EXTENDED URBANIZATION AND RURAL RECONFIGURATION IN THE AMAZON: A THEORETICAL-METHODOLOGICAL PROPOSAL BASED ON DEMOGRAPHIC AND SPATIAL INDICATORS

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Abstract

This paper unfolds to develop a new theoretical-conceptual reference about urbanization, working with demographic parameters into the extended urbanization theory. We intend to explore how the urban tissue contributes to the rural reconfiguration in the Brazilian Amazon fostering the multiples dimensions of urban phenomenon. Based on demographic indicators that are sensitive to socio-spatial processes, we build a methodological framework to analyze rural landscapes of two areas in the west side of Pará state, in Brazil. The results confirm that propagation of urban vectors tends to intensify the population agglomeration (Gini Index) and the women predominance (Sex Ratio) by mechanisms of spatial differentiation. The existence of a mobility axis, the population settlement regime and the distance from the urban center are the structural elements for creating a mosaic of ruralities immersed in urban contexts. With our findings, we conceived a theoretical-methodological model with an analytical approach unprecedented in the literature on urbanization.

Keywords

Urban transition; Ruralities; Population distribution; Brazilian Amazon.

URBANIZAÇÃO EXTENSIVA E RECONFIGURAÇÃO RURAL NA AMAZÔNIA: UMA PROPOSTA TEÓRICO-METODOLÓGICA BASEADA EM INDICADORES DEMOGRÁFICOS E ESPACIAIS

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Resumo

Este trabalho resulta da reconstrução teórico-conceitual realizada para verificar empiricamente a existência de urbanização extensiva na Amazônia com base na incorporação de noções demográficas ao referencial em questão. Observou-se como o tecido urbano contribui para a reconfiguração rural, evidenciando as múltiplas dimensões que perpassam o fenômeno urbano. Com indicadores demográficos sensíveis aos processos socioespaciais urbano-rurais, foram analisados territórios rurais de dois recortes regionais no oeste do estado do Pará. Os resultados confirmam que a propagação dos vetores urbanos tende a intensificar a aglomeração populacional (coeficiente de Gini) e a predominância espacial de mulheres (razão de sexo) por mecanismos de diferenciações espaciais. A existência de um eixo de mobilidade populacional, o regime de ocupação e a distância do centro urbano são os elementos estruturantes da emergência de um mosaico de ruralidades imersas em contextos urbanos. Com os resultados, concebeu-se um modelo teórico-metodológico com uma abordagem analítica inédita na literatura sobre urbanização.

Palavras-chave

Transição urbana; Ruralidades; Distribuição populacional; Amazônia brasileira.

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Introduction

Urban transition may already be considered an inexorable global process, and has been occurring more intensely over recent years (UN, 2014; COHEN, 2004). From a Latin American perspective, Brazil stands out for the precocity and speed with which this process has taken place, which, according to data from the 2010 Demographic Census, has resounded in the concentration of more than 80% of the population living in areas classified as urban. Despite the country's advanced stage of urban transition, there are regional peculiarities and inequalities within these trajectories. With specific regard to the Northern region of Brazil, the fact that there was a delayed start to this transition process would explain why the levels of urbanization are lower than in other regions, except for the Northeast, despite the fact that the growth rate of the urban population in the Northern region is above the national average (MARTINE; MCGRANAHAN, 2010).

In the northern part of the country, the region that contains the Amazon biome is perceived as a forest undergoing a rapid urbanization process, on which there is a vast, detailed literature dedicated to understanding its specificities and diversity, as well as its regional and global connections, its economic and social relations, and the role of cities in the rural-urban connections, amongst other themes (DA COSTA; ROSA, 2017; BROWDER; GODFREY, 1997; BECKER, 1995; 2005; 2013; CASTRO, 2006; 2009; GUEDES; COSTA; BRONDÍZIO , 2009; PADOCH et al., 2008; PE-

REIRA, 2006; SCHMINK; WOOD, 1992; SCHOR et al., 2014; TRINDADE JÚNIOR, 2011). The demographic contribution of recognizing the region as an urbanized forest offers indicators grounded on the urban transition framework (SKELDON, 1990), with calculations based on the population volume and on the proportion of urban inhabitants. Hence, it is characterized by analyzes that consider the number and size of cities, the rate of population growth and the distribution of the rural-urban population.

However, we recognize that, in order to encompass the urban complexity of the Brazilian Amazon region, as has been described, it would be necessary to rethink the methodological design. The traditional approach reproduces macro-structural components with little, if any, adherence to the social processes that characterize the urban way of life. Although the social dimension of urbanization in the Amazon has been the object of discussion and studies, hardly any work has been conducted to develop analytical instruments sensitive to factors that are not only volumetric or distributary in relation to the population. Hence, in order to contemplate the multidimensionality of the urban phenomenon and the hybrid dynamics of the Amazonian territorialities, we have adopted the framework of extended urbanization (MONTE-MÓR, 1994), which extends the idea of urbanization beyond the nuclei consolidated within the conformation of an urban fabric, whilst not being restricted to features that are often dichotomously typified as "urban" or "rural".

The data and analyzes were systematized considering the historical process of the urban trajectories of two sub-regions in the western part of the state of Pará, between the municipalities of Santarém and Altamira (Figure 1). Although it is not possible to consider the part (the case study) in terms of the whole (the Amazon region), the study area is nonetheless relevant for an investigation into urbanization in the Amazon, since it presents: a) coexistent areas of both recent and long occupation (consolidated); b) diverse forms of population occupation, including agricultural settlements, conservation units, indigenous lands and urban nuclei of varying sizes; c) a geographical position, which incorporates structural elements of urbanization, such as federal highways and large rivers; and d) a prominent position within the Amazonian scenario, given its economic and demographic relevance. Accordingly, the study of the Western Amazon sub-region considered herein may also shed light onto the regional context, despite the diversity of intraregional configurations, thereby giving rise to other case studies and the inclusion of other processes.

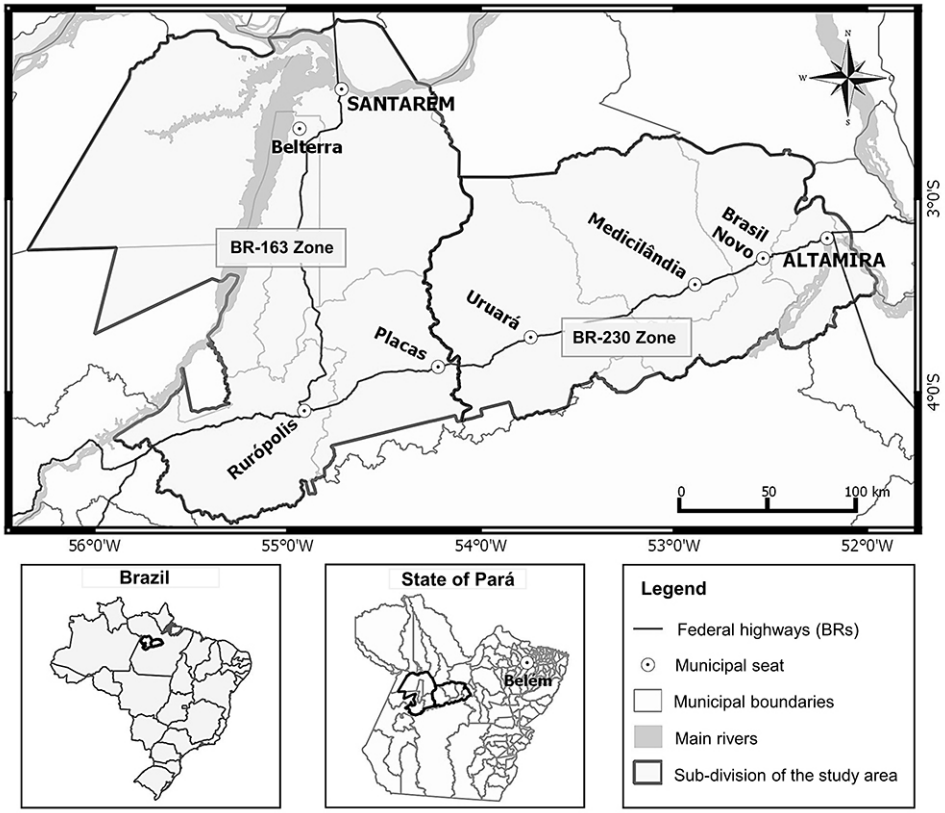

Figure 1. The study area and the two sub-regions under analysis located in the state of Pará, Brazil.

*The study area includes, either partially or wholly, the territories of eight municipalities, according to demarcation for the year 2010.

Source: Produced by the authors.

Based on this situation, we defined two guiding questions for the work. The first would be to understand how the urban fabric develops in the rural space within the context of its heterogeneity - a mosaic of ruralities. The second is expected to reflect the way in which different urban contexts interfere in the strength of the expansion vectors and in consolidating the urban fabric. The two investigative approaches merge to support the general objective of the work, namely: to undertake an empirical investigation into the extended urbanization and its mechanisms of rural reconfiguration in the Brazilian Amazon, based on the case studied, in order to enable the formulation of a theoretical-methodological model from an urban measurement perspective, which is not limited to population volumes and their spatial distribution.

For the analysis, we have systematically incorporated demographic notions into the concepts and processes contained within the framework of extended urbanization (MONTE-MÓR, 1994). We reinforce urbanization as a spatial demographic

phenomenon (PEBLEY, 1998) - an expression of the concentration of people, goods and capital - and we define urbanization as a product of rationalities and land uses, therefore, a combination of the material and social morphologies of the urban phenomenon. The results confirm different intensities of reconfiguration of the functionalities and meanings of rural spaces in the conformation of a broad, dynamic, heterogeneous urban fabric. Thus, we contribute to a conception with a broader view of the urban phenomenon and to new analytical contributions of measurement and evaluation.

Theoretical foundations on urbanization

The traditional narrative on urbanization suggests a trajectory marked by an economic transformation from an agricultural to an industrial society (MARTINE; MCGRANAHAN, 2010). The theory of urban transition, originally postulated by Skeldon (1990), is structured within descriptions of demographic transition and migratory dynamics to describe urbanization as a tendency for the population to concentrate in high-density urban occupations - with greater opportunities for education and work due to industrial economic activities and a concentration of services (MONTGOMERY et al., 2003). The approaches of this theoretical construction are supported by a survey of the absolute number of the urban population and its growth, by the change in the size of the municipalities and, equally, by the increase in the proportion of the urban population.

It is our belief that this theoretical-empirical perspective fosters an antagonistic perception of rural versus urban, reiterating the outdated dichotomy between rural-countryside and urban-city. While the theoretical basis is founded on macro-structural elements, the definition of these spaces is composed of fiscal instruments that are guided by political-administrative issues – thereby reducing urban and rural to the role of territorial adjectives (ENDLICH, 2006). Criticism of this dichotomous model is huge and from different disciplinary fronts, with a broad scientific consensus on its limitation for representing the complexity of spaces and the challenges involved in analyzing them (CAIADO; SANTOS, 2003; CASTRO, 2006; CHAMPION; HUGO, 2003; SILVA, 2001; WANDERLEY, 2000).

Urbanization is conducive to the emergence of a transition zone between urban and rural areas, where transformations in their physical and social aspects take place, thus dissolving the sharp definition of their limits (SPOSITO, 2006). The rural and the urban tend to interrelate in a process of converging lifestyles, which marks a gradual, continuous, unruptured passage (CHAMPION; HUGO, 2003; WANDERLEY, 2000). This idea is also expressed in the concept of rural-urban continuum, in which the urban pole assumes the role of dissipating values and practices, by

integrating and connecting extremes through a scale of intensities, rather than contrasts (MARQUES, 2002; WANDERLEY, 2000). The application of the rural-urban continuum concept is varied and is also open to criticism, as it preserves the duality of poles and expresses a transition mechanism that leads to complete urbanization with the elimination of rural space (WANDERLEY, 2000).

This perspective exposes the multiplicity of rural configurations, surpassing the rural-agricultural paradigm. By proposing a rural renaissance, Kayser (1990) emphasized that its representation emanates from the way of life and from identity ("the place where one lives") and from its insertion into the broader spheres of society ("the place where one sees and lives the world ") - it is, therefore, a particular way of using space and social life. The new socio-spatial relations and the exercise of pluriactivity demonstrate the malleable face of the rural, which is recreated with the support of cultural ties and identity references. Urbanization, from a phenomenon of spatial and social homogenization, becomes transformed into a process that triggers the emergence of new ruralities immersed in urban contexts (MARQUES, 2002; WANDERLEY, 2000).

The distinction between these spaces is not eliminated, although their functions and contents are no longer contradictory, and become integral parts of an urban fabric (LEFEBVRE, 1999). Henry Lefebvre foresaw the complete urbanization of society through the implosion-explosion dialectic of cities, in a trend of agglomeration and intensification of density in the urban pole and in its horizontal expansion. The rural space would then be more and more intertwined by the urban fabric inside the configuration of an urban society, represented through the production of space in its material morphology - physical transformations linked to the city's conception, such as infrastructure and buildings - and social - transformations in the way of life linked to the conception of the urban, such as values and daily life (ENDLICH, 2006; MARQUES, 2002; MONTE-MÓR, 2006).

Extended urbanization, a concept presented by Monte-Mór (1994), enables urbanization to be understood as a transformation of society and its values, also resulting from the emergence of new ruralities - or urbanities. Within this framework, each rurality is connected to the urban nucleus by supporting socioeconomic activities, identified, therefore, as operational landscapes of urbanization. Thus, urbanization extends beyond the cities and spreads in networks that virtually penetrate spaces, constituting the urban fabric (BRENNER; SCHMID, 2015; MONTE-MÓR, 1994).

This theoretical construction is outstanding in that it incorporates the sociological question inherent to urbanization - minimized, if not absent, in investigative approaches based on urban transition. It is our understanding that working with

the multiple dimensions that permeate the urban phenomenon is a favorable strategy with which to address the complexity of contemporary processes. The challenge we faced was to move from the theoretical level to the analytical, minimizing simplifications in the methodological procedures. We have assumed that the connection point between the material and social morphologies of urbanization stems from socio-spatial processes, which has enabled us to consider a spatial demography to examine the extended urbanization framework and to investigate how the urban fabric has contributed to rural reconfiguration in the Amazon.

Research methodology

Characterizing the sub-regions of the study area

The decision to develop a comparative analysis of the two sub-regions (Figure 1) is justified by the need to discuss the propagation force of urban morphological vectors within the contexts of greater or lesser urban intensity. Furthermore, it supports our criticism on the widespread use of the indicator for the proportion of people living in areas classified as urban, since both sub-regions present the same degree of urbanization, although with differing urban expressiveness, due to the historical trajectories of their constitution.

The definition and demarcation of this zoning adhered to three conditions. The first consisted of incorporating a river component into the two sub-regions, with the aim of expanding the temporal perception of the studied urban contexts, in view of the importance of rivers. The second, in respect of the main roadway axes, since they help to guide the flow of capital and people, by structuring the logic of municipal territories and internal circulation. The third was a question of abiding by the emancipation process of the municipalities while respecting their original features, in which the historical perspective of regional urbanization is valorized. This approach also enables the spatial correspondence to be maintained throughout the demographic censuses, which is fundamental for longitudinal analyzes.

The municipalities of Santarém, Belterra, Rurópolis and Placa[1] belong to the first sub-region analysis, called the BR-163 Zone. It is characterized by its long history of occupation, particularly connected to the trajectory of Santarém, which in 1828, was already an urban reference in the Amazon, during the period of the rubber cycle. In a strategic position between the Amazon and Tapajós rivers, and equidistant from the capital cities of Belém and Manaus, the municipality of Santarém is an important transition point in the flow of people and goods. The

1. And, more recently, the municipality of Mojuí dos Campos, emancipated from Santarém in 2013.

opening of the agricultural frontier in 1970 and the construction of the BR-163 Highway boosted its urbanization and as early as 1980, absorbed the majority of the population into the urban area. Over the next decade, Placa and Belterra became emancipated from Santarém.

The municipalities of Altamira, Brasil Novo, Medicilândia and Uruará belong to the second sub-region of analysis, called the BR-230 Zone. With a more recent dynamic, the region was formed from Altamira, a municipality, which was formally established on the banks of Xingu River in 1911, but which took on particular relevance after the agricultural border plans were implemented in 1970, when the Trans-Amazonian (BR-230) ground zero was established. From that moment onwards, the main transformations in the region may be observed, including deforestation in a fishbone pattern, resulting from spontaneous occupations or conducted by the State in the strips adjacent to the highway (BECKER, 2001). From the expanding villages and agri-villages, municipalities were established along the BR-230, and became emancipated during the 1980s and 1990s. Beginning in 2000, new, intense transformations occurred with the approval of the Belo Monte Hydroelectric license, something that triggered a new dynamism across the region (FEARNSIDE, 2015).

Method for defining the urban landscapes

To assess extended urbanization (Monte-Mór, 1994), defined by the emergence of new ruralities that are woven into the urban core in the configuration of a virtual fabric, urban landscapes were defined as an analytical unit, in reference to the operational landscapes, as presented by Brenner and Schmid (2015). Considering the challenges involved in theorizing and mapping new urban formations, this study has adopted the criterion of exposure to and absorption of the vectors of social and material morphology of urbanization. The urban landscapes, which represent the different ruralities along the spectrum of the urban fabric, were determined by the proximity to the urban nucleus and with normative issues of the territories, in order to incorporate the differentials that directly and indirectly condition the mobility of people and land uses.

As a result, six urban landscapes were determined: Urban Surroundings, Highways, Agricultural Unit, Environmental Unit and Other Urbanities, in addition to the Urban Nucleus[2]. This mosaic of occupation was constructed with the contri-

2. Although rivers still played an important role in the flow system of the Amazon, for technical reasons of analysis the river courses were not incorporated into the construction of the landscapes, since practically all their buffer zones in the study area would be superimposed on the axes of land regularization (Conservation Units, Agricultural Settlements and Indigenous Lands).

bution of geoprocessing techniques, the source of which was the Brazilian Institute of Geography and Statistics (IBGE) and the National Institute of Colonization and Agrarian Reform (Incra). The final configuration of urban landscapes determined as the analytical units of the study is presented in Figure 2.

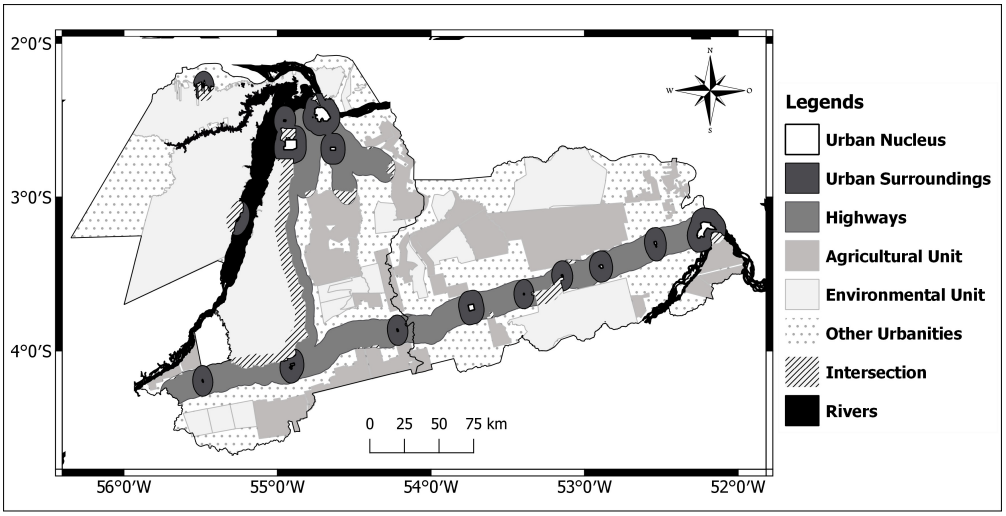

Figure 2. The spatial configuration of the urban landscapes in the study area.
Source: Produced by the authors.

The Urban Nucleus is the representation of the maximum agglomeration and refers to the urban pole in the rural-urban continuum. It is defined by administrative determination, according to the IBGE 2010 classification of the census sector situation (2010). The starting point for constructing the Urban Surroundings landscape was a buffer zone of 10 kilometers from the Urban Nucleus. The Highway landscape, in turn, considered an area of 10 kilometers surrounding both sides of the federal highways – the Trans-Amazonian (BR230) and the Cuiabá-Santarém (BR163) - and on the main state roads, discarding the effect of any other roads, so as to obtain a less-fragmented thematic map. The 10-kilometer buffer zone from the urban and from the highways was determined through a set of tests aimed at attenuating any loss of data and the explanatory capacity of the results by overlapping with other landscapes adopted in the study.

Land regularization areas were categorized according to the nature of their creation proposals. The Agricultural landscape included units that encourage land use and occupation - such as agricultural settlement projects. The Environmental landscape incorporated population containment units and land use restrictions - Conservation Units, Indigenous Lands, Sustainable Development Projects, and Agri-extractive Settlement Projects. The Other Urbanities landscape represent the areas not included in the other categories.

The process of constructing these layers generated the intersection areas. The predominance of the presence of the Urban Nucleus over the others was maintained. Other situations were discarded from the analysis in order to reduce the complexity of investigative elements – e.g., overlaps between the Highway surroundings and a Conservation Unit. The final delimitation of the study area followed the demarcation of these urban landscapes, in such a manner that, at several points, the administrative limit of the municipality was disregarded so as to fully incorporate a determined occupation area. Due to the vast extension of the municipality of Altamira, the spatial sample prioritized the northern portion, which actively participates in the dynamics of the BR-230 and the urban hierarchical network of the other municipalities.

Constructing the demographic indicators

Defining variables that are able to represent the spatiality of urbanization as a demographic phenomenon and the urban expressiveness that exists in urban landscapes evoke the challenge of discovering alternatives for the degree of urbanization indicator, or urbanization rate, which entails the percentage of the total population living in urban areas (SKELDON, 1990). Used in a conventional, monolithic manner, the degree of urbanization presents a number of theoretical and operational limitations: it disregards the diversity of occupations and territorialities (a simplified perception of the rural and antagonistic to the urban); it does not consider the history of the municipalities and their urban contexts (a linear perception of the urbanization process); it does not reflect the real social, spatial or even demographic appropriation of the urban (a one-dimensional perception of urbanization); it depends on legal definitions of political-administrative limits (a Cartesian perception of space) - criticism on the official criteria for defining urban in Brazil is not uncommon.

To apprehend the multidimensionality of the urban phenomenon, we set out to work with indicators that were more sensitive to urban-rural socio-spatial processes. As an alternative to the degree of urbanization, the indicators we used were the Gini coefficient and the sex ratio. The Gini coefficient may be applied to any distribution. We used this measure of inequality in order to indicate the tendency of population agglomeration or dispersion in the space under analysis. Expressed in percentages of numerical equivalence, it ranges from 0 to 1, whereby 0 corresponds to complete equality. The sex ratio, a measure of the population composition that expresses the number of males per hundred females, is applied herein to indicate the feminization process connected to urbanization and the masculine character of rural areas (CAMARANO; ABRAMOVAY, 1999; DINIZ, 2002).

For these analyzes, we used data from the universe of the 2010 Population Census organized in a regular grid with cells of 1 km² in rural areas and approximately 250 m² in urban areas (IBGE, 2016), processed in a Geographic Information System to extract information according to the sub-regions of the study area. The cells provide a better spatial resolution of the data and are more suitable for intra-municipal cross-sections and do not adhere to political-administrative limits (D'ANTONA; BUENO, 2016).

The discussion on this work is based on the results of the demographic indicators for each urban landscape and by each sub-region analyzed. Initially, we analyzed variations in population dispersion throughout the urban fabric, underpinning the discussion on differentials regarding the exposure and susceptibility of landscapes to absorbing urban morphological vectors. Following on, we investigate the differences between the two sub-regions of the study area to analyze how the composition of the population varies according to urban intensities. Finally, we converge the two discussions into a theoretical model on the mechanisms of extended urbanization in the Amazon.

Results and discussion

The urban fabric in rural areas: the results of variations in the index of population dispersion

The analysis on the population dispersion corroborated the initial assumption that urban morphological vectors are more present in certain rural areas and are seen to be less permeable in others. There is a scale of urban expressiveness in a gradient of territorialities for which the Urban Nucleus is the propagator. Panoramically, we observed that the search for spatial aggregation is a predominant behavior of the population, since all the rural units analyzed presented Gini coefficients of the total area greater than 0.9 (Table 1). These decisions are not fundamentally rational, but they express social relations and bonds in the forms of organizing society.

The only landscapes that are off-key with this profile are exactly the Urban Nuclei, with a Gini coefficient of 0.7. Within these units, the population occupies a proportionally larger area, ensuring a more uniform distribution. In other urban landscapes, the population tends to concentrate in certain regions, which ultimately generates extensive areas with population voids[3]. The land regularization landscapes, and, therefore, with targeted occupation, present the lowest percentages of

3. Empty spaces do not necessarily mean unused areas. An empty cell within a Conservation Unit may be a forest area for managing an extractive base, just as an empty cell along the Highways may be the pasturelands of a big land owner or the plot of a family farmer who resides elsewhere.

occupied area: 12.7% in the Agricultural landscape and 3.7% in the Environmental landscape.

Urban Landscapes	Area (Km²*)				Gini coefficient			
	Total		Occupied (%)		Total area		Occupied area	
	BR163 Zone	BR230 Zone	BR163 Zone	BR230 Zone	BR163 Zone	BR230 Zone	BR163 Zone	BR230 Zone
Urban	220	135	79,1	71,1	0,770	0,794	0,709	0,709
Urban Surroundings	2188	2069	34,4	33,6	0,908	0,890	0,733	0,673
Highway	5761	2897	24,7	29,0	0,915	0,887	0,657	0,612
Agricultural	6716	8133	11,3	14,1	0,947	0,924	0,531	0,461
Environmental	16743	6156	6,2	0,7	0,978	0,998	0,645	0,650
Other Urbanities	10505	10847	9,4	12,8	0,959	0,931	0,565	0,462

Table 1. Occupied area* and population dispersion indicators by urban landscapes in the analyzed sub-regions, 2010.

* Values estimated considering that each cell contains approximately 1 km².

Source: Statistical Grid for the Demographic Census 2010 (IBGE).

We confirm that the proportion of the area with no occupation is directly related to the dispersion indicator calculated for the total area - the lower the percentage of the area with population, the greater the Gini coefficient. On the other hand, the calculated indicator, based only on the occupied area, demonstrated more accentuated variations (Table 1). The situation becomes reversed in this approach to measurement and the Urban Nucleus suffers the lowest variation of the Gini coefficient, and begins to present the highest levels - as well as the Urban Surroundings landscape. The most homogeneous distribution in the occupied space occurs in the Agricultural landscape, reflecting the process of population allocation. Another urban landscape with a low coefficient was Other Urbanities, a region of spontaneous occupation supposedly without direct interference from vectors of spatial structuring of the population.

The results obtained for the Urban Nucleus are insufficient to fully understand its formation process. Taking into account the historical process of each sub-region, attention is drawn to the uniformity of the Gini coefficients for the area occupied in units recognized by the different urban intensities - despite the same degree of urbanization. We emphasize, therefore, that the spatial pattern of the population in strictly urban spaces does not depend on its history of consolidation, its demographic density or the volume of the urban population. Our hypothesis is that this behavior is universal in such spaces – i.e., all urban centers will have very close dispersion rates.

The results regarding the population dispersion in the rural spectrum of the urban fabric indicate a hierarchical susceptibility. The Urban Surroundings and the Highways landscapes, in that order, tend to converge towards the characteristics of the Urban Nucleus - high Gini coefficients in the occupied area and a lower proportion of empty areas. Thus, it may be stated that urban landscapes with spontaneous occupation and with the presence of flow structures and a population structure are the units in which the highest presence of urban morphological vectors may be confirmed. The areas of controlled occupation (Agricultural and Environmental landscapes) present the most rigid and least permeable structures, suffering less interference from urbanization - which somehow demonstrates the effectiveness of these policies in the process of controlling the use of space.

The propagation force of these vectors fluctuates according to the specificities of each unit of analysis. In the BR-163 Zone, with the oldest and most advanced urbanization, it may be observed that the extended urbanization is more intense. The Gini coefficients are higher in all Urban Landscapes when compared to that in the sub-region BR-230 Zone analysis - with the exception of the Environmental landscape, in which very similar levels are presented. The proportion of the occupied area, however, does not change according to the analyzed sub-region, but according to the landscapes – i.e., due to the exposure to urban vectors, and not due to their strength.

This situation reveals that the urban trajectory interferes with the distribution patterns of the rural population, without directly associating itself with the occupied area of the rural space - deconstructing the supposed relationship between urbanization and the spread of inhabited spaces. We have established as an explanatory assumption that, in the conformation of the urban fabric, there is a proliferation of rural micro-regions in the process of emerging urbanization, characterized by high migratory attractiveness. This inhibits the movement of population expansion, intensifies concentration and accentuates urban morphologies - in a cyclical and dynamic process. In order to confirm this evidence and assess whether the observed agglomeration trend represents an urbanization process, the composition of the population is taken into account.

Rural reconfiguration and urbanization: the composition of the population groups

The population dispersion analysis demonstrated that the manner in which the components of the Urban Nucleus act is to potentialize rural population agglomerations within a spatial hierarchical structure. The same comparative effect may be observed in the scale of the urban transition, whereby the more advanced it becomes, the greater the potential for concentration. From this perspective, the

socio-spatial significances of the patterns of population dispersion, derived from a combination of these two dimensions, remain as gaps. In order to verify the existence of extended urbanization, it is necessary to assess whether the trend of concentration, thus observed, also intensifies urban expressiveness.

The demographic indicator of the sex ratio enables the nature of the agglomerations to be observed, considering the tendency for the feminization of the urban spaces and for the masculinization of the rural spaces (CAMARANO; ABRAMOVAY, 1999; DINIZ, 2002). Figures 2 and 3 present the composition by sex of the two sub-regions based on the spatial analysis in the occupied areas of the Urban Landscapes. The results are organized in cumulative frequency graphs of the sex ratios.

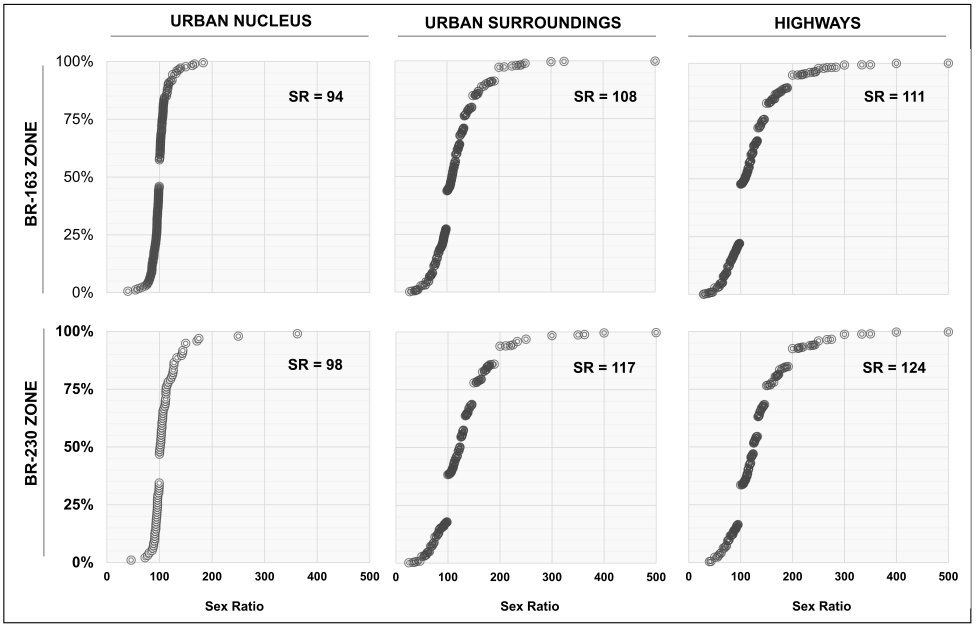

Figure 3. Total sex ratio and cumulative proportion* by analyzed sub-region in the Urban Landscapes: Urban Nucleus, Urban Surroundings and Highway.

* Cumulative proportion of the frequency of the sex ratios calculated for each cell of the regular grid, IBGE.

Source: Statistical Grid of the 2010 Demographic Census (IBGE). Produced by the authors.

In agreement with the literature, the Urban Nucleus is composed mostly of females. The graphs present a particular pattern, with levels oscillating very close to 100 - almost perpendicular to the ordinate (y) axis. In the BR-230 Zone, the added value of the ratio is very close to the total equilibrium between the groups. In the distribution, there is a predominance of males in 52% of the occupied area, and there is a majority of females in only 34% (Figure 3), which indicates an alignment with the characteristics expected in the rural environment and with an embryonic

urban transition. In contrast, the urban area of the BR-163 Zone confirms feminization, with a predominance of females in 46% of the area and of males in 42% (Figure 3), which is consistent with the advanced process of urban transition. This situation reinforces the limitation of synthetic indicators and proves the existence of a significant difference in the urban expressiveness of the two Urban Nuclei, even though the municipalities have an equal degree of urbanization and a total sex ratio value of below 100.

The sex ratios in the urban fabric exceed a value of 100 in all Urban Landscapes, but vary according to the urban intensities of the sub-regions and their contexts. Supported by the population dispersion, we observed that in spontaneously occupied rural areas, the process of population concentration conditions the inversion of the composition of these population groups - with a trend in the prevalence of females in relation to males. This transition denotes the existence of mechanisms of extended urbanization, in which propagation vectors of urban morphologies act in the formation of rural clusters characterized by the transformation of functionalities and also by the significances of rural spaces - new ruralities or urbanities.

In the Urban Surroundings landscape of the BR-163 Zone, 27% of the occupied area is composed mostly of females, compared to 19% in the BR-230 Zone. In the occupied area of the BR-163 Zone there is a majority of males in only 56%, a value that reaches 62% in the BR-230 Zone (Figure 3). The same is true in the Highway landscape, where there is a prevalence of females in 22% of the occupied area in the BR-163 Zone and in only 16% in the BR-230 Zone. There is a 52% predominance of males in the BR-163 Zone (a value which is below that observed in Urban Surroundings) and of 66% in the BR-230 Zone (Figure 3). While the rural area of the BR-163 Zone is occupied by population groups where females have a greater presence, as expected in urban spaces, in the BR-230 Zone the population groups are more characteristic of a rural description - with a profile similar to that obtained in the Agricultural landscape.

The Agricultural landscape, in turn, presents the highest value of the sex ratio - alongside the Other Urbanities landscape, thereby revealing its predominantly male character (Figure 4). The value in the BR-163 Zone is slightly lower, but the distribution is similar: on average, 60% of the occupied area is predominantly male and 22% female. In the Environmental landscape, there is a majority of females in 27% of the occupied area, whereas for males, this value is 59% (Figure 4). The existence of extreme values in the Agricultural landscape is justification for the difference in the added value of the sex ratio compared to the Environmental landscape, which, in turn, is consistent with the nature of these units. On the one hand, there are areas that encourage agricultural practices, traditionally linked to

males; and on the other, extractivism and the sustainable use of natural resources is promoted, which provide more attractive conditions for the permanence of females.

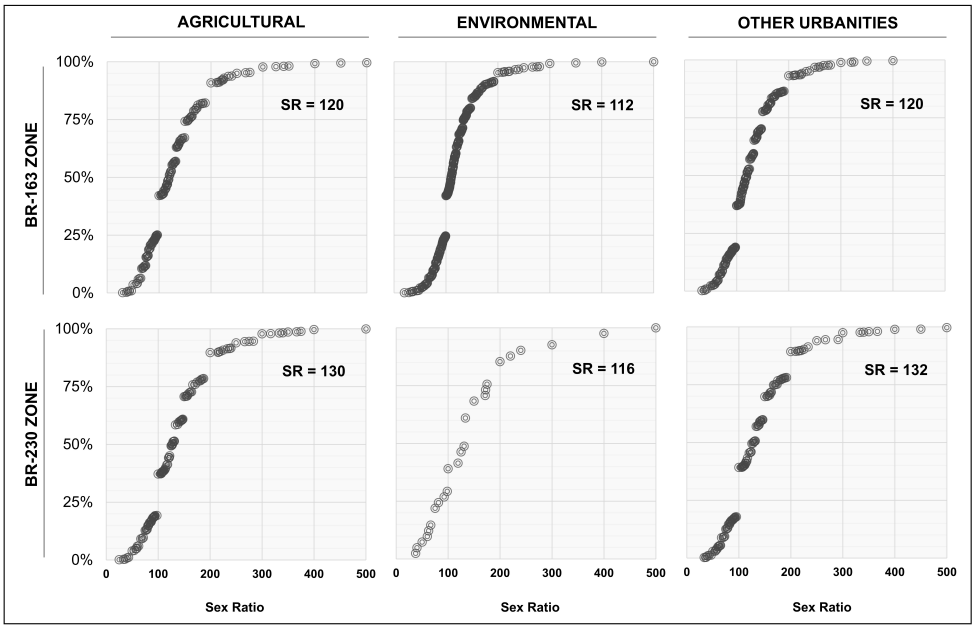

Figure 4. Total sex ratio and accumulated proportion* by analyzed sub-region in the Urban landscapes: Agricultural, Environmental and Other Urbanities.

* Cumulative proportion of the frequency of the sex ratios calculated for each cell of the regular grid, IBGE.

Source: Statistical Grid of the 2010 Demographic Census (IBGE). Produced by the authors.

Since the urban landscapes with planned occupation are less permeable to urban morphological vectors, they should also not be affected by the variation in urban intensity. This conjecture is confirmed, despite the subtle difference in patterns observed in the Agricultural landscape – presenting the most prominent female character in the BR-163 Zone. It is possible that these types of units are more sensitive to urban vectors than those belonging to the Environmental landscape. The answer to these queries requires studies that incorporate the differentials at the time of creating the units, the norms that dictate the endogenous processes and the definitions of the social and environmental functions of the land. In view of what we have presented, it is possible to perceive that the intervention of the urbanization is weaker (or non-existent) in these urban landscapes, which, for the purpose of this work, contributes to the perception that the regime of occupation

is the striking feature in the forms of disseminating urbanization and, on a second level, the distance from the urban nucleus.

The Other Urbanities landscape is marked by the presence of males, which is to be expected in rural areas (Figure 4). The compositions of the two analyzed sub-regions are almost equally distributed - on average, 18% with a prevalence of females and 62% of males. The weak interference of the urban vectors is also reflected in the inexistence of effects caused by changes in the urban intensity of the pole - as well as in areas of land regularization. This result is important because it highlights the fundamental role of the elements that shape the spatial structure of the population, responsible for physically enabling the population mobility flow.

The analyzes presented herein establish a relationship between population dispersion and changes in the gender composition of these groups. The trend of agglomeration is accompanied by the feminization of spaces in a process of reconfiguration of rural landscapes through extended urbanization. This dynamic, which occurs on a continuous plane of the urban fabric, builds a mosaic of landscapes with different intensities of urban expressiveness. We highlight three elements responsible for the spatial characterization of this regional landscape: the existence of an axis for structuring the population (which enables mobility), the occupation regime (which imposes rules of use) and the distance from the urban nucleus (which regulates the strength of morphological vectors) – determined in this hierarchical order.

Final considerations: a proposal for an extended urbanization model in the Amazon

This study has presented a methodological proposal that resumes the discussion on urbanization in the Amazon and indicates how the extended urban reverberates across rural landscapes. As this is an innovative proposal of analysis, there is room for questioning, expansion and improvement. Since this was a case study, the results reflect specific realities of the region, which signals the need for studies to consolidate a model that contemplates the diversity of urban configurations coexisting in the Amazonian regional context. The empirical broadening, whether due to the regional expansion of the study area or the incorporation of other case studies, enables, in addition to validating and making adjustments to the model, the conception of a perspective compatible with the contemporary complexity of the Brazilian Amazon.

For new incursions, we consider it relevant to rethink the treatment of the analytical units - in this case, urban landscapes. New developments may accrue by adopting other criteria in the differentiation of urbanities in the urban fabric.

Amongst them, the incorporation of waterways and other forms of spatial structuring of the population, ecological characteristics and land use and coverage. This process requires an expansion of the theoretical framework on the factors and mechanisms that influence the spatial distribution of the population in the Amazon. The joint effort contributes to the creation of new categories of landscape, such as other buffer zones, assists the strategies to deal with cases of multiple landscapes, with overlapping units, and, finally, helps to redimension some of the previously defined landscapes, such as redefining the radius size of the urban environment. Thus, we consider that improving the analytical unit potentializes the analytical capacity of the methodological design, as a result of adjusting the definition of urban landscapes and of the improved performance of the analyzes.

While we recognize that there are aspects that still need to be given some thought, we are sure that the proposal presented in the study is a promising starting point. We highlight two methodological strategies that were fundamental for the obtained result. The first is the use of regular and tiny scalar units (the grid cells), which do not depend on administrative limits, the best spatial resolution of which improves the analysis of the research object. The second is the use of an indicator that is more sensitive to the sociodemographic and spatial processes in question, which is essential for representing the diverse configurations of urbanization. Thus, we obtained a differentiation that may not be perceived conventionally with the use of indicators such as the degree of urbanization by administrative units. It was observed, therefore, how two sub-regions with similar degrees of urbanization are different.

The results obtained leave little doubt that there are landscapes directly affected by the urban pole, which, consequently, are more susceptible to variations in the strength of the morphological vectors of urbanization - according to the regional urban intensity into which they are inserted. These units have a regime of spontaneous occupation and structures for planning the population flow, as occurs in the region surrounding the urban environment and in the buffer zones of the highways. The reconfiguration of these rural landscapes is characterized by the tendency of population agglomeration (an increase of the Gini coefficient) and by the inversion of the population composition (a reduction of the sex ratio), intensifying the urban expressiveness itself in a system of complex interaction.

In the other analyzed urban landscapes, the morphological vectors revealed no noticeable transforming performance. In the Other Urbanities landscape, the absence of an axis of population structure cushions the means of propagating these vectors. On the land regularization landscapes, the normative structures filter the input of the vectors, whereby the endogenous dynamics of the units prevail,

which demonstrates the effectiveness of these policies in planning the population occupation. However, evidence of the extended urban area in such units is not to be discarded, although occurring slowly. In this case, the reconfiguration of the planned units is guided according to their specificities.

The regional urban intensity is guided by the reference Urban Nucleus of the urban fabric, which, in the case of the present study, is the municipal urban centers (and other areas classified as urban). The lower the urban intensity, the weaker the morphological vectors, thereby favoring greater openness for the reproduction of rural values (present in its remote origin and propagated in rural landscapes in the reverse direction), in a process that could be idealized as rural urban (urban ruralization) - against the conception of the rural-urban continuum, which only assumes the urban pole as a dissipator of values and practices. The greater the intensity and the stronger the urban vectors, the more accentuated the rural reconfiguration and the outreach of the urban fabric will be, in a mechanism that may be described as the urbanization of the rural. From this balance between the flow of values and space relationships, we conceived an idea of the dynamics of extended urbanization. Based on this dynamic, we have sketched out a representation of extended urbanization, presented in Figure 5, to express the scale of urban intensity and the strength of the propagation vectors of rural and urban morphologies on the landscapes that make up the urban fabric.

According to Figure 5, extended urbanization in the Amazon is a product of the strength of the urban and rural vectors in the axis of regional urban intensity and the hierarchy of landscapes to which they are exposed. The combination of these conditions reflects the degree of urban expressiveness in the mosaic of rural landscapes - urbanities. In view of a continuous spatial system in the formation of an urban fabric that is integrated with the rural environment, there should be an overlap of multiple microsystems as certain landscapes reach a degree of urbanity and begin to play the role of an urban reference node, constituting a complex multiscale model.

From an empirical perspective, we highlight the relevance of the population dispersion indicator in representing the degree of urban expressiveness of rural landscapes, even if it is limited in determining the expressiveness of the Urban Nucleus - perhaps due to the delimitation still based on political-administrative criteria. Presenting the same Gini coefficient (and degree of urbanization), but with different contexts of constitution, the regional urban intensity was assumed through an historical approach and only observed in the analysis of population composition (sex ratio). A gap remains regarding the differentiation of these urban centers in order to clarify the formation of reference nodes and the changes in

their forms of distribution, composition and occupation of space. This is a fundamental understanding so as to reflect on the analytical structures related to the way in which urban landscapes are defined. Thus, the strategy for improving the model begins with an understanding of this constructive process in urban centers, seeking regional expansion for a description consistent with the diversity of the Amazonian framework.

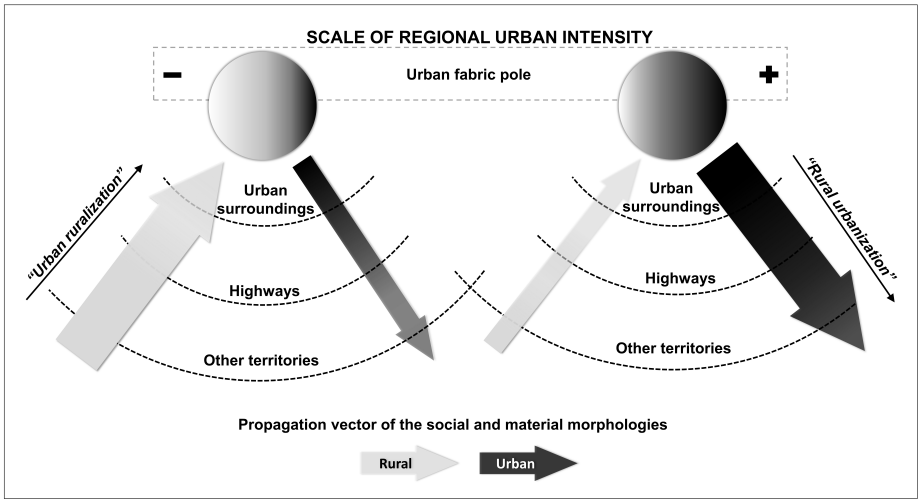

Figure 5. Representation of the extended urbanization in the Amazon.

*The arrows represent the vectors of material and social morphologies propagated in rural and urban spaces, characterized by their strength (the width of the arrow) and reach (color gradient). These two attributes vary according to the regional urban intensity, defined by the urban expressiveness of the reference pole (municipal urban centers). These mechanisms allow us to observe the process of extended urbanization, which constitutes the urban fabric in the spatial plan that encompasses the urban pole and its area of morphological coverage.

Source: Produced by the authors..

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