Difficulties in the Process of Protecting the Brazilian Amazon Region

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SUMMARY

This study addresses deforestation in the Amazon as one of the greatest environmental challenges in Brazil and the world, highlighting its causes, impacts, and possible solutions. In addition to being an important climate regulator and one of the largest reservoirs of biodiversity on the planet, the Amazon faces a continuous process of degradation, driven by activities such as livestock farming, agriculture, and mining. The central problem lies in the difficulty of reconciling economic development and environmental preservation, aggravated by the fragility of public policies, land conflicts, and international pressures for commodities. Deforestation compromises both local sustainability and global climate balance, requiring an integrated and urgent response. The main objective of this study is to understand how public policies and historical and contemporary economic practices influence deforestation in the Amazon and impact the environment and local populations. The research adopts a qualitative approach and content analysis based on Bardin (1977), using bibliographic and documentary sources, including reports from INPE and IBAMA. The results show that deforestation is the result of agricultural expansion, mining and ineffective policies, and in addition to affecting biodiversity and the climate, it generates social and economic conflicts. Weak monitoring has worsened the situation, requiring integrated actions between governments, society and the international community to curb degradation and promote sustainability.

Keywords: Deforestation; climate change; sustainability.

INTRODUCTION

Deforestation in Brazil, especially in the Amazon, represents an environmental crisis that requires urgent international action. The Amazon rainforest plays a vital role in climate regulation, absorbing carbon dioxide and maintaining biodiversity.

The destruction of tropical forests, both in Brazil and worldwide, is one of the greatest challenges to global well-being, impacting climate change and exacerbating biodiversity loss. The consequences include increased greenhouse gas emissions, which accelerate global warming, contributing to natural disasters, agricultural crises, and population displacement. The impact of deforestation transcends national borders, affecting the future of generations across the planet.

Between the 16th and 19th centuries, the Amazon region was the target of territorial disputes between European powers, especially Spain and Portugal, based on the 1494 Treaty of Tordesillas. However, nations like France, England, and the Netherlands also sought to control parts of the Amazon, particularly in the Guianas, aiming at the economic exploitation of the region (Costa, 2009).

With the arrival of Europeans, especially the Portuguese, between the 16th and 18th centuries, the Amazon was intensely exploited for its natural resources, such as the "drogas do sertão" (backland spices), as well as through the establishment of religious missions (Veríssimo, 2020).

Public policies aimed at land occupation have stimulated deforestation and burning in the Amazon, resulting in the expansion of agricultural activities, with an emphasis on pasture creation and soybean cultivation. This strategy of preparing the soil has altered the water cycle, with effects such as reduced rainfall and higher

temperatures, hindering the transportation of moisture to other regions of the country (Carmo; Carmo, 2019).

Although the focus of this study is the Amazon region, it is important to highlight that deforestation is a reality present throughout the Brazilian territory.

In addition, in both the Amazon and the Cerrado, deforestation has reduced rainfall and intensified heat at local and regional scales, negatively impacting the agricultural sector. In the southern part of the Amazon, where 60% of the forests have been transformed into areas for agriculture and cattle ranching, annual rainfall has fallen by up to 50% in the last twenty years, which has led to considerable economic losses in soybean, corn and meat production, estimated at around US$ 1 billion per year (Leite Filho, 2022).

Biodiversity plays an essential role in the balance of ecosystems, sustaining processes such as nutrient cycles, pollination and pest control. More diverse ecosystems tend to be more resilient to disturbances and climate change, and genetic diversity is crucial to enable adaptations to new conditions (Thompson *et al.,* 2009).

The ability of ecosystems to maintain their functions in the face of environmental change is directly linked to biodiversity, with mechanisms operating at different levels, such as species, communities and landscapes (Oliver, 2015).

Although sustainability is widely promoted in political and business discourses as a solution to the global environmental and social crisis, it is often used as a justification for practices that are, in reality, unsustainable, especially in the context of global capitalism (Ampolini; Renk; Winckler, 2024).

OBJECTIVE, STRUCTURE AND METHODOLOGY

Deforestation in the Amazon is a multicausal problem, involving historical, social, economic, and political factors, such as colonization, agricultural expansion, livestock farming, and mining. Encouraged by public policies, these activities cause environmental degradation, social conflicts, and affect Indigenous populations.

Addressing this crisis requires coordinated action between various sectors of society and the Brazilian government, along with international collaboration. Given its globais impact, particularly on climate change and biodiversity loss, international involvement is essential. Thus, conserving the Amazon is not just a national challenge but a shared global responsibility.

The main objective of this study is to understand how public policies and historical and contemporary economic practices influence deforestation in the Amazon and impact the environment and local populations. From this general objective, three specific objectives unfold, each listed in a topic.

The first axis addresses the historical causes of deforestation, considering colonial occupation, agricultural frontier expansion, and public incentives for land use. The second axis examines the socio-environmental impacts of deforestation, focusing on biodiversity loss, climate change, and social conflicts, especially involving Indigenous and traditional communities. And the third axis deals with solutions and strategies for mitigating deforestation, exploring public conservation policies, international cooperation, and sustainable development models.

Through this structure, the study seeks to demonstrate how historical and contemporary exploitation practices, combined with ineffective public policies, have led to serious environmental and social problems in the Amazon.

This study employs a qualitative and interpretative methodology, combining bibliographic and documentary analysis. It draws on frameworks from Bardin (1977), Cervo and Bervian (2002), Gil (2010), Mezzaroba and Monteiro (2009), and Richardson (1999).

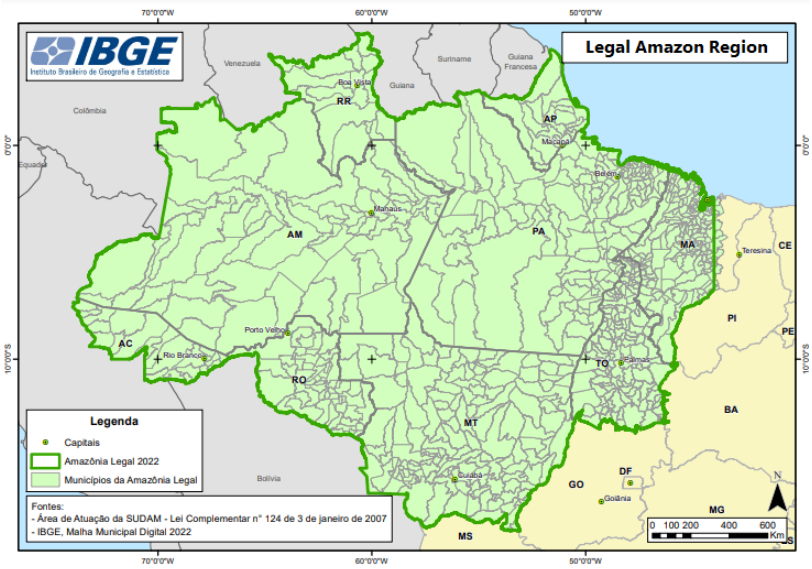
The qualitative approach enables an in-depth exploration of deforestation in the Amazon, analyzing historical causes and contemporary impacts. Data collection includes scientific literature and official documents, such as reports from INPE and IBAMA. Using Bardin's (1977) content analysis, the study identifies thematic categories,

offering critical insights into the social, economic, and environmental dynamics of the region.

Exploration and History of the Amazon Region

This topic aims to discuss the relationship between the intense exploitation of natural resources in the Amazon[1] and the history of colonization and occupation of the region. The exploitation of natural resources is deeply intertwined with the historical processes that shaped the social, economic and environmental transformations of the Amazon, influencing its territory and its population to this day**.**

Figure 1 – Map of the Legal Amazon Region (Brazil)



Source: IBGE, 2022[2].

During this process, indigenous labor was widely used, often under conditions of slavery. Colonization had devastating effects on indigenous populations, which were drastically reduced by diseases brought by the colonizers (Veríssimo, 2020).

Portuguese sovereignty over the western region was consolidated after Pedro Teixeira's expedition, with the Treaties of Madrid (1750) and San Ildefonso (1777) establishing colonial borders, despite indigenous resistance. Various peoples were forced into labor, including indigenous groups, Africans, and later Asians (Costa, 2009).

The enslavement of native peoples was a common practice, while Africans were mainly employed on plantations in eastern Amazonia. After the abolition of slavery, Asian immigrants were brought in to replace African labor, altering the region's demographic composition (Costa, 2009).

After independence, the national states faced the challenge of consolidating their territories in the Amazon, driving economic exploitation based on natural resource extraction and missionary labor. Although the region was already inhabited, many territories were perceived as "empty," which led to tensions and conflicts throughout the 19th century (Costa, 2009).

The Amazon's economy grew significantly with the extraction of products such as quinine and especially rubber, whose demand increased after the invention of vulcanization in 1850. This growth attracted migrants and fostered the development of cities like Manaus and Belém, facilitated by steam navigation (Costa, 2009).

[1] The Legal Amazon region, which covers 59% of the national territory and occupies approximately 5 million km², includes eight states (Acre, Amapá, Amazonas, Mato Grosso, Pará, Rondônia, Roraima and Tocantins) and part of Maranhão (west of the 44ºW meridian), and is home to 56% of Brazil's indigenous population, com cerca de 38 milhões de habitantes (IPEA, 2008; BRAZIL, 2023).
[2] Available at <https://shorturl.at/gAiCL>. Accessed on: October 13, 2024.

However, the rubber economy eventually entered into crisis due to competition from production in Southeast Asia, resulting in economic stagnation and the abandonment of various areas (Veríssimo, 2020; Costa, 2009).

Extractive practices, such as quinine and rubber collection, caused significant environmental impacts, including forest destruction and resource exhaustion. Although some techniques in Brazil were less harmful, the ecological impacts were severe, affecting local fauna due to hunting and animal trade (Costa, 2009).

Between 1755 and 1778, during the colonial period, the creation of the General Company of Grão-Pará and Maranhão by Pombal promoted the occupation and economic integration of the Amazon, encouraging agriculture and livestock farming. Under the leadership of Francisco Xavier de Mendonça Furtado, villages were founded, and settlers from Atlantic islands were incentivized to establish themselves in the region (Dias, 1967).

After the abolition of indigenous slavery, the company imported African slaves, essential for agricultural development. The promotion of marriages between settlers and Indigenous people, along with the introduction of Africans, altered the social structure (Dias, 1967). The production of cocoa, cotton, and other tropical products expanded, integrating the Amazon into international trade. The expulsion of the Jesuits in 1759 allowed the government to take control of the villages and modernize the infrastructure (Dias, 1967).

During the Brazilian military dictatorship, vast areas of public land were transferred to large landowners, promoting land grabbing, speculation, and fraud. Tax incentives for livestock farming, mining, and logging were not utilized as planned, resulting in deforestation and land conflicts (Loureiro, 2005).

Armed violence and impunity facilitated the expulsion of residents and the assassination of rural leaders, while the state neglected the rights of smallholders and allowed illegal land exploitation (Loureiro, 2005).

From the 1960s, during the military regime, a new phase of colonization began, marked by the construction of highways and mineral exploration. This led to large-scale deforestation and worsened land conflicts (Veríssimo, 2020).

Between 1990 and 2015, deforestation in the Brazilian Amazon was mainly driven by cattle ranching, road infrastructure expansion, population growth, and agricultural expansion. Cattle ranching was the primary cause, while road construction also strongly influenced deforestation rates (Vasconcelos et al., 2017).

The northern region of Brazil experienced significant demographic growth, driven by economic cycles such as the rubber boom and internal migrations, especially from the Northeast. However, the demographic transition occurred more slowly compared to the rest of the country, lagging about 30 years behind the national average (Turra *et al.*, 2022).

Fertility and mortality rates remain above the Brazilian average, and the population growth rate, expected to fall to 0.7% by the 2030s, should stabilize by 2060. Additionally, population aging will be a relevant trend, with the proportion of elderly people tripling by 2060. Internal migrations during the 1970s and 1980s were crucial, influenced by government occupation policies (Turra *et al.*, 2022).

An analysis of changes in federal environmental policies between 1981 and 2021 reveals significant dismantling, especially after 2016, during the Bolsonaro administration (Neves, 2023). During this period, essential activities were halted, environmental oversight power was reduced, and budget cuts affected environmental agencies. Moreover, measures that relaxed legislation contributed to the state's loss of credibility in the environmental sector (Neves, 2023).

IBAMA employs an evidence-based approach, collaborating with INPE to combat deforestation and forest fires. However, it faces significant challenges, such as a lack of personnel and resources, compromising its oversight capacity (Araújo, 2022).

In 2004, the launch of the Action Plan for the Prevention and Control of Deforestation in the Amazon significantly bolstered monitoring initiatives, contributing to a steady decline in deforestation rates over the

following years, particularly up to 2012. Nevertheless, the subsequent weakening of enforcement mechanisms after that period triggered a resurgence in deforestation, underscoring the need for sustained regulatory vigilance to safeguard the ecological integrity of the Amazon (Rajão, Schmitt, and Soares-Filho, 2021).

Since 2019, changes in the sanction process, such as the introduction of environmental conciliation, have reduced the effectiveness of penalties and fostered impunity (Rajão, Schmitt, and Soares-Filho, 2021). Additionally, budget cuts and staff shortages further undermined IBAMA's efficiency. In 2020, there was a significant reduction in fines and embargoes, while deforestation continued to grow, underscoring the loss of the agency's punitive capacity (Rajão, Schmitt, and Soares-Filho, 2021).

Thus, the colonization of the Amazon resulted in intense economic exploitation, deforestation, profound social transformations, and severe impacts on indigenous populations. These historical processes continue to influence territorial occupation, land conflicts, and environmental challenges the region faces today.

Amazonian Duality: Desires For Protection and Uncontrolled Exploration

The objective of this topic is to analyze the socio-environmental impacts of agricultural expansion and deforestation in the Amazon, highlighting activities such as livestock farming, soybeans and mining. It also addresses the role of public policies and corporations, highlighting social inequalities, environmental degradation and the need for sustainable strategies that reconcile economic growth and environmental preservation.

Deforestation is a major source of greenhouse gas emissions, second only to the burning of fossil fuels. The destruction of the Amazon rainforest, a major carbon sink, not only releases large amounts of carbon dioxide but also undermines climate mitigation efforts (Stuart-Smith et al., 2021).

In recent years, weakened environmental regulations and incentives for economic exploitation have accelerated deforestation, increasing emissions. This process contributes to extreme weather events, sea level rise, and affects health and food security. Even with action to reduce emissions, the consequences of ongoing deforestation will have lasting impacts on global climate and humanitarian conditions (Stuart-Smith et al., 2021).

Between August 2022 and July 2023, the Amazon lost 9,001 km² of forest, according to Greenpeace Brazil. Although this represents a 22.3% reduction compared to the previous period, the situation remains critical, driven primarily by cattle ranching, soybean cultivation, land grabbing, illegal mining, and logging. These activities generate approximately $317 billion in annual economic losses (Greenpeace, 2024).

Illegal deforestation in tropical regions has grown steadily, with forest conversion for commercial agriculture accounting for 60% of forest loss between 2013 and 2019, and 69% of that occurring illegally (Dummett; Blundell, 2021). Brazil leads in irregular deforestation, with around 95% of forest clearing carried out unlawfully, particularly for soy, palm oil, and cattle-related activities, where illegality exceeds 80% in some areas (Dummett; Blundell, 2021).

In the Cerrado, deforestation-related climate change has caused economic losses of $23.8 billion over 13 years, impacting agricultural productivity, especially soy-corn double cropping systems. In Mato Grosso, forest conversion has reduced annual rainfall by almost a month, posing risks to future harvests (Leite Filho, 2022).

Additionally, agricultural expansion in the Amazon has escalated deforestation, intensified cattle farming and soy production, and triggered conflicts with indigenous and local communities, compromising biodiversity and traditional ways of life (Monteiro, 2024).

Although agricultural expansion—centered on beef and soy production—has contributed to economic growth, it has caused severe environmental damage. This process was accelerated by the National Integration Plan (PIN) in the 1970s, which promoted colonization and agricultural development in the Amazon (Walker et al., 2009).

The Real Plan and modern agricultural techniques further boosted global competitiveness, particularly in Mato Grosso and Rondônia, where cattle ranching and crop adaptation drove large-scale forest conversion (Walker et

al., 2009) and the intensive pesticide use has transformed these regions into toxic zones, impacting both the environment and local communities (Monteiro, 2024).

Brazil's rise as the world's largest soy exporter has intensified deforestation in the Amazon and Cerrado, as soy

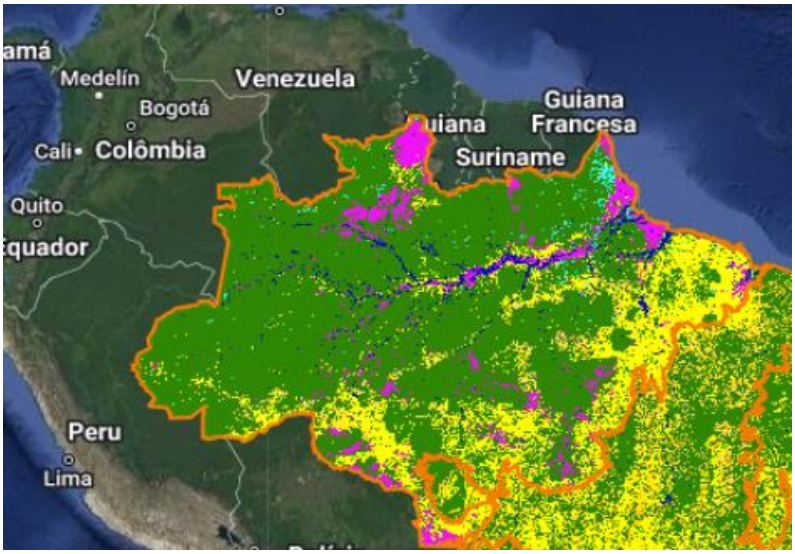
cultivation advances into degraded pastures, indirectly sparing some forest areas but still causing substantial environmental harm (Domingues; Bermann, 2012). Large multinational corporations dominate this agricultural expansion, leading to land concentration, displacement of small farmers, mechanization, rural exodus, and accelerated deforestation (Domingues; Bermann, 2012).

Between 2006 and 2017, Brazil's agricultural growth strengthened the Amazon's economic contribution, though the region remains economically underdeveloped and lags behind the rest of the country. While family farms are increasing in the Amazon, contrasting with national trends, land concentration and environmental challenges persist (Cavalcante Filho et al., 2023).

Furthermore, expanding infrastructure such as highways and ports has facilitated soy and mineral exports but also intensified environmental destruction and social displacement (Fearnside, 2001).

The "knock-on effect" of soy expansion stimulates other destructive activities, such as cattle ranching and logging. Government subsidies and transgenic seeds have further accelerated this growth, lowering costs but increasing environmental degradation. Ecosystems such as the Cerrado and Pantanal have also suffered from rising global demand for soy, particularly from China and Europe (Fearnside, 2001).

Figure 2 – Map showing deforestation in the Brazilian Amazon region[3]



Source: TerraBrasilis (2024)[4].

Industrial mining in the Eastern Amazon over the past 50 years has failed to drive regional development, relying heavily on foreign capital and lacking robust local production chains (Monteiro, 2005).

Despite environmental damage and limited economic benefits, mining has had minimal interaction with local communities. State-supported mining projects often benefit corporations while exacerbating inequalities, environmental contamination, and conflicts with indigenous populations (Monteiro, 2005; Hauradou; Amaral, 2019) and these conflicts, initially linked to mining, have expanded to include land disputes, involving corporations, traditional communities, and the state (Wanderley, 2008).

[3] In green, preserved areas; the rest, deforested areas or areas with recent deforestation.
[4] Available at < https://terrabrasilis.dpi.inpe.br/app/map/deforestation?hl=pt-br>. Accessed on: October 13, 2024.

The Brazilian government's transfer of public land to private sectors during the military regime in the 1960s and 1970s facilitated land grabbing, speculation, and environmental degradation. Although tax incentives encouraged cattle ranching, logging, and mining, they failed to deliver promised economic development and worsened social inequality. Land grabbing led to violent evictions of small squatters, often enforced by armed militias, and contributed to the rise of slave labor (Saraiva, 2021).

In Rondônia, criminal organizations profit from illegal logging, using falsified documents and sophisticated operations to exploit forest resources, harming both the environment and local communities. These activities have led to poor health, forced migration, and rising unemployment among affected populations (Teixeira, 2018).

A study on selective logging in Pará from 1992 to 2018 revealed that 20% of logged areas eventually suffered deforestation, with protected areas increasingly targeted by such operations. Forest degradation has heightened fire risks and carbon emissions, necessitating stronger oversight (Souza *et al*., 2024).

During the military dictatorship, the Brazilian government promoted land concentration by incentivizing ranching, mining, and logging, leading to widespread environmental and social harm. Even today, land concentration and violence persist, with illegal practices and conflicts unresolved by the state (Loureiro; Pinto, 2005).

Fires in the Amazon surged in 2019, with over 45,000 hotspots detected by August—the highest since 2010—largely linked to deforestation and land grabbing (Alencar *et al.*, 2019), although the exploitation of the Amazon's natural resources has boosted Brazil's economic growth, it has caused severe environmental and social consequences, including deforestation, biodiversity loss, and escalating agrarian conflicts (Rodrigues; Silva, 2023).

The concentration of wealth among large corporations contrasts starkly with the poverty endured by local populations, 21% of whom live below the poverty line. Basic infrastructure and sanitation services remain inadequate across the region (Rodrigues; Silva, 2023).

Sustainable forest management offers an alternative to deforestation, allowing timber production without extensive environmental harm. However, illegal logging, bureaucratic challenges, and high costs hinder its implementation (Angelo *et al*., 2014). While public policies support forest management, illegal activities and agricultural expansion pose significant threats, underscoring the need for stricter oversight and more effective governance (Angelo et al., 2014).

Despite efforts to promote sustainable practices, the Amazon remains vulnerable to destructive development models. Large-scale infrastructure projects, such as hydroelectric dams, highways, and ports, have prioritized commodity exports over local needs, perpetuating environmental degradation and social inequality (Castro, 2017).

To ensure a more sustainable future, it is crucial to develop new strategies that balance economic growth with environmental protection and respect for indigenous rights (Prasniewski, 2024).

Impacts of Deforestation and Climate Change in the Amazon

This topic aims to analyze how the reduction of biodiversity and unsustainable exploitation practices in the Amazon impact ecosystem services and aggravate climate change, in addition to discussing the social and economic consequences of this degradation.

Although low levels of biodiversity can maintain ecosystem functions in the short term, preserving these functions in the long term and in the face of environmental disturbances requires greater biological diversity, increasing nature's capacity for regeneration (Oliver, 2015).

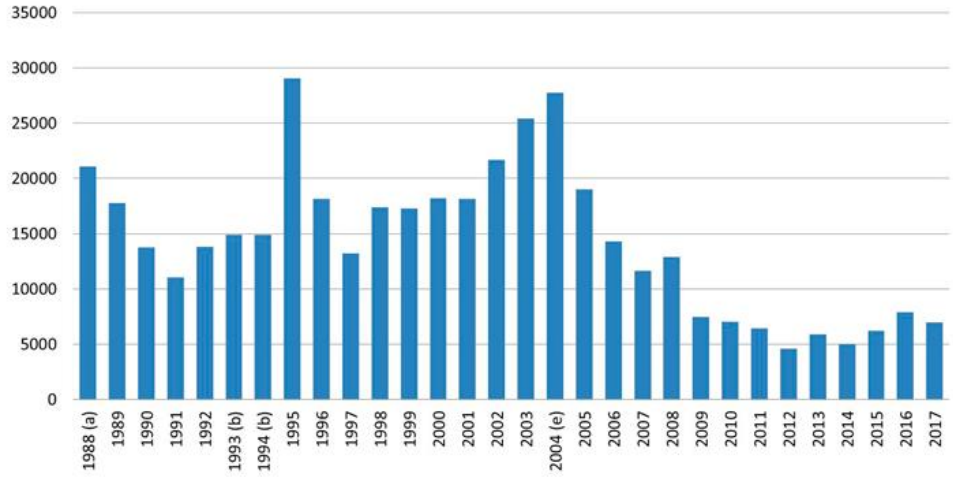
Ecosystem services include air and water purification, waste decomposition, and soil fertility maintenance, and can be classified into provisioning, regulatory, cultural, and supporting services. These services are fundamental for the proper functioning of ecosystems and for maintaining balanced environmental conditions. Forests, for

example, play a crucial role in regulating temperature, filtering pollutants, storing carbon, preventing erosion, and promoting climate stability (Jo et al., 2024).

Activities such as deforestation and burning negatively affect the soil microbiota in the Amazon, which is essential for processes such as nutrient cycling and fertility. These practices alter abiotic factors such as temperature and humidity, causing stress on the microbiota, loss of biodiversity, and consequent reduction in soil quality. In addition to their ecological impacts, these changes generate economic repercussions and threaten genetic resources that are important for biotechnology (Lopes; Santiago; Gurgel, 2023).

In addition, the emission of greenhouse gases, such as carbon dioxide (CO_2) and methane (CH_4), worsens global warming, and the loss of biodiversity resulting from deforestation is irreversible, leading to the extinction of species and a decrease in the capacity of forests to provide environmental services. Aerosol particles exacerbate the greenhouse effect by interfering with rainfall formation and global climate balance (Carmo; Carmo, 2019).

Figure 3 – Annual deforestation in the Legal Amazon (km2), between 1988 and 2017[5]



Source: INPE (2017).

The integration of principles such as environmental sustainability, social participation and decentralization is essential to promote more efficient and equitable management of water resources. However, tensions persist between economic development and ecological preservation, especially in a scenario of administrative reforms that have weakened the role of the State in regulating and monitoring these resources (Ampolini; Winckler; Renk, 2024b).

Deforestation in the Amazon, driven by activities such as livestock farming and agriculture, causes significant local climate changes, including reduced rainfall, prolonged dry season and changes in the hydrological cycle. In turn, fires release greenhouse gases and aerosols, which affect cloud formation and radiative balance, interfering with precipitation and increasing temperatures (Santos et al., 2017).

These changes also influence the climate in the South and Southeast regions of Brazil, directly impacting agriculture, especially soybean and corn crops, due to the interdependence between moisture flow and climate variables in these areas. The complex interaction between the biosphere and the atmosphere affects evapotranspiration and moisture transport to other parts of South America (Santos et al., 2017; Dutra, 2022).

Research indicates that deforestation harms the hydrological cycle in the Brazilian Midwest, compromising hydroelectric power generation due to the tendency for reduced rainfall and flow in reservoirs, directly related to increased deforestation. Although there are formal mechanisms for social participation, these spaces often do

[5] The deforestation rate in the Brazilian Legal Amazon (ALB) between 2017 and 2023 (km²) were as follows: (a) 2017: 6947; (b) 2018: 7536; (c) 2019: 10129; (d) 2020: 10851; (e) 2021: 13038; 2022: 11594; (f) 2023: 9064 (Peixoto: Barreto, 2024).

not guarantee real influence of communities in the decision-making process, with participatory control being more symbolic than effective (Leonardis, 2021; Ampolini, 2021).

Data from a 30-year period show a considerable drop in precipitation and water volume in reservoirs, affecting the phenomenon of "flying rivers," which transport moisture to other regions of Brazil. The relationship between deforestation and climate change in the Amazon reveals that if 40% to 50% of the forest is destroyed, there is a risk of irreversible transformations, in which the vegetation could become a savannah. This process, known as the "point of no return," can be accelerated by increasing carbon dioxide concentrations (Leonardis, 2021; Marengo, 2009).

Projections indicate that, by the end of the 21st century, warming in the region could reach up to 6°C, which should intensify droughts, reduce precipitation, and increase evapotranspiration, compromising water availability, biodiversity, and local populations, highlighting the urgent need for mitigation measures (Marengo, 2009).

Deforestation increased significantly in the Amazon, Cerrado and Pantanal, with increases of 9.5% and 13% in the first two regions, respectively, in 2020, with the impact being more severe for indigenous and traditional communities, deepening environmental racism (Aleixo & Arima Junior, 2022).

Since 2019, there has been a decline in environmental monitoring, with the weakening of agencies such as IBAMA and ICMBio and under the management of the federal government (2019-2022) environmental policies were dismantled, the Climate Fund was weakened, and practices such as land grabbing were encouraged, undermining compliance with the Paris Agreement (Aleixo & Arima Junior, 2022).

Since the mid-20th century, the Amazon has been experiencing a gradual increase in temperatures, ranging from 0.6°C to 0.7°C by 2017. Projections suggest that this warming could exceed 4°C by the end of the century, accompanied by a possible reduction of up to 40% in precipitation, which would have profound impacts on ecosystems, including the extinction of species and damage to agriculture and the regional economy (Marengo; Souza Jr, 2018).

Deforestation and forest degradation intensify climate change, increasing the frequency of droughts, fires and loss of biodiversity. If deforestation reaches between 20% and 25% of the total forest area, there is a risk of "savannization", in which the Amazon could become a drier region (Marengo; Souza Jr, 2018).

Deforestation and climate change in the Amazon increase heat stress, affecting both ecosystems and human health. In the most critical global warming scenarios, temperatures predicted for the end of the century could exceed the conditions' ability to adapt, putting millions of people at risk, especially in the most vulnerable areas of northern Brazil (Oliveira et al., 2021).

Moreover, the transformation of the forest into savanna will exacerbate droughts and fires, hindering outdoor activities. Agricultural and construction workers will be particularly affected, with significant productivity losses, deepening social inequalities, and placing additional burdens on the region's economy and healthcare infrastructure (Oliveira et al., 2021).

Factors such as deforestation, population density and greenhouse gas emissions are clearly related to the increase in hospitalizations due to respiratory diseases, while factors such as the capital-labor relationship and precipitation tend to have the opposite effect (Bento, 2024).

Research on the impact of deforestation on regional climate indicates that temperature increases can be felt more than 100 kilometers away from deforested areas, with more intense warming than expected, hence the urgency of controlling deforestation to mitigate climate change and increase the region's resilience (Butt et al., 2023).

Deforestation and fires have direct and significant effects on health, especially during periods of drought, highlighting the importance of public policies aimed at minimizing these damages. These impacts make it even more urgent to create government measures to reduce the negative health effects caused by these practices (Bento, 2024).

Illegal gold mining, particularly in the state of Roraima, has triggered a serious health crisis among the Yanomami indigenous people. Deforestation and mercury contamination of rivers compromise biodiversity and poison the food chain, causing problems such as malnutrition, malaria, and respiratory diseases in indigenous communities (Basta, 2024).

Although the Amazon is recognized for its immense natural wealth, it also faces serious problems of environmental degradation and extreme poverty, and the current development model is largely based on the unsustainable exploitation of natural resources, disregarding local ecological and cultural dynamics, which generates negative impacts on both the environment and communities (Gutberlet, 2002).

RESULTS AND DISCUSSION

Results

The results show that deforestation in the Amazon is a complex phenomenon, with deep historical roots and multiple socioeconomic factors that remain relevant to this day. Between 1990 and 2015, livestock farming was the main cause of deforestation in the region, driven by government incentives and highway expansion, so that the growth of road infrastructure facilitated both territorial occupation and the transportation of goods, intensifying pressure on the forest.

Another significant result is the identification that the production of soybeans and other monocultures has expanded degraded areas and, although agricultural expansion is often associated with the recovery of pastures that were already in use, the indirect effect on the forest is undeniable.

Between 2013 and 2019, 60% of tropical forest losses were attributed to the expansion of commercial agriculture, often carried out illegally, while livestock farming and soybean cultivation have generated social and environmental conflicts, especially with indigenous and traditional populations.

The direct environmental impact includes not only the loss of biodiversity, but also the alteration of the hydrological cycle and the intensification of climate change, with the transformation of more than 60% of the forests in the southern

Amazon into agricultural areas reducing annual rainfall by 50% in the last 20 years, with direct implications for agricultural productivity and water supply in other regions of Brazil. These changes also affect the phenomenon of "flying rivers", which transport humidity to the center-south of the country, aggravating water crises and interfering with the generation of hydroelectric power.

The results also highlight that illegal mining and fires are persistent problems. For example, in 2019, more than 45,000 fires were identified, most of which were linked to agricultural expansion and land grabbing. Illegal mining, especially in indigenous territories such as the Yanomami Land, has caused mercury contamination and severely affected the health of local populations, in addition to contributing to violent conflicts and environmental degradation.

Discussion

The results found reflect the strong historical dependence of the Amazon region on predatory economic activities and a prolonged absence of effective public policies to promote sustainable development. The analysis shows that the development model adopted in the region is based on a cycle of intensive exploitation of natural resources, where short-term economic gains are prioritized over environmental preservation.

This is evident in the tax incentives offered during the military regime and in the current practices of expanding livestock and agriculture, which are the main causes of deforestation. The climate impacts identified are consistent with existing literature, which indicates that the destruction of large areas of forest affects not only the local climate, but also globally.

The reduction in vegetation cover limits the forest's ability to act as a carbon sink, which contributes to increased

greenhouse gas emissions and intensifies global warming. Furthermore, the study confirms that changes in the hydrological cycle resulting from deforestation harm agriculture in other regions of Brazil, reinforcing the interdependence between the preservation of climate balance.

Another relevant point in the discussion is the issue of social conflicts. The expansion of the agricultural frontier has led to the expulsion of small farmers and indigenous communities, generating disputes over land and violating the rights of traditional populations.

The results reveal that land grabbing and illegal mining are directly associated with violence in the countryside and the weakening of the State's regulatory power, and the lack of an effective government presence in isolated areas facilitates the action of criminal groups, intensifying environmental degradation and social inequalities.

Although initiatives such as the Action Plan for the Prevention and Control of Deforestation in the Amazon (PPCDAm) showed positive results until 2012, with a significant reduction in deforestation rates, the research reveals that the weakening of these policies since 2016 has resulted in a new wave of forest destruction.

The restructuring of inspection agencies, such as IBAMA, and the reduction of resources allocated to environmental protection have compromised Brazil's ability to comply with international conservation commitments.

The study suggests that holding agribusiness accountable and implementing stricter policies are essential to curbing the advance of deforestation, and that including sustainable practices in agricultural and livestock production, combined with strengthening inspections, can mitigate the negative impacts.

However, this will require effective international cooperation, since global demand for commodities, especially soybeans and meat, continues to drive forest destruction. It is therefore essential that importing countries adopt stricter sustainability criteria for goods from the Amazon.

Finally, the results reinforce the need for more integrated public policies that reconcile economic development and environmental conservation. Promoting agroecological models and encouraging a green economy are promising alternatives, but they require structural changes and greater engagement from the public and private sectors.

Preserving the Amazon rainforest is fundamental not only for Brazil, but for global climate stability, and requires a coordinated effort to ensure that the region’s development occurs in a sustainable and inclusive way**.**

CONCLUSIONS

Deforestation in the Amazon is a multifaceted phenomenon, rooted in historical, economic and social factors, and intensified by ineffective public policies. The exploitation of the forest for agriculture, mining and agricultural production compromises not only biodiversity and local hydrological cycles, but also affects the global climate, reinforcing environmental and social crises.

The results reveal that, although deforestation control initiatives have shown temporary effectiveness, the lack of continuity in public policies and the dismantling of monitoring agencies since 2016 have accelerated environmental degradation. The study also highlights the social conflicts resulting from agricultural expansion, especially in indigenous territories, aggravating inequalities and violence in the countryside.

Curbing deforestation requires an integrated approach that reconciles economic growth and environmental conservation, with the active participation of the government, the private sector and the international community. The implementation of sustainable models, such as agroecology and the green economy, is essential, but depends on structural changes and global cooperation.

Finally, the study concludes that the preservation of the Amazon is fundamental not only for Brazil, but for global climate stability, demanding a joint and coordinated effort to ensure that the region's development occurs

in an inclusive and sustainable manner.

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