

Slums and Their Relationship With Urban Waters: Current Context and Considerations

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Abstract: The demographic explosion of the last decades has brought an accelerated growth of the cities. This growth made master plans fail and shanty towns inhabited by the excluded have sprung up in the cities, due to the high price of planned cities. Other factor that leads to a demand for these slums is their accessibility. However, in general, these places have other liens intended for public facilities, squares, parks and others. The permanent preservation areas on the banks of watercourses and hillsides should be the object of study in order to enable their land regularization, since they are directly related to micro and macro drainage. Another factor that should be taken into consideration is the universalization of basic sanitation. It should be preceded by an “Urban Feasibility Study” and an environmental study under the risk of encouraging the occupation of inadequate lands without a solution to vulnerability and risk, which can lead to unpredictable consequences, including the loss of human lives.

Key words: shanty towns, slums, urban waters

1. Introduction

What defines a city is the agglomeration of residences. The demographic explosion not foreseen by the city in its formal design planning generated the informal city, i.e., shanty towns. Over time, these slums gained a life of their own and there was an inversion of values: instead of seeking to adapt the informal housing centers to the formal design of the city, the formal design of the city was redesigned, including the informal housing centers. The approach to the housing problem has already been faced in various ways between successes and mistakes. The difficulty of insertion in the formal housing market of this part of the population impels them to places called “unoccupied” by the formal city. These places are not “unoccupied” but they have other liens, such as: resettlements, public facilities, squares, parks and others. The main problem occurs in permanent

preservation areas such as banks of watercourses, springs and risk areas.

It is in these areas of environmental protection that populations are most at risk of floods and landslides. In these areas it is difficult to do land regularization. For the lands on banks of watercourses, due to the conformation of the floodplain and its size, it is possible to make studies that enable a partial regularization for the areas outside the flood range and also allow the stabilization of the slope. For lands of great slope, such as hillsides, studies should be done to identify safe areas for housing. In other situations, resettlement is indicated.

Another problem of the slums is their social vulnerability and unhealthiness. Residences in general are precarious, due to low income and to the large number of inhabitants per residence, among other social problems. In these slums the residences are very close to each other which facilitates the spread of diseases and violence. Water connections are usually clandestine and sewage runs in the open. With the search for the universalization of sanitation, it is

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intended to include these slums in the formal design of the city and to answer mainly the low-income population. However, this will not solve the problem if the area's vocation is not considered and the area is not properly regularized with identification of the state of the area, i.e., its age and agglomerations, level of illness and violence. It should also be considered the availability of residents to pay for regular connections, which are generally very expensive for this range of the population, even if it has a social tariff.

2. Objective

The objective of this work is to address the formation of slums as a result of social exclusion, and present how their relationship can be directly associated with urban waters. The reinsertion of these slums in the design of the formal city.

3. Methodology

The slums are directly related to what is most sensitive in a society: human frailty in the face of social vulnerability and unhealthiness. Due to the high cost of the formal city, these shanty towns proliferate in all cities. Generally marked by the low income of its population, the Social Interest Housing then emerges as an alternative to insert the inhabitants of these slums to the formal city. However, the difficulty of locating these areas in Permanent Preservation Areas and Risk Areas increase, which often prevents land regularization. This work is a record of the authors' professional experience in the context of land regularization, as well as research work in papers related to the theme, as a source of information, during many years of work. The following sections are some topics that explain the problem: Housing and the City; Slums and Urban Waters; Questions that should be Answered; Difficulties in Quantifying the Cost of Housing in Flood-Prone Areas in Slums. Finally, the results of the analysis are presented in the section: Search for the Ideal Solution for the Problem of

Housing Informality and its Relationship with Urban Waters.

4. Housing and the City

What defines a city are the agglomerations of housing. First, small housing units emerge and as they develop, the city conformation and the housing become more complex. Initially single-family homes become multi-family homes. Thus, the city gives way to verticalization. The water proof areas are increased. Green areas are reduced. The urban economy studies the structure of the city and according to Chaves (1998) [1], we find its relationship with water resources. Also, the relationship with location and development is evident. It is highlighted in the study that "several authors indicate that accessibility and price" are the determining factors.

4.1 Housing and the Excluded

The formal city follows laws and regulations. Its implementation is expensive and inaccessible to the low-income population. With the rapid growth of the population and rural exodus the cities grew in a disorderly manner. Unable to access the formal city these people often have their dignity taken from them, becoming vulnerable and unhealthy. The need to be close to their personal relationships such as work, school and so on, make them choose the areas with accessibility. The relationship arises from the formation of shanty towns in "unoccupied" but inadequate areas, or by the occupation of the city outskirts, which can be formal or informal, but usually without infrastructure.

4.2 Configuration of the Informal Housing Centers

The slums have their own configuration. This setting varies according with their location, characteristics, state, and status. The location indicates where the slums are formed. Its characteristics are related to the number of dwellings, families by household, income, etc. Its state is indicated by the number of interventions

already undergone and whether it is recent, developing or consolidated; the level of agglomeration, illness, violence, etc. Status is the priority level for interventions within public policies. For the city of Porto Alegre, we mention with emphasis DEMHAB (2009) [2], the department that deals with the “Diagnóstico do Setor Habitacional de Porto Alegre” (Diagnosis for the Housing Sector of Porto Alegre).

4.3 Difficulties in Facing Sub-Housing

Coping with the problem of sub-housing has many difficulties and multiple objectives, according to Chaves (2015) [3]. In the city of Porto Alegre, the *Departamento Municipal de Habitação* (Municipal Department of Housing) — DEMHAB has worked for more than 55 years in the confrontation of sub-housing. Over this period much has been learned from our successes and mistakes. The main challenges are the characteristics of the areas occupied by slums, the quality of built housing, the resistance of the population that inhabits the slums and neighborhoods, the resources available for interventions, and the speed with which these characteristics change, making projects obsolete before they are even completed.

5. Slums and Urban Waters

The slums are related to urban waters, whether by the need for water supply, lack of effluent depletion, their location in areas of floodplain of watercourses and springs (when applicable), and risk areas (when applicable). Each of these items are going to be developed below.

5.1 Slums and Water Supply

The most in need housing centers are supplied by clandestine water supply network connections. This is not the area that has already suffered due to land regularization. This deficiency became quite clear and was treated in Chaves (2020) [4] due to the COVID-19 pandemic. The paper analyses the correlation between the need for the universalization of basic sanitation and

its relationship with the vocation of the area: the universalization of water supply networks. Without proper study of the area's vocation, it can encourage the occupation of inadequate areas, which can bring unpredictable consequences. The sections above are about slums located in risk areas.

5.2 Slums and Effluent Depletion

In the slums, in general, most residences do not have a network of effluent depletion. The sewage is released into the open, which highlights the vulnerability of the area and makes the environment unhealthy. Almost in its entirety, the sewage is released into watercourses which contributes to the pollution of these watercourses. Not only the slums, but there are several sources of waterways pollution, which are caused by the disorderly growth of the city. In Chaves et al. (2012) [5], there is an example of how the problem could be addressed. In the slums, it should be taken into account that often the houses do not have the proper conditions to be inhabited, for they are precarious constructions.

5.3 Slums and Pluvial Drainage

Rain drainage, from the point of view of the slums, should be treated taking two aspects into consideration, microdrainage and macrodrainage. Microdrainage is non-existent in precarious slums that have not been undergone to a land regularization intervention. After the intervention, the network integrates the formal drainage network. The macrodrainage suffers a direct interference from the location of the slums. When the slum is located in floodplain area of watercourses and it begins to suffer frequent floods, which causes damage to the populations that live there, the banks of watercourses must be protected in such a way that riparian forests are preserved. Under the perspective of Chaves et al. [4, 6], a study was carried out that correlates the flood lines and permanent preservation area for return times of 10, 25, 50 and 100 years, taking into account the conformation of the floodplain in the cross section; which indicates that the degree of risk

and places for housing may vary more or less in relation to the distance fixed for the permanent preservation area.

5.4 Slums and Risk Areas

There are some conditions that may indicate that the slum is located in a risk area: banks of watercourses, springs and hillsides. As previously mentioned, the location of the watercourse-floodplain defines its risk in accordance to the proximity of the course and to the characteristics of the cross-section of the same point. The springs in general are soggy soils and when the rains increase their flow, the risk is to increase both the flow that can destroy and/or carry soils, due to the strength of the waters; or flood entirely the slum. On hillsides the soils are prone to landslides, and with the rains the risk gets even greater. With the disorderly occupation of these areas and reduction of vegetation, the risk of a landslide during the rains is even greater. The problem of urban erosion is addressed by Galerani et al. (1995) [7] when discussing the issue of the transport of the watercourses banks in urban centers as a consequence of the removal of vegetation and the problems that arise as a result of this and how to seek solutions to the problem.

6. Questions That Must Be Answered

Some questions arise when the problem of slums and their relationship with urban waters are analyzed. These questions are pondered in order to cope with the irregularity and housing deficit.

6.1 Why Are Slums Formed?

The slums arise due to the difficulty of access to a formal city, either by the value of the land and accessibility, which has been mentioned by several authors, as we saw in Chaves (1998) [1]. The watercourse banks are permanent preservation areas and in the formal design of the city, they must be preserved. Because of this, these areas considered “unoccupied” by the formal city are occupied in the

shanty towns. As they are commercialized illegally, their cost is lower and they are inserted in the urban core which facilitates the access to urban infrastructure.

These areas are not “unoccupied”, but they rather have a specific destination, liens, within the design of the formal city, which are necessary for resettlements, to public facilities such as schools, squares, parks and etc. Also, they may not be suitable for construction due to the risk of flooding or collapse. When they are public areas the problem is great, and when they are particular areas, the problem is also serious.

In relation to private areas there are both sides: the so-called “good” area that is invaded and the owner has to sue appealing for the repossession of the land, or asks for an exorbitant price for the expropriation; the area considered “bad” and not fit for housing but the owner lots and sells anyways, for not accepting the low value of the land, and then it becomes the government’s responsibility to find the solution to solve the problem.

6.2 Why Isn’t Land Regularization Always the Best Solution?

Land regularization is not always a solution to the slum problem. This is because of the vocation of the area within the formal design of the city. Some areas present risks to housing and because of their vocation they must be preserved, such as hillsides, watercourse banks and springs. These areas offer risks to the housings that are built there. As it can be seen in Chaves and Mendes (2001) [8], land use is directly related to population, impermeable areas and the topography of the land. A social study of the area should be done to verify the housing conditions, number of inhabitants per household, income, among others. Once the feasibility is verified, it is necessary an “urban feasibility study” of the area and an environmental study to define which areas will be regularized and which should be resettled. Only after those, all the other engineering and architecture projects are developed. Often regularization is not possible due to the destination of the land. The land is

destined for a certain purpose and it is not subjected to regularization.

6.3 Why is There Resistance to Resettlement?

It is not always easy to change residences. Often resettlement is not well seen mainly by the people who claim that the house offered in the resettlement is worse than the one they inhabit. This is a very subjective thinking. It occurs, for example, that the house in the informal area is made from wood and in a moderate state of conservation, but with a greater number of rooms than the resettlement brick house. Another very common claim, is when the residents own a good house and do not want to change place, but their houses are in a risk area. Mostly, the main factor that is claimed is that in general, in consolidated slums there are personal relationships such as workplaces, school(s), social relationships and etc. and specially for this reason, the resettlements are hampered.

7. Difficulties in Quantifying the Cost of Housing in Flood-Prone Areas in Slums

When the study Chaves et al. [4, 6] was elaborated, it correlated the flood lines with the permanent preservation area, for four return times, 10, 25, 50 and 100 years, and highlighted residences with gradual levels of flood risk. If the area suffered land regularization including with public registry, it should be described in the registry its risk of flooding and which the frequency was. However, if there was a flood with longer return time and reached homes outside the risk area of the return time of 100 years, or with greater risk than the one projected for return times for 10, 25 and 50 years. How to predict the state of conservation of the residence and movable assets in it at the time of the flood. One solution would be to make an insurance with annual renewal, along the lines that is made, for example, car insurance, and buildings, but how can the government guarantee the annual payment of insurance? How to assist homes that were not covered by insurance? Would these people be in eternal

dependence on public power? How to provide compensation for the affected homes? Are insurers interested in taking on this degree of risk? How far does the responsibility of the government go?

8. The Search for the Ideal Solution to the Problem of Housing Informality and Its Relationship with Urban Waters

It is difficult to say which is the ideal solution for housing informality. The issue goes far beyond building houses. It is about social welfare. *Departamento Municipal de Habitação* (Municipal Department of Housing) from Porto Alegre City hall has worked for more than 55 years with the problem of housing and at DEMHAB (2009) [2] this representation was made. There has been several attempts and several programs that had successes and mistakes. Various housing policies. As always, like in all sectors, it is difficult to please everyone.

The urban design of most cities did not predict their demographic explosion, which brought disorderly growth. Small shanty towns developed rapidly and became larger in a short time. They acquired their own lives and there was an inversion of values: instead of seeking to integrate these slums into the formal design of the city, it sought to redefine the formal design in order to integrate these slums. With this tendency, there was the overload of the water, sewage and rainwater supply networks. The problem, however, is not only of the slums, but also the verticalization of the city.

As explained earlier and approached by Chaves (1998) [1], two decisive factors are accessibility and price; and, this is what we have to focus on. The need for accessibility favors the occupation of the so-called “unoccupied” areas due to the proximity to housing centers. The price, due to real estate speculation, drives the poorest populations to less valued areas, in general, areas that are unfit for construction or at risk. These areas are, in general, banks of watercourses, hillsides, springs and so on. Also, more distant areas from the

city center. For the city outskirts we have both situations — the formal and informal city.

Urban waters for the search of the universalization of sanitation — as addressed by Chaves (2020) [4] — brings a strong focus to the low-income population and intends to meet the situation of vulnerability and unhealthiness of these slums. It is necessary to consider the vocation of the area on which the slums were installed, to verify if the location is on the banks of watercourses and risk areas.

Far from being an easy problem to solve, the problem of housing is at the same time a social, economic, cultural and environmental problem.

9. Conclusions

Many cities were planned, but in this planning the demographic explosion that occurred in the last decades was not predicted. The high cost of the formal city caused the shanty towns to emerge in the so-called “unoccupied” areas. These areas, however, have specific records, liens, such as: resettlements, public facilities, squares, parks and others. However, this work focused on the permanent preservation areas: banks of watercourses and hillsides. These areas are inadequate to housing due to the high risks of flooding and landslides. There is a strong relationship between the slums and the urban waters “rain drainage”.

Another strong link with urban waters is the state of the slums in terms of the level of illness with regard to water and sewage. The claim to the universalization of sanitation in these areas should be accompanied by proper land regularization with all the infrastructure and observation of the vocation and aptitude of the area for urbanization.

Therefore, it is necessary to insert the housing centers in the formal design of the city. Seeking to redesign the formal design by force, to include these slums, without proper studies, can result in the occupation of inadequate areas and the overload of water and sewage supply networks and rain drainage. It

may cause serious consequences including even the loss of human lives.

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References

- [1] E. M. B. Chaves, A Economia Urbana e os Recursos Hídricos, in: *Simpósio Internacional sobre Gestão de Recursos Hídricos*, Gramado, Anais, 1998, available online at: <http://geocities.yahoo.com.br/singreh/web>.
- [2] DEMHAB, Plano Municipal de Habitação de Interesse Social – Etapa II – Diagnóstico do Setor Habitacional de Porto Alegre, Porto Alegre: DEMHAB, 2009, p. 248, accessed on 08 Nov. 2015, available online at: http://proweb.procempa.com.br/pmpa/prefpoa/demhab/usu_doc/diagnostico_porto_alegre.pdf.
- [3] E. M. B. Chaves, A Regularização Fundiária Vista do Enfoque da Análise Multiobjetivo, *Revista da Associação dos Técnicos de Nível Superior do Município de Porto Alegre* 37 (2015) 18-19.
- [4] E. M. B. Chaves, Covid-19 Versus Novo Marco Regulatório do Saneamento Versus a Regularização Fundiária, *Revista da Associação dos Técnicos de Nível Superior do Município de Porto Alegre* 46 (2020) 23.
- [5] E. M. B. Chaves, A. E. L. Lanna, C. E. M. Tucci, Optimization of alternatives for depollution of Sinos river with multiple objectives, in: *Sustainable Water Management in the Tropics and Subtropics and Case Studies in Brazil* (1st ed.), Vol. 3, Jaguarão/RS; Fundação Universidade Federal do Pampa, UNIKASSEL, PGCult-UFMA, 2012, pp. 1125-1146.
- [6] E. M. B. Chaves, J. F. R. Furtado, C. Spohr, M. R. Fernandes and S. M. Carpenedo, A Gestão dos Recursos Hídricos Aplicada a Áreas de Regularização Fundiária, in: *XXII Simpósio Brasileiro de Recursos Hídricos*, 2017, available online at: <http://www.abrh.org.br>, Republicado em (2019) *Brazilian Journal of Development* 5 (2019)

- 8262-8273, e republicado em (2020) As Ciências Agrárias e seus Impactos na Sociedade. 01.ed São José dos Pinhais – Paraná: Editora Brazilian Journals, Vol. 1, pp. 1-12.
- [7] C. Galerani, E. M. B. Chaves, J. Macedo Filho, L. Santos and P. Silva, *Controle da Erosão Urbana*, in: *Drenagem Urbana* (1 ed.), Vol. 1, Porto Alegre ABRH/Editora da Universidade – UFRGS, 1995, pp. 349-385.
- [8] E. M. B. Chaves and C. A. B. Mendes, Diretrizes Básicas para Concepção de Sistemas de Geoprocessamento para Planos Diretores de Drenagem, in: *Simpósio Brasileiro de Recursos Hídricos 14 – Simpósio de Hidráulica e Recursos Hídricos dos Países de Língua Oficial Portuguesa 5*, Aracaju. Divulgação em meio magnético, 2001.