



Analysis of the urban morphology of Macapá’s wetlands (*ressacas*): the case of *Congós* neighborhood

Raysa Oliveira Spíndola

Professora Substituta, UNIFAP, Brasil
arqraysaoliveira@gmail.com

Patricia R C Drach

Professora Doutora, DAU/ESDI/UERJ, Brasil
patricia.drach@gmail.com

ABSTRACT

This research approach on the study of urban form was based on the concepts of M. R. G. Conzen (1960) that founded the studies of the English School of Urban Morphology. The research aims to analyze the urban development of the wetlands (*ressacas*) of the city of Macapá, Amapá, with an emphasis on *Congós* neighborhood, where a complex of two wetlands areas is found: *Ressaca Chico Dias* and *Ressaca do Beírol*. Analyzing *Congós* neighborhood and its respective wetlands areas, two morphological regions were identified, each one with specific characteristics: one in a non-flooded area with a regular occupation pattern and the other on the wetlands areas with an on stilts occupation pattern. From the developed maps it is observed the expansion of the Cartesian urban form along with the expansion of the city. On the wetlands this model becomes more organic, presenting a design similar to a herringbone pattern or even plants, such as ferns.

KEY WORDS: Urban morphology. Urban Form. Wetlands.

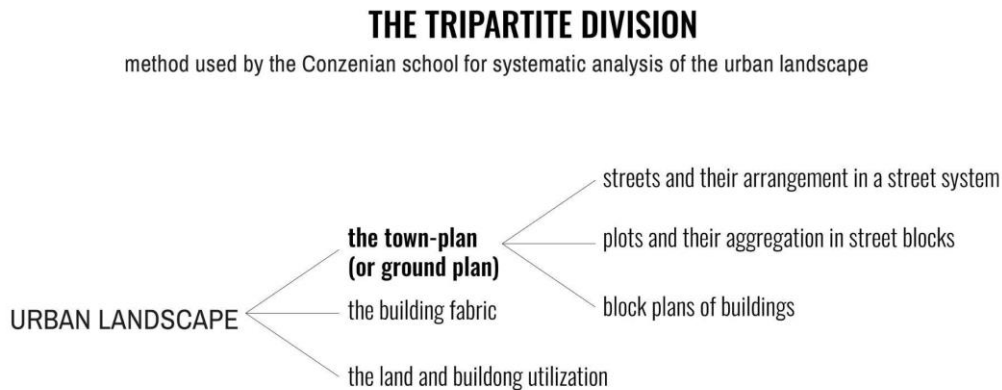
1 INTRODUCTION

The study of urban morphology, in addition to involving the study of the urban form, or in other words the physical part of a given region, includes in its analysis the various actors and processes involved in the formation and development of the city (OLIVEIRA, 2016). Its study is an important analysis tool that enables understanding not only how the city presents itself at the moment, but also the process through which it arrived at this configuration.

The analysis approach developed in this article is based on Michael Robert Günter Conzen's (1960) concepts that founded the studies of the English School of Morphology. Based on the concept of morphological regions, the urban characteristics of a given region are evaluated through three elements, which is called the tripartite division of the urban landscape, which includes the city plan, the building volume and the land use and occupation.

In this research, the tripartite division of the concept of city plan is applied. And two out of three complex elements of the plan are used: the analysis of the streets and their organization in a system and the analysis of the plots and their aggregation, as can be seen in Figure 1. As a result of this analysis, two morphological regions were defined in the neighborhood of *Congós*, located in the city of Macapá, capital of Amapá. Each morphological region pointed out has specific patterns that make each one of them unique, therefore, with its own characteristics..

Figure 1 - Method used in research analysis.



Source: developed by the authors.

The city of Macapá in the state of Amapá is cut by water veins which form its wetlands, locally called *ressacas*. Its flood stage depends on both rains and tides, as well as its location. While some are permanently flooded. Others are prone to flooding due to the influence of rain. Its vegetation is adequate for this transitory presence of water. The variety of flora involves aquatic macrophytes (*mururés, água pés, alfaces d'água*) and reeds, as well as, in some regions, the presence of papyrus can be observed.

The urban perimeter has 21 *ressacas* interconnected by on stilts footbridges that provide the connection for a significant number of existing dwellings over the waters. It should be noted that the city of Macapá is going through an expansion process towards the *ressacas*, and this is often followed by a land reclamation from the wetlands (land fill) sometimes on the initiative of residents, other times by public authorities themselves. These populations deal with the lack of urban infrastructure, most of them not having adequate sanitation and mobility.

The city has specificities regarding its urban form and the relationship with the orthogonal grid implemented throughout the city. The *Fortaleza de São José de Macapá* fortress presence, installed along with the initial core of the orthogonal urban fabric, met the paradigm of the beginning of “Portuguese expansion urbanism”, which associates the presence of the city and the fortification (ARAÚJO, 1998). This gives Macapá a distinct landscape from other cities studied in the North region of Brazil, such as Belém do Pará, with extensive research on its on stilts occupied wetlands. The research presented here focuses on *Congós* neighborhood, where there is a complex of wetlands (*ressacas*): *Ressaca Chico Dias, Ressaca do Tacacá* and *Ressaca do Beiro*, which continue to suffer a constant reduction of their area by land filling processes. The analysis follows an approach involving the morphological regions, defined by M.R. G. Conzen (1960). It seems possible to trace the paths and recognize the urban characteristics of the “non-flooded city” that the inhabitants of Macapá wetlands try to replicate in their lives above the water.

2 STUDY OF URBAN FORM

The theoretical framework presented here seeks to cover the aspects involved in the urban forms observed in the city of Macapá - Amapá, in addition to the fundamentals of the approach adopted in this work, in which the survey of the urban landscape is developed through the construction of a historical-geographical profile.

The urban environment undergoes constant changes in its development process. The analysis of the urban form of the different areas that constitute the city enables the understanding of its development until its current configuration. Urban form is related to “the main physical elements that structure and shape the city – urban fabrics, streets, urban plots (or lots), buildings, among others” (Oliveira, 2016). In this way, it can be said that its study involves the physical space and the transformations of this space over time. It is one of the aspects involved in the study of urban morphology.

Lamas (2004) details that when studying urban form, social, political and economic issues are necessarily involved, due to their reflection in the urbanization process, since these are inspiring elements in the production of urban form. However, these issues are not part of the object of study itself (Lamas, 2004).

The study of urban morphology, in addition to involving the urban form, with the physical aspect of space, will take into account, as Oliveira (2016) defends, the actors and processes involved in its transformation. For Lamas (2004) the scope of his study involves aspects that go beyond the urban environment, as it includes the reciprocity of the relationships that involve the urban landscape and its structure. It would be possible to say that the study of urban morphology will encompass the entire territory under the interference of man in its past or present, contributing to the understanding of the structure of the city, its formation and transformation through its constituent elements. He also points out the morphological elements, which he calls the physical parts that are associated or structured and constitute the urban form: the ground, the lot, the buildings, the block, the façade, the street, the street, the square, the monument, the vegetation and urban furniture. Del Rio (2000) points out the study of urban morphology as an important means for understanding how the city is in its present moment, since this study connects to several areas and, thus, enables the construction of a more comprehensive image.

Rego and Meneguetti (2011) suggest two categories through which studies of urban morphology could be approached. In a cognitive approach, the studies seek to understand “how the city is” and, in a normative one, there is the intention of indicating “how the city should be”. In both forms, therefore, there always seems to be a need for a detailed reading of the city, in order to design appropriate interventions that result in its effective incorporation by the city.

For the urban analysis of the wetlands (*ressacas*) of Macapá, it is necessary to understand and conceptualize urban morphology and urban form as an introduction to the analysis carried out in Macapá with a focus on *Congós* neighborhood, which comprises three *ressacas*. Considering all the diversities that the Amazon offers and the urban characteristics of the non-flooded city that inhabitants bring to live above the water. From this it is possible to understand, analyze and evaluate the relationship of these regions with the water and define how this urban form could be considered – is it an urban form sensitive to water?

2.1 Schools of Urban Morphology

Urban morphology can be defined as the study of the urban form of cities, which includes its actors and the processes involved in the development of its form. His study encompasses several disciplinary areas that contribute to the study of the city's form, such as geography, architecture, urban planning and history. Research on urban form and the creation of concepts that support further analysis of other cities were founded more than a century ago by German geographers, according to Oliveira (2018).

For Costa and Netto (2015) this is the study that encompasses the buildings, the way the city is formed, the shape of the streets system, the subdivision of the land, the residences and the open spaces.

In the process of founding the study of urban morphology, three schools should be highlighted, namely: “English School” (or Conzenian School), “Italian School” (or Muratorian School) and “French School”. It should be noted that the term “school” initially appears in the article by Anne Vernez Moudon (1997), and is currently still used. The first two schools were created based on the work of researchers who gained prominence, such as Michael Robert Günter Conzen (1907-2000) and Saverio Muratori (1910-1973), respectively. The French School emerged from the joint work of three scholars, Philippe Panerai, Jean Castex and Jean-Charles DePaule with the founding of the Versailles School of Architecture in 1969.

The approach of this research is related to that of the Conzenian School, however, a brief description of the thinking of the two other schools that contributed to the bases of urban morphology seems important.

The Italian School or Muratorian School was named after the work of the architect Saverio Muratori (1910-1973). Muratori sought to develop concepts that would help in the development of urban and architectural design. This school was born with a particular concern for interventions in historic cities and thus the possible destruction of part of their heritage. In order to organize the urban space, it was necessary to understand the history of its form, establishing a direct link between the building typology and the urban morphology (Ximenes, 2016). Muratori's ideas reflected in the Italian School continued through architects such as Alessandro Giannini (1929-2015), Aldo Rossi (1931-1997), Paolo Maretto (1932-1988), Gianfranco Caniggia (1933-1987), among others.

The French School of Urban Morphology emerged from the creation of the *École d'Architecture de Versailles* – the Versailles School of Architecture, in the 1960s. The architects Philippe Panerai (1940), Jean Castex (1942) and the sociologist Jean- Charles DePaule (1945) developed the research line of urban morphology in France. Moudon (2009) indicates that the “French School” or French current of typology is inspired by the Italian School. The similarities with Italian thought, regarding urban issues, involve both the creation of architectural and urbanistic theories and the production of critical analysis of the modern movement.

Moudon (2009), establishes a relationship between the three schools, indicating that the French School occupies a place between theory, very present in the English School, and the capacity for action of the Italian School. The proximity of interests between the two schools, Italian and French, lies in the interest in the typology of buildings and preservation of historic sites. However, Moudon (2009) points out that characteristics such as: the development of conceptual projects; the elaboration of theories for urban analysis and the development of a

study about the origins of modernist theory are actions closer to those developed by thinkers of the English School. Its concepts, particularly the morphological region, will be used in the analysis developed in this research.

Chronologically, the historical context of urban morphology begins with the research of Michael Robert Günter Conzen (1907-2000), a German geographer, precursor of the Conzenian School. Influenced, at the beginning of his career, in Berlin, by the field of German human geography and also by reading publications from the end of the 19th century, by authors such as Johannes Fritz. Even though Fritz was a historian, he had a strong influence on the geographers that were researching cities in that century.

Fritz's 1894 work, "*Deutsche Stadtanlagen*" ("German Cities"), in which he comparatively analyzes more than 300 German cities, represented a milestone given the use of cartography, in an innovative way, as a research tool, and the introduction of the term 'plan' of the city, until then not adopted by the others. In 1899, the geographer Otto Schlüter, also influenced by Fritz (1894) presents his work "*Über den Grundriss der Städte*" ("On the Structure of Cities"), in which he deepens the analysis of the plan of German cities and also identifies the various parts that form the center of the surveyed cities. After other publications by other geographers, Walter Geisler, in 1918, publishes an analysis of the Polish city of Danzig (now Gdansk), "*Danzig: ein siedlungsgeographischer Versuch*" ("Danzig: an essay on the geography of settlement"), in which he details all its characteristics and conditions of formation of the territory. He also produces several maps, in which he separates by color the land use and the number of floors of residential buildings in the city center of Danzig. Hofmeister (2004) points out that in the 1930s German human geography undergoes a change of course, where the focus of research that aimed solely at urban form turned to the urban function.

M. R. G. Conzen's dissertation, "*Die Havelstädte*" ("The Cities of Havel"), University of Berlin in 1932, still deals with analysis through urban form. Studying 12 German cities, located west and north of Berlin, the author mapped the cities and divided the number of floors and different types of buildings by color, clearly influenced by the publication of Geisler, 1918 (WHITEHAND, 2001). Herbert Louis, in 1936, researched the city of Berlin, Germany, maintaining the analysis of urban form, but bringing the concept of "fringe belt". Louis finds that, from time to time, urban growth suffers interruptions or the slowdown of its development, which leaves a mark on the city and is configured as the "fringe belt". This deceleration or stagnation happens again periodically and, therefore, prints new urban fringes in cities. The fringe belts are, therefore, connected to disruptions in the construction process and one of the possible factors may be the rising land prices. They are composed of a variety of plots both in terms of shape and size. Its formation process does not occur in isolation and the presence of obstacles to the expansion of the built area, including physical ones, such as the landform itself, can lead to the existence of urban areas in which there is a notable alternation of residential growth zones and fringe belts (OLIVEIRA, 2018).

Whitehand (2001) points out that M. R. G. Conzen and his predecessors invested mainly in visual tools for analysis and demonstration of what they were researching, contributing to the understanding of the presented ideas, which has become indispensable nowadays. In 1960, M. R. G. Conzen publishes his work "*Alnwick, Northumberland – a study in town-plan analysis*", a geographical analysis of the plan of the town of Alnwick, in

Nothumberland, northern United Kingdom. Revised in 1969, this was considered one of the most important publications in the field of urban morphology (OLIVEIRA, 2018).

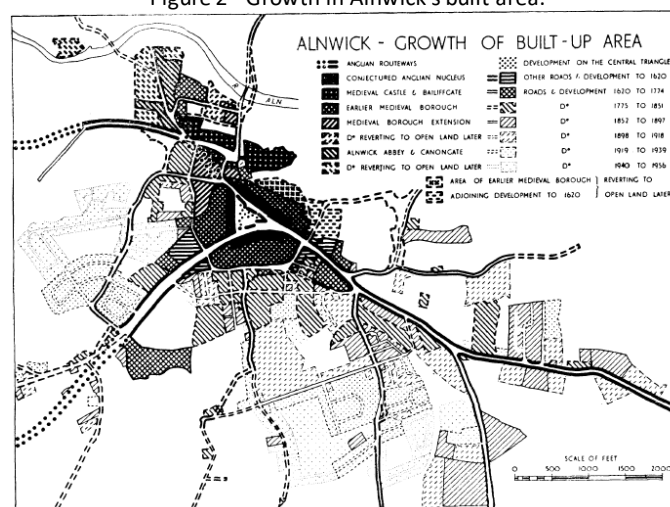
The author emphasized, in the first part of the work, that the internal structures of the blocks should not be ignored and that they could help in a more in-depth analysis of land use. He introduced the theme of the concepts of the urban plan, which comprises these three elements: the streets and the street system, the plots and their aggregations and the buildings and their implantations (M. R. G. CONZEN, 1960). This is an important point where the tripartite division stands out, a method used by the English School (or Conzenian School) for the analysis of the urban landscape. This vision comprises the analysis of the city through three basic elements: the “plan” (or blueprint) of the city that represents the two-dimensional element and is formed from systems of streets, plots and buildings; the so-called built volume, which is the three-dimensional element, and land uses:

- Plan of the city (two-dimensional)
- Street system, which involves the street and its organization into a street system;
- System of plots or lots and their aggregation into blocks;
- Building system, which handles deployments.
- The building volume or building fabric (three-dimensional)
- Pattern of land use and occupation

For Whitehand (2001) the Conzenian School, “is undoubtedly geographical”, since its focus is directly related to the way in which things fit the place.

The second part of the publication presents an analysis of the growth of the city of Alnwick, divided into five historical periods: Anglian Alnwick, Medieval and Early Modern Alnwick, Later Georgian and Early Victorian Alnwick, Mid- and Late Victorian Alnwick and Modern Alnwick. The development of the built area of the town of Alnwick is shown on the map in Figure 2.

Figure 2 - Growth in Alnwick's built area.



Source: M.R.G. Conzen, 1960.

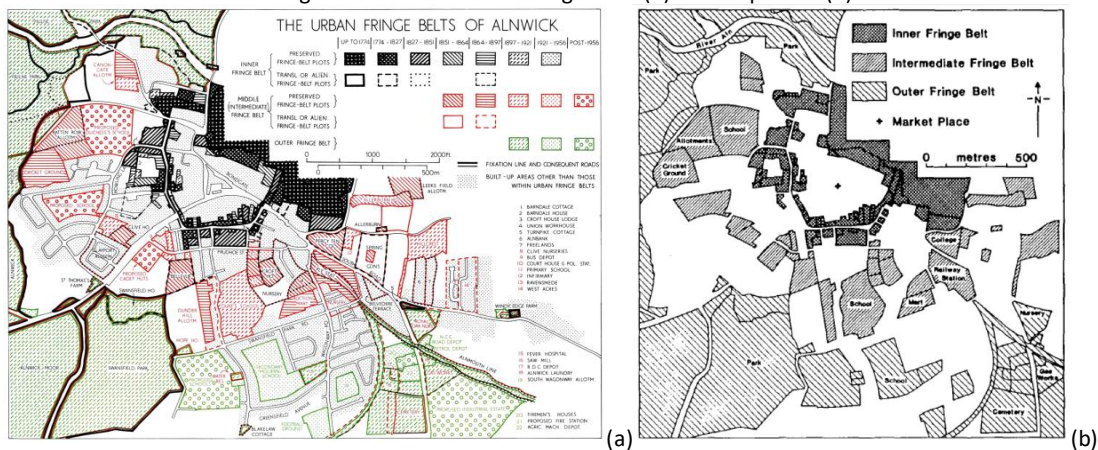
It is observed, from the legend information, that the regions are indicated not only by their current occupation, for example, “earlier medieval borough” and “medieval borough

extension”, but also by a relation of their past to a current status, as is the case with the caption indicating “reverting to open land later”. Another interesting observation is related to the routes, which starting from the central triangle of the city, marked with dotted lines, are separated by periods as indicated: development in the central triangle; development of other roads until 1620; 1620 to 1774; 1775 to 1851; 1852 to 1897; 1898 to 1918; 1919 to 1939 and 1940 to 1956. This detail enables an understanding of the city's expansion dynamics and its connections with other regions.

In his analysis of growth within the five historical periods, M. R. G. Conzen made use of concepts such as fringe belts (Louis, 1936) and the burgage cycle. The latter is adopted to demonstrate the process of filling the plots or lots through the introduction of new constructions in the back part and subsequent demolition (OLIVEIRA, 2018). This withdrawal of land from “production” or the “market” is like a period of rest for the soil that precedes a new cycle of development.

Oliveira (2018) points out that one of the important contributions of M. R. G. Conzen (1960) was the integration of “patterns of the fringe belt of a city in a morphological theory about the interactions between different formative and transforming spatial processes”. On the map in Figure 3a, this relationship is evidenced through the marking of fringe belts and the representation of the physical development of the city of Alnwick, through the hatches indicated for each period. It should be noted that this map includes the period after 1965, which was not part of the information presented in Figure 2. In the image of Figure 3a, it is evident how complex the classification system he developed is, since it involves the “training processes and subsequent modification of fringe belts” (OLIVEIRA, 2018). Introducing, in this way, temporality in his analysis. The detail of the fringe belts of Alnwick (Figure 3b) enables observing the internal, intermediate and external fringes marked by M. R. G. Conzen, already in 1960.

Figure 3 - Alnwick urban fringe belts (a) and map detail (b).



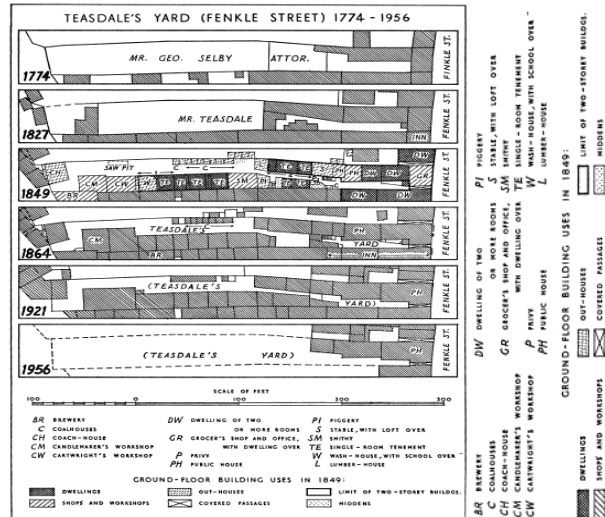
Source: M.R.G. Conzen, 1960.

A noteworthy observation, according to Whitehand (1988), is the distinction made by M. R. G. Conzen in relation to the development of the original notion by Louis (1936). M. R. G. Conzen, based on the analysis of the case of a marginal strip on both sides of a city wall, observes a similar, well-defined limitation to growth between the restricted intramural zone and the less compressed extramural zone, creating the concept morphological frame. This addresses the

urbanization process in relation to rural land and its long-term consequences for the city's territory.

To understand the analysis in relation to streets and plots, it is interesting to look at the detail (Figure 4) developed by M. R. G. Conzen (1960) of the burgage cycle, which analyzes the occupation of Teasdale's Yard on Fenkle Street, from 1774 to 1956.

Figure 4 - Application of the bourgeois parcel cycle concept in Teasdale's Yard.

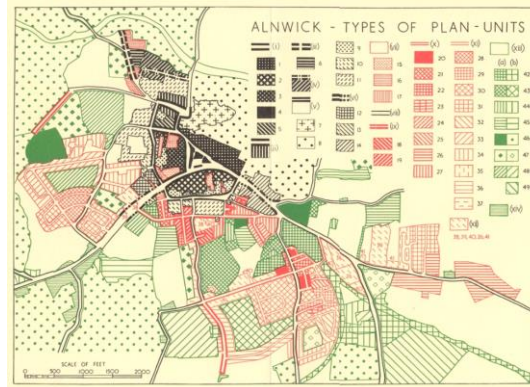


Source: M.R.G. Conzen, 1960.

From the image of Figure 4, one can observe the intense occupation between the years 1827 and 1849, with coverage of practically 62.9%, leaving no open space, except for a very narrow alley (M. R. G. Conzen, 1960). The virtually complete occupation of Teasdale's Yard takes place in 1849.

In the third and final part of his work, M. R. G. Conzen (1960) analyzes the existing Alnwick town plan, classifying it into types of plan units. It indicates 14 main types, including farms and other buildings related to agriculture, and 49 subtypes, which relate to the detailing of patterns involving temporal and historical variation in their characteristics (Figure 5). The 14th main type involves the morphological frame, for it is about rural soil and its long-term interaction with the city territory. The morphological frame can be associated with the shape of the land on which a city or neighborhood develops and represents a kind of sketch that directs the planning and development of the city. In this way, he sought to obtain patterns that could indicate layouts common to an era or function, creating a complex system of temporal and functional classification, taking into account the implantation and volumetry of constructions.

Figure 5 - Types of plan units.

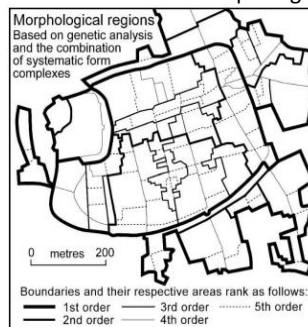


Fonte: M. R. G. Conzen, 1960.

The Conzenian School also introduces the concept of morphological regions. In each morphological region, the characteristic patterns are distinguished from those observed in surrounding areas, thus making each one distinct from the others.

Oliveira (2018) also points out the advances of M. R. G. Conzen, from Alnwick, which are related to the form, initially, of a two-dimensional reading of the city from streets, plots and implantation of buildings (Figure 6). In the city of Ludlow (Figure 6), his analysis involved the hierarchy of five orders, no longer related only to the city plan, but also involving the built fabric and land uses (M. R. G. CONZEN, 1975, 1988).

Figure 6 - Ludlow Old Town – morphological regions.



Source: M. R. G. Conzen (1988) *apud* Oliveira (2018)

Whitehand (2001) points out that for M. R. G. Conzen the division of an urban area into morphological regions represents the maximum point of exploration of physical development. He also points out that his studies in these cities in the United Kingdom enabled the understanding that through the analysis of the urban landscape it is possible to understand its history and identify the range of morphological regions present there (WHITEHAND, 2009).

In this research, the study of urban morphology directly involves the wetlands (*ressacas*), for these are the focus of the intense occupation that develops in the region. Therefore, to understand the morphological regions of *Congós* neighborhood, in the city of Macapá - Amapá, it is necessary to analyze the alterations in the urban form and the occupation of the areas of three *ressacas* (wetlands) that comprise the region.

3 MACAPÁ'S WETLANDS (*RESSACAS*)

One way of dealing with the need for housing in areas with an abundant presence of water, whether canals, rivers, lagoons or sea inlets, can be the construction of floating houses, on stilts houses or boats. This urban form, adequate to the presence of the waters, is not always accompanied by the proper infrastructure that enables bringing a minimum of comfort to its residents and care for the environment.

Altorfer (2010) indicates that the first buildings on stilts date back to the Neolithic period. So-called “prehistoric stilt houses” were discovered in lakes and marshy regions of Europe during the 19th century.

3.1 Living in *ressacas*

In some countries, such as Holland, the use of housing over water is a possible alternative to the lack of land for construction and agriculture. The presence of extensive areas of peat, which is a material of plant origin, causes the habitable areas to undergo changes over time, due to processes of retraction and expansion of the material. The country constantly seeks strategies to deal with these issues and, thus, has achieved “resilient solutions over the centuries, particularly on issues related to water management and climate adaptation” (CARDONE and RAMOS, 2019).

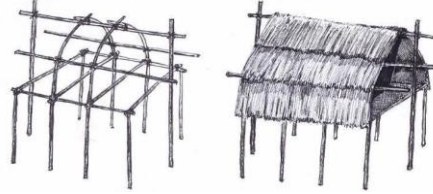
The predominant way of building in the informal occupations of the city of Macapá are houses on stilts, which are a type of construction that enables dealing with the inconstancy of the water level. Other factors may contribute to this choice, such as protection against animals, minimizing risks to residents.

It seems interesting to point out that in regions of Malaysia and Indonesia, with a range of latitude similar to Macapá, they have similar construction systems on wetlands, also with the presence of stilt houses.

In addition to being part of the balance of the microclimate, the waterlands, as indicated by Silva et al. (2009), contribute to local supply, serving as “groundwater suppliers and water reservoirs”. Another important contribution is its role in reducing the risk of flooding, as it absorbs part of the rainwater. Silva et al. (2009) point out that the *ressacas* are characterized “as a humid area periodically flooded, but which harbors channels or perennial watercourses”.

In Brazil, stilt houses are present in the most diverse regions and in the Amazon region they can be seen along the rivers and are an important means of dealing with the movement of water in the flood season. Figure 7 presents a model of a Waiãpi house on stilts (*iura*). The Waiãpi, are an indigenous people from the north of Brazil, who live in a locality in the west of Amapá. The “climate-sensitive” architectural design and the process of raising and lowering the water level indicates the harmony of this architecture with local meteorological variations.

Figure 7 - Waiãpi Houses: house on stilts (iura) 1.5 meters or 2 meters above the ground.



Source: Drawings by Eduardo Augusto Roxo, 2015.

The construction of floating houses or stilt houses seems to be a constructive system adopted by populations around the world to deal with difficulties related to living. In the Amazon there are stilt houses located in urban and rural areas, the latter often located on islands in the region. Occupations in urban areas are usually dense and Menezes and Perdigão (2013) report the “negative impacts, such as unhealthy conditions, which are highlighted as indicators of the eradication of this way of life”. However, the amphibious houses in Holland, despite being on the water, have electricity, water, sewage and gas services (MOON, 2015 apud CARDONE and RAMOS, 2019).

The analysis of *Congós* neighborhood, applying the concept of morphological region, can deepen the research of urban morphology in a more detailed scale, in which it may be possible to understand the regions and their subdivisions.

3.2 *Congós* neighborhood

When analyzing the urban development of the city of Macapá, it seems possible to indicate that there is an attempt to replicate the orthogonality of the urban fabric, expansion of which has to deviate from *ressacas* (wetlands). The built geometry presents a richness of forms including spaces over water.

This process usually has as its starting point the informal occupation of the wetlands, and the subsequent land fill of that water body, either by the initiative of residents or the public authorities. The view of *Congós* neighborhood with the boundary of the *ressaca* (Figure 8) enables us to observe three scenarios related to the issue of street paving. There is a peninsular core with paved streets, a transition strip with dirt streets and a border with streets advancing over the water. These scenarios suggest the existence of three periods of occupation co existing in a continuous process. The variation in the paving of the streets could indicate the presence of a fringe belt (M. R. G. Conzen, 1960) since it may involve the deceleration or interruption phases of the urban expansion process, with a land fill process where the belt is created on its edge, to resume the expansion process later. After analyzing the stages of Macapá’s development, it was noted that growth is also interrupted when it encounters the boundaries of the non-flooded surface.

The sudden increase of these regions' occupancies sometimes happen connected to events in the city, but there seem to happen new occupations in these regions constantly, due to a local demand, related to a growing population that has no place to live. Thus, the occupation of *ressacas* persists in a permanent process of expansion, which is apparently associated with an attempt to reproduce the model of the city's streets and lots. This model fails to preserve the

rigidity and becomes more organic, presenting a design similar to a herringbone pattern or even plants, such as ferns.

Figure 8 - *Congós* neighborhood with its expansion areas.



Source: Google Earth Pro, 2020.

The water is very present in the urban morphology of Macapá, surrounded both by the hydrographic basins of the *Igarapé da Fortaleza* and the *Curiaú* and by the Amazon River. The *Congós* neighborhood was formed from the expansion of the city in one of its peninsulas. When observing, one notices the replication of the orthogonal mesh used since the beginning of the installation of *Vila de São José de Macapá* (Macapá's original name before it was promoted to the category of city) until the present day in the various expansions over the years.

The wetlands (*ressacas*) of *Congós* neighborhood have an urban mesh, herringbone, which has a pattern that comprises a main walkway connected to secondary walkways, of smaller dimensions, that give access to the residences. In its non-flooded area, it has an orthogonal grid with a linear layout where *Rua Benedito Lino do Carmo* (street) stands out for its dimensions (it has two lanes and a median strip) and for being the main access street to the neighborhood given its connection with *Rua Claudomiro de Moraes* (street), from the *Novo Buritizal* neighborhood.

Within the *Congós* neighborhood are inserted two *ressacas*: *Ressaca Chico Dias* and *Ressaca do Beírol* (Figure 9), that are bordered by Lagoa dos Índios, which, given its dimensions, encompasses other wetlands in the city. *Chico Dias* and *Beírol* *ressacas* are considered the two largest Macapá's *ressacas* in terms of population. Each of them comprises 13.60% and 13.54% of the population of these areas, respectively (AGUIAR E SILVA, 2003).

In the mid-1960s, the city expanded towards the south, where, as Portilho (2010) points out, there were formations of neighborhoods adjacent to what is now *Congós*.

The urban formation of the *Congós* neighborhood took place in the continuity of the orthogonal grid as the city expanded, probably following the already existing stilt houses. The implementation of the regular grid, influenced by Portuguese colonization, remained so ingrained that the master plans *Grumbilf*, *Fundação João Pinheiro* and *HJ Cole* replicated its use in the new projected areas. In the new areas of stilt houses, this dynamic remains with the stilt

houses distributed in a continuity of the asphalt streets and the design of the cross streets, possibly giving residents the feeling of belonging to the urban core of the city.

Figure 9 - Map of *ressacas* (wetlands) in the *Congós* neighborhood.



Source: Prepared by the author.

The analysis of wetlands in the city of Macapá is based on the fundamental concepts developed by M. R. G. Conzen (1960) and applied research by Oliveira (2018), Oliveira et al. (2015) and Netto et al. (2014).

In this research, the concept of 'urban plan' was used, a component of the tripartite division of the urban landscape, presented by M. R. G. Conzen (1960) with its complex elements formed by the streets and their organization, plots and their aggregation and the implantation plans, identifying the morphological region. It is mainly considered that the urban plan “represents the logic of occupation of the territory, it is the way of organizing the space in relation to the topography and the natural characteristics of the site” (NETTO et al., 2014, p. 31).

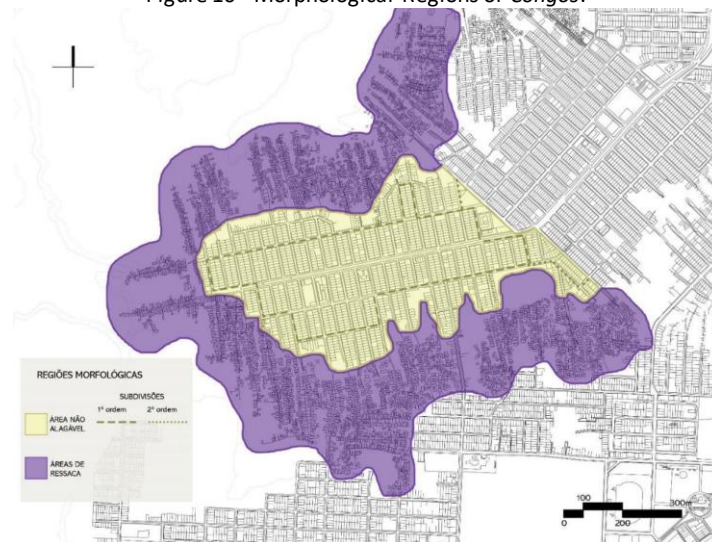
When analyzing *Congós* neighborhood, it was possible to identify two orders of morphological regions, based on the recognition of two types of units. The morphological regions had their boundaries identified according to their urban plan units and the differentiation of occupation patterns. There are two morphological regions, one corresponds to the non-flooded area that has a regular occupation pattern, and the other on the wetland (*ressaca*) that have an organic occupation pattern defined by the tradition of the local construction process of stilt houses in floodplain areas.

The map in Figure 10 shows the identified morphological regions of the *Congós* neighborhood, and the second and third order subdivisions (indicated in the map caption) of the non-flooded area region.

When observing Figure 10, the first order morphological region is identified in yellow, which is formed by the non-flooded area of the neighborhood, which in its first order is identified by an orthogonal layout arranged in a grid and, therefore, presents a Cartesian logic. This set gives rise to rectangle-shaped blocks, which thus present a unity of similar elements. The street

system and its arrangement is predominantly grid-like until it reaches the edges of the non-flooded area, thus making the mesh adapt to the environment, but without giving up the attempt to keep following the layout of the streets, as seen on the northwest edge and east of the map. The eastern border, marked by the encounter with the neighborhood nearby, presents an adaptation of the implantation, with the same route, but with a different direction.

Figure 10 - Morphological Regions of *Congós*.



Source: Prepared by the author.

The analysis of the second order subdivision (Figure 10) for the streets, their organizations, plots and their aggregation into blocks enabled the identification of a pattern, both in the number and size of the lots. It is notorious the presence of the same number of lots (22 lots) in the blocks, where their uses are varied between institutional, commerce, leisure, but residences predominate. Plots measuring 65m x 150m prevail.

The third-order subdivision has an orthogonal grid with blocks, mostly measuring 65 x 150m, a measure similar to that observed in the second-order region. However, this region on the edge of the peninsula has a process of “dilution” of the block at its border points, on the vicinity of the access walkways to the stilt houses. However, it is important to point out that this “dilution” is sometimes caused by land fill processes, leaving a suggestion of continuity in the courts installed there.

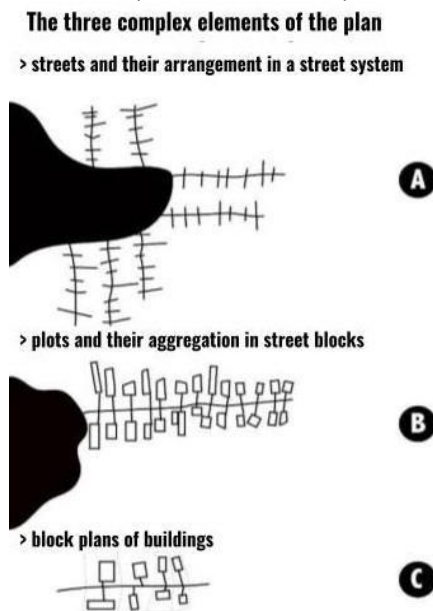
The first-order morphological region defined in purple (Figure 10) constitutes the floodable area, which comprises the two *ressacas* (wetlands) that are part of *Congós* neighborhood. It contains on stilts constructions, which have main walkways that advance towards the lower areas of Lagoa dos Índios. The expansion of the Beiril *ressaca* created links between the neighborhood of *Congós* and the neighborhood of Marco Zero. It is interesting to note that the communication paths between the two neighborhoods, via wooden walkways, provide faster access to the Marco Zero neighborhood. To walk the path through the city, the distance to be covered is much greater.

During the analysis of possible subdivisions of the *ressaca*'s morphological region - in purple - it was identified that all the main walkways have secondary development branches,

which expand to the sides where they cause a denser cluster between the main walkways of access to these areas.

The three complex elements of the plan were identified on the wetlands (*ressaca*) and are shown in Figure 11. The streets and their organization into a street system (Figure 11 a) are represented on the wetlands (*ressaca*) by the main and secondary walkways that together form a system with a very characteristic implantation pattern. The plots and their aggregation into blocks (Figure 11 b) can be identified in a single “arm” of an arterial walkway that comprises the secondary walkways that give access to the residences. The third element (Figure 11c), the building's implantation plans, are recognized by the implantations of each stilt connected to the smaller, or secondary, walkways and connected to the arterial walkway.

Figure 11 - Application of the three complex elements of the plan to the wetland occupied by stilts.



Source: Prepared by the author.

In the image of *Ressaca do Beiro* (Figure 12), we can see the system indicated in Figure 11. It is interesting to identify, here too, the reproduction of the system of division of the soil into plots. This process would not be surprising, since the streets presented in Figure 10 already replicated the dynamics present in the formal city, however, the division of plots in the water seems to legitimize the ownership of a “piece of water”, a concept that at first would seem applicable only to the land.

Would this be a mode of internal order in these communities? A way of organizing tenure and local hierarchies? Or an anticipation of the “imposed” order in the high areas and previously defined, waiting for the land fill?

Figure 12 - "Terrain" division system between houses.



Source: Jhonatan Ferreira for this research.

However, it is interesting to observe, from the image of Figure 12, the relativization of the concept of lot or parcel in relation to a piece of land. In each plot there is a difference in the way residents take care of their lot, where some remain covered with vegetation and others formed only with water.

4 CONCLUSION

In the analysis of *Congós* neighborhood, using the concept of morphological regions of the English School of Morphology developed by M. R. G. Conzen (1960), it was possible to identify two morphological regions and two subdivisions of second and third order (Figure 10). It is interesting to point out that the neighborhood of *Congós*, unlike the subdivisions, preserves the orthogonality of its layout, including the areas on stilts. These tend to define their main walkway, following the paved streets. When meeting other neighborhoods, orthogonality remains, only changing its direction when there is a need to adapt to the urban fabric.

In Figure 08, a possible fringe belt was identified, indicating the transition between the two morphological regions. This region, with dirt streets, is possibly an old area of stilt houses in the process of being incorporated into the city with asphalt.

It should be noted that the differences in implantation observed in relation to the so-desired break in orthogonality of the urban fabric occurs in subdivisions implemented by the real estate market. In wetlands (*ressacas*) this dilution of orthogonality occurs, but with a detectable attempt to replicate the model. The reasons for such an action can be several and, among them, the land fill dynamics itself can be pointed out, which puts these regions in a kind of waiting compass, with the houses already “ordered” according to the “appropriate mode”. Another possibility is the very need to replicate the model so that the region can “belong” to the city.

The issue of sanitation does not seem to have been resolved, not even for the non-flooded region, therefore being a general need in the neighborhood of *Congós*. The possibility of implementing a sanitation program, even in *ressacas*, would enable the reduction or extinction of the land fill dynamics. This process brings as important consequences the

vulnerability of the city to flooding and the rise in temperatures due to changes in the microclimate of the city of Macapá.

References

- AGUIAR, J. S.; SILVA, L. M. S. Caracterização e Avaliação das Condições de Vida das Populações Residentes nas Ressacas Urbanas dos Municípios de Macapá e Santana. pp. 165-236. In: TAKIYAMA, L. R.; SILVA, A. Q. da (orgs.). **Diagnóstico das Ressacas do Estado do Amapá**: Bacias do Igarapé da Fortaleza e Rio Curiaú, Macapá-AP. Macapá: CPAQ/IEPA e DGEO/SEMA, 2003. p.165-230.
- ALTORFER, K. **Lacustres**. Tradução de Laurent Auberson. *L'Académie suisse des sciences humaines et sociales (ASSH)*, 2010. Disponível em: <<https://hls-dhs-dss.ch/fr/articles/007856/2010-09-27/>>.
- ARAÚJO, R. M. **As Cidades da Amazônia no Século XVIII** - Belém, Macapá e Mazagão. FAUP - Faculdade de Arquitectura da Universidade Porto, 1998.
- AYODE, J. O. **Introdução a climatologia para os trópicos**. 4. ed. Rio de Janeiro: Bertrand Brasil, 1996.
- CARDONE, L.; RAMOS, R. C. L. A habitação flutuante como uma resposta resiliente: entre o vernacular e o contemporâneo. In: Simpósio Brasileiro de Qualidade do Projeto no Ambiente Construído, 6, 2019, Uberlândia. **Anais...** Uberlândia: PPGAU/FAUeD/UFU, 2019. p. 585-595.
- CATALDI, G.; MAFFEI, G. L.; VACCARO, P. Saverio Muratori e a escola Italiana de tipologia projetual. **Revista de Morfologia Urbana**. v.2(1), p. 25-36, 2014. Rede Lusófona de Morfologia Urbana.
- CONZEN, M. R. G. Alnwick, Northumberland – a study in town-plan analysis. London: Institute of British Geographers Publication 27, 1960. Disponível em: <https://www.jstor.org/stable/621094?read-now=1&seq=77#metadata_info_tab_contents>. Acesso em: 12 jan. 2020.
- CONZEN M. R. G. Curriculum Vitae. University of Birmingham, UK (website). Disponível em: <<https://www.birmingham.ac.uk/Documents/college-les/gees/MRGConzenCV.pdf>>. Acesso em: 20 maio 2020.
- DEL RIO, V. Introdução ao desenho urbano no processo de planejamento. São Paulo: PINI, 2000.
- HOFMEISTER, B. 'The study of urban form in Germany', **Urban Morphology** 8, 3-12, 2004.
- LAMAS, J. M. R. G. **Morfologia urbana e desenho da cidade**. Lisboa: Fundação Calouste Gulbenkian, 2004.
- MENEZES, T. M. dos S.; PERDIGÃO, A. K. de A. V. **Modo de Habitar Amazônico em Sistemas: Aproximações com o Tipo Palafita**. 2013. 6º Projetar. O Projeto como Instrumento para a Materialização da Arquitetura: ensino, pesquisa e prática. Salvador, 2013.
- MOUDON, A. V. *Urban morphology as an emerging interdisciplinary field*. **Urban Morphology. International Seminar on Urban Form – ISUF**. v. 1, p.3-10, 1997. Disponível em: <<http://urbanmorphology.org/pdf/moudon1997.pdf>>. Acesso em: 02 fev. 2020.
- OLIVEIRA, V.; MONTEIRO, C.; PARTANEN, J. *A comparative study of urban form*. **Urban Morphology. International Seminar on Urban Form – ISUF**. v.19, p. 73-92, 2015.
- OLIVEIRA, V.; MONTEIRO, C. As origens da morfologia urbana e a geografia alemã. **Revista de Morfologia Urbana**. 2, p. 37-40, 2014. Rede Lusófona de Morfologia Urbana.
- OLIVEIRA, V. **Diferentes Abordagens em morfologia urbana**. Contributos luso-brasileiros. Porto: 2018.
- OLIVEIRA, V. Morfologia urbana. Uma introdução ao estudo da forma física das cidades. **Revista de Morfologia Urbana**. 4(2), p. 65-84, 2016. Rede Lusófona de Morfologia Urbana.
- PANERAI, P. *Typologies*. In: PANERAI, P. [et al.]. **Analyse urbaine**. Marseille: Éditions Parenthèses, 1999. p.105- 132.
- PEREIRA COSTA, S. A. P.; NETTO, M. M. G. **Fundamentos de Morfologia Urbana**. Belo Horizonte: C/Arte, 2015.

PEREIRA COSTA, S. A. P.; Teixeira, M. C. V. *The study of urban form in Brazil. Urban Morphology. International Seminar on Urban Form – ISUF.* v.18, n.2, p. 119-27, 2014.

PEREIRA, J. A. **Urban fringe belts em cidades novas:** o caso de Maringá – Paraná. Dissertação de mestrado. Programa de Pós-Graduação em Engenharia Urbana da Universidade Estadual de Maringá - UEM, Maringá, 2011.

PORTILHO, I. dos S. **Políticas de desenvolvimento urbano em espaços segregados** - uma análise do PDSA na cidade de Macapá. Belém: 2006.

REGO, R. L.; MENEGUETTI, K. S. *British urban form in twentieth-century Brazil. Urban Morphology. International Seminar on Urban Form – ISUF.* v. 12, n. 1, p. 25-34, 2008.

_____. A respeito de morfologia urbana. Tópicos básicos para estudos da forma da cidade. *Acta Scientiarum. Technology* Maringá, v. 33 n. 2, p. 123-127, 2011.

SILVA, A. Q. [et. al]. **Carta ambiental da bacia hidrográfica do igarapé da Fortaleza.** Secretaria de Estado do Meio Ambiente – Amapá (website). Disponível em: <<http://www.sema.ap.gov.br>>. Acesso em: 23 nov. 2005.

_____. Valoração ambiental das unidades fitoecológicas remanescentes da bacia hidrográfica do Igarapé Fortaleza. **OLAM – Ciência & Tecnologia.** Rio Claro – SP. Ano IX, jan.-jul. 2009, Vol. 9, n. 2, p. 354. ISSN: 1982-7784. Disponível em: <<http://cecemca.rc.unesp.br/ojs/index.php/olam/index>>.

XIMENES, N. L. B. **Morfologia Urbana:** teorias e suas inter-relações. 2016. 170 f. Dissertação (Mestrado em Engenharia Urbana) – Universidade Federal do Rio de Janeiro, Escola Politécnica, Programa de Engenharia Urbana, Rio de Janeiro, 2016.