

RIVER DREDGING: WHEN THE PUBLIC POWER IGNORES THE CAUSES, BIODIVERSITY AND SCIENCE

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Urban river

Most urban areas in tropical countries faced an accelerate growth, with negative effects on streams and rivers. Walsh et al. (2005) proposed the “urban stream syndrome” as an attempt to find generalities about the urbanization on these important ecosystems. The river is undoubtedly a determinant element in the urban landscape, which first shaped the cities organization, but became shaped with the engineering advance. Historically, many cities have emerged on the river banks, however, over time they have been overshadowed by no criteria interventions, such as plumbing, dams construction, rectifying, dredging, among others (PAUL & MEYER, 2001). The anthropic actions, many times, has as purpose dominating the river, ignoring its real condition, biodiversity and the real phenomena causes that are attributed to the river (GUIDA et al., 2016; WATSON et al. 2016).

The river silting has different causes, although the most important is deforestation (ZELHUBER & SIQUEIRA, 2007). Besides that, in cities, the sand employed in the civil sector can also be carried to the rivers and cause the silting. The conservation questions that affects the rivers, specially the tropical ones, are complex and resultant from combination of socioeconomic factors and ecological responses that we are just beginning to understand. The socioeconomic realities that imply in disordered occupancy of permanent protected areas, as well as housing speculation, result in river degradation, and at same time, the rivers answer to degradation in forms that cannot be expected

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taking as base our actual comprehension. Well succeed conservation strategies require a clear comprehension of how the socioeconomic factors acting as driving forces and how the rivers answer to these forces.

Otherwise, for the rivers valuation by population is necessary a conscientization work and participative projects elaboration that qualify them, more than only laws and regulation mechanisms. When parks are creates – a low environmental impact intervention – and the riparian vegetation recovery in the river areas protection occurs flooding episodes reduction during intense summer rains, contributing to the urban drainage, reverse situation in relation to the water bodies channelization. The river visualization by population allows that they be valuate as an integrant part of the place history, offering to the population life quality in the social, cultural and environmental ambit (CONSTANTINO, 2014).

Relation of the environmental impacts and flooding

The urbanized areas are the most ones that explicit man interventions in the nature (BEICHLER et al. 2017). The deforestation, disorderly territory occupancy, the soil impermeabilization and water bodies channeling result in many effects on rivers. These impacts are realized by the population, mainly for the flooding. That is an urbanization consequence and has as principal cause the edification, industries and highways in floodplains or rivers banks, becoming a recurrent problem in the most important cities in world (BASSI et al. 2014; SILVA et al. 2015).

The floodplains occupancy, river valleys and permanent protected areas propitiated during the time the man subject to flooding – natural phenomena happens that happens when the rain occurrence is high and the water flow excess the runoff capacity (JUSTINO et al., 2011). In another words, when the rain is intense and constant, the water quantity in rivers increase, the amount of water in the rivers increases, extravasating to the margins (i.e. floodplains). All drainage channels have this floodplain area to receive the water excess when it surpasses its limits. However, these areas occupancy and soil impermeabilization intensify the floods (CADORIN & MELLO, 2011).

The significant increase in soil impermeabilization induces a decrease in the infiltration rate and the water quantity in the soil. The watercourses channeling causes accumulations and changes in the natural water flows and the intense movement of large soil volumes by earthworks means, that causes silting and contribute to the flow capacity of urban drainage systems (CARVALHO et al., 2017). As consequence of these impacts, we have floods increase (POLI, 2013), once that during rain and flood episodes have their impacts amplification, due to the marginal vegetation absence, which also favors the river bed silting (NOVA et al., 2015). The marginal vegetation lack in consequence of deforestation results in physical, chemical and ecological order disbalances, given the marginal vegetation from hydric bodies removal implies in soil erosion and consequently river silting (SILVA et al., 2015b).

The dredging

As the most usual way to resolve floods, both population and public power call for the dredging. Briefly, the river dredging consists in the removal process of the material (i.e. sediment, vegetation) present in a river bed (SCOTTISH NATURAL HERITAGE, 2017). Nowadays in Brazil, the CONAMA Resolution n° 454/2012 establishes guidelines for material dredging in national waters. The CONAMA Resolution n° 420/2009 provides guideline values to assist in the management process. These normative devices together bring many elements that must be fulfilled in the material dredging procedures of the aquatic bodies.

Desanding, therefore, is a procedure for dredging or cleaning the river bed. The flood causes, however, is not limited to the river and is also associated with the rainfall volume, surface runoff, soil sealing, tributary conditions (e.g. streams, main river tributaries), among others. Desanding works realization constitutes a drastic and curative action, since it does not reach the problem cause, usually related to the erosive processes, for example, deforestation, high impermeabilization rates, inadequate particulate material allocation etc. (ZELLHUBER & SIQUEIRA, 2007). The siltation causes are also related to climatic factors, water action on the ground, vegetation cover lack and urban area expansion (ACCORSI et al. 2017). Thus, dredging is mistakenly referred to as the solution to repeated flood events, a measure to be taken in an emergency to avoid further damage and risks. Londe et al. (2014) emphasize the need for planning, especially regarding the sediments regulation that are carried to the water bodies and interventions realization that involve the river banks depopulation and urban expansion control.

Oliveira & Mello (2016) point out that the materials extraction from rivers has an immediate effect on the river dynamics, since it causes changes in the patters associated with the sediment flow, as well as its transport. The authors further stand out that such changes in the water body canal can be propagated upstream and downstream, negatively impacting the aquatic ecosystems and altering the physical and chemical water parameters (e.g. nutrients, suspended solids).

Dredging impacts on river

Carrol et al. (1994) demonstrated the importance of verify the impacts that can be caused by contaminants movement from the sediments. Still in this sense, Tsangaris et al. (2014) emphasize that the urban sediment dredging is not the best solution to reduce flooding risks or water bodies maintenance.

Heinrich et al. (2015) point out that dredging works take large material amounts from river bed, sediment that needs an adequate disposal other than the landfill and that does not occur in inadequate places, due to the its maintenance necessity and possible associated impacts. The sediment can be understood as a compound formed by the material coming from erosive processes, solid derived from the water and sewage plants treatment, besides the mud and particulate matter generate by the industrial sector and urban environment (LEMIERE et al. 2014).

It is worth noting that water quality, as well as its consumption, are points that appear in the questions about the desanding of aquatic environments (DUARTE et al., 2016). Erfteimeijer & Lewis (2006) point out increases in turbidity and sedimentation as well as reductions in dissolved oxygen concentrations due to resuspension of the organic material present in the sediment and removal of the substrate used by plants and animals. These factors affect the reduction of the light region in the water bodies, a factor that reduces photosynthesis and may adversely affect the biota there, due to the sublethal effects of low luminosity (ERFTEMEIJER et al., 2012). Moreover, the mixing of the natural sediments with the dredged sediment can result in the resuspension and /or remobilization of chemical elements that can have impacts on the biota, a situation that demands an integrated approach for the evaluation of sediment toxicity (TSANGARIS et al. 2014).

Dredging impacts on aquatic biota

Sediments resuspension may influence the contaminants chemical form, a situation that might generate bioaccumulation in aquatic organisms, as these elements become bioavailable, as well as toxicity (COTOU et al. 2005; FICHET et al., 1998). This statement corroborates with De Jonge et al. 2012 findings, where the authors highlight a reduction in the number of sensitive macroinvertebrates species (e.g. Ephemeroptera, Trichoptera and Plecoptera) during a river desanding procedure. The macroinvertebrate community changed its composition and recovered only two years after the procedure. De Jonge et al. (2012) also point out that the heavy metals mobilization presents in the sediment caused by the dredging process, as well as the mechanical effects (e.g. increased turbidity) influenced the macroinvertebrate community composition. Thus, it is possible to infer that river dredging negatively impacts the aquatic biota and perhaps result in other problems, such as downstream flood risks due to increased water flow, erosion processes acceleration, natural species habitats destruction and damage to sensitive taxa (SEPA, 2017).

This procedure also results in (SCOTTISH NATURAL HERITAGE, 2017): (i) water bodies bed uniformity, (ii) increase of the suspended particulate matter and water turbidity; (iii) changing in the substrate composition; (iii) damage to the fish juvenile species due to the substrate removal used throughout its life cycle; (iv) the fine particulate material can affect the ichthyofauna creation and incubation, due to the habitats reduction and interstitial spacesfilling; (v) impacts on the ichthyofauna breathing system; (vi) primary productivity reduction due to the light reduction in the aquatic environment; (vi) predation capacity reduction of some species due to turbidity; (vii) reducing the macroinvertebrates abundance and modifying the structure of their communities.

These hydrological changes result in increased erosion rates leading to geomorphological changes in channel dimensions (WALSH et al., 2005) and encourage the engineering development for responses such as channeling. The impermeable surfaces also decrease water infiltration and result in low tides in urban streams, where a decrease in baseline flow is often observed (WALSH et al., 2005). The organisms are affected by the suitable habitats decrease and a severe habitat reduction during dry periods in tropical

urban streams. Consequently, it reflects in highly impoverished and simplified invertebrate assemblages (BATALLA SALVARREY et al., 2004, CRUZ-MOTTA & COLLINS, 2004).

The public power and the rivers

The ecological systems and organisms distributed throughout the planet coexist and, consequently, interact with each other and with the physical environment in ways not completely known (DOMINGUES et al., 2017). The apparent simplicity and naturalness of the environment functioning hides extremely complex relationships. Human knowledge, for its turn, has only begun to have a more detailed rivers understanding. Understanding ecological processes often requires decades of study, and the conclusions are often accompanied by many questions that call for new approaches (KUHN, 1996).

A troubling fact is that the technical-scientific information produced by the academy related to river ecology has been slowly incorporated into environmental laws and, more specifically, to administrative practices, making the public power another environment degradation agent. The scientific knowledge incorporation is essential to the decision making, as in the intervention cases in the river bed. Although, the large information amount and the conceptual distance between the different sciences branches makes this desirable interaction difficult, requiring approximation mechanisms between the academy and the public power (DICS et al., 2014, DOMINGUES et al., 2017).

It is precisely the distance between science and public power that carries a serious risk of the decisions perform certain works and interventions in the rivers that cause, at the end of the process, an environmentally negative result. This information gap consequence and/or specific misinformation may result in greater damages than those associated with conduct prohibited by law.

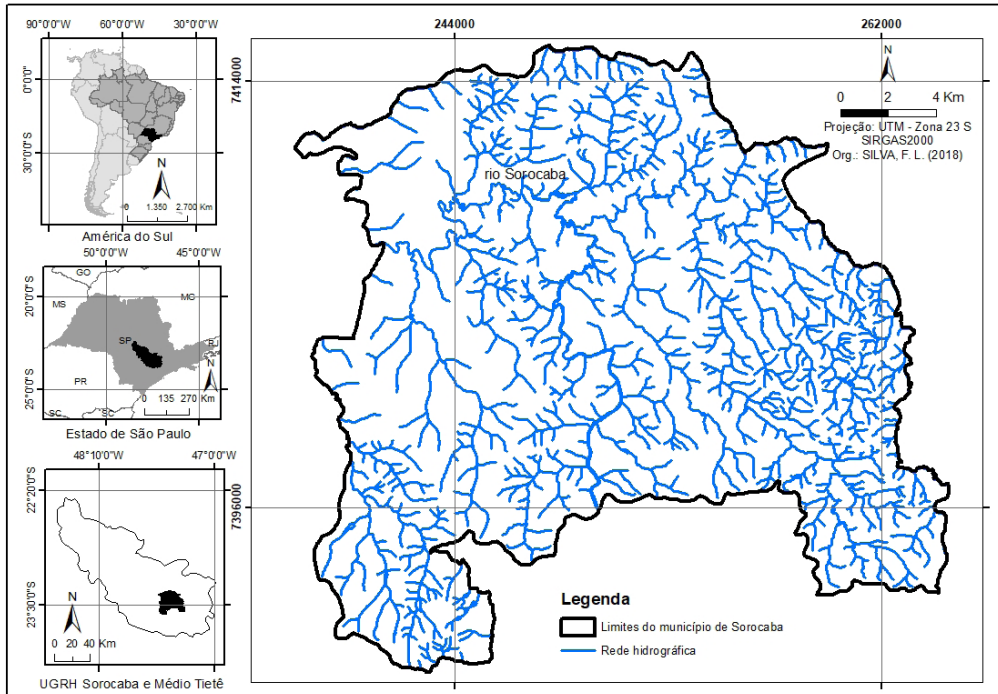
In the sequence will be presented a study case, which exemplifies events that can happen over all Brazil. The study purpose was to address essential aspects that should be considered during the desanding process, as well as the ecological effects related to this intervention on aquatic ecosystems and adverse effects on biota.

Introducing a case: The Sorocaba River

The Sorocaba urban area is crossed by the Sorocaba river, considered the largest left bank tributary of the Tietê river, which is 180 kilometers long straight and 227 kilometers, if we consider its bed in a natural trajectory (Smith, 2003).

The river has its origin in the Ibiuna municipality, by the rivers Sorocabuçu, Sorocamirim and Una junction and, within the limits of the Votorantim municipality, was dammed giving rise to the Itupararanga reservoir. In Sorocaba, the river of the same name receives several tributaries waters, among which the Pirajibu and Ipanema rivers stand out, responsible for supplying part of the city's public water demand (Figure 1).

Figure 1. Thematic map of the Sorocaba river basin location, Sorocaba municipality and its drainage network, including the Sorocaba river



The Sorocaba river has suffered some interventions in its section inserted in the Sorocaba municipality, a situation that has led it to have a more rectilinear shape and a lower meanders presence, situation that result in changes of the flow speed of its waters and the solid cargo transported. The urbanized areas proximity to the water body and the ecological integrity compromise of its marginal vegetation in some localities is verified. Despite the land conversion influence and organic pollution from upstream areas, the Sorocaba River provide habitat to a large ichthyofauna.

The Sorocaba river basin has an average slope of 0.28%, showing that it has, on average, low flow velocity (SMITH, 2003). This fact contributes to the fact that the Sorocaba River has many marginal lagoons, such as those located in the Sorocaba urban area, in the Jardim Sandra, Iguatemi, Vitória Régia and Itavuvu neighborhoods. They are permanent or temporary lagoons, formed during the flood period when the river invades lower areas and they are permanently or seasonally connected with the main river.

Every year the news reports countless floods and the questions and answers are always the same. Many myths have been nurtured in the face of dredging and need to be clarified. It worth to be mentioned that the Sorocaba river has been rectified over time, which results in a smaller volumetric capacity compared to before this intervention. This

aggravates the situation and if we add the Sorocaba city occupation made in the river banks, the resolution possibility is impossible.

Summarizing the floods that occurred in the municipality to the Sorocaba river sedimentation is somewhat simplistic and shows how much we ignore the main causes: permanent areas preservation occupation, land movement without containment measures, disrespect to the floodplains, garbage in the public roads, among others. When it comes to the Sorocaba river, establishing a causal relationship without even considering the main and unequivocal floods cause, is undoubtedly a misunderstanding. With or without dredging, there would be the floods risk and to understand better first we must to know the river.

The river Sorocaba was reference for the “*tropeiros*”; was used as a barrier to tax collection and witnessed a large region development, which was gradually suffocated by urban sprawl and pollution (Smith, 2003). From the beginnings, all the Sorocaba residents need have been satisfied by the river, for example, water supply, creation, agriculture, factories, etc. Until the late 1940's, there were boat trips along the river from where, today, it is the Pinheiros bridge. The *Diário de Sorocaba* (05/09/99) reports that the river, still without pollution, supplied the population with fish and sand for the construction, also serving the small boats navigation.

Historians report that the Sorocaba municipality growth occurred to the north and west, bypassing the Sorocaba river banks. Votorantim, Tatuí and Cerquillo also grew on the river banks. This historic makes it possible to understand why the Sorocaba River was one of the problems for the Sorocaba and Votorantim growth, given the changes that have been made in its bed to suit the municipalities needs.

Its course began to be modified at the beginning of century XX, when the Itupararanga dam construction began. According to ancient reports, the Sorocaba river had curves and spilled on the banks, in the Sorocaba urban area. In its passage by Sorocaba, its width was of 15 to 20 meters (observation made in 1929). This is true, since there are photos from 1929 photos showing the flood that occurred that year and the river occupied the entire adjacent area (Smith, 2003).

Over time, the Sorocaba river underwent profound changes. The first occurred in 1891 in view of the need to build a bridge to the railway, next to the existing bridge, which involved the landfill construction in the river. However, the work in question caused a lot of controversies between the Camara and União Bank, due to the landfill that would have to be erected near the right river bank to reach the land level (SMITH, 2003). This work would prevent the river from spreading to the right side and eventually flooding to the left side. Many people at time were against the work because they thought that heavy rain could flood part of the city. However, even so the landfill was done, and its main consequence appeared in 1929, when the Sorocaba river had its volume increased by the constant rains. The most affected Sorocaba city part by the flood was the lower left bank, the current streets Leopoldo Machado and the beginning of the street Coronel Cavalheiros.

The Votorantim and Sorocaba cities went through calamitous situations in some periods of the century XX. Such situations resulted from numerous floods that occurred.

Many people attribute these floods to the Itupararanga floodgates opening and to the river rectification works. We can add to these factors its irregular banks occupation, since from the beginnings it was known several river floodplains stretches, including those where today are the marginal ones in Sorocaba, area that in rains time were and still are flooded by the river waters. Maybe this is the explanation for the Tupi Indians who lived in the region had not occupied the Sorocaba river valley preferring the higher areas (SMITH, 2003).

The 1929 flood was the largest ever reported. It occurred at the beginning of the year, after a rainy month. In Leo village, 50 houses collapsed and another 30 in the Beyond Bridge. The old Estamparia was submerged in the waters and the traffic with the neighboring cities was interrupted by more than 10 days. According to the *Cruzeiro do Sul* newspaper of January 12, 1979, the day after the flood, a rumor, unconfirmed, ran free that on the day before the flood, public power was consulted on the possibility of Itupararanga opening gate to avoid further damage to Votorantim. In addition to 1929, the dam was also opened in 1974, causing serious problems for the Sorocaba and Votorantim populations. There were other major floods in 1977, 1982 and 1983 extensively documented by newspapers at time.

Possible dredging impacts on the fish migration from the Sorocaba River

Despite the interest that migratory species have aroused for several decades and the research already done, few studies have investigated biological aspects, especially the reproductive strategies of these species in the Sorocaba River. We can cite two studies focused on the reproductive aspects of *Salminus hilarii* (tabarana) (TAKAHASHI, 2006; VILLARES JUNIOR et al., 2007). According to Portela et al. (2012) Smith et al. (2014) the Sorocaba River has a considerable number of so-called migratory species, and important sites that have long been cited by fishermen and in the literature as areas marked by fish migration.

The most emblematic migratory species mainly by the size and fishing are *Prochilodus lineatus* e *Salminus hilarii* that present wide distribution in the basin, occurring in the Sorocaba river and tributaries. There is no record of these species in the Sorocaba river headwaters and only *P. lineatus* was captured in the Itupararanga reservoir (upper Sorocaba region). These species occur mainly in large and lotic stretches (SMITH et al., 2003; SMITH, 2003; TAKAHASHI, 2006). This is due to the biotopes abundance along the river and to the high ichthyological fauna diversity, many running waters spots, typical environments of these species and waters with low pollution rates (SMITH, 2003; TAKAHASHI, 2006).

According to Honji et al. (2011) the *S. hilarii* species can be used as a good environmental indicator due to its environmental selectivity degree and to be at the food chain top. This species is currently classified as “almost threatened” in the São Paulo State (SÃO PAULO, 2008). The Sorocaba river section that cuts the city of the same name is of extreme importance for the two species reproduction mentioned above. This can be explained by four factors: a larger free stretch without buses, an improvement

in river water conditions in the last decades, is located in the stretch where the largest tributaries (Ipanema, Sarapuí and Tatuí rivers flow on the left bank and Pirajibu on the right bank); and where there are the largest marginal lagoons number (approximately 45 lagoon areas). It should be noted that deforestation may result in losses to the ichthyofauna existing in this stretch.

When performing this intervention type, the sediment removal can cause massive eggs and larvae death. In addition to destroying specific habitats for these species spawning and others that do not migrate. It should be mentioned that the river bed sediment movement can cause eggs and larvae burial, causing their death. In order to mitigate this impact, the season choice for the realization should be considered, avoiding the months from October to March, since it coincides with the fish migration period, such as curimbatá and tabarana. According to Bray et al. (1997), the bottom sediments rupture and disintegration can cause a wide environmental impacts variety. The problem intensifies when the sediments are contaminated by chemical compounds, domestic waste, oils and greases. Toxic products and contaminants released by disturbed soils may dissolve and contaminate water or cause fish species mortality and the suspended particles can settle to the bottom by suffocating the benthic species and forcing the migration. Organic compounds in suspension can consume the oxygen available in the water and cause stress conditions for many aquatic animals, including fishes. In addition, if high suspended sediments concentrations persist for a long period, light penetration into the water column might be reduced, causing damage to photosynthetic algae, and other aquatic organisms.

Unrestricted dredging maybe leads to the migration routes blocking, obstructing access to private habitats that are located mainly in Sorocaba and are important places for certain life phases and may reduce population recruitment. Migratory fish populations have declined in several tropical rivers (AGOSTINHO et al. 2005). Godinho et al. (2007) and Bailly et al. (2008) affirm that the species success that perform reproductive migrations is related to the presence of development sites and to the connectivity between these and the spawning sites. Smith & Barrella (2000) verified the importance of the marginal Sorocaba River lagoons in the Sorocaba municipality for *P. lineatus*, noting that they are favorable environments, since they often offer more satisfactory conditions than the river. In addition, they play important roles for the lotic ecosystem that border and for the fish community, providing shelter, feeding and development of fingerlings.

How should the public power act?

The ideal preventive measures for the flood solution are mainly institutional. The action and supervision of the responsible agencies, both state and municipal level, regarding the landscape use and cover, the water resources use and compliance with legislation, would be a good starting point for the problem (BERTONE & MELLO, 2004; CARNEIRO et al., 2008). Public policies that prioritize urban growth planning outside areas with restrictions occupancy (e.g. slopes, floodplains) may contribute to this issue resolution (SILVA et al., 2017).

Thus, poor attributions definition, a unified policy lack, competition among public agencies, and projects conflict are factors that influence the problems resolution in the short term (SILVA et al., 2000a, CARNEIRO, 2018, CARVALHO, 2018). Therefore, in view of the elucidated problems, an urban planning consistent with the water resources management and land use cover is necessary (CARNEIRO et al., 2008), respecting the floodplain areas and the slopes. It should be emphasized that these areas can be occupied, but in a planned way, and the activities should be compatible with their characteristics (RODRIGUES, 2004; REZENDE & ULTRAMARI, 2007), such as parks, bicycle paths, sporting practices or exhibitions in floodplain areas. The technicians and population awareness that floods are a natural process of the river hydrological regime is essential for the preventive measures implementation that avoid the losses currently seen and with which the whole society must to pay.

It is believed that in order to combat low soil permeability in cities, ways must be sought to recover, at least in part, the original rainwater retention capacity in the urbanized region, which can be done by increasing the infiltration capacity or creating these water accumulation mechanisms (LONDE et al., 2014). Possible types of interventions that can be conducted in the river and their positive aspects are presented in Table 1.

Table 1 - Alternatives to avoid the dredging or desanding process.

Possible actions or techniques	Positive aspects
Floodplains recovery	It assists in the river stability and control of the sediment input and deposition
Rehabilitation	Ecological functions recuperation, ecological integrity maintenance, sediment input reduction, water level maintenance and connection to backwater areas
Eco-hydrology	Native vegetation recovery at strategic sites in the relief, influence on water transport in the watershed, guarantee of water infiltration in the soil, erosive processes reduction, surface runoff and sediment input reduction
Intelligent drainage systems	Urban drainage management, water balance management, water retention in the system (water conservation), recharge areas protection, surface runoff and sediment input reduction

Source: Beechie et al., 2015; Fletcher et al., 2015; Hermans et al., 2007; Tambosi et al., 2015; Theiling, 1995; Tundisi; Tundisi, 2010.

The National Water Resources Policy (Federal Law 9.433/1997) establishes as one of its guidelines the articulation of water resources management with the land use cover, a situation that shows a direct relationship with the Master Plan, an instrument instituted by the City Statute (Federal Law 10.257/2001), responsible for the land cover discipline and guidelines establishment; a situation that may contribute to the sediments reduction to aquatic environments. It should be noted that there is a relationship with other instruments, such as the State Plan for Water Resources (State Law 16.337 / 2016) and the Sorocaba and Medio-Tiete River Basin Committee Plan, which maybe contribute to

water resources quality of Sorocaba municipality and the remaining ones in the coverage area, favoring the strategies elaboration to cities drainage.

For example, the Territorial Physical Master Plan of Sorocaba municipality classifies floodplains or alluvial plains as Macrozonas with great restrictions to urbanization. These are areas along the Sorocaba, Pirajibu, Pirajibu Mirim rivers and other places whose limits were defined through some information crossing from both the environmental diagnosis and those presented in the thematic cartography, so that the aspects used were: areas with very high fragility, pedology and vegetation presence, considering the following classes: middle stage, advanced stage, ciliary and cerrado forest.

In this way, the Plan provides for the rules for the occupation of the Water Supply Protection Areas, providing: (I) the floodplains occupation restriction, (II) the requirement, in urban projects, reserving spaces for the future reservoirs construction and (iii) the measures adoption prevent erosion, such as slopes vegetation covering and earthworks minimization. It also suggests that, in the city urbanization process, the floodplains occupation and built-in rainwater retention and retardation devices should be adopted in order to reduce the impact on the natural watercourse regime.

Therefore, as a guideline for this macrozone, supervision and control are indicated to avoid the establishment of occupation any type in the permanent preservation areas, since the current federal legislation prohibits the permanent preservation areas occupation. In the other hand, in areas where urbanization is already consolidated, the guideline is to implement specific projects, whose primary objective is to minimize risks arising from periodic flooding, such as drainage, population relocation, road and block system, parks creation and municipal environmental protection areas, incentive to implement sustainable activities, reforestation of areas formerly occupied by pioneer vegetation and fiscal incentives.

This environmental regulation shows the technicians concern who act in the public power in river vail recovery and protection areas. The parks implantation, social and leisure facilities in these areas shows good results in the use by population, besides preventing these areas from being invaded or degraded.

The contact with the river, besides being very attractive to the people, emphasizes the public space value of its banks and promotes the environmental responsibility towards, not only for the visual access possibility but also for its waters physical access (COSTA & MONTEIRO, 2002).

The water courses are degraded, silted and polluted by domestic sewage, often clandestine, although municipal plans contain important guidelines for areas preservation along the water bodies. This shows that there is an urban management model inadequacy that entails a lack of integration between the environmental and urban legislation provision.

Final considerations

Based on the premises mentioned here, it is assumed that revitalization works are necessary to improve the water bodies environmental quality, as well as to adopt actions that aimed reaching the problems roots related to rivers silting.

The rivers are important biological corridors that allow the presence and circulation of flora and fauna inside the cities, as well as free public spaces of great social value, providing opportunities for collective living and leisure that meet the most diverse interests. Not to mention that if we look through the relations between cities and river basins, it will enable to us expand and interweave cultural and environmental dimensions. This relationship of intimacy between rivers and cities does not occur without conflicts.

A very important detail to be considered in desanding initiatives is that the rivers are most often not dead, because it presents biodiversity, so that interventions for the sandbanks removal or dredging bring irreversible consequences to numerous species, (i) water supply, (ii) biomass provision, (iii) habitat provision, (iv) recreation opportunities, (v) matter cycling, (vi) water purification, (vii) microclimate improvement, (viii) biodiversity maintenance, (ix) support for biogeochemical processes, (x) primary production and (xi) aesthetic values (CROOK et al., 2013, LEE & LAUTENBACH, 2015, SCHULTZ et al., 2015).

Thus, we either learn to live with the situation or we choose to by the renaturalization, giving back to the rivers their floodplains and their original form since over time great changes in their paths were made. As this is a very distant dream, the dredging realization in small stretches, once duly licensed and accompanied by careful environmental monitoring, would be a palliative form, but it would not solve the problem. In addition, special attention should be given to real estate projects, as these are responsible for thousands of sand tons carried to the municipality streams, as well as the continued Sorocaba river banks recovery and its tributaries would be the most effective measures to mitigate floods.

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Original Article

RIVER DREDGING: WHEN THE PUBLIC POWER IGNORES THE CAUSES, BIODIVERSITY AND SCIENCE

Abstract: The river silting is usually solved by dredging the sediment deposited in its bed, employing many techniques. In dealing with a concrete case, the objective is to expose the technical criteria lack for the execution of such intervention, the impacts to the river, aquatic biota and its real need. Here aspects of the dissociation between consecrated understandings in the engineering and their mismatch with the ecological theories are presented. This work aimed to study urban floods, elucidating their causes, to propose measures and new technologies to deal with them, through programs and urban policies. The intention is to detail the causes of urban floods, understanding the factors involved and with that, discuss how the public power should proceed in what refers to the dredging. The main objective of this work is to stimulate the incorporation of urban rivers into ecological studies and to draw public attention to this issue.

Key-words: Sedimentation, environmental impacts, flood, urban rivers.

Resumo: O desassoreamento de rios, geralmente, é resolvido através da dragagem dos sedimentos depositados em seu leito, utilizando diversas técnicas. Tratando de um caso concreto, objetiva-se expor a falta de critérios técnicos para a execução de tal intervenção, os impactos para o rio, biota aquática e a sua real necessidade. São apresentados aspectos da dissociação entre entendimentos consagrados na engenharia e seu descompasso com as teorias ecológicas. Este trabalho buscou estudar as enchentes urbanas, elucidando suas causas, para propor medidas e novas tecnologias para combatê-las, através de programas e políticas urbanas. A intenção é detalhar as causas das inundações urbanas, entendendo os fatores envolvidos e, com isso, discutir como o poder público deve proceder no que se refere ao desassoreamento. O principal objetivo desse trabalho é estimular a incorporação dos rios urbanos em estudos ecológicos e chamar a atenção do poder público para essa questão.

Palavras-chave: Assoreamento, impactos ambientais, enchentes, rios urbanos.

Resumen: El desasociamiento de ríos, generalmente, se resuelve a través del dragado de los sedimentos depositados en su lecho, utilizando diversas técnicas. Tratando de un caso concreto, se pretende exponer la falta de criterios técnicos para la ejecución de tal intervención, los impactos para el río, biota acuática y su real necesidad. Se presentan aspectos de la disociación entre entendimientos consagrados en la ingeniería y su descompresión

con las teorías ecológicas. Este trabajo buscó estudiar las inundaciones urbanas, dilucidando sus causas, para proponer medidas y nuevas tecnologías para combatirlas a través de programas y políticas urbanas. La intención es detallar las causas de las inundaciones urbanas, entendiendo los factores involucrados y, con ello, discutir cómo el poder público debe proceder. El principal objetivo de este trabajo es estimular la incorporación de los ríos urbanos en estudios ecológicos y llamar la atención del poder público para esa cuestión.

Palabras-claves: Asentamiento, impactos ambientales, inundaciones, ríos urbanos.
