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Environmental Diagnosis of the Permanent Preservacion Area (PPA) of the Capibaribe River in the city of Recife - PE

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ABSTRACT
Permanent Preservation Areas (PPA) are fundamental in the preservation of water resources, it highlights the quality of water. However, disorderly urban growth produces undesirable consequences for the environmental. In this context, the present paper had to analyze the environmental impacts that intensify the degradation of the Capibaribe River PPA, in the city of Recife. Two points were determined (Ilha do leite and Coelhos) in which an impact was identified in loco. It was observed that the chosen points are with the PPA well below what is determined by the laws, in most cases, they are the result of anthropogenic activities. The release of solid waste and organic matter in these areas enhances the PPA degradation, directly affecting the physical and biological characteristics of the rivers. Thus, it is fundamental the application of awareness programs for the population and combat the impact in this areas.

Keywords: Urban river, riverside communities, environmental impacts

Introdução

Great part of Brazilian cities emerged next to rivers, and its relation to mankind - and its cities with the rivers, follows a complex path marked by various forms of interaction throughout history, based on the natural dynamics and seasonality of water bodies, but mostly, in its significant needs and human expectations (BAPTISTA; CARDOSO, 2013).

The process of urban growth in a disorderly way has generated a deficit in the growth of public services. This has favored the pollution and degradation of the environment, leading to a decline in the quality of life of human beings and numerous environmental problems which affect the balance of systems.

One of the major systems affected are the watercourses and the areas around it. With the intensification and consolidation of urban centers, the rivers began to feel the impacts of urbanization, receiving high sanitary loads, waste from commercial activities, diffuse urban pollution, margin occupation, removal of its vegetation, among others.

Urban rivers interact with a complex system, with representations in the socio-environmental dynamics of the city, performing the function of temperature control and also regulation of the effects of rains, besides enabling the drainage or surface runoff of rainwater (ROSSI et al., 2012).

Vegetated areas around rivers are called riparian forests, or yet gallery woods and are fundamental to protecting water resources and ecological integrity in the floodplain areas, besides functioning as an ecological corridor for wild fauna and flora (LIMA; ZÁKIA, 2000apud BELUTTA et al., 2011).

According to Pereira et al. (2012), the riparian forests play an important role in the protection of rivers against siltation by various types of erosion, they serve as habitat for numerous terrestrial and aquatic species providing a gene flow among

populations and also promoting thermal comfort, especially when dealing with urban centers.

These areas around the river are known as Permanent Preservation Area (PPA) which is regulated by the New Forest Code (Lei 12.651/12). The Code determines that these protected areas, whether or not covered by native vegetation, hold the environmental function of preserving water resources, landscape, geological stability, biodiversity, fauna and flora gene flow, soil protection and ensure the well being of human populations (BRASIL, 2012).

However, the PPAs on the margins of watercourses has been simply ignored in great parts of urban centers, this reality associates with serious environmental damage such as the sedimentation of water bodies, and events that pose serious risks to human populations, such as floods and landslides (ARAUJO, 2002).

If the vegetation of these areas is maintained intact or partially intact, it can guarantee the preservation of rivers, geological stability and ecosystem diversity (OJEDA et al., 2013).

Environmental degradation has caused a very high degree of uncertainty, not only by its rhythm, but also by the uncontrolled, the diversity and by the proportions of the impacts occurred (OLIVEIRA; MONTAÑO; SOUZA, 2009).

In large urban centers, there are clear indications that the use of the edges of watercourses is saturated, requiring an environmental approach that, of course, is associated with urban planning.

In the sixteenth century the process of urbanization began in Recife, when several mills were installed on the estuarine plain of the Capibaribe river, starting settlement centers (CABRAL; PREUSS; FONSECA NETO, 2014).

The first urban nuclei appeared in the extreme points of the port, with the modification of the horizontal and vertical space, causing transformations in natural ecosystems. Around that same time, Recife received many immigrants from the interior of the state of Pernambuco and the entire Metropolitan Region of Recife (MRR), with the occupation of many riparian areas (CABRAL; PREUSS; FONSECA NETO, 2014).

The Capibaribe river contributed as an important element in the construction and structuring of the city of Recife being intimately linked to its history (MELO, 2007).

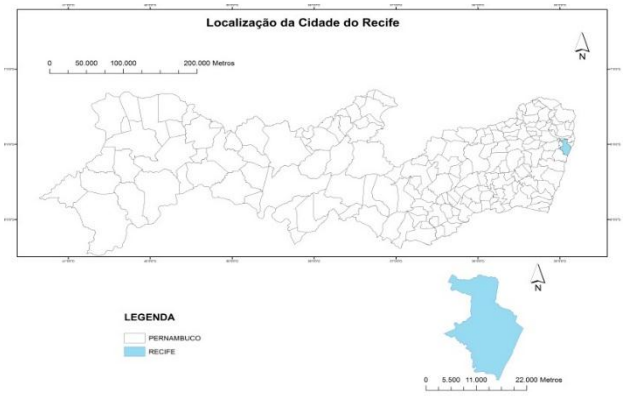
In this context, this article aims to evaluate the environmental impacts that accelerate the degradation of the riparian forest, responsible for the maintenance of the physical and biological characteristics of the rivers, especially of the urban rivers, in two stretches of the Capibaribe river in the city of Recife/PE, which contributes to the survival of the city.

Material e Métodos

The city of Recife comprises an area of 2,768,454 km2 and has an estimated population, for 2015, of 1,617,182 inhabitants (Figure 1) (IBGE, 2013).

The city's climate is hot and humid presenting higher incidence of rain in June, July and August with constant sun in the other months which appears as an important characteristic for tourism since it enables visitation to points of interest for the most of the year (PREFEITURA DO RECIFE, 2016).

Figure 1 - City of Recife.



Source: Author, 2016.

Its hydrography is constituted of three main hydrographic basins, formed by meandering rivers, being: Capibaribe's river basin, embracing the central area of the city; Beberibe's river basin which covers the northern part of the city and its gutter borders with Olinda; and Tejipió's river basin. This last one is divided into three sub-basins: Tejipió's river which drains the part of the center-south and west part of the city; the Jordan's which drains the southern zone, and the Juiquiá's which drains the rest of the central zone of the city (NÓBREGA, 2011). The Capibaribe river is one of the main rivers of Recife, this city had its urban formation historically associated with this river, serving as the route of the territory. Therefore, it was the disordered urban growth and natural limitator for the occupation of the last decades, responsible for the degradation of the environmental resources that surrounded the river, especially the mangroves, therefore compromising the quality of life of the riverine populations (NÓBREGA, 2011).

For the analysis of this paper, two sections of urban areas were chosen in the neighborhoods of Ilha do Leite and Coelhos, located on the banks of the Capibaribe River between the coordinates 8° 4'11.78"S Latitude and 34°53'29.67"W Longitude (Figure 2).

For the analysis in compliance with the guidelines of the current legislation of the municipality of Recife, related to the margins of the Capibaribe River, it was used a checklist carried out by means of field observation, evaluating if the legislation is being met

to the requirements and determinations defined by law.

Figure 2 – Location of study points.

Source: Google Earth Adapted, 2016.

For the prognosis of the environmental impacts of the area, the CheckList method was used or verification list method. The CheckList was chosen because it's a simple method yet suiFrame for the identification of environmental impacts (BRAGA et al., 2005).

This methodology, when used alone, should develop the Environmental Impact Assessment (EIA) in a simple way, of easy interpretation and in a dissertative way. It is also suiFrame for situations with data shortages and when the assessment should be made available in a short time (CREMONEZ et al., 2014).

This methodology was divided into two stages: Stage 1: Identification of impacts in loco. Stage2: qualification of potential environmental impacts (qualitative approach).

The extension measures of the Capibaribe River and of the areas 1 and 2, defined as APPs, are approximate values and calculated by the software GE (Google Earth).

The possible environmental impacts are listed and qualified considering the following attributes: character, magnitude, importance, duration, reversibility, order, temporality, and scale (CELPE, 2014) (Frame 1).

Frame 1 – Conceptualization of the attributes and definition of environmental impact assessment parameters. (CELPE, 2014).

Attributes	Rating Criteria	Symbols
MAGNITUDE Expresses the extent of the impact, in that it assigns a rating to gradual variations that actions can produce a given component or environmental factor affected by it.	SMALL When the change in value of the indicators is expressionless, not changing the environmental factor considered.	S
	MEAN When the change in value of the indicators is significant, but without power to disfigure the environmental factor considered.	M
	BIG When the change in value of the indicators is such that it could lead to mischaracterization of the environmental factor considered.	B
IMPORTANCE Establishing the significance or quantum each impact is important in interference relationship with the environment, and compared to other impacts.	NOT SIGNIFICANT The intensity of the interference impact on the environment and in relation to other impacts implies no alteration of the quality of life.	1
	MODERATE The intensity of the impact on the environment and in relation to other impacts, take on recoverable dimensions when adverse, for decrease in quality of life, or take on improvement of quality of life when beneficial.	2
	SIGNIFICAT The intensity of the interference impact on the environment and at the other carries impacts, in response, loss of quality of life when adverse or gain, when beneficial.	3
DURATION It is the impact of the residence time of registration after completion of the action that generated it.	SHORT There is the possibility of reversal of previous environmental conditions to share, in short time, that is, immediately after completion of the action, there is the neutralization of the impact generated by it.	4
	AVARAGE It is necessary to run certain time period so that the impact generated by action is neutralized.	5
	LONG It joins a long period of time for the permanence of the impact, after completion of the action that created it. In this degree, will also be included those impacts whose length of stay, upon completion of the generating action takes on a definite basis.	6

Cont. Frame 1 – Conceptualization of the attributes and definition of environmental impact assessment parameters. (CELPE, 2014).

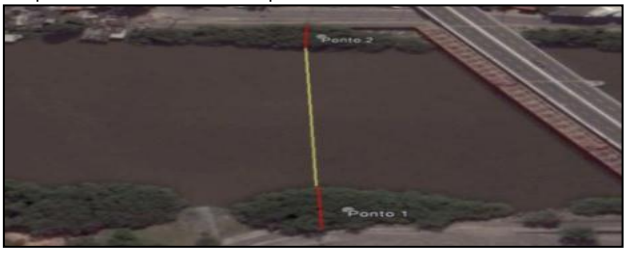
Attributes	Rating Criteria	Symbols
CONDITION OR REVERSIBILITY Delimits the reversibility of the environmental impact as a result of this action.	REVERSIBILITY When stopped the action that caused the change, the environment affected can return to its former state.	O
	IRREVERSIBLE When stopped the action that caused the change, the environment affected will not return to its previous state..	Ø
ORDER Establishing the degree of relationship between the impacting action and impact to the environment generated.	DIRECTLY Results from a simple relationship of cause and effect, also called primary impact or first order	D
	INDIRECT When it generates a secondary reaction to the action or when it is part of a chain of reactions also called secondary impact or nth order, according to the situation in the chain of reactions.	I
TEMPORALITY Expresses the temporary posting of changes or modifications generated by a project action on a given component or environmental factor affected by it.	TEMPORARY When the effect generated display a certain period of time.	T
	PERMANENT When the effect generated is definitive, ie endures even when ceased the action that generated it.	P
	CYCLIC When the desired effect has an occurrence of seasonality.	C
SCALE It refers to the magnitude of the environmental impact in relation to the geographical area covered.	LOCAL When the scope of the environmental impact be restricted only to the direct area of influence where the action was generated.	L
	REGIONAL When the occurrence of environmental impact is broader, extending beyond the geographical boundaries of the area of direct influence of the project.	R

Resultados e Discussão

The existing legislation establishes parameters (principles and limits) for urban areas aiming the protection of the soil, of the water resources and biodiversity.

Between the two chosen points, the Capibaribe river has an extension of 87.2m, in this sense the parts of the PPA are 22,5m and 16,9m for point 1 and 2, respectively (Figure 3).

Figure 3 – Measures of the extension of the Capibaribe River and points 1 and 2.



Source: Google Earth Adapted, 2016.

It is perceptible that the chosen points are with the PPA well below of what is determined by current legislation thus altering the original characteristics of this type of vegetation. Bocaiuva (2012), found that at Rainha river, in the municipality of Rio de Janeiro, the PPA Ripária densely occupied, does not preserve the natural characteristics. This same author also affirms that it will not be possible to reverse the damage caused to the environment through its non occupancy without investing significant value, often not bearable by the State.

According to the Master Plan of the municipality of Recife (Law Nº 17.511 / 2008) determines that Natural Environment Zones (NEZ) are defined according to the courses and bodies of water, formers of the hydrographic basin of Beberibe and Capibaribe (PREFEITURA DO RECIFE, 2008).

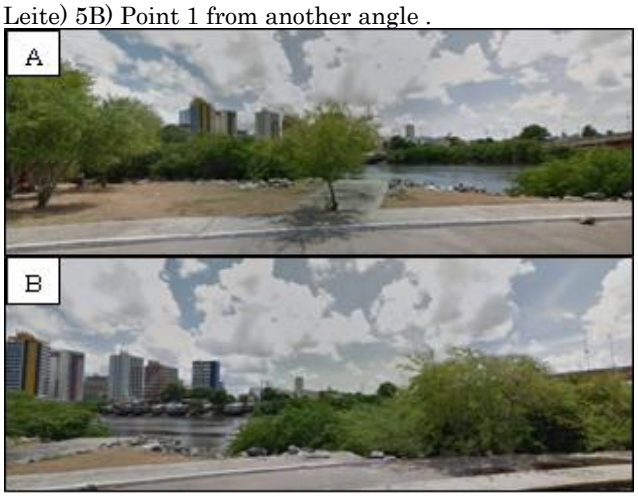
In relation to the Capibaribe NEZ, composed of the courses and water bodies that form the hydrographic basin of the Capibaribe River, is characterized by the concentration of the Atlantic

Forest and its associated ecosystems and urban public parks (PREFEITURA DO RECIFE, 2008).

What is noticeable is that legislations are not being met according to the guidelines and that the municipality has no concern to comply with.

Performing an analysis of the points of this study, in the section of point 1 there was soil covered by grass, with a part covered by asphalt and there are erosive processes ongoing. Around the area, there is mangrove vegetation composing a delicate ciliary forest (Figures 4 and 5).

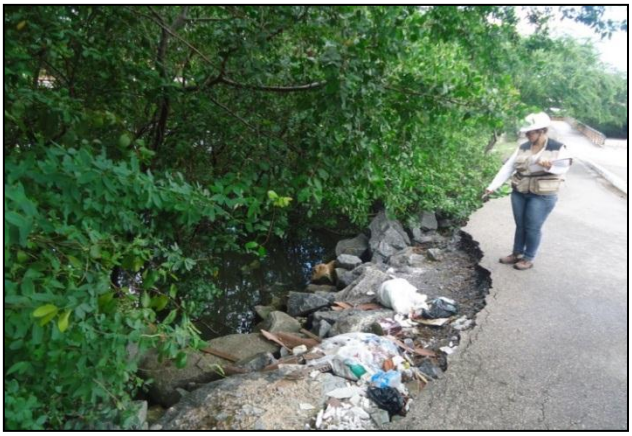
Figures 4,5 – 4A) Characterization of point 1 (Ilha do Leite) 5B) Point 1 from another angle .



Source: Google Earth, 2016.

However, even in these areas with vegetation, erosive processes were identified with damage to the sidewalks and adjacent pedestrian lane which are intensified by the presence of solid wastes Figure 6). The area is sparsely inhabited and with moderate flow of vehicles and pedestrians.

Figure 6 – Identification of erosion in point 1 (Board River Avenue).



Source: Author, 2016.

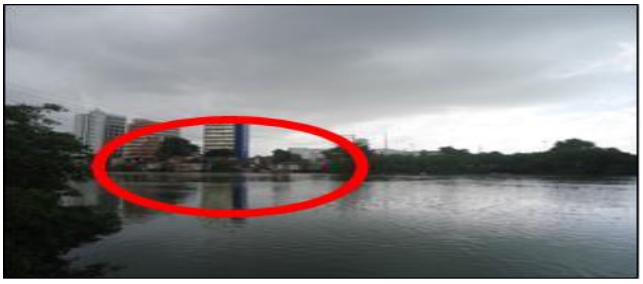
In the section of point 2, located at Coelhos street, the area is habited and has intense flow of vehicles and people due to the presence of a nursery, small businesses and stilt houses. Around it there is a small vegetation of mangrove composing a small ciliary forest (Figure 7).

Figure 7 – Characterization of the Point 2.

Source: Author, 2016

It is noticed that the occupation is quite disorderly and in stilt (Figure 8).

Figure 8 – Identification of communities next to the Capibaribe river at point 2 (Coelhos street).



Source: Autor, 2016.

Nóbrega (2011) identified, besides the sewage galleries, riverine communities or "stilt houses" as they are known, which release their domestic effluents directly into the waters of the Capibaribe River.

Rossi et al. (2012) mentions that as in all urban areas of large cities, the occupancy of the urban basin of the city of Salvador occurred over unsustainable urban patters.

In relation to the occupancy of the margins of Riacho Doce in Lajedo/PE, Santos, Santos e Silva (2011), verified that the riverine populatation of some places in the city, especially in poorer places establishes several practices with the river, such as: raising of animals (chickens, dogs, goats, oxen and horses); children's leisure practices; use for bath; solid waste disposal; and also, housework (washing clothes). These practices were not observed in point 2 of this study.

Nóbrega (2011) observed that various waste is released daily in the body of the Capibaribe river, indiscriminately and without control (Figure9).

Figure 9 – Waste identification in point 2 (Coelhos Street).

Source: Author, 2016.

A study carried out at the margins of the Mossoró river, in the urban area of the city of Mossoró-RN, found the presence of garbage on its margins being repeated in several parts observed along the course of the river, mainly in the suburbs, caused by the lack of garbage collection (ARAÚJO et al., 2012).

It can be observed in figure 9 that due to the accumulation of domestic waste below the domestic waste posts there is a presence of a garbage collection system that contemplates this place, especially due to the presence of businesses and municipal school.

However, the lack of awareness and recognition of the importance of these areas to maintain the dynamics of the city contributes for the degradation of the environment. So much that waste will end up on the margins of the river as seen in figure 9 and under the footbridge (Figure 10).

Figure 10 – Presence of household waste under the footbridge Joaquim Cardoso Bridge at point 2 (Coelho Street).

Source: Google Earth, 2016.

After these observations, the identification of the environmental impacts on both points was compacted in Frame 2. In the case of water pollution in point 1, there is the presence of pluvial outlet which has a certain impact due to surface runoff, that is corroborated with the research of Rossi et al. (2012), which highlights that rainwater can be considered as a source of pollution and contamination since they can carry various pollutants, including atmospheric pollutants from the emission of particulate matter, into the rivers.

At point 2 the impact is more intense due to the dumping of human waste directly into the river. According to Rossi et al. (2012) human excreta/sewage can cause several types of discomfort visible to the naked eye, such as: dark colored water; generation of foul odors; eutrophication of the waters and impairment of beach balneability; poor aesthetic visual; proliferation of vectors that transmits diseases; besides compromising the fauna and flora, that is, it makes the rivers degraded or even dead.

Frame 2 - Check List of environmental impacts predicted at each point of the study. (Author, 2016).

Local	Impacts Identifications	Impacted System			Impact Characterization							
		PE	BE	HE	C	M	I	D	R	O	T	E
Point 1: Beira Rio Avenue (Ilha Do Leite)	Intensification of Erosion	X			-	S	2	4	Ø	I	P	L
	WasteDisposal	X			-	B	2	5	O	D	T	L
	Waterpollution	X			-	S	2	6	O	D	C	R
Point 2: Coelhos Street	Waste Disposal	X			-	G	3	5	O	D	T	L
	Water pollution	X			-	G	3	6	Ø	D	C	R
	Siltation of river	X		X	-	G	3	6	Ø	I	C	L

Legend: PE: Physical Environment; BE: Biotic Environment; HE: Human Environment; C: Character; M: Magnitude; I: Importance; D: Length; R: reversibility; O: Order; T: temporality; E: Scale

It is perceptible that both points have equal impacts, but with different intensities (Frame 3).

This is due to the amount of waste present in the area of point 2, the flow of people and irregular housing in this area. This also happened in the research of Souza, Trovão e Farias (2011) which report that it is not only the lack of education of the residents near the studied area but also the real disregard for the protection of the area, and the lack of an effective public cleaning practice and supervision. Solid waste contributes to the main form of degradation of the environment and poses as a potential threat to public health (SOUZA; TROVÃO; FARIAS, 2011).

Frame 3 – Comparative results for Water pollution according to the variables analyzed (Author, 2016).

Point 1: Beira Rio Avenue (Ilha Do Leite)	Point2: Coelhos Street
WATER POLLUTION	WATER POLLUTION
Physical Media	Physical Media
Negative Character	Negative Character
Small Magnitude	Big Magnitude
Moderate Impotence	Importance Moderate
Long Duration	Long Duration
Reversibility Reversible	Reversibility Irreversible
Order Direct	Order Direct
Temporality Cyclic	Temporality Cyclic
Regional Scale	Regional Scale

In relation to the residues, there was a small difference in relation to the magnitude and importance (Frame 4).

Frame 4 – Comparative results for waste disposal. (Autor, 2016).

Point 1: Beira Rio Avenue (Ilha Do Leite)	Point2: Coelhos Street
WASTE DISPOSAL	WASTE DISPOSAL
Physical Media	Physical Media
Negative Character	Negative Character
Small Magnitude	Big Magnitude
Moderate Impotence	Significant Importance
Average Duration	Long Duration
Reversibility Reversible	Reversibility Reversible
Order Direct	Order Direct
Temporality Temporary	Temporality Temporary
Local Scale	Local Scale

With regard to erosive processes Santos and Vital (2016) verified that the expansion of urban areas along riverbanks is also responsible for the formation of erosive processes. In the case of point 1, it was verified that there are erosive processes, especially because of the construction of the bridge Joaquim Cardoso and its footbridge. For being considered a public construction, that is, to benefit the population, deforestation of the vegetation of the area can occur, even if it is a PPA.

Regarding the silting of the river at point 2, it is mainly a consequence of irregular occupancy. This is also verified at Araújo's el at. (2012) research that the areas occupied irregularly generate serious problems to the environment, such as soil erosion and silting of water courses.

According to Nóbrega (2011) among the main cities that are located on the margins of the Capibaribe river, the city of Recife is the one that most contributes to the degradation of the river. Although this paper is limited to two points of the Capibaribe River in the city of Recife, the situations discussed are reflected throughout the course due to the expansion of the city.

Conclusões

There is an accentuated ecological instability in the Permanent Preservation Areas (PPA), of the studied areas, caused by anthropogenic actions resulting from disorderly growth and lack of urban planning.As conclusões devem dar resposta aos objetivos do trabalho tratados na introdução.

Among the analyzed points, point 2 (Coelhos) is the most impacted, mainly due to the presence of the local population (stilts housing).

The main problems generated by the studied points are solid wastes. The lack of awareness programs for the population and also an effective monitoring system support the increased impact in the areas studied.

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