

ENVIRONMENTAL CONDITIONS' DIAGNOSIS OF THE RIVER MIRINZAL IN
THE WESTERN NORTHEAST COAST OF MARANHÃO

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ABSTRACT

The research diagnosed the environmental conditions of the significant river Mirinzal which attends the municipality Apicum-Açu's population on the western northeast coast of Maranhão. The realization of this investigation enables the broad recognition of the importance of this river to the local population as well as reveals the main problems that affect the environmental water, soil, vegetation, and fauna conditions. It was accomplished a wide bibliographic revision related to the theme and most importantly the federal, state, and municipal legislative documents about the superficial hydric resources, "in loco" visits for observations, photographic records, and interviews with residents close to the high, medium and low course of the river. The investigation apprehended the existence of negative impacts in diverse locals, such as erosion, deforestation, silting, pollution, and reduced flow of the water body caused by intense human activities, however, it was also registered in varied points areas in positive states of preservation. The research also presents suggestions of action and management to the reversion of the degradation state in the Mirinzal river, so that it will be guaranteed to the future apicum-açuense generations the maintenance of this significant course of water to the municipality and its total population.

Keywords: River Mirinzal; Apicum-Açu; environment.

**DIAGNÓSTICO DAS CONDIÇÕES AMBIENTAIS DO RIO MIRINZAL NO
LITORAL OCIDENTAL MARANHENSE E NORDESTINO**

RESUMO

A pesquisa diagnosticou as condições ambientais do importante rio Mirinzal que atende a população do município de Apicum-Açu no litoral ocidental maranhense e nordestino.

A realização da investigação possibilitou um amplo reconhecimento da importância deste rio para a população local, bem como de revelar os principais problemas que afetam as suas condições ambientais atuais de qualidade da água, do solo, da vegetação e de sua fauna. Foram realizados uma ampla revisão bibliográfica relacionada ao tema e principalmente documentos legislativos federais, estaduais e municipais sobre os recursos hídricos superficiais, visitas "in loco" para observações, registros fotográficos e entrevistas com moradores residentes próximos ao alto, médio e baixo curso do rio. A investigação apurou a existência impactos negativos em vários locais de seu curso, tais como: erosão, desmatamento, assoreamento, poluição e redução da vazão do corpo hídrico ocasionados por intensas atividades antrópicas, porém, também foram registrados em vários pontos, áreas em estado de preservação muito positiva. A pesquisa também apresenta sugestões de ações e planejamento para a reversão do quadro de degradação do rio Mirinzal, para que seja garantido às futuras gerações apicum-açuense a manutenção deste importante curso d'água para o município e toda a sua população.

Palavras-chave: Rio Mirinzal; Apicum-Açu; meio ambiente.

INTRODUCTION

Throughout the whole formation process of the planet Earth, the water had and still has a fundamental role in the emergence and maintenance of life since it's known that it precedes the existence of every other form of life on the planet and for that reason, its preservation and conservation became a subject in word discussions, especially the shallow waters that are considered the most vulnerable to pollution and its contamination.

The shallow waters, like rivers, have always kept multiple relations to humanity that since times utilize this natural resource for various activities: animal water supplies, food attainment and production, leisure, work, and other uncountable utilities. The rivers are understood as determinant resources in the emergence of the first social groupings - being the starting point to the first city configurations, therefore, was, and is, the conditional factor to the installation and development of the urban centers.

This old and mutual relation of the hydric bodies and urbanization nearly never is harmonic, for many times the anthropic actions done by different forms and situations have been modifying and influencing directly the natural dynamic of these water resources. And the cities' urbanization process in the manner they have intensified, propelled by the industrial and technological revolutions and migrations, lean towards turning these environments each time more explored and degraded, being in many periods supplanted by the urbanization.

Between the many problems occasioned in the hydric bodies by the poorly planned human occupation process, it's emphasized the deforestation of the riparian forests and the river springs; the discard of solid residues - both in the water bodies as in the addresses, these which are carried by floods and deposited in the rivers; the silting - occasioned by the removal of vegetation in its surroundings; the diminution of exit measure caused by the dams or the installation of concrete rings (tubes), alterations in the rain regime and rise in temperature, besides many other environmental and urban problems, triggered by the degradation of the rivers.

Even though existing Federal, State, and Municipal Legislations grant preservation and protection of the water resources, in practice the reality is quite different, for many of these laws are not implemented or supervised, be it by the civil society or by the Public Power. There is no sensibility, education, care, or preoccupation with these natural resources, which makes their existence each time more at risk of degradation.

Diagnostical studies in the existing hydric resources situation make themselves necessary for the attainment of knowledge of the real situation in which they will be found as well as the entailed impacts on the disordered and poorly planned human occupation process in these spaces. Enabling so the identification of the principal originators of the river's degradation, as well as contributing to the planning of measures and actions that will be conducted to minimize such problems identified while also demonstrating the shallow waters' importance to the well-being and social o the community.

The research pursues diagnosing the environmental conditions in the micro hydrographic basin of river Mirinzal in the municipality of Apicum-Açu - MA, categorizing its occupation process and identifying which are the principal existing negative impacts, promoting the complete diagnosis of the current condition of the preservation as well as reveling the importance this river has to the apicum-açuense population.

The methodological procedures used in the research were the qualitative-deductive method, which is depicted by the *in loco* observation and the photographic records of the study's local, there were wandered across the entire rote of Mirinzal's river from its spring to the downstream interviews with varied habitats that reside for a long time in these locations. In addition the bibliographic revision of articles, reports, sites, and environmental Federal, State, and Municipal legislation, as well as the Law of the Water and the Forest Code.

MATERIALS AND METHODS

LOCATION AND CHARACTERIZATION OF THE STUDY AREA

Apicum-Açu is of the 217 municipalities of Maranhão and is located in the mesoregion north of the state, inside the microregion of the occidental coast of Maranhão, with a territorial area of 353,2 kilometers (Cidade-Brasil, 2019) being state's 195^o municipality in territorial extension (Picture 1). Presents the estimated population of 14.413 habitants (IBGE, 2020) and the estimated demographic density of 45,38 hab./km² (Atlas Brasil, 2013). The municipality of Apicum-Açu limits itself to the North with the Atlantic ocean, to the South and West with the municipality of Bacuri, and East to the municipality of Cururupu (Cidade-Brasil, 2019). The municipal headquarters has the following geographic coordinates: -01°27'36" to the South Latitude and -45°06' to the West Longitude. The urban zone is composed of the following districts: Center, Tabating, Mangueirão, Nambu, Novo Apicum, Campelos, Turiranda, Caruaru and Alto Alegre (Municipal Law 217/17). According to IBGE data (2010), 9.162 habitants, about 61,25% of the population lives in the urban zone.

Picture 1 - Localization map of Apicum-Açu in the State of Maranhão



Source: IBGE (2010). Elaboration: Souza, J.F.M. (2020)

Apicum-Açu's climatic profile

The municipality's weather is semihumid tropical since it's located between the Cancer and Capricorn Tropics, because of this reason it attains the characteristics of hot and humid, influenced by some factors that are determinants to this classification, such as: proximity to the Equator Line, the Intertropical Convergence Zone phenomena, Amazon Forest and ocean breezes by the proximity to the Atlantic Ocean ((VAZ et al., 2017, p. 8).

The localization of Apicum-Açu close to the Equator Line is one of the reasons to explain the local climatic conditions for the solar incidence to occur with high frequency and intensity in the areas of the terrestrial globe, contributing largely to the clouds' constitution in the way of surface warming, influencing a hot local micro climate, many times with sensations of thermal discomfort, due to the swift heat absorption by the virtue of materials used in the asphalt pavements, residential constructions, and other buildings.

The Intertropical Convergence Zone phenomena (ZCIT), to the southern hemisphere (HS), in the month of January, remaining until the month of June, happens in Ecuador's latitudinal line because it forms a low-pressure zone that concentrates the trade breezes from both the northern hemisphere as well as the southern hemisphere, allowing to the water restores in the aquifers and the hydric bodies, with the decrease of the thermal discomfort conditions and the local vegetation coverage preservation.

From the proximity of the municipality to the Amazon Forest, it's noticeable the major influences on the air humidity in Apicum-Açu, since the forest's extensive vegetal coverage focuses large amounts of humidity once the sun rays don't penetrate a vast part of the soil, thus this humidity is dissipated by the wind in the forest's proximities entertaining a significant part of the country, as well as the municipality of Apicum-Açu.

Besides the emphasis above, there are still influences of the sea breezes in the municipality's climate from the Atlantic Ocean for the municipality's territory is located in the coastal area of Maranhão where the humidity responsabilization is constant, enabling orographic precipitations (rains) and a sensation of alleviation of thermal discomforts.

Evidently, all these factors earlier depicted influence the municipality's climate of Apicum-Açu, which during the year owns two very defined climatic periods, a rainy and drought period, the former happens from January to June, with monthly rainfall measures varied between 130mm and 380mm, possessing a peak amid March and April, the second one ensues between the months of July to December with rainfall measures varied amid 4mm and 40mm, with the months of September to October acting as the peak of the drought. Thus, the annual rainfall measures arrive at 1.871mm, with average temperatures of 27.0°C. (Climate-Data, 2020).

Water Resources according to the Legislations

Although the water resources since the beginnings have fundamental importance to the manutention of life on the planet, especially the human beings, in accountable activities and utilities, the concern with the impacts of its exploration only was seen more prominently in the 60s and 70s decades, with the approval of the "Clean Water Act" in the United States in 1970, forming to "adopt measures to the correction of the impacts in

the natural water cycle, complementary to the already existing structures" ((PERES; POLIDORI, 2011, p. 4), is considered the initial milestone to the effectuation of legislations that assure the protection and preservation rights to natural resources, such as rivers.

The Legislation on water resources in Brasil has its initial milestone as the Water Code (Código das Águas), institutionalized by the Decree n° 24.643 on July 10th of 1934, assuring the free use of water for basic necessities in life. Although, only in Constitutional Reform in 1988 it's started the creation of the National Policy of Water Resources, establishing responsibilities to both the Union and the States regarding the water resource management, culminating in 1997, with the promulgation of the Law of the Waters. (UEMA, 2016, p.11).

Amid the Legislations currently in force that establish guidelines and recommendations, ensuring the right to protection and conservation of the water resources in Brazil, it's emphasized with higher relevance to the structuration and grounding of addressing this theme, the Federal Law n° 9.433 on January 8th of 1997, known as Law of the Waters; the Law n° 12.651 on May 25th of 2012; the State Law 8.149 on June 15th of 2004, that manages the State Policy of Water Resources; and the Municipal Laws: Organic Law, Complementary Law n° 191/2013 and the Law of Environmental Licensing n° 252/2017.

Federal Legislation - National Policy of Water Resources

The Federal Law n° 9.433, sanctioned on January 8th of 1997, instituted the National Policy of Water Resources and created the National System of Water Resources Management determines in the Article 1°, items I to III, that the water is a public domain asset; a limited natural resource, endowed with economic value, and that in a scarcity case its priority use must be for human and animal consumption. Stated still in item VI that the management of this resource must be decentralized and distributed by the Public Power and the general community.

This Law's goals are "assure to the current and future generations the disponibility to water in adequate quality standards to its respective uses" along with the "preservation and defense against critical hydrological events, be they either from an ecological or anthropic origin, occasioned by the inadequate use of this resource. (Article 2°, items I to III).

The Article 3° conducts general guidelines of action for the implementation of this policy, indicating in the items I, V e VI that the management of the water resources mustn't be disassociated from quantity and quality aspects, requiring the articulation with the soil use, and "the integration of the hydrographical basin's management with the estuarine and coastal zones systems".

The Article 11 discusses the necessity of authorization to the water resources' rights, obtaining as an objective assuring the control of quantity and quality in water use. As indicated in Article 12 the use of water resources is subject to the authorization done by the Public Power: attention is drawn to item III, which refers to the release of sewage and liquid and gaseous residues, treatable or not, in bodies of water, with the goal to dilution, transport or final disposal.

The values collected by the Public Power, to the water resources' use, from the bestowals, must be the priority and applied "in the studies, programs, projects and included works' financing in the Water Resources Plans", referents to the hydrographic basin in with its created such values. (Article 22, item I).

According to Article 49, "Constitutes as an infraction of the utilization norms of the shallow or subterranean water resources", to be known:

- I - Derive or use the water resources for any intent, without the respective authorization of right to use;
- II - Initiate the installation or install business related to derivation and or usage of the water resources, shallow or subterranean, that applies alterations to the regime, quantity, or quality to them, without authorization of the qualified organs or entities;
- IV - Utilize the water resources or execute service works related to the stated in disagreement with the conditions established in the bestowal.

The infractions and uses in disagreement with the established definitions in the Laws are subject to penalties, stated in Article 50 items (I to V) and paragraphs (1° to 4°), that range from written admonitions to the correction of the irregularities, simple or daily fines proportional to the gravity of infraction, temporary or defined impediments, or even so, "replenish incontinent, to its original state, the water resources, river beds, and shores", it that's the case.

The Law n° 12.651, best know as Forest Code, was sanctioned on May 25th, 2012. Article 1°, it's established the general norms for the vegetation's protection, Permanent Preservation area; forest exploration, raw material, forest fire prevention and delivers other measures.

In item 1 it's brought to attention Brazil's compromise on the forests preservation, native vegetation, biodiversity, soil, water resources, and climatic systems. The item affirms that it's the Union's, State, Federal District, and Municipaliies' communal responsibility, with society's collaboration, to create preservation and restoration policies of the native vegetation in both urban and rural areas.

According to Article 4°, it's regarded the Permanent Preservation Areas - APP "the marginal cones of any natural perennial and intermittent watercourse, excluding the ephemeral, from the *regular bed gutter edge* (?) (item 1). Depending on the water resource's width, the permanent protection area must obey the following established resolutions, to be known:

- a) 30 (thirty) meters, to the watercourses of less than 10 (ten) meters wide.
- b) 50 (fifty) meters, to the watercourses of 10 (ten) to 50 (fifty) meters wide.
- c) 100 (a hundred) meters, to the watercourses of 50 (fifty) to 200 (two hundred) meters wide.
- d) 200 (two hundred) meters, to the watercourses of 200 (two hundred) to 600 (six hundred) meters wide.

Item II, subitem b determines that for lakes and ponds the area it surrounds must have a range of at minimum 30 meters to urban zones. Item IV establishes for river springs, in any topography situation, a protection area of at minimum 50 meters in its surroundings. In other words, without deforestation episodes or occupation in their nature in these areas.

All vegetation situated in the Permanent Protection Area must be maintained by its proprietor, be it in a public or private domain, in case there's the removal of vegetation the proprietor is obliged to promote the vegetation reposition of the deforested area, excepting the authorized uses by Law (Article 7° paragraph 1°). Article 9° allows access to those areas as long as it's for the acquisition of water or it's a low-impact environmental activity.

In Article 61, paragraph 14, it's appointed that the Public Power, when verifying aggravating risks to erosive process and inundations in APP areas, determines adherence and mitigating measures that guarantee the stability of the margins and water quality of the water resources, in conformity to the State Council of Environment.

State Legislation

The Law n° 8.149, June 15th of 2004, disposes of The State Policy of Water Resources and the Integrated Management of the Water Resources of Maranhão, establishing on Article 2° items IV and V, that the "water resources management must always provide the multiple uses of the waters". Requiring the compartmentalization between the National, State, Municipal, and user sectors Water Resources Plans.

Amid the State Policy of the Water Resources' goals, cited in Article 3, it's emphasized items IV to VIII, which indicate the "national use of the subterranean and shallow waters"; multiple uses of the water resources; utilization management, and urban soil occupation, aiming the springs' protection; and the conservation and permanent protection of areas of natural aquifer recharge.

According to Article 4°, it's constituted the general guidelines for the implementation of the Water Resource Policy, with emphasis on items IV, V, and X, and the State Plan's articulation, with national and municipal plannings, the water resources management to the environment's protection, in its multiple uses.

Relies on the State Executive Powe, to the implementation of the Water Resource Policy, to take essential measures for the functioning of the integrated water resources system; "implement and

conduct the state water resources information system and put into practice the federal and state environmental legislation, integrated into the water resources policies". (Article 26, items I, III, VI)

To the State Policy of Water Resource's execution, the integrated management System has as its objectives: "coordinate the waters integrated management; with planning, regulation and utilization control, to the preservation and recuperation of the water resources; as well as promoting the charge for water use. "Article 28, items I, VI, and V).

On Article 32 that addresses the State Environmental and Water Resources Management, assigns as functions for this sector: exercise supervision, apply administrative sanctions and fines; "provide technical orientation to the Municipals and emit authorization to the right of use of the water resources."

The infractions and penalties for non-compliance to the norms and orientations, foreseen in this Law, are indicated by Articles 39 and 40, and their respective items, correlate to the established Federal Law 9.433, in the Articles 49 and 50, mentioned in the previous topic. For such, it won't be done the reinsertion of this information, elucidated that both laws share the same penalties for infractions on the water resources' inadequate use.

Municipal Legislation

The municipality of Apicum-Açu doesn't dispose of exclusive Laws regarding the municipal water resources' policy and management, according to the responsible agencies. However, of the current laws, some make vital mentions to the topic, reserving some Articles to the water resources, like the Organic Law and the Directing Plan.

The Organic Law of the municipality of Apicum-Açu was enacted on the day June 30th, 1997, and amid its assignments and recommendations, it's emphasized Article 10 items VI and VII, which indicate the municipality's competency, "to protect the environment from pollution in any of its forms" preserving nature, fauna, and flora, encouraging the reforestation.

Article 96 affirms that all have a right to a healthy ambiance, it being ecologically balanced and adequate do the qualify of life, and that everyone, especially the Public Powe, must defend and preserve it for the current and future generations. The sole paragraph on items I, IV, and V reiterates that the municipality, in conformity with the Federal Constitution, won't allow: flora devastation in springs and water bodies' shores in its territory; "the destruction of native landscapes and the occupation of demarcated areas as those for the environment's protection".

The actions in nonconformity to these recommendations and conducts that are considered damaging to the environment are subject to criminal and management sanctions, as well as the infractor's obligation to repair the caused damages (Article 98). Article 111 founded the creation of the Environment's Municipal Council, a fact that doesn't translate to the reality of the Municipality of Apicum-Açu.

The Complementary Law nº 191/2013 (Directing Plan) in its Article 26 indicates as guidelines to the Municipal Environmental Policy: to protect and restore the environment and the urban landscape; control and reduce the pollution levels; expand the green areas of the municipality and preserve the natural ecosystems (Items II, III, and VII).

In the same Article there are reserved some items with indications and assignments to the municipality, beyond the already mentioned, directed to the environment, flora, fauna, soil occupation, and water resources protection. Although the reality presents itself as distanced from what is advocated in the Law, to be known:

XXI - to guarantee the existing vegetal cover's protection in the municipality and the environmental and natural biological diversity's area of interest.

XXIII - to guarantee the permeability of urban and rural soil;

XXV - to promote hydrogeological studies in the municipality;

XXVI - to guarantee the soil conservation as a form of protection for the underground streams;

XXXVIII - to raise awareness among the population regarding the correct use of water.

XXIX - to protect the water's course and its bodies of the municipality, its springs, and riparian forests;

XXX - to desilt and keep the watercourses, channels, and galleries of the drainage system clean, respecting environmental legislation.

The municipality of Apicum-Açu disposes of still in the Environmental License Law nº 252 of October 11th of 2017, not being considered as relevant to this work's construction for not creating direct recommendations to environmental issues, be it of protection or preservation, that it might found norms to the utilization of such resources.

With an emphasis on only Article 4º sole paragraph that notes the environmental licenses are just emitted to activities or businesses not considered potentially damaging of impacts or degradation, depending on previous studies and reports of environmental impacts, being the Municipal Environmental Secretary's responsibility to emit the environmental license and supervise if the activities and businesses act accordingly to the environmental recommendations.

Nonetheless, the reality live by the municipality of Apicum-Açu, related to the environment's protection and conservation, in conformity to what is foreseen by the Law is extremely different, not being by far prosecuted and implemented all that is foreseen and determined. In the following sects, it will be more evident how the reality of the fact doesn't express what the in-force laws determine, and the water resources are being degraded and supplanted by urbanization.

RESULTS AND DISCUSSION

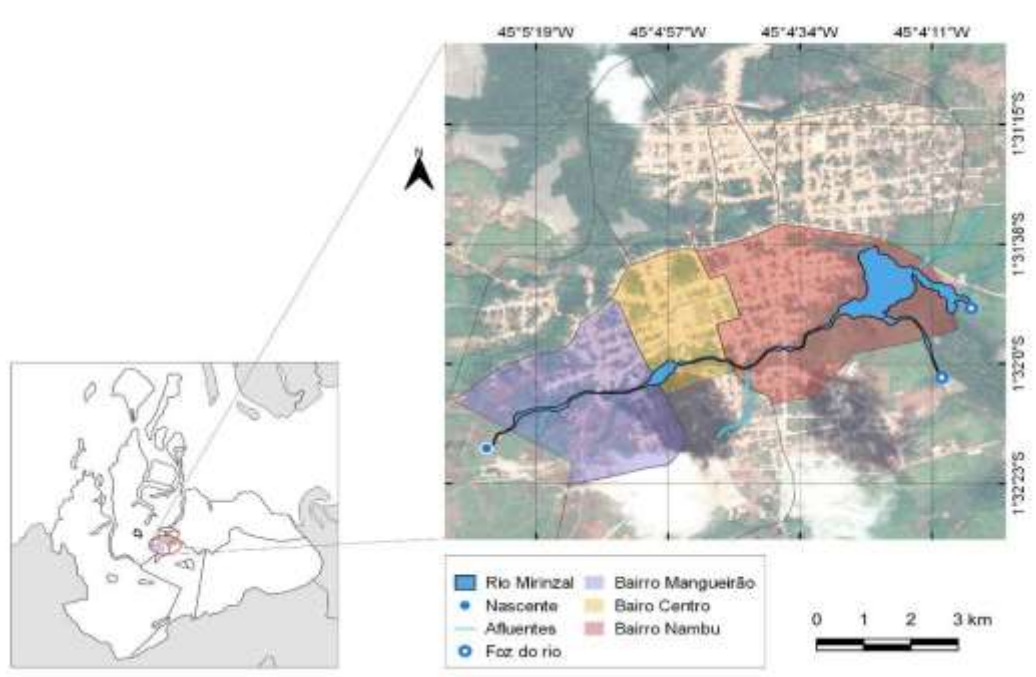
GENERAL CHARACTERISTICS OF RIVER MIRINZAL

The river Mirinzal is located in the municipality of Apicum-Açu (Picture 2). It possesses 12 kilometers in extension from its spring to its outfall. Its primary course cuts the *focus* in a west-east way, running through three neighborhoods: Mangueirão, Centro e Nambu.

The river Mirinzal is also known by other names and these names vary according to its passage across all neighborhoods, it s also known as Marajá and Nambu. It's worth mentioning that this and other existing bodies of water in the municipality are not cataloged in IBGE or any other Federal or State Government's official site.

The river Mirinzal's spring is in the neighborhood Mangueirão, where it's popularly called Marajpa, by the fact it's river springs' shores has been for a long time occupied predominantly by this type of vegetation - tall palm tree, very thorny at the entire end of the trunk, with a dark-colored stone fruit similar to açai.

Picture 2 - River Mirinzal's map in the municipality of Apicum-Açu.



Source: Data-base: IGBE (2010). Elaboration: Souza, J.F.M. (2020)

Impacts observed in river Mirinzal

During the camp's research, it was identified many signs of deforestation, for example, it can cite the absence of vegetation around the river's spring and the marajá's almost nonexistence, as can be viewed in Picture 3 in Photo 1. In this part, notices still a process of erosion, silting, and reduction of river flow caused by the removal of vegetation cover and even pollutions problem by the solid wastes discard. What it means is that the preservation and environmental protection of the water resources are only in the laws, not bearing commonplace to the reality.

It is founded that in some of the margin's points, the vegetation remains preserved, and the soil is without erosive process, siltations, or the accumulation of solid waste. Thus, it's remarkable on the right margin the presence of a gallery of woods, since in these spots there is no habitation, which means that, little or no human interference in the locations.

Even though it's known that there as laws and codes concerning water resources that discern that water bodies' margins are deemed as Permanent Protection Areas (APP), as were cited previously. The river is suffering intense changes in its margins, mainly due to the intense deforestation originating from the badly planned human occupation and the non-compliance with the law, since the residential residence is getting more frequent in these areas and many have yet to be aware they are using and occupying and undue area.

Picture 3 - Environmental impacts identified in river Mirinzal



Note: photo (1) - river Mirinzal's spring; photo (2) Concrete rings installed at the beginning of river Mirinzal's course; photo (3) Wire fences installed on the banks of the Mirinzal River; photo (4) Cacimba-type well-installed near the Mirinzal river; photo (5) Waste residue discarded on the margins of river Mirinzal.

Source: PIRES, Tailene de J. Santos (2020)

It's remarked the continued siltations process in the river's margins, occasioned by the appropriation of the left bank floodplain, to constructions of residences, roadways, leisure areas (clubs), wells, schools, and cultivation areas, because it's known that to build it's necessary to deforest, an action which exposes the soil to erosive process, especially on the rain periods, in which the carrying of sediments is greater. Therefore, the local reality opposes the Federal, State, and Municipal Laws.

The river Mirinzal is cut by 5 (five) roads, of which 1 (one) contains asphalt paving and concrete tubes, and the other 4 (four) are not paved and of these four 2 (two) have concrete tubes to allow the shallow water to keep its course but this strategy is insufficient to maintain the amount of river flow, as it can be observed on Picture 3, photo 2.

Hence, a major part of the materials that are eroded and the ones carried by the river are deposited on the riverbed forming a type of barrier diminishing the potential for the transport of water, inducing siltations in determined points, making so the river gets slower and loses its capacity to keep its course, that for medium/long-term occasions the river's drought and even the migrations of riverbeds to other localizations.

It's emphasized as well that through the river there are many fences present as forms of delimitating the ground, as can be seen in picture 3, photo 3, complicating the access as well as verifying the intense appropriation of the river by illegal private action.

There were also verified by the research several abandoned cacimba-type wells drilled on the river banks, that accumulate water without any use and compel erosive processes and silting in the river's bank as well as the spreading of diseases whose vector is the mosquito such as Dengue, Zica vírus, and Chicungunha, as it is possible to see in picture 3, photo 4.

As it's analyzed the existing municipal laws, it's has been proved that there is no planning for the multiple uses of shallow waters and the fact that for not owning of municipality's urbanization law, the urban growth happens in an unorganized way and the river's situation is on the primary examples of this reality. It's known that the integrated management doesn't happen from night to day, but it's up to the public power to implement laws that guarantee the spring's preservation, as well as the organic law of the municipality, sole paragraph art. 96, cited in the previous section that contemplates these resources.

Another observation contemplating the municipal laws is the fact that there are environmental license laws, that are not implemented in actuality because the funds raised are not applied to the springs' recuperation, in addition to how common it is to have an environmental license for the functions of car washes in the margins of water bodies without overseeing, and also discard its residues directly on the river without penalties, not retaining conformity between the legislation and reality.

It can be perceived that beyond the cited impact, there is still degradation by the discharges of domestic effluents that are produced and released both on the banks and in the river itself, causing pollution and possible contamination of the same (Picture 3, photo 5) as well as the animals that depend on it to survive. Because the people lacking basic sanitation and solid waste collection, comprehend as an easier way to discard sink, bath, and toilet waste in the river, making it improper for human use or consumption.

CONCLUSION

The water is a natural resource that will never stop existing and much less will it not be fundamental in the cycle of maintaining life on Earth, but its quality is being each time more limited, with that, it becomes more frequent absence since the urbanization is a continuous and rapid process that infers directly to the shallow water resources, making

those more subjected to degradations, for this reason, is one of the primary issues discussed and studies, with the intent to preserve it.

It was evident that the discussion of the integrated management of these resources is on the main measures to ensure the quality of the rivers as well as the multiple uses of water, as it's defended by many authors, in the same manner, the legislative and executive power to sanction protection and recuperation laws of the existing river in any and every localization. And, still, the implementation of these actions is more than urgent in the scenario where the bodies of water can be found.

In Apicum-Açu, the degradation situation of the shallow water resources, not only of the river Mirinzal as well as other, is critical, the environmental impacts found in the river is a reality triggered by the lack of planning that contemplates the preservation of the river's margins, the absence of basic sanitation, adequate zoning for the authorization of certain types of constructions, be they residential or commercial; as well as the continued preservation of the water existing resources in the municipality, but the omission of this action has reflections in the quality of life of the population, as well as the rising of cases of Schistosomiasis, increasing thermal discomfort and the local biome contamination that depend on these rivers.

From the research's development, it was possible to diagnose numerous impacts on the river, such as: deforestation of the riparian forest in several places along the banks, as well as silting, pollution, and a decrease in river flow, it being the occurrence of these problems with high levels where the river is cut by the roadways, in the anthropic interference is higher, being it also reasons for this situation the management and population's negligence concerning the environment.

Beyond that, it was possible to understand through the interviews with late habitants how was the river before the urbanization process, the influences it performed on the economic sector of plant and animal extractivism, and in the agricultural production, in addition, it was possible to learn the exuberance of a river that assisted a population from antique times and the contrast between the reality of very distinct periods although the is not photographic register of the river during that time.

Although the shallow water resources of Apicum-Açu, especially the river Mirinzal, present degrading impacts, there are still possibilities for its recuperations, but for that is crucial planning that contemplates the diminishing of every problem found in a long essential period to the restoration of the local ecosystem. Reforestation measures for riparian forests are urgent and vital to preserve the local biome that is disappearing, along with a form to prevent the occurrence of negative impacts in the local ecosystem, like, for example, the disappearance of some species of vegetation that depend on the pollination and/or the activity of dispersion of seeds and fruits that are made by birds (ornithochory) and the migration of river springs, stopping that from vanquishing.

Besides the cited problems, it will help to combat the thermal discomfort, balance the local rainfall index, diminish the occurrence of erosion and silting, along with bettering the landscape scenery, increase the shallow water levels and tourism potential of the municipality, and from medium and long term enables the total restoration of the existing river, guaranteeing that the future generations will also have access to these resources.

The measures to be taken to ease the encountered impacts on the river's course are: reforestation, reforestation, de-silting processes, chemical and physical treatment of water's course, reconstruction of roads compatible with the river flow, in the same way, investments in environmental education and implementation of the Municipal Directing Plan and the laws in force to preserve the water bodies of Apicum-Açu.

It's concluded that the micro-basins of the river Mirinzal can be found with many environmental degradation problems generated by the process of human occupation, mainly in the badly-planned urbanization, as well as, the omission of the implementation of preservation laws for the river of national, state and municipal nature.

Be that if these impacts are not immediately repaired, the river, vegetation, and all local biota will disappear, generating other problems for society, especially health and local economic issues. Despite this, the damages as reversible. If the measures above are put into practice, in a few years it will be possible to observe positive results.

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