

The Impacts on the Fauna and Flora of Igarapé Mindu Realities Told in the City of Manaus – AM

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Abstract

In this study whose objective was to evaluate the process of degradation of the fauna and flora of the Mindu stream between two existing stretches in the eastern zone, the need to use the analytical and comparative method as a method of approach in the urban area of Manaus as a focus to understand the reality of the environments, in this study an analytical approach with bibliographic characteristics was carried out. Historical factors that influence the environmental degradation and life characteristics of native species as mechanisms that facilitate or restrict invasion by exotic species were evaluated. They were compared at two points on the stream, where the main

environmental characteristics such as; structure, width and depth, biodiversity and natural ecosystem, physical and chemical characteristics of its waters.

Keywords: Environmental Impact, Biodiversity, Nature, Igarapé.

1. INTRODUCTION

The igarapés of Manaus are typical of terra firms, with general ecological characteristics that probably limit their occupation. These include the small size of these water bodies (which in turn limits the biomass of the species present), the relatively low water temperature, by Amazon standards (23 - 25°C) and, especially, the low native primary productivity, due to the poverty of nutrients dissolved in the water and the low light input, filtered by the forest canopy (Junk & Furch, 1985; Walker, 1995; Anjos, 2014).

This set of characteristics, which possibly represent important selection pressures for occupation by native species, should also have effects on the probability of invasion of these environments by non-native species. In Manaus, the igarapés are increasingly suffering from the urbanization process, which is advancing on urban forest fragments, where a good part of the sources of these water bodies are found.

This process leads to the loss of the natural characteristics of these aquatic environments, due to changes in structural aspects (with the suppression or alteration of the riparian forest, which causes an increase in water temperature and siltation of the channel, for example) and limnological aspects (with the increase in nutrients from the discharge of sewage directly into these water bodies, causing an increase in pH and conductivity) (Couceiro, 2007; Dos Anjos, 2007).

The physical characteristics of the aquatic and terrestrial environment are important factors that determine which species will be present. According to the templet habitat theory, an environmental template by Southwood (1977), similar characteristics among species are due, in part, to the combinations of evolutionary responses of organisms that live in particular environments. The close dependence on the forest causes changes in the terrestrial environment to directly and indifferently affect the system, both in its habitats and in its ecological functions. Thus, all environmental changes such as those produced by deforestation and pollution can condemn the streams to disappearance.

This faunal mischaracterization can be even more intense with the invasion or establishment of exotic species. In this way, the study of the life strategies of native communities, together with information about the state of

the environmental integrity of their environments, generates important data for the understanding of their environmental susceptibility.

This study brings the perspective of observing the impacts caused on the flora and fauna of the Mindú stream, within this multitude of challenges, the study proposes to trigger different forms of access to information and from the historical bibliographic perception, it also proposes to survey the impacts environmental and chemical in water-courses, forest, and anomalies present in the region.

It is known that the existence or not of riparian forest in accordance with the forest code – law 4,772/65 permanent preservation areas – article 2°. The loss of environmental quality in the stream results from the impacts caused by the use of streams as dumps and mainly as a sewage treatment plant. With the results, it will be possible to predict which exotic species have the potential to occupy and which native species will adapt to the heavily polluted environment. Based on the results found, it will be possible to assess measures that reduce or reduce environmental impacts.

These results are extremely important, both to avoid a greater disappearance of native species in these environments, and for the well-being of the human population that lives on the banks of this stream in Manaus. As the proposal is to evaluate the physical and water factors of the water body, areas subject to erosion, land use and occupation, socioeconomic characterization and diagnosis of water quality and their influence on local biodiversity, with the task of analyzing the physical characteristics and chemicals from the water of Igarapé Mindu; assess the existence or not of riparian mink in accordance with the forest code – law 4,772/65 permanent preservation areas – article 2;

Carry out tests to measure acid levels at two different points on the mindu stream that cut across the eastern zone; observe the characteristics of biodiversity and the natural ecosystem at the collection points; take measurements on the margins of the collection points to analyze the level of siltation of the stream; calculate the water velocity at these points and the depth of the stream.

In this study, the aim is to understand the levels of contamination of the environment, it is to talk about the possibilities of changes in the real scenario, valuing both flora and fauna, more especially, visualizing the possibilities of changes in procedures for valuing science as a means of rescue, validation of procedures that can help in the search for short-, medium- and long-term solutions for the environmental causes of the green corridor of the Mindu stream.

Even though part of the forest is still preserved, the risk of contamination and aggression to the environment is visible, this is noticed when the advance of urbanization changes cycles, as the water-courses carry

waste to the rivers and carry with them countless harping objects of contamination. The lack of basic sanitation and the absence of more effective public policies cause setbacks and worries environmentalists and students who need to join forces to act in favor of environmental balance.

2. MATERIAL AND METHODS

To carry out this study, the scenario for cataloging information that touches the results was prepared, within this perspective, the following steps were carried out:

2.1 Study Area

The area of studies is the path of the Mindu stream, Segundo de Queiroz (2020) the path of the stream follows a flow directed to the Rio Negro, as follows:

“The Mindu hydrographic basin has an estimated area of 67 km². The drainage density (Dd) is 1.3 km.km⁻¹, and its main channel (Mindu igarapé) has an average width of fewer than 10 meters in its high course, whose value increases in the medium and low course. reaching a width of 15 to 20 meters during the flood. The sinuosity index of this channel is 1.1, being classified as straight, which leads to a reduction in the water permanence time in the channel and an increase in the flow velocity, which, in principle, would not contribute to flooding in the basin. The hydrological regime of the Mindu stream is differentiated along its length. Filizola and Oliveira (2012) observed the rainfall/elevation relationship and concluded that the rainfall regime influences the elevations in the Mindu stream. In the middle and upper course, the river has its own regime that follows the rainfall regime in the Manaus region, while in its low course the stream follows the hydrological regime of the Rio Negro. It is difficult to define precisely the influence of the Negro River within the Mindu stream, but in field research, it was found that this influence can reach up to approximately 1.5 km from the mouth to the upstream”. (De Queiroz, 2020.p. 226).

The representation of the location of the igarapé is shown in Figure 1. In the city of Manaus, the Mindu complex is well known, as it was labeled as an environmental conservation area and, in recent years, the scenario has shown itself to be aggressive and degrading on a large scale.

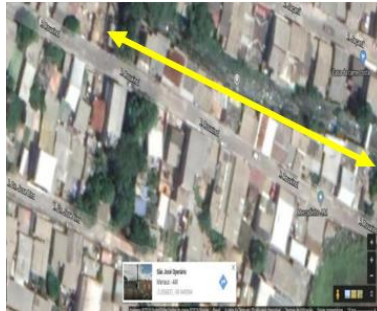


Figure 1: Location of the Igarapé do Mindu in the East Zone seen by satellite. Source: Google Maps, 2019.

As it is an urban region that intersects the city of Manaus, the Mindu stream is an important ecological corridor within the urban region of the city. Due to this magnificence and characteristic, Mindu must be widely studied so that its potentials are valued and preserved.

2.2- Data collection

According to Costa (2018), observation as a data collection instrument is used in social sciences to study the behavior of the phenomenon in environmental conditions and spontaneous circumstances of its occurrence, with the purpose of extracting situations that may be valid as research results. According to Vergara (2012), the perception and recording of events, physical conditions, and non-verbal and linguistic behavior, making it possible to describe such circumstances.

There are three predominant possibilities of observation in research. The first can be called simple or unstructured observation, which occurs when there is no standardization of observation recording techniques. The recording of events takes place in an unplanned and spontaneous way, in line with an exploratory character that will serve as a basis for structured observations in the future.

They were carried out in two mapped locations where the environmental impact is constant, figures 2 and 3 show the location and the impacts caused by human actions on the environment.



Figure 2: 1st collection point Igarapé do Mindu (mutirão). Source: Own (2019).



Figure 3: 2nd Igarapé do Mindu collection point in the SauimCastanheira State Park, Source: Proprie, 2019.

THE Igarapé do Mindu, with its source in the East Zone of the city of Manaus and flows into the São Raimundo district, West Zone of the capital, intersecting 20 neighborhoods and is one of the largest in the city, with 22 kilometers in length. The collection of water will be carried out at two points for quality comparison, in accordance with Decree No. 79,367, of March 9, which provides for norms and standards for water portability.

And there will be an observation and collection (when possible) of animals and plants to compare the existing biodiversity in the stream. In order to describe the adaptive processes of these species in relation to violent changes in the environment.

3. THEORETICAL REFERENCE

According to Albuquerque (2020), interconnection benefits the gene flow of flora and fauna, as it is responsible for the spatial homogenization of genetic variability within and between populations, counteracting the effects of other microevolutionary factors that generate differentiation, such as selection natural, mutation and genetic drift.

Nature is strongly affected by human action, and fauna and flora are strong targets of environmental impact. Nature needs harmony between man and the conservation of natural resources.

According to De Queiroz (2020), the flood period in the stream begins in September and ends in December.

“The flood occurs between January and April, with the maximum flood level in March. The ebb starts in May and runs until August, the lowest quota levels occur in July. Therefore, the risk of flooding increases in the first four months of the year because the volume of precipitation is greater, increasing the volume of water that enters the system. In the Rio Negro, in the first three months of the year, the flood occurs with more intensity, in April it starts to stabilize and in May the flood begins. The flood on the Rio Negro has minimal variations in the levels of May, June and July. In August and September, the ebb occurs with more intensity to stabilize from October and end in December (FILIZOLA, 2009). It was observed that the risk of flooding is greater in the high course. The overflow waters in the floodplain of the igarapé can reach, during extreme precipitation events, 100 meters wide. In this area, the river has an average width of less than 10 meters and the depth of the channel does not exceed 1.30 meters during the flood”. QUEIROZ, 2020.p. 227).

Mindú is very rich in biodiversity and the reflection of environmental degradation actions has put this entire ecosystem at risk, according to the collections and observations of the environment, nature feels the impact of the houses that develop in the environment around the stream. The release of sewage into watercourses is extremely harmful to the environment, lacking respect for the environment, lack of responsibility and policies to care for the maintenance of the environment.

According to Albuquerque (2020), the vegetation of the Upper Course of the Igarapé do Mindu comprises: green areas, forest fragments, conservation units, and permanent protection areas. This composition reflects accelerated urbanization that over the decades 1980/1990/2000 intensified and significantly changed the landscape in the study area.

Among the types of vegetation found in the upper course, forest fragments appear with greater representation. According to the Manaus Environmental Code of Law N°605/01, Art.5°, item XVIII, forest fragments are areas of remaining native vegetation located within the urban perimeter of the Municipality, on public or private property, which perform a role in maintaining the quality of the urban environment.

In this way, the forest fragments are spread out and concentrated in certain regions, as well as in the northern portion of the basin with the highest proportion between Cidade de Deus and Jorge Teixeira districts, and towards the east between the Tancredo Neves and São José Operário districts in which there are several islands of forest fragments. Forest fragments exert

a significant influence on meteorological variables that make up the local microclimate.

4. RESULTS AND DISCUSSION

Mindú is a type of ecosystem that cuts across the city of Manaus and passes through it matters that could be avoided if the authorities and society took precautions to minimize environmental problems. According to Andion (2020) the city has serious problems in dealing with the stability of water-courses. Much study has been carried out so that the coexistence between man and nature can have a harmony.

The clamor of nature is for people to become aware of the risks that are triggered as society advances, given the possibility of colonization of the environment, causing impacts that can be felt as humanity does not see its role as an environmental manager. The Mindu Municipal Park is a Conservation Unit with infrastructure for leisure and ecological tourism, located in the Parque Dez de Novembro neighborhood, in the Center-South Zone of the city of Manaus-AM (Cascas, 2011. p. 2).

It occupies an area of 40 hectares and is home to several species of fauna and flora in the region: animals such as the Sauim-de-Coleira (*Saguinus bicolor*), an endemic monkey threatened with extinction, belonging to the Callitrichida family existing only in the Manaus region, the sloth (*Bradypus tridactylus*), rodents typical of the region such as agouti (*Dasyprocta aguti*) and squirrel (*Sciurus antunes*), birds such as the hawk (*Buteo* spp), macaw (*Ara macao*) and a variety of plant species (De QUEIROZ, 2020).

It has native vegetation of lowland/igapó forest or floodable areas, terra firme and secondary scrub forest. It is cut by the Mindu stream, from which the park's name originated.

One of the main objectives of the National Parks provided for in the National System of Conservation Units - SNUC "is to promote education and environmental interpretation, recreation in contact with nature and ecotourism, considering the basic objective of preserving highly relevant natural ecosystems ecological and scenic beauty" (FONTES, 2007, p.1).

In this sense, Parque do Mindu is contemplating the objectives prescribed by the SNUC, promoting the aforementioned activities through the "Project Knowing the Municipal Park of Mindu", as we will see later.

Also, according to the same authors, this contact with nature has the primary objective of providing the visitor with the opportunity to get to know, in a pleasant way, the environmental wealth protected by the conservation unit. As the objective was to evaluate the process of degradation of the fauna and flora of the Mindu creek between two existing stretches in the eastern

zone, it was observed that part of the ecosystem is strongly affected in some regions due to the presence of tailings that will set the alert for water intakes. attitudes.

5. CONCLUSION

The environment of the Mindu stream is a very important region in the Manaus ecosystem, its maintenance provides quality of life for the populations and promotes awareness. Society enjoys the Mindu park and all the existing biodiversity, even within a controlled environment, is not enough to ascertain the importance of keeping the ecosystem in balance.

When it comes to streams with its own characteristics, with its fauna and flora prone to be attacked by human action in the urban region. The Igarapé has undergone degrading changes that have been accentuated over the years, which is noticeable when one observes signs of residues that lodge in the course of the stream.

Another form of degrading material is detergents that are released into watercourses, a sign of which is the foam that appears along the entire length of the stream. These signs of degradation reveal the risk that poses a threat to local biodiversity. Buildings in places close to the stream favor the disposal of materials in water-courses, the impacts are monitored so that the intensities of waste can be minimized.

This study raises the perception of the conservation of local fauna and flora in the Mindu stream, which is strongly affected by human action. As future works, we suggest that polluting sources be surveyed so that it is possible to characterize the contaminants and later implement actions that can minimize their actions with methodologies adapted to mitigate the degrading actions to the environment.

REFERENCES

- ANDION, Carolina; ALPERSTEDT, Graziela Dias; GRAEFF, Julia Furlanetto. Ecosystem of social innovation, sustainability and democratic experimentation: a study in Florianópolis. *Journal of Public Administration*, v. 54, p. 181-200, 2020.
- ANGELS, Karla Ferraz dos; BOERY, Rita Narriman Silva de Oliveira; PEREIRA, Rafael. Quality of life of family caregivers of dependent elderly people at home. *Text & Context - Nursing*, v. 23, p. 600-608, 2014.
- CASCAIS, Maria das Graças Alves; TERAN, Augusto Fachín. Mindú Municipal Park: leisure, culture and environmental education space. XII Biennial Meeting of the POP Network – Latin American Network for the Popularization of Science. *Content Magazine*, Campinas, São Paulo, 2011.
- COSTA, Diogo Menezes. ECOARCHEOLOGY OF THE NON-HUMAN IN THE MURUTUCU ENGINEERING: AN ESSAY ON THE FAUNA AND FLORA OF THE COLONIAL AMAZON. *Habitus Magazine-Goiano Institute of Prehistory and Anthropology*, vol. 19, no. 1, p. 6-21, 2021.

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- COSTA, Wagner Fernandes et al. Use of data collection instruments in qualitative research: a study in scientific tourism productions. *Tourism-Vision and Action*, v. 20, no. 1, p. 02-28, 2018.
- Couceiro, SRM; Hamada, N.; Light, SLB; Forsberg, BR; Pimentel, TP 2007. Deforestation and sewage effects on aquatic macroinvertebrates in urban streams in Manaus, Amazonas, Brazil. *Hydrobiology*, 575:271–284.
- FROM ALBUQUERQUE, Natalia Ramos; MOLINARI, Deivison Carvalho. Characterization of Vegetation Cover in the Upper Course of the Igarapé do Mindu-Manaus Basin (AM). *Brazilian Journal of Physical Geography*, vol. 13, no. 01, p. 406-422, 2020.
- Dos Anjos, HDB 2007. Effects of forest fragmentation on fish assemblages from streams in the urban area of Manaus, Amazonas. Masters dissertation. National Institute for Research of the Amazon/Federal University of Amazonas. 101 pp.
- FILIZOLA, NP; OLIVEIRA, MBL Multiscale hydrological variability in the Amazon. *Science & Environment*, 44, pp. 59-70, 2012.
- SOURCES, Silvana Lopes; SIMIQUELI, Raquel Ferreira. Perspectives of interpretive signage in conservation units. In: II Interdisciplinary Meeting on Ecotourism in Protected Areas, November 8th to 11th, 2007, Itatiaia-RJ. Payment 1-10.
- JUNK, Wolfgang J.; FURCH, Karin. The physical and chemical properties of Amazonian waters and their relationships with the biota. In: *Key Environments: Amazon*. Pergamon Press, 1985. p. 3-17.
- QUEIROZ, Matheus Silveira et al. *Mindu Expedition: Geographical Analysis of the Igarapé Do Mindu*. 2020.
- Southwood, TRE 1977. Habitat, the Templet for Ecological Strategies? *Journal of Animal Ecology*, vol. 46, No. 2, pp. 336-365.
- VERGARA, Syntana E.; TCHOBANOGLIOUS, George. Urban solid waste and the environment: a global perspective. *Annual Environment and Resources Review*, v. 37, p. 277-309, 2012.
- Walker, I. 1995. Amazonian streams and small rivers. pp. 167-193. In: Tundisi, JG; Beaker, CEM; Matsumura-Tundisi, T. (Eds). *Limnology in Brazil*. Soc. Bras. Of Limnology/Acad. Bras. Of Science