



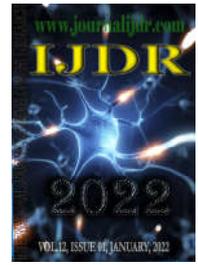
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RESEARCH ARTICLE

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QUANTITATIVE ANALYSIS REGARDING DEFORESTATION IN THE MUNICIPALITY OF PLACAS, PARÁ, BRAZIL

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ABSTRACT

In the Amazon region, especially in the western part of the state of Para, in the municipality of Placas, deforestation intensified after the “integrate but not deliver” program. The objective of this research was to verify anthropic actions such as the opening of roads, extraction of wood, population growth, and the local economy, such as the increase in cattle and soybean farming. The method used was deductive, with a quantitative scope. The obtention of data in free-access electronic databases such as the CAPES Periodical Portal. The analysis of these data indicated that both cattle-raising ($R^2 = 63\%$) and agriculture ($R^2 = 19\%$) contributed to deforestation in this municipality, besides the construction of two highways: BR 163 and BR 230. Local population growth was not as effective in this action. Currently, the implementation of conservation units, settlement and sustainable development projects has contributed to a decrease in the deforestation rate but has not slowed down this action in that municipality.

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INTRODUCTION

Deforestation in the Brazilian Amazon extension occurs in three ways: shallow cutting, selective logging, and forest degradation. This action became more intense in the period of the military government (1964 to 1985) and has suffered from changes in land use and occupation (MELLO; ARTAXO, 2017; SANTOS *et al.*, 2017), and in the last three years, it has increased even higher: 2018 (5,345 ha), 2019 (6,299 ha) and 2020 (7,332 ha). In the latter, the state of Pará (area = 1.25.103 km²; 73% are forests), a component of this region, completed 15 years as a champion of deforestation and burning, justified by the expansion of soybeans, with 41 million ha, from 1990 to the present day and the exploitation of mineral deposits (bauxite, calcium, phosphorus, gold, among others) in the territory of Pará (BARROS *et al.*, 2020; OSÓRIO, 2018; SAUER; PIETRAFESA, 2013; TEIXEIRA, ISALSO. WEDGE; EARTH, 2012). As observed, the western region of this state presents land with the agricultural predisposition and mineral exploitation, thus subject to deforestation, especially in the municipality of Placas (RODRIGUES, 2020). This municipality, whose name is associated with the rural agrovillages in which the plaque that indicated the boundaries between the cities of Altamira and Itaituba, during the construction of the BR-230 highway, dismembered from the municipality of Santarém and officially has existed since 1993, with the promulgation of State Decree No. 5,783 (IBGE, 2020).

But what is deforestation? It is the removal, in its entirety, that is, trunk, roots, and other arboreal components, or that there may still be something left of this tree in a specific locality. In addition, they cause significant losses, such as soil loss (COSTA, 2018; MAPBIOMAS, 2020). To better understand this problem, it is necessary to know that it involves three factors: 1) time scale; 2) successive events, and 3) economic factors, in addition to the small farmer who produces crops to own subsistence, in the cutting and burning system and, if there is surplus, commercializes it, or when these workers decide by an easier way to acquire financial resources: logging (BISTENE; GUIMARÃES, 2019; SANTOS *et al.*, 2017).

To increase subsistence in rural areas and better control deforestation, settlement projects arise, from projects elaborated by the National Institute of Colonization and Agrarian Reform (INCRA), and legally established with the publication of Ordinance No. 477 (BRASIL, 1999) and, according to Souza (2020), so that the land fulfilled its social function, i.e., reducing poverty in rural areas. In this context, Farias *et al.* (2020) summarized that it is a project with social, environmental, and economic objectives in two aspects: Settlement Project (PA) and Sustainable Development Project (PDS), which cause as minor an impact as possible to the environment, but that are not obstacles to the economy, and maintain sustainability via the family of agriculture.

Another problem to be solved: the growth of agricultural production in these settlements to meet population growth in these areas, should be drained, in addition to spaces for the construction of new residences, do not contemplate a growth in deforestation? The flow of the displacement production of the population in western Pará was possible thanks to the construction of two major highways: BR 163 and BR 230. In addition to farmland, Rodrigues (2020) associates with deforestation the large areas of gold minerals (Au), bauxite, limestone, and phosphorus (P), in this Pará, where the municipality of Placas is located. All these facts justified and increased the relevance of this analysis on plant cover in the municipality of Placas to understand the causes of the exploitation of timber forest resources and the main consequences that this entailed for two sectors: environment and the platelet community, as well as generating information that, soon, may help in other analyses regarding the evolution/involution of these actions.

MATERIAL AND METHODS

Study area: The municipality of Placas, in the east of the state of Pará, has an approximate area of 7,173,194 km² and an estimated population of 32,325 inhabitants for 2021 (IBGE, 2020). Geographically, it is located between the geographic coordinates of Latitude: -3.87307, Longitude 3°, 52' 23" S, 54° 13' 11" W at an altitude of 89 m, in the mesoregion of the Lower Amazon and the Microregion of Santarém (TOMAELA, 2014) and Mesoregion of the lower amazon (DNIT, 2019), concerning Highway BR - 230, it occupies km 270 of this highway (Figure 1).

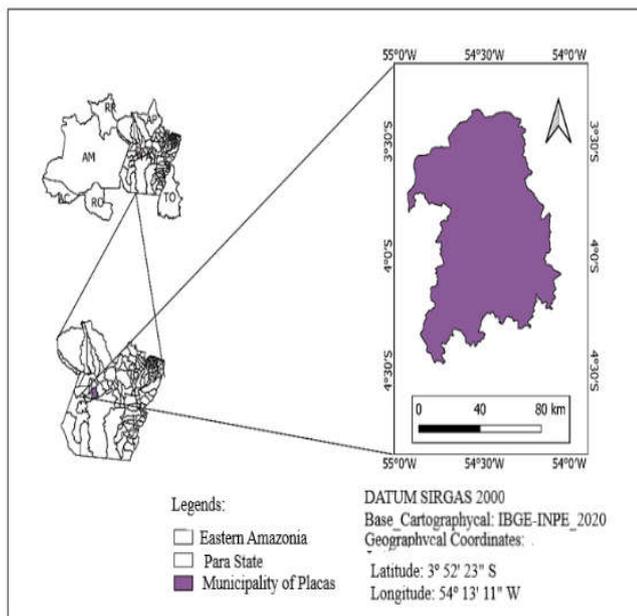


Figure 1. Location map of the municipality of Placas, West of Para State

This marginal location on this highway was provided from the support of the strategy created by the then president of the "Military Republic", under the aegis of the 28th Brazilian president, Emílio Garrastazu Medici (1905-1985), in which, both banks of the highway under construction, would be occupied by suitors to owners of land lots with 100 ha, and this caused a large displacement of individuals, to leave their native lump, usually from the southern region of the country, to finally own a lot of farmland (?) in Vila das Placas or km 240 (TOMAELA, 2014). Therefore, it comes from the numerous agrovillages that formed at that time, and was elevated to the current category, after the enactment of State Law n. 5.783, of December 20, 1993 (IBGE, 2021; PARÁ, 1993; SOUZA, 2010), enactment of State Law No. 5.783, of December 20, 1993 (IBGE, 2021; PARÁ, 1993; SOUZA, 2010). The geographical limits of Placas, to the north with the municipality of Mojui do Campos and Belterra; already to the

south, with Altamira; to the east, with Uruará, and to the west, with Rurópolis (Figure 2).

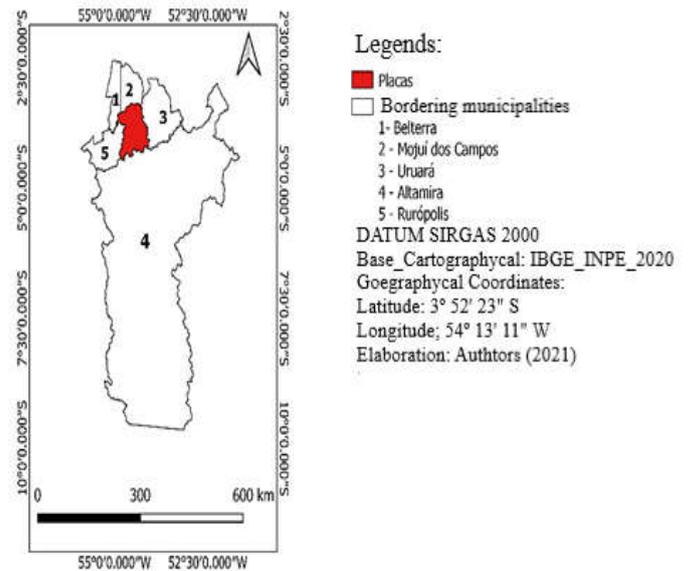


Figure 2. Municipal geographic boundaries of Placas, west of Para State

The climate is classified, according to Köppen-Geiger, in Am, i.e., monsoon, with an average annual temperature between 25° C to 26° C. In the hydrographic context, this municipality composes the Lower Amazon Hydrographic Basin (PARÁ, 2012), with two rivers: 1) Curuá-Una, clear water that has a spring in the Serra do Cachimbo and serves numerous communities, farms, and cities, with the drain in the Amazon River since it is a tributary of the right bank of it, and 2) Curuatinga, which flows into the Curuá-Una river, of which it is a tributary of the right bank (JATI; SILVA, 2017). Both have springs south of this municipality. The economic sector has several aspects; among them, three deserve highlights: agriculture, livestock, and cocoa production, and occupies the position of number 754, regarding the Sustainability Index of the Municipalities of the Amazon-ISMA (SILVA; AMIM; NUNES, 2015).

It's included in the Sustainable Regional Development Plan (PDRS) because the municipality composes the Xingu Integration Region with the following municipalities: Uruará, Medicilândia, Brasil-Novo, Altamira, Vitória do Xingu, Anapu, Pacajá, Senador José Porfírio and Porto de Moz (NEVES; MENEZES; PENA, 2014), and receives government support through Sustainable Participatory Territorial Planning, as well as is engaged in the Growth Acceleration Program (PAC). As for the environmental legal framework, the municipality under analysis has defined criteria: Organic Law of the Municipality, n°. 020 (PLACAS, 1997), Article 7, item XVII, determines that "forests, as well as flora and fauna, must be objects of preservation by the municipal power"; Master Plan for Municipal Development of Placas no. 286 (PLACAS, 2020); Municipal Basic Sanitation Law, no. 289 (PLACAS, 2021) of April 23, 2021, and Bill no. 300 (PL) no. 300 (PLACAS, 2021), which deals with collecting taxes in the face of environmental control. As for the method, the deductive was used because, according to the synthesized by Guedes (2016), it started from general to specific. For the former, the valid premise that deforestation occurs in the Brazilian Amazon was adopted; for the specific, it was conducted in the form of questions: and in the municipality of Palmas? The scope followed the recommendations of Pereira *et al.* (2018).

For these authors, the quantitative and qualitative allows the association between the analysis of the content concerning the object of the research, in addition to the use of past data, as well as new data, in numerical form, which characterizes the quantitative, and may serve as a basis for new analyses on the progress of deforestation in the state of Pará. Three steps were necessary to better apply this methodology to this research (Figure 3).

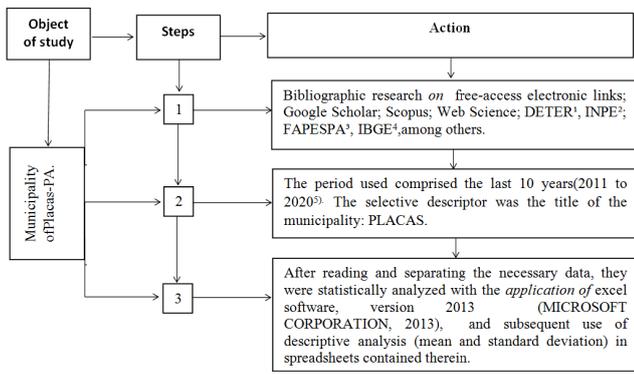


Figure 3. Steps applied to the methodology of this research

¹Evidence alert system in the alteration of forest cover in the Amazon; ²National Institute of Space Research; ³Amazon Foundation for Research and Study Support; ⁴Brazilian Institute of Geography and Statistics; ⁵The following are the exception of the pioneer literatures (ROS-TONEN,1993; UHL *et al.*, 1991; VERÍSSIMO *et al.*, 1995), as well as the environmental legislation in force.

On the other hand, the calculation for the number of hectares was conducted using Equation 2.

$$ha = A_{M2} \times 100 \quad (1)$$

$$Total \text{ (em ha) ocupadopelorebanho} = \frac{2,6 \times xn^{\circ}totaldeanimais}{1 \text{ haparacadaanimal}} \quad (2).$$

As for Equation 2, it was used from the recommendations of the livestock agency Ideagri (ip.edagri.com.br): 2.6 animals/ha. The statistical analysis of the data was performed using electronic spreadsheets contained in the BioEstat 5.3 software (IDSMS, 2020). Soon after, the data obtained were allocated in tables and graphs according to the standardized by The Brazilian Geographic and Statistic (IBGE, 1993).

RESULTS

Deforestation and disposal of extracted timber:

Regarding deforestation in the municipality of Placas, the data was obtained and analyzed. In the first decade, 2001 to 2010, the accumulated value was equivalent to 14.887 km², and, second decade, 2011 to 2020, the accumulated value was even higher and reached 20.961 km² (Figure 4).

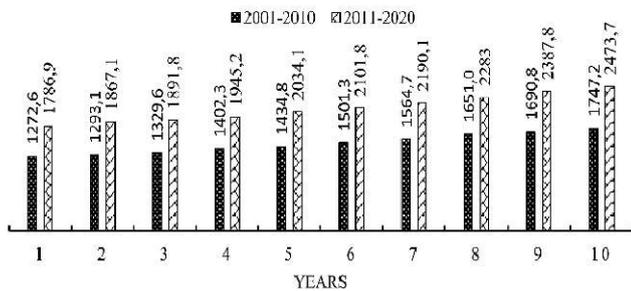


Figure 4. Evolutionary values, em Km², of deforestation in the two decades analyzed. Municipality of Placas, west of Para State

In Figure 4, it is visible a loss of vegetation cover was increasing since the first decade, 2001-2010, analyzed (1488.7±170.2) and continued an increasing scale (2096.2±238.8) until the end of the second decade, 2011-2020, with a greater increase in this last period. It was also verified, 1) the loss of vegetation cover in relation to the total area of the municipality, in the two decades, corresponds to approximately 50% of the total territorial area of Placas; 2) the destination of this logging company exploration, involved the local

economy, both in the first (Figure 5a) and in the second decade (Figure 5b).

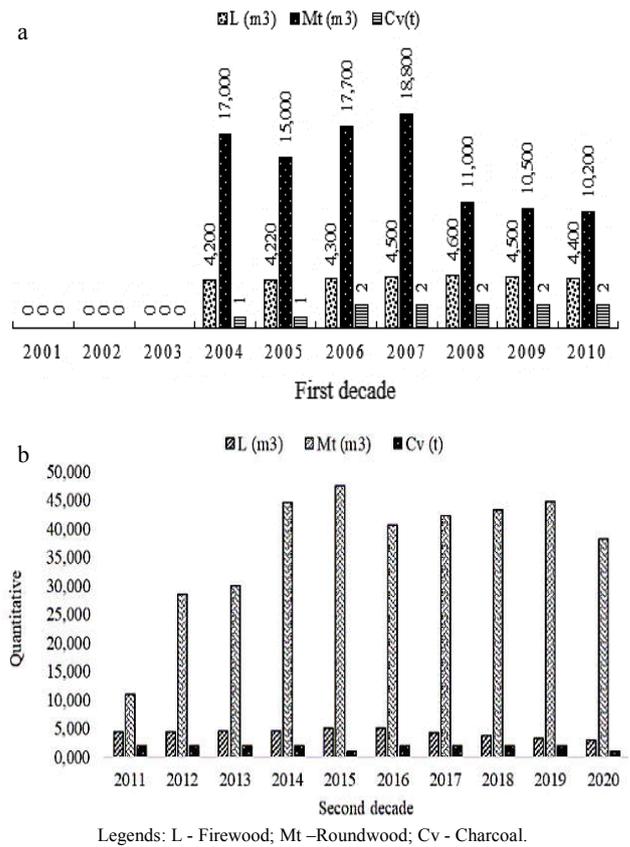


Figure 5. Comparisons between the first (a), and two decades (b) regarding deforestation. Municipality of Placas, west of Para State

The deforestation in the two decades was identified by: 1) publication made by the Deforestation Alert System (SAD, 2019); 2) data cataloged in PRODES, which contains a loss by deforestation of 2.473,7 km² of forest, which corresponds to 34.5% of the territorial area of the municipality, by 2020, and this is concatenated with the data recorded by the Instituto Nacional de Pesquisa Especial (INPE, 2019).

This system also reported that the municipality under analysis returned to the list of 10 critical municipalities, eight of which are in the Pará State (Figure 6).

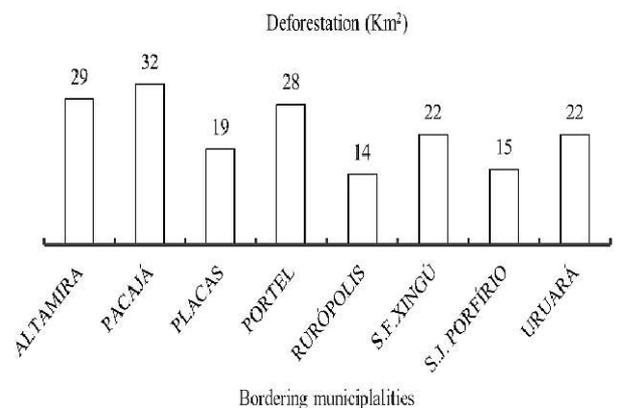


Figure 6. The eight municipalities of the state of Pará, considered "critical" regarding deforestation. Among them is the municipality of Placas, Para State

Population growth, Sawmills, Indigenous Lands (IT), and Conservation Units: The data obtained and analyzed on this topic indicated that, at the state level, population growth between 2001 and 2010 was equivalent to 2.04% (IBGE, 2011). This year, the population living in the municipality under Analysis amounted to 23.934 inhabitants, of which 4.854 in the urban area and 19.080 in the rural area. About *Sawmills*, regarding this topic, the Analysis of the data obtained indicated that the installation of this economy came in the area because the data indicated that there was deforestation of 41% when compared to 2018. The justification for this increase was the removal of IBAMA inspection bases in September 2019. However, the increased efficiency of environmental surveillance in 2020 was reduced by up to 85% compared to 2019. To *Conservation Units*, in these areas (Figure 7).

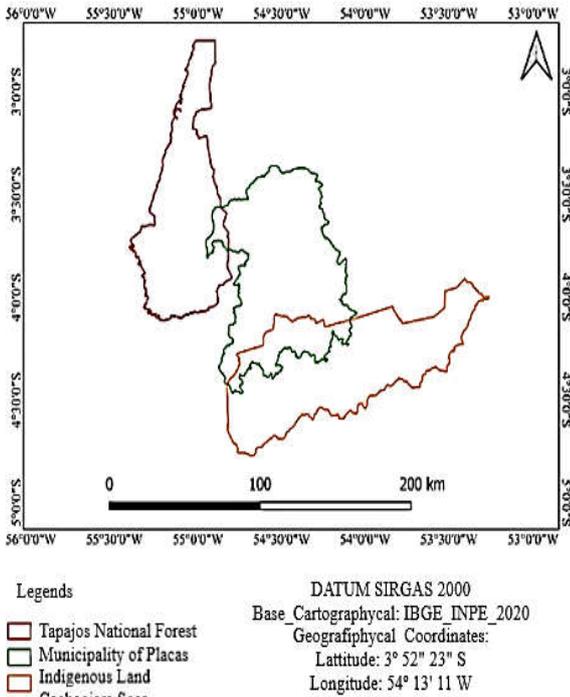


Figure 7. Tapajos National Forest, and Indigenous Land "Cachoeira Seca" of the Araratribe. Municipality of Placas, west of Para State

A fact that proved this evolution, was recorded, in 2019, by the Bulletin of the System a road extension, such as BR-010, BR-230, and BR 163, which generated the so-called "timber poles." Finally, the *Indigenous Lands (IT)* In the IT areas, a fact that proved this evolution was registered in 2019 by the Bulletin of the Deforestation Radar Indication System in the Xingu Basin, No. 22 (SIRADX, 2020), the IT called "Cachoeira Seca" is described as a "critical area" because the data indicated that there was a 41% deforestation rate when compared to 2018. However, the greater efficiency of environmental surveillance, in 2020, there was a reduction of up to 85% compared to 2019. Agriculture, forest species and communities in service:

Agriculture, forest species and communities in service: Regarding the agricultural production process, the data obtained and analyzed indicated that the areas used for permanent tillage, between the two decades analyzed, there was a significant growth in the second (108,858 ha) when compared to the first (39,025 ha) for permanent crops (Figure 8a). In relationship between the cause-effect relationship between agribusiness and deforestation, the data obtained indicated that this relationship was less impacting when compared to cattle ranching in Placas. This is because the correlation coefficient has no high value ($R^2 = 0.1951$ or 19.51%, adjusted = 0.0801). This shows that there are other variables that participated in the increase in deforestation (Figure 8b).

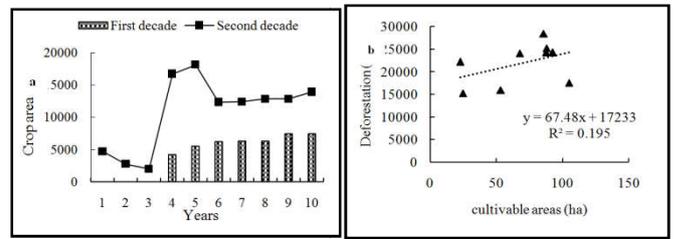


Figure 8. a) Expansion and contraction, in ha, of cultivated areas between 2001 and 2020; b) Comparison between deforestation rates and use of agricultural areas. Municipality of Placas, western Para State

The expansion of agriculture, as can be observed in the first decade (Figure 9a) and second decade (9b), in georeferenced images, makes it clear that the advance of this economic vie was not as effective on deforestation, as was indicated from the values found for R^2 .

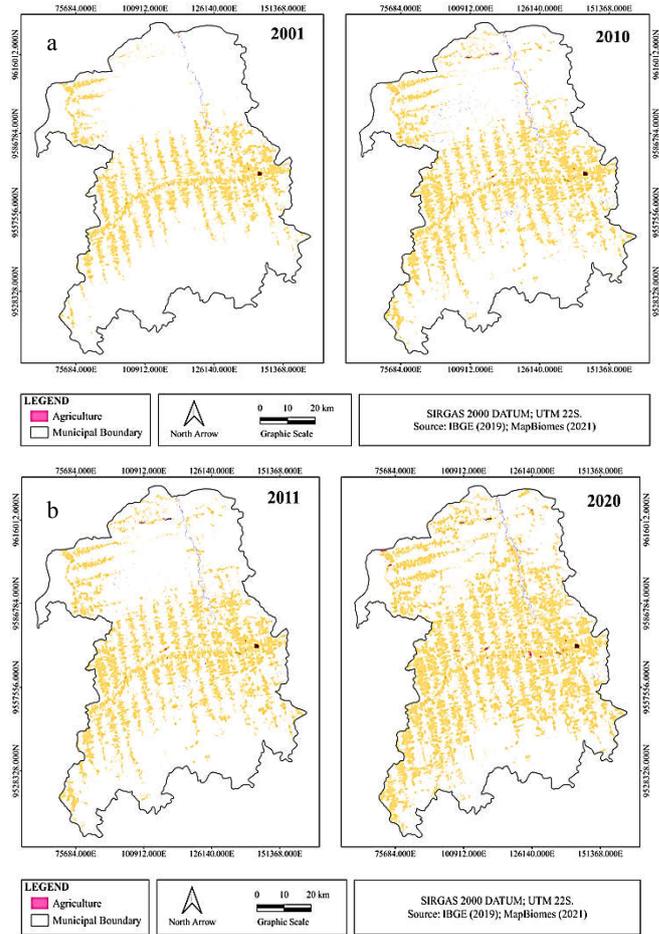


Figure 9. Agriculture expansion between (a) 2001 and 2010; (b) 2011 and 2021. Municipality of Placas, Para, Brazil

About the participation of the community's inhabitants in Placas originates in the implementation of the II National Plan for Agrarian Reform. Boards has six Settlement Projects (PA) and four Sustainable Development Projects - PDS (Figure 10).

Livestock: This is one of the economic activities associated with the nutritional need for population growth. However, it does not develop or evolve if there is, in the view of the rancher, standing forest, since one of the dynamics of cattle farming is the foraging of the animal in the field, which decreases the cost of feeding the ox, in the form of nutritional complement of them. This relationship was observed by the ata obtained in the two decades analyzed (Figure 11a). The value for the correlation coefficient ($R^2 = 0.6324\%$; adjusted = 0.5795; $p = 0.0105$) indicated that cattle herd growth (Figure 11b) in Placas contributed to deforestation.

Species	Vernacular name	Production of...
<i>Licania Canescens</i> Ben	Caraipé	Rustic tool cables and sticks
<i>Aubl pouteria guianensis.</i>	Red Abil	Background of musical instruments
<i>Mezilaurus itauba</i> Taub. ex Mez	Itaúba	Shipbuilding
<i>Eschweilera coriacea</i> Mart ex Berg	Kill-kill; white kill-kill; purple kill-kill.	Animal feed (fruit) and sawmill
<i>Protium tenuifolium</i> Engl. and Cuatric pallidum protium	Pitch and pitch red	Resin used for caulk vessels, smoking and wood for firewood
<i>Pouteria Radlk pie</i>	Duckling	Animal feed (fruit)
<i>Pouteria Radlk pie</i>	Duckling	Animal feed (fruit)
<i>Manilkara Standley Huberi</i>	Maçaranduba	Construction and floor manufacturing
<i>Ocotea caudata</i> Mez. and <i>Manilkara huberi amazonica</i>	Laurel and Maçaranduba	Wood for sawmill and furniture.

Chart 1. Forest species of commercial and industrial value. Municipality of Placas, west of Para State. Adapted from data contained in Ribeiro et al. (2013)

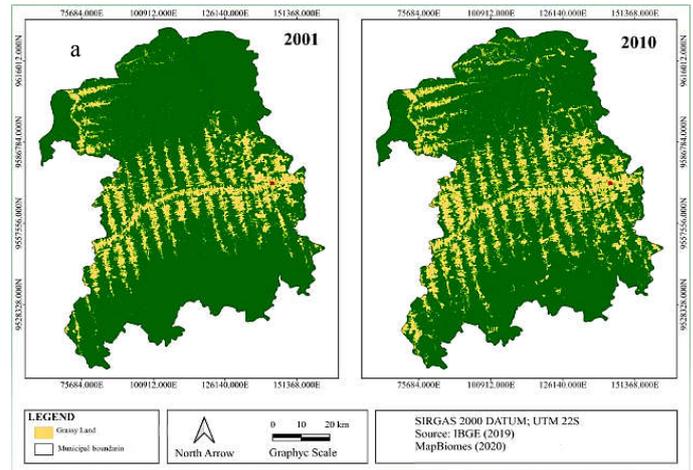
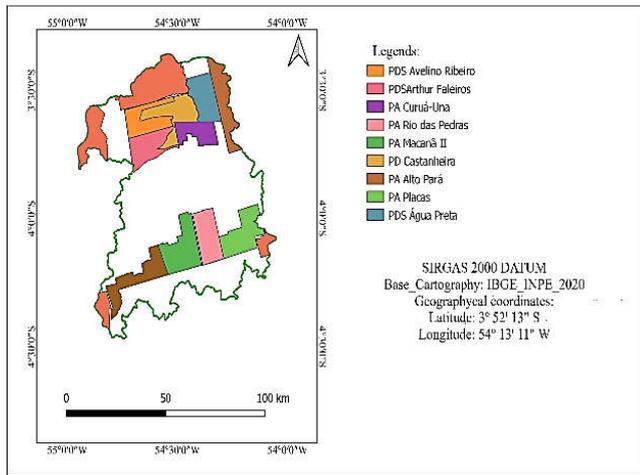


Figure 10. Settlement Projects (PA) and Sustainable Development Projects (PDS) in the municipality of Placas, west of State Pará

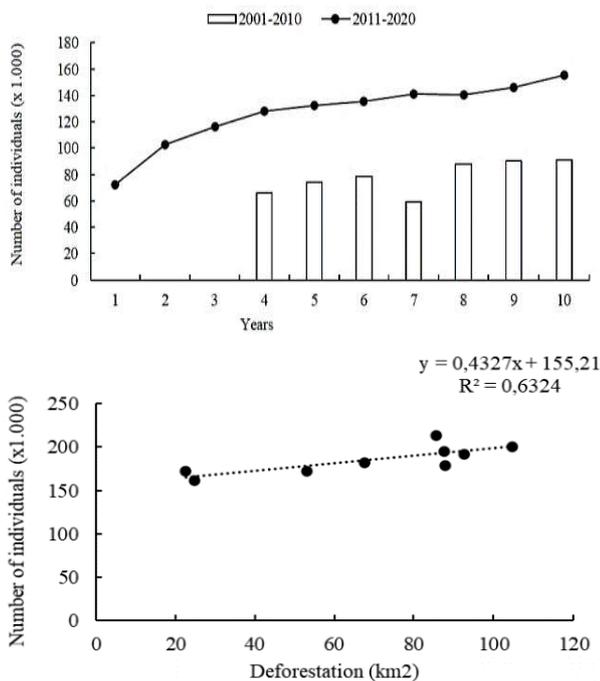


Figure 11. a) Evaluation of the livestock between 2011-2020; b) Relationship between livestock ground and deforestation

Highways: The municipality of Placas is associated with two federal highways: BR-163 (Cuiabá-Santarém) and BR-230 (Figure 12), and the analyzed data indicated that the process of implementing road infrastructure was also a preponderant factor of deforestation, as well as a contributor to the marginal emergence of agricultural/extractive communities and vicinal highways in the form of fishbone.

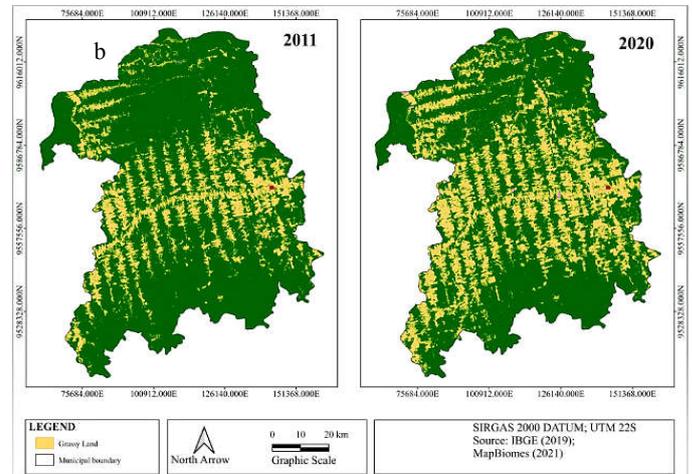


Figure 12. a) Evaluation of the grassy land between 2001-2010; b) Between 2011-2020. Municipality of Placas, west of State Pará

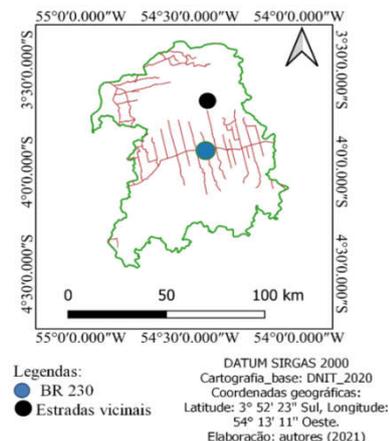


Figure 13. BR 230 and the vicinal roads through the municipality of Placas, western Pará

DISCUSSION

About the deforestation in the municipality of Placas, in 2016, occupied the fifth position when compared to the other municipalities that most deflowered in the state of Pará. However, this disclosure did not determine a decrease in the loss of vegetation cover in this municipality, so much so that Palmas entered the list of priorities, via Ordinance No. 428, of November 19, 2018, occupied the 38th position (MMA, 2018a; 2021). Three years later, on April 28, 2021, the Secretariat of Environment and Sustainability (SEMAS-PA) announced news about an embargo in ten municipalities in Pará, among them, Placas, due to the high rate of deforestation in 2019, equivalent to 7.351,5 ha (SEMAS, 2021). Two facts drew attention to why they are opposed to deforestation: 1) the area surveyed participates as a component of the Sustainable Forest District (DFS) of BR-163 created in 2006 and integrates either the Sustainable Development Plan (PDS BR-163) of the Ministry of the Environment (MMA); 2) The Objective of the DFS is to generate income, increase the quality of life of the participating communities and maintain the forest standing (our griffin) for biodiversity conservation. It is noteworthy that the BR-163 Plan, generated from the previous one, was closed in 2012. These two pieces of evidence make it clear that deforestation is not tied to and has not been limited by the environmental conservation standards that the municipality of Placas adopted when participating in these projects. We then tried to investigate the population growth and the relationship between this growth and deforestation from studies already published on this relationship. In one of them, Dal'Asta *et al.* (2012) conducted research in the ten municipalities of western Pará and concluded that between 2000 and 2010, there was an increase: from 13,394 to 23,934 inhabitants. ($\pm 75\%$) in this municipality and deforestation also increased: from 1226.2 km² to 1,747.2 km² (± 51 km²).

Regarding the probability of this relationship, that is, population growth and deforestation, two studies that occurred in western Pará: one along BR163, by Bistene (2019), and another, in the Tapajos National Forest, by Carvalho, Magalhães, and Domingues (2016), analyzed deforestation in the Amazon region, and concluded that there was yes, a correlation between the coming of families in the 1970s, with credit offers and extensive areas of land to the west of Pará, which caused greater population density and forced the opening of access roads to these places, which increased deforestation. However, it is necessary to remember that the process of occupation and population growth of the Amazon was disseminated from the 1970s on. In this line of thought, Bistene and Guimarães (2019) conducted the study along two highways: Santarém-Cuiabá and Transamazônica, and Veríssimo and Pereira (2020) analyzed human occupation in the Amazon. The first two reported that the adoption by the military government of the motto "Integrate not to deliver" and the opening of highways such as Transamazônica and Santarém-Cuiabá was affected at the expense of deforestation. The latter two, on the other hand, are emphatic about the two causes of the increase in deforestation, of this action: 1) population growth, and 2) development of the economy, the former being a factor and a social structure within the territory where these facts occur, and that encourage growth and co-notation. The relationship between this population growth and the local economy was also verified by analyzing the Chico Mendes Institute (ICMbio, 2019). This body concluded that the working population in the labor sense, aged between 15 and 59 years, which corresponded, in 2019, to more than three thousand individuals, was not absorbed in the local economy, which may have determined the growth of the extractives of the forest timber resource for commercial purposes, not as "boss," but in the function of "cutter."

In addition, the more than 29,000 (+119.4%) residents in this municipality needed urban infrastructure, housing, schools, daycare centers, hospitals, other basic needs, which increased deforestation. They increased land use and occupation, and Boards. On these poles, pioneering studies (ROS-TONEN, 1993; UHL *et al.*, 1991; VERÍSSIMO *et al.*, 1995) reported that this occurred due to the

impulse provided by the federal government and increased in the 1980s and 1990s, where there were no restrictions on logging and wood depletion in the southern region due to overexploitation. In the research conducted by Macpherson *et al.* (2009) on the efficiency of sawmills in the Amazon, these authors described that there was a displacement of logging enterprises to work with other sectors of the economy, such as livestock and agriculture, and, with this, the growth rate increased in the 1980s and 1920s. The better location of these associations was identified and colonized areas along the Trans-Amazon highway, the BR-230. Currently, six sawmills are active in this municipality. Another context is determined by the Socioenvironmental Institute (ISA), which stated that logging in these lands could be curbed, in contrast to what was reported by Ness/Enso/Fiocruz (2021), when frequent conflicts between Indigenous people and settlers. However, the research conducted by the Ministry of the Environment found that, from 2012 to 2015, there was deforestation equal to 46.85 km², whose action was denounced by the community itself.

The research also warns that this area is subjected to environmental impacts caused by the Belo Monte Hydroelectric Power Plant, in addition to the proximity to BR-230 (MMA, 2016; 2018b). Further research on deforestation in it has already been conducted. Other study effected by Verdélio (2016), where the researcher argued that the 730,000-ha approved by the federal government, it was composed of lands belonging to three municipalities: Altamira (559,579.5 ha), Placas (128,271.96 ha.), and Uruará (51,829.19 ha), where plant cover of Open Ombrophile Forest (67.45%) and Dense Ombrophile (32.55%) predominates, with a substantial risk of logging. The other research was conducted in a Technical Note for IPAM by Fellows *et al.* (2021). In this document, the researchers summarized that, in IT, deforestation rates are low (2019 = 5%; 2020 = 3%) due to the legal context of environmental preservation of them. A confirmed the irregularity identified by the MMA between 2012 and 2015. Another area analyzed existed since 1974: the National Forest (FLONA) of Tapajos, whose area is equivalent to 549,066.87 ha., according to Article 14, item III, of Lei no. 9,985 (BRASIL, 2000), it is of sustainable use. It allows the exploitation and the use through the exploitation of natural resources, such as wood. About this area, Carvalho, A., Carvalho, T., and Gama (2019) and Guimarães *et al.* (2018) wrote that the communities living there are mainly dependent on the natural resources contained in FLONA. Logo, the logging extraction is an economic shaft for them, and the physical environment of this place suffers from this type of action, whose product is removed from the area with tractors of the type skidders. The expansion of the crop in 2020 occurred because the justification for this is the growth in soybean cultivation (*Glicine max*) that increased from 700 ha to 800 ha. It may have occurred as a function of the price in the international market. On agribusiness in the municipality of Placas, Araújo (2021) and Costa (2011), conducted research and the data obtained by them allowed them to affirm that sojiculture is treated as a negative indicator for the conservation of Amazonian forests and that it involves the following agents: farmers, ranchers, and loggers. All these agents are active in the municipality under analysis.

In Figure 9, the low value for the correlation coefficient can be explained by the downward trend of the agricultural areas that occurred between 2017 (24,263 ha) and 2019 (17,550 ha), but, in the same period, the rate of deforestation increased from 87,600 ha to 104,800 ha, during which the logging in logging also increased from 43 m³ to 44.8 m³. This growth, according to the Deforestation Alert System (SAD, 2019), was more pronounced in indigenous lands since, in Cachoeira Seca do Iriri, it occupied, in that year, the first position in this ranking. For Ferreira Filho, Ribera and Horridge (2016) and Santos *et al.* (2021), two economic aspects with high impact on deforestation in the western region of the state of Pará should be considered because (1) agricultural production may exert more effective pressure on logging extraction, due to the changes that the various world scenarios have presented, for example, changes in the climate, (2) mining, whose degradation of the landscape begins in deforestation and ends with the exposure of open-pit tills, which alters

the microclimate and impairs soil fertility, in addition to compromising the agricultural sector. As for the vision of the danger posed by deforestation, especially for farmers, Pinheiro *et al.* (2019) and Gonçalves *et al.* (2021) conducted a study on this. They concluded that farmers realized that the forest has non-forest resources, such as oilseeds (Ex.: copaiba, *Copaifera* L.), açai, tucumã pit, among others, which can be used in the production of oils and bio jewelry.

To increase farmers' sensitivity, as well as their income generation, IDEFLOR-BIO (PARÁ, 2016) developed the creation of fruit seedling nurseries with the communities of the Xingu region, with forest species (1) and fruit (5): açai (*Euterpe oleracea*), cocoa (*T. cacao*), black pepper (*Piper nigrans*) cumaru (*Dipteryx odorata* (Aublet) Willd), cupuaçu (*Theobroma grandiflorum*), and mahogany (*Swietenia macrophylla* King). In the medium and long term, these actions may enable the recovery of the suppressed forest and improve the human-nature interaction, which will characterize a genuinely sustainable development while generating income for family farmers in this region, where that plaquense are located. In Table 1, it is noted that there are, in this region, species whose exploitation and marketing has significant market value and utility, such as Maçaranduba, it meets two exploratory issues: the processing and the furniture industry, this, associated with population growth. Can further increase deforestation in Plaques. In research conducted by Alves *et al.* (2019), the data they obtained allowed them to affirm that this species has great commercial importance in this region, which increased the exploitation but may determine its non-sustainability. This statement is based on the research conducted in the West of Pará by Torres (2016). He concluded that this plan did not serve farmers' families but rather the speculation of the timber agribusiness. In Figure 6, was observed the PA Placas located southeast of this municipality, where Nascimento (2005) researched the deforestation caused by the settlers of this PA and concluded that some of them promoted the "cleanliness" of the forest to generate areas intended for planting crops such as cocoa, cassava, and peanuts and that they only did so because they were unaware of the meaning of the term "Permanent Preservation Area (APP)."

As can be seen, it is not enough just the assignment of land, but the training of how to conserve and the correct use of both the soil and the underlying forest the land where the PA is installed. Another study in PA (Moju I and II) was carried out by Santos (2020). The researcher concluded that this structure allowed social and economic improvements to the component communities. Among the 21 component communities called "São Mateus," whose foundation took place in 1985 and currently reside so, they are linked to the Association of Small Farmers (APROSCOSMA). The territorial area occupied by this community is equivalent to 2.431 ha and is located at Km 145 of BR-163. In the research conducted by Gama and Monteiro (2019). Silva and Pinheiro *et al.* (2019), the data they obtained, allowed them to affirm that the environmental view regarding the "standing forest" is an obstacle to the crops of the economic shaft to produce cassava flour (*Manihot esculenta* Crantz.), pepper (*Piper* sp.), beans (*Phaseolus* sp.), cane (*Saccharum* sp.), corn (*Zea mays*) rice (*Oryza* spp.) and coffee (*Coffea* spp.). On the other hand, they also observed that the expectation of *monthly per capita* income with these agricultural productions is less than one minimum wage (R\$ 482.00), which in terms would not justify deforestation, and this was proven in the study conducted in this community, by Pinheiro *et al.* (2019). These authors concluded that this production encouraged the extraction and sale of wood with commercial value, such as Ipê (*Handroanthus* sp) and cedar (*Cedrela* sp.) for the supply of sawmills municipality of Placas. As can be seen, this involves an economic factor because, in the research conducted by Lima *et al.* (2020) and Ferreira *et al.* (2016), the conclusions were divergent. The first authors concluded that these resources could generate income for the communities that make use of them and, thus, contribute to deforestation. For the latter, the increase in environmental education of this agroforestry community/agroextractive, based on the knowledge of the value of this type of resource, can raise the level of information and, thus, increase the maintenance of the forest standing,

without ceasing to obtain income, from the most frequent exploitation of non-timber forest resources. In Figure 11, it was observed that in the first five years of the first decade, the average evolution of livestock growth (28,086±38,560) in the last five years, there was a tendency to increase this average (80,383±15,302). In the second decade, from 2011 to 2015, the growth trend continued (124,250±29,362) and continued until the end (143,608±7.550). In the context of the evolutionary process of livestock, Dias-Filho and Lopes (2020), the herd in the Amazon, in 2018, was already composed of 50 million heads in 36 million ha, and the desired growth for pasture productivity should comply, as a priority, with environmental criteria.

In other words, the use of deforested areas should be examined to verify the development of foraging necessary to increase the cattle herd and, thus, increase productivity without increasing the rate of deforestation. About the relationship between livestock and deforestation, Costa (2018) conducted a study. The author analyzed the use of soil after wood extraction and concluded that, since 1993, the deforested areas, around 38%, have been used for this new economical line in the municipality. In two other research on the same topic, were conducted by Freitas Júnior e Barros (2021) and Rossoni and Moraes (2020). In both, the researchers concluded that the increase of this herd negatively impacts the environment, where the relationship "Herd size x deforestation" is more frequent. About the Highways, Figure 12 shows the BR - 230, "divides" the municipality of Placas in the North-South axis. This highway would be a "national integration project" and would have the mission of reducing tensions in the field. In this context, Bistene and Guimarães (2019), Oliveira Neto (2019), and Souza *et al.* (2017) conducted studies in western Pará. They concluded that the opening of roads was and continues to be one of the most critical factors to deforestation in this region, especially during the military government that stimulated the settlement of the Amazon region and the displacement by interstate roads and even vicinal roads that led to sawmills. Another factor that concatenates deforestation is associated with traffic routes to transport the extracted forest resource. It is noticed that, from the municipality of Placas, the wood, either in Roundwood or on planks, goes to Itaituba, Santarém, and Altamira, or Cuiabá, by BR - 163. In this bias, Oviedo, Lima, and Augusto (2019) and Costa (2011) reported that, in the region of the so-called "deforestation arc," the municipality of Placas managed to break the borders of deforestation between 2008 and 2018, which was proven by the data generated by PRODES/INPE. About these data, Rosario (2020) reports that, in this last year, deforestation reached an area equal to 92.9km², which resulted in four police incidents and a criminal investigation for non-compliance with current legislation.

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