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Evaluation of environmental impacts related to the implementation of the business district of Morro Agudo/SP: possible scenarios and mitigation strategies

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SUMMARY

For decades, debates and discussions about the environment and its preservation have gained strength internationally, especially on the issue of climate change associated with greenhouse gases-GHG. For this reason, normative initiatives have been adopted to minimize or redirect anthropic practices that can contribute to the preservation of nature, in order to keep natural resources available, and with quality, for future generations. In this scenario, this work evaluated the environmental impacts related to the implementation of the Business District of Morro Agudo/SP, presenting possible scenarios and strategies to mitigate the anthropic activity. After the studies, it was concluded that, for the implementation of the business district of the municipality, there would be positive and negative impacts for the place and its citizens. Despite the interventions in the natural resources of the delimited area, the pre-established compensation is consistent with the mitigation of impacts, as well as the strategies strengthen the conservation and recovery of the municipality's resources.

KEYWORDS: Environment. Public Policy. AIA.

1 INTRODUCTION

For decades, debates and discussions about the environment and its preservation have gained strength internationally, especially on the issue of climate change associated with greenhouse gases-GHG. For this reason, standardization initiatives have been adopted to minimize or redirect anthropic practices that can contribute to the preservation of nature, to keep natural resources available and with quality for future generations (Pereira and Curi, 2012).

In this context, subsidized by the National Environmental Policy (PNMA - Law No. 6,938/81), there are instruments that aim at "the preservation, improvement and recovery of the environmental quality conducive to life", such as the environmental impact assessment (EIA), for example (Art. 9, Item III). And, in the meantime, it is considered that the definition referring to impacts is commonly linked to any type of changes, alterations and transformations that occur in the environment (Dagnino and Carpi Júnior, 2007, p. 22; Rubira, 2016, p. 136; Meneguzzo and Chaicouski, 2010, p. 183).

Guerra and Cunha (2001) point out, for example, that the disorderly growth of cities is one of the main causes of environmental impacts. The author states that the generation of impacts on the environment can have "offsite and onsite" effects or, in other words, can cause damage both at the intervention site and in other areas located at long distances (Guerra and Cunha, 2001, p. 3). Therefore, it can be understood that the study of the environmental impacts caused by anthropic activities of any nature is of great importance for the local and regional environment, considering that the product resulting from this study guides the environmental management of geographic spaces, such as those belonging to the municipality involved.

In this sense, the strategic actions that the municipality of Morro Agudo/SP has been developing for the management of its administrative areas, to conserve and recover them, are highlighted. The Conservation and Recovery Plan for the Atlantic Forest and Cerrado biomes in the municipality of Morro Agudo (2023) is an example of this, as its proposals contribute to the use and occupation of the land with guarantees of environmental preservation on a local scale.

The geographical conditions and favourable soil fertility make the municipality of Morro Agudo/SP a national reference in agriculture, not only for the large production of grains,

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especially soybeans and corn (IBGE, 2010), but also for having most of its land destined to the planting of sugarcane, which has been favoring economic activities related to the trade of agricultural products in the region in recent decades and, consequently, influencing the main local landscape, which reinforces the need to establish environmental public policies in the municipality.

As a result, economic agents interested in settling in the municipality motivated the local government to reserve an area planned to serve as a business district, whose spatial organization could promote local productive efficiency, facilitating the logistics of the interested parties, interaction and mutual collaboration, ensuring the applicability of sustainable development strategies based on the actions implemented.

With the Conservation and Recovery Plan for the Atlantic Forest and Cerrado biomes in the municipality of Morro Agudo (2023), there is a greater possibility of understanding and diagnosing the current situation of the municipality with regard to its priority areas for conservation and recovery, standardizing guidelines and actions that provide for such demands, in accordance with the Environmental Public Policies already implemented with the Municipal Plan for Urban Afforestation and the Municipal Education Program Environmental Plan, which will be integrated into the aforementioned plan. The mutual action of these legal municipal instruments provides the strengthening of other actions related to Brazil's commitments to the global SDG agenda (Agenda 2030 – UN, 2015).

And this is also why the study of environmental impacts for the licensing of enterprises in the municipality of Morro Agudo/SP deserves to be highlighted: for exemplifying environmental management practices to consolidate environmental management actions in accordance with the document prepared and the Brazilian legal system (Brasil, 1981; Brazil 1988; Brazil, 1999; Brazil, 2000; Brazil, 2010; Brazil, 2012; CONAMA, 1986; CONAMA, 1997).

In view of this, this article discusses the evaluation of the environmental impacts related to the implementation of the Business District of Morro Agudo/SP, based on the study of its feasibility, presenting possible scenarios and strategies for mitigation and enhancement of related anthropic activities.

2 METHODOLOGIES

For the environmental impact assessment (EIA) study, related to the implementation of the Business District in the municipality of Morro Agudo/SP, the *Check ist method was applied L* (Westman, 1987; Barbieri, 2016; Sánchez, 2020), which consists of the preparation of checklists or control lists, identifies the impacts of environmental diagnosis carried out in the physical, biotic, and socioeconomic (anthropic) environments. Calling

For the study, some of the relevant environmental impacts were selected, according to the type of project, about the type of anthropogenic modification introduced in the analyzed system (Sánchez, 2020).

Table 1 shows the types of environmental impacts considered, organized into evaluation parameters.

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Table 1. Environmental Impacts analyzed in the *"Check List"*

Types of impacts	Description
Positive or Beneficial	If the effect generated is positive or beneficial for the environmental factor considered
Negative or Adverse	If the effect generated is negative or adverse to the environmental factor considered
Temporary	If the effect is only for a certain duration
Permanent	If the generating effect is definitive, lasting after the action that generated it has ceased
Short Duration	When a short period of time is necessary for the impact generated by the action to be neutralized; when there is the possibility of reversing the environmental conditions prior to the action, in a short period of time, that is, that immediately after the conclusion of the action, there is a neutralization of the impact generated by it
Medium Duration	When a certain period of time is necessary for the impact generated by the action to be neutralized
Long Lasting	When there is a long period of time for the impact to remain after the completion of the action that generated it
Reversible	When the action that generated the change ceases, the affected environment will return to its original state
Irreversible	When the action that generated the change ceases, the affected environment will not return to its original state

Fonte: Adapted from Sánchez (2020).

In this way, according to Barbieri (2016), the *Check list method L* makes it possible to list the verification items that influence the environmental quality of the directly feted area (ADA) by the enterprise. Therefore, we sought to organize environmental impacts by relating them to possible predictability scenarios (Sánchez, 2020).

2.1 Strategic Location of the Enterprise

The space intended for the implementation of the Business District of Morro Agudo called "Shigeyuki Yamaguchi", has an area of approximately 89,053.87 m² and is located on the banks of the Altino Arantes Highway (SP-351) that connects the municipality of Morro Agudo with the municipalities of Sales Oliveira-SP and Orlândia-SP (Figure 1).

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Figure 1. Project location: 2011 and 2015

Source: Google Maps (2011) and Google Maps (2015) .

The area directly affected (ADA) by the project has approximately 881,080.25 m², or 88.11 ha, corresponding to the "Cidade Nova" neighborhood. In this neighborhood, there are about 1,120 inhabitants, according to data from IBGE (2022). In addition, two new allotments are being implemented in front of the site, which will increase the number of inhabitants to the level of around 2,250 inhabitants, considering the extension of the subdivision and the number of lots (Figure 2).

Figure 2. Areas contiguous to the project.

Source: Google Maps (2024)

2.2 Location Characteristics

2.2.1 Relief

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Located at an altitude of 563 meters, the development in the business district of Morro Agudo/SP has the following geographic coordinates: Latitude: 20° 43' 39'' South, Longitude: 48° 3' 14'' West and altitude of 546 meters (IBGE, 2010). More specifically, the site of the development has a flat relief, with a variation in the terrain of about 1 meter, according to the Google Earth tool.

2.2.2 Infrastructure

In addition to facilitating logistics, due to its proximity to the road modal, the area was selected considering the location of the new allotments and the consequent urban expansion of the city. Another factor considered for the choice of location is that the area has already been used as a base for other medium and large companies, precisely because of its strategic position for the flow of production and services to the municipalities in the region such as: Ribeirão Preto, Barretos, Sales Oliveira, Orlândia, São Joaquim da Barra, Batatais and others.

2.3 Predictability Scenarios

Despite the need to meet the demand provided by agribusiness in the administrative region of the municipality, the choice of the location of the business district required a socio-environmental and socio-economic feasibility study, characterized by the resource of creating scenarios for the study of the direct and indirect environmental impacts related to the implementation of the project (Sánchez, 2020). To this end, the location, geography, urbanization was considered as relevant factors for analysis.

In this sense, as exemplified in Table 01, the following analysis items were outlined and arranged in the following format: in rows, Aram the analytical items for the socio-environmental feasibility study were listed, and in columns, the scenarios were listed, namely:

- Scenario 1: Construction of the district with strong governance – removal of vegetation cover, grounding and constructions related to industrial activities, paving, with private and public efforts for the execution of mitigating measures such as TCRA's, inspection and execution of legal measures;
- Scenario 2: Construction of the business district without governance – removal of vegetation cover, grounding and constructions related to industrial activities, paving, without private or public efforts to implement mitigating measures;
- Scenario 3: "Witness" scenario in which there is no intervention in the area.

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Table 1. Socio-environmental and socio-economic feasibility study scenarios.

Analytical items	Scenario 1	Scenario 2	Scenario 3
Environmental Control	Ostensible	Precarious	No changes
Environmental Situation	Maintaining environmental quality	Reduction of environmental quality	No changes
Natural resources	Intensification of pressure on natural resources in the short term, with mitigation in the medium and long term.	Intensifying pressure on natural resources in the short term	No interventions
Employability	Improvement in the population's income	Improvement in the population's income	No changes
Market articulation	Integration of local and regional markets.	Integration of local markets.	No changes
Tax Collection	Increased revenues to fund operations and services offered to the community	Increased revenues to fund its operations and services offered to the community	Predial and Urban Territorial Tax (IPTU)
Role of the State (municipal public governance)	Strong	Weak	No interventions

Source: Prepared by the authors (2024).

The scenarios presented were built based on studies carried out *in loco*, preceded by analysis of municipal normative and legal documents, including Complementary Law No. 45, of December 5, 2023 (Construction Code); Municipal Complementary Law No. 009, of September 27, 2006 (Master Plan of the Municipality of Morro Agudo) and Law 750, of December 4, 1979 (Law of Land Use and Occupation), approved by the Brazilian legal system.

3 RESULTS AND DISCUSSIONS

Table 1, which describes the scenarios of the socio-environmental and socio-economic feasibility study of the enterprise of the business district of the municipality of Morro Agudo/SP, provides the observation that both in scenario 1 "Construction of the business district with strong governance", and in scenario 2 "Construction of the business district without governance", there are possibilities of occurrences of direct environmental impacts, in the short and medium term; However, most of these occurrences can be mitigated, as the environmental impacts that may occur in the operation phase of the business districts will depend on the types of industrial units that are installed in the area.

For example, in the implementation phase, the environmental impacts are characterized as short-lived, because when activities such as cleaning the area and demarcation of the lots are closed, these impacts will no longer occur, as reported and recorded in Table 2.

However, in the operation phase, the impacts need to be mitigated by adopting control and monitoring practices.

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Table 2. Some environmental impacts, mitigating and enhancing measures.

Environmental Impacts		
Scenario 1		
Business District Implementation Phase		
Physical Environment	Biotic Medium	Anthropic Medium
Noise pollution/ Increase in particulates in / atmosphere (Negative impacts; Temporary; Short Duration; Reversible) Increased soil erosion processes (Negative impact; Permanent; Long Duration; Reversible)	Vegetation suppression/Reduction of biological populations/Scaring away fauna/Increase in trampling of fauna/ (Negative impacts; Temporary; Short Duration; Reversible) Siltation of watercourses (impact on aquatic fauna) (Negative impact; Temporary; Short Duration; Reversible)	Increased noise pollution/ Harm to human health (Negative impacts; Temporary; Short Duration; Reversible) Eviction of the area for the implementation of the Enterprise (Positive impact; Permanent; Long Duration; Irreversible) Valuation of real estate in the vicinity of the development area (Positive impact; permanent; Long-lasting; Reversible)
Mitigating Actions		
Physical Environment	Biotic Medium	Anthropic Medium
Waterproofing of construction areas (Negative impact; Permanent; Long-lasting; Reversible)	Planting of seedlings and practices of replacement of tree and shrub species of the cerrado in the lots (Positive impacts; Permanent; Long-lasting; Reversible) Terrestrial Wildlife Management (Positive impact; Permanent; Long-lasting; Reversible)	Compensation of the owners of the area/ Campaign of clarification and participation with the ADA community (Positive impacts; Permanent; Long-lasting; Reversible)
Business District Operation Phase		
Physical Environment	Biotic Medium	Anthropic Medium
Increase in noise and air pollution/ Increased runoff in soil/ Alteration of the local landscape/ (Negative impacts; Permanent; Long-lasting; Reversible)	Reduction of biological populations/Scaring away of fauna (Negative impacts; Permanent; Long-lasting; Reversible)	Creation of expectations in the population/ Increase in the supply of jobs and income of the population/ Growth of public infrastructure (Positive impact; Permanent; Long-lasting; Reversible)
Mitigating Actions		
Monitoring of sound pressure levels in internal environments of buildings; of air pollution by current regulations/ Waterproofing of construction areas	Creation of ecological niche in APP areas	Planting trees in the surroundings/sound inspection/Increasing purchasing power/Improving quality of life
Enhancing Actions		
Training and qualification of labor, aiming at the qualification of individuals for the exercise of functions in the companies allocated in the Business District		
Offer of employment of an inclusive and sustainable nature in the industrial park, providing the applicability of the fundamentals related to the Sustainable Development Goals (SDGs), in compliance with the Public Inclusion Policies, especially the Federal Affirmative Action Program (PFAA). Social		

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Therefore, it can be understood that the environmental impacts in the studied area are mitigation, in view of the evident positive socioeconomic impacts, such as the generation of employment and income for the places in the surrounding area (ADA). In this sense, such actions can compensate for the intervention carried out.

In addition, the impacts detected as positive or beneficial (those described in Table 2) should be treated as potentiating measures. These measures are endorsed by a strong public environmental governance action, in which leadership, strategy and control mechanisms are put into practice, in order to evaluate, direct and monitor public management, with a view to conducting environmental policies and providing services in the interest of society (BRASIL, 2014; Teixeira and Gomes, 2019).

3.1 Participatory governance actions and strategies

According to Jacobi and SinisgalII (2012), Environmental Governance in the context of the study seeks to overcome the concept of a set of management formats, considering that it is based on the expanded participation of all stakeholders in the implementation of the project. In this sense, considering participatory governance as one of the strategic management tools that can and should be used, based on the pre-establishment of actions and goals for the mitigation of impacts, such as, for example, in the execution of the Environmental Recovery Commitment Term (TCRA) for the implementation of mitigation strategies, it is possible to achieve more satisfactory results in terms of mitigation and inspection actions, taking into account the interests of the parties, especially the local population. from to the Interested

To compensate for the interventions caused by an enterprise, such as the one under study, there are means to mitigate direct and indirect environmental impacts, based on the execution of the strategies pointed out by the TCRA. Certainly, there are other ways to list actions to mitigate environmental impacts, based on a more joint, complex and holistic action, considering that the project is in an area belonging to a hydrographic basin, in which there are several interests among the social actors involved.

3.2.1 Environmental Recovery Commitment Term

The TCRA (Term of Commitment for Environmental Recovery) prepared to meet the mitigation of the environmental impacts caused as a result of the project of the Business District of Morro Agudo/SP was agreed together with CETESB in which for the project, the stretches selected for the planting of seedlings of lot 01 were established, referring to the leisure systems 01 (Figure 3) and leisure 03 (Figure 4) demarcated in the project for the implementation of the Business District, with total areas of 805.51 m² and 27,853.24 m², respectively. ,

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Figure 3 - Leisure Area 01, located in the Business District

Source: Google Maps (2023)

Figure 4 - Leisure area 03, located in the Business District

Source: Google Maps (2023)

For each advance in the District's implementation phase, it was established that a part of the agreement should be fulfilled. Therefore, 480 seedlings were planted in the leisure system 02, leaving only the planting and maintenance of the seedlings of the leisure system 01 and 03 to finalize the agreement. The total stretch selected for planting seedlings in lot 02 refers to the permanent protection area - APP - of Ribeirão do Agudo, as shown in figure 5.

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Figure 5 - Ribeirão do Agudo Permanent Preservation Area

Source: Google Maps (2023)

Thus, it was sought to comply with the determinations contained in the TCRA related to environmental compensation, considering the particularities of the enterprise, as well as the stakeholders involved in carrying out tree management and maintaining the positive impacts arising from the installation of companies in the area.

3.2.2 Actions and targets to mitigate impacts

In addition to the Terms of Commitment for Environmental Recovery, it is important to emphasize that strong governance provides direct mitigation of the environmental impacts caused by an intervention, such as the construction of a business district. Thus, it is valid to list and define actions and strategies that permeate the main priorities. Thus, we have the following table that is developed based on the enterprise in question.

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Table 3. Strategic planning: actions and goals aimed at mitigating impacts in the area of the project to the

Strategy 1 - Recovery of vegetation cover through seedling planting	
Actions	Goals
1. Planting in the surroundings of the area 2. Incentive to the planting of native trees in the urban area (ADA).	1. Connect forest fragments (ecological corridors), when the need for intervention is observed; 2. Produce and distribute free native seedlings suitable for urban afforestation throughout the year; In projects for afforestation of squares and green areas, at least 70% of the indicated species must belong to the cerrado and Atlantic Forest biomes;
Strategy 2 - Update environmental information in the municipality	
Actions	Goals
1. Monitoring of the possible impacts resulting from the intervention; 2 - Preparation and updating of data Cartographic; 3 – Indication of potential and priority areas for protection of the surroundings.	1. Periodically inspect the quality of the water in the nearest watercourses. 2. Keep the aerial images of the municipality of Morro Agudo/SP up to date for urban/environmental planning work; Georeferenced 3. Update the mapping of urban green areas, with data review annually.
Strategy 4 - Raising Public Awareness	
Actions	Goals
1. Promotion of Environmental Education in Schools (based on the Municipal Environmental Education Program of Morro Agudo/SP); 2. Promotion of municipal awareness campaigns (with a focus on the surrounding community and future installed companies);	1. Periodically raise awareness among children and adolescents about the importance of preserving biodiversity, following the schedule available in the municipality's Environmental Education Program; 2. Disseminate materials and develop awareness and awareness activities with the population and companies, taking into account the municipal EE Program.
Strategy 5 - Minimize the Impacts of Solid Waste on Forest Remnants	
Actions	Goals
1. Promotion of maintenance and optimization of the selective collection of solid waste on site; 2. Promotion of Environmental Education (Solid Waste).	1. Create 1 EcoPoint near the project; 2. Make the community and companies aware of the importance of recycling with periodic events, following the schedule available in the municipality's EE Program.
Strategy 6 - Fauna Preservation	
Actions	Goals
1. Support for the performance of the municipality's Zoonoses Control Center; 2. Promotion of adherence to Operation Firebreak - PAME.	1. Build facilities and enable them to support the recovery and reintroduction of the native fauna of the biomes, victims of inspection actions or accidents (such improvements must occur uninterruptedly, when there is an allocation).
Strategy 7 – Awareness and Effective Inspection of Fires	
Actions	Goals
1. Inspection by SEMAS through weekly rounds through the city's neighborhood and adjacent to the location of the Business District;	1. Carry out at least one (1) weekly inspection with a city hall vehicle;

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2. Assistance, by the Civil Defense, of complaints and occurrences of fires; 3. Promotion of educational actions regarding fires.	2. Carry out fire control with equipment and vehicles suitable for the action, always when requested and/or identified the fire in the area; 3. Carry out educational actions at least once a year, before the beginning of the dry season.

Source: prepared by the authors (2024)

Through strategic planning, it becomes possible to address various environmental issues in a municipality, such as urban afforestation highlighted by Pinheiro and Andreani Júnior (2020). However, Guerra and Cunha (2001) point out that interventions often fail to comply with existing environmental legislation. To address this, measures such as enhanced monitoring and initiatives to encourage participatory governance have been proposed (Table 3). These efforts aim to mitigate potential risks effectively.

Dagnino and Carpi Júnior (2007) conceptualize risk "as the probability that an event – expected or not expected – will come true". Therefore, with the interventions and actions mentioned above, events that may negatively impact the environment in the municipality can be suppressed or dampened.

Pereira and Curi (2012, p. 53) point out the importance of the social good and the responsibility of managers in planning and execution:

> It is emphasized that any initiatives aimed at environmental quality, through actions and attitudes that are conscious and coherent with the current environmental crisis, will only be implemented when social well-being overrides political interests, since such actions are necessarily implemented by managers and it is up to them to conduct actions that promote a balanced environment with a view to obtaining a healthy quality of life.

The association of factors such as wildlife, vegetation, water resources, soil, and other components of the environment in question directly affects the quality of life and environmental balance of a city (Guimarães; Pasqualetto, 2020).

Finally, it is understood that planning is ineffective when there is no strong governance or execution of the established actions. It is then up to municipal managers to properly apply the budget allocated to the environment, so that these goals are met. Despite the lack of detailed knowledge of municipal plans by public managers, as observed by Morais, Zampler and Stefano (2019), they recognize the importance of strategic planning, such as environmental planning, on the part of other civil servants.

The most environmentally viable scenario would be scenario 3 "witness", a scenario in which there is no intervention in the area, thus maintaining its natural characteristics. However, it is known the importance of the project for the municipality.

From a socioeconomic point of view, in view of the significant results for the public administration in terms of tax collection, the project is interesting for municipal development. Consequently, based on the applicability of its public policies, this initiative will have a positive impact on basic health and education services, housing, as well as employability, fostering economic growth combined with social and environmental governance practices.

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4 CONCLUSIONS

Environmental Governance can be considered a basic factor for sustaining the various types of enterprises in the face of environmental risks, social implications and opportunities in the socio-environmental area in which they are associated. To this end, the environmental impact assessment study related to its implementation and operation helps in the construction and validation of regulatory documents, such as the TCRA.

For the implementation of the business district of the municipality of Morro Agudo/SP, it was possible to evaluate the positive and negative impacts for the place and its citizens. Despite the interventions in the natural resources of the delimited area, the pre-established compensation with the TCRA allowed the elaboration of actions to mitigate the impacts, as well as the design of other actions that strengthened the conservation and recovery of the natural resources of the municipality. Strategic

More broadly, it is concluded that in the municipality of Morro Agudo/SP, it is necessary to develop more environmental governance practices, through diagnoses and strategic planning, in view of its strong agricultural aspect and its large territorial extension. In this aspect, both its rural and urban areas must be considered in these studies, so that the conservation and restoration requirements occur in awareness actions, recovery of degraded areas, inspection, management and use of technology in an intersectoral way, factors that enable environmental governance.

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