Mura	652,8	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Arary	Mura	40548,6	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Ariramba	Mura	10357,5	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Cuia	Mura	1322,4	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not

INDIGENOUS LAND	INDIGENOUS PEOPLE	AREA	STATUS	MODALITY	FUNAI REGIONAL COORDINATION	BORDER
Cunhã-Sapucaia	Mura	471450,5	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Fortaleza do Castanho	Mura	2756,2	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Gavião	Mura	8611,9	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Itaitinga	Mura	135,9	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Jauary	Mura	24831,0	Bounded	Traditionally occupied	Coordenação Regional de Manaus	Not
Lago Aiapua	Mura	24866,1	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Lago Capanã	Mura	6321,6	Regularized	Traditionally occupied	Coordenação Regional do Madeira	Not
Lago do Limão	Mura	8210,0	Declared	Traditionally occupied	Coordenação Regional de Manaus	Not
Lago Jauari	Mura	12023,1	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Lago do Marinheiro	Mura	3586,3	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Miguel-Josefa	Mura	1628,8	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Murutinga-Tracajá	Mura	13286,0	Declared	Traditionally occupied	Coordenação Regional de Manaus	Not
Natal-Felicidade	Mura	313,3	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Padre	Mura	797,5	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Paracuhuba	Mura	927,5	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Patauá	Kanamari e Mura	615,9	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not

INDIGENOUS LAND	INDIGENOUS PEOPLE	AREA	STATUS	MODALITY	FUNAI REGIONAL COORDINATION	BORDER
Pinatuba	Mura	29564,9	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Recreio-São Félix	Mura	251,1	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Rio Jumas	Mura	9462,7	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Rio Manicoré	Mura	19481,9	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
São Pedro	Mura	726,2	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Setemã	Mura	49773,0	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Tabocal	Mura	906,2	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Trincheira	Mura	1624,6	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Ponciano	Mura	4329,0	Declared	Traditionally occupied	Coordenação Regional de Manaus	Not
Vista Alegre	Mura	13206,0	Bounded	Traditionally occupied	Coordenação Regional de Manaus	Not
Boa Vista - AM	Mura	337,4	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Sissaíma	Mura	8780,0	Declared	Traditionally occupied	Coordenação Regional de Manaus	Not
Pirahã	Isolados do Rio Maici e Pirahã	346910,6	Regularized	Traditionally occupied	Coordenação Regional do Madeira	Not
Coata-Laranjal	Munduruku e Sataré-Mawé	1153210,1	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Paumari do Rio Ituxi	Paumari	7572,4	Regularized	Traditionally occupied	Coordenação Regional Médio Purus	Not
Sepoti	Tenharim	251349,0	Regularized	Traditionally occupied	Coordenação Regional do Madeira	Not

INDIGENOUS LAND	INDIGENOUS PEOPLE	AREA	STATUS	MODALITY	FUNAI REGIONAL COORDINATION	BORDER
Tenharim -Marmelos	Tenharim	497521,7	Regularized	Traditionally occupied	Coordenação Regional do Madeira	Not
Tenharim -Marmelos (Gleba B)	Tenharim	474741,6	Regularized	Traditionally occupied	Coordenação Regional do Madeira	Not
Lago do Beruri	Tikuna	4080,4	Regularized	Traditionally occupied	Coordenação Regional de Manaus	Not
Torá	Torá e Apurinã	54961,0	Regularized	Traditionally occupied	Coordenação Regional do Madeira	Not
Jarawara/ Jamamadi/ Kanamati	Jamamadi e Jarawara	390233,1	Regularized	Traditionally occupied	Coordenação Regional Médio Purus	Not

### Realization

BR-319 Observatory  
WCS Brazil

### Authors

Francisco López Loffsner (WCS AAO)  
Ana V. Garrido (WCS Brazil)

### Geoprocessing

Felipe Salazar (WCS Colombia)

### Technical Review

Fernanda Meirelles (Idesam)  
Izabel Santos (Idesam)  
Marcos Amend (WCS Brazil)  
Carlos Durigan (WCS Brazil)  
Guillermo Estupinán (WCS Brazil)  
Vanessa Garcia (WCS AAO)

### English revision

Thárin Gomes Radin (Contexto Acadêmico)

### Graphic Design

Silvio Sarmento (SS Design)

[observatoriobr319.org.br](http://observatoriobr319.org.br)

This publication was only possible thanks  
to the support of:

 Mitsubishi Corporation Foundation  
FOR THE AMERICAS



FONDATION SEGRÉ

