ARTICLES
ENVIRONMENT, GOVERNANCE AND DEVELOPMENT

THE AMAZON URBAN WEFT: A METHODOLOGICAL PROPOSAL FOR RECOGNIZING A TERRITORY OF POSSIBILITIES

Renata Maciel Ribeiro[*]
Amanda Estefânia De Melo Ferreira[**]
Ana Cláudia Duarte Cardoso[***]
Antônio Miguel Vieira Monteiro[****]
Ana Paula Dal'Asta[****]
Monique Bruna Silva Carmo[****]
Silvana Amaral[****]

[*]Instituto Nacional de Pesquisas Espaciais, Divisão de Impactos, Adaptação e Vulnerabilidades, São José dos Campos, SP, Brazil
[**]Universidade Federal do Oeste do Pará, Instituto de Formação Interdisciplinar e Intercultural, Santarém, PA, Brazil
[***]Universidade Federal do Pará, Faculdade de Arquitetura e Urbanismo, Belém, PA, Brazil
[****]Instituto Nacional de Pesquisas Espaciais, Divisão de Observação da Terra e Geoinformática, São José dos Campos, SP, Brazil

Abstract

In the Amazon, urbanized areas, stretching beyond the cities, constitute a complex urban network, with exchanges of economic and sociocultural capital, mediated by the management of socio-biodiversity. Despite holding the potential for an open future, this territory is generally rendered invisible by the instruments and methods used to understand and represent urbanization in the Amazon. Based on a reinterpretation and analysis of the original classes of the situations of the census tracts, combined with environmental data, this article proposes a methodological alternative that seeks to represent the complex and extensive Amazonian urban weft, considering the state of Pará as the spatial focus and three of the state's distinct integration regions as the study area. The results have demonstrated that the proposed methodology was able to spatially delineate this weft – much larger than the municipal seats – and highlight areas where the urbanization-nature relationship is still preserved and has more chances to evolve.

Keywords

Urbanization in the Amazon; the Pará Amazon; Urban Weft; Urban Gradient; Urban Sustainability in the Amazon.

A TRAMA URBANA AMAZÔNICA: PROPOSTA METODOLÓGICA PARA RECONHECIMENTO DE UM TERRITÓRIO DE POSSIBILIDADES

Renata Maciel Ribeiro[*]
Amanda Estefânia De Melo Ferreira[**]
Ana Cláudia Duarte Cardoso[***]
Antônio Miguel Vieira Monteiro[****]
Ana Paula Dal'Asta[****]
Monique Bruna Silva Carmo[****]
Silvana Amaral[****]

[*]Instituto Nacional de Pesquisas Espaciais, Divisão de Impactos, Adaptação e Vulnerabilidades, São José dos Campos, SP, Brasil
[**]Universidade Federal do Oeste do Pará, Instituto de Formação Interdisciplinar e Intercultural, Santarém, PA, Brasil
[***]Universidade Federal do Pará, Faculdade de Arquitetura e Urbanismo, Belém, PA, Brasil
[****]Instituto Nacional de Pesquisas Espaciais, Divisão de Observação da Terra e Geoinformática, São José dos Campos, SP, Brasil

Resumo

Na Amazônia, as áreas urbanizadas, para além das cidades, constituem uma rede urbana complexa, com trocas de capital econômico e sociocultural, mediada pelo manejo da sociobiodiversidade. Apesar de portador de possibilidades para um futuro em aberto, esse território é geralmente invisibilizado pelos instrumentos e métodos utilizados para apreender e representar a urbanização na Amazônia. Este artigo propõe uma alternativa metodológica que, baseada na reinterpretação e na análise das classes originais de situação dos setores censitários, associada a dados ambientais, busca representar a complexa e extensa trama urbana amazônica, considerando o Pará como recorte espacial e três distintas regiões de integração do estado como área de estudo. Os resultados demonstraram que a metodologia proposta foi capaz de delimitar espacialmente essa trama – muito maior do que as sedes municipais – e destacar áreas onde a relação urbanização-natureza ainda se preserva e tem mais chances de evoluir.

Palavras-chave

Urbanização na Amazônia; Amazônia Paraense; Trama Urbana; Gradiente Urbano; Sustentabilidade Urbana na Amazônia.

THE AMAZON URBAN WEFT: A METHODOLOGICAL PROPOSAL FOR RECOGNIZING A TERRITORY OF POSSIBILITIES[1]

Renata Maciel Ribeiro
Amanda Estefânia De Melo Ferreira
Ana Cláudia Duarte Cardoso
Antônio Miguel Vieira Monteiro
Ana Paula Dal'Asta
Monique Bruna Silva Carmo
Silvana Amaral

Introduction

Global contemporary urbanization, driven by the dynamics and demands of industrial capital, within its evolution and materiality, fosters an ongoing process of disconnection with the cycles of nature, gradually reshaping the relationships between people and their living spaces. In Europe, the proposal to create green belts around the peripheral areas of cities gained prominence during the twentieth century as a strategy to preserve nature within the context of industrial urbanization (Amati, 2016). However, space, as a historical-geographic, social and political product (Lefebvre, 2008 [1976]), demands that the possibilities of understanding it become expanded, breaking with commonplace dichotomies, objectivity and spatial neutrality. This broader, yet simultaneously particularized, perspective enables other narratives to be identified – specifically in the present study, the Amazonians, which, despite being historically rendered invisible, have resisted, and in the (re)production of urban space, have manifested their compatibility with the (re)production of their very existence in a forest biome and with the possibilities of a future that is contested, although still open.

1. The first author of this study is a mixed-race woman from Southeast Brazil. Based on the recognition of this social and territorial identity, it is essential to highlight that the construction of the narrative and the discussions proposed herein have prioritized dialogue with both male and female Amazonian authors. Moreover, the work has been carefully designed so as to emphasize the importance of inclusive communication, therefore, it is sensitive to the inclusion of neutral language and uses a color palette suitable for people with impaired color vision (daltonism). This initiative is a small effort to recognize silences and the need to adapt scientific language so as to foster a more equitable and inclusive scientific discourse.

Driven by the goal of homogenizing behavioral patterns, for the Amazon, the political-economic-spatial process that reshapes the contemporary urban space and extends capitalist-industrial relations beyond urban centrality, Monte-Mór (1994, p. 1), based on Lefebvre (1999 [1970]) has termed *extended urbanization*. This process produces a context of conflicts and disputes and takes place in a disruptive urban space, lacking infrastructure, with poor environmental quality and unable to provide quality of life for the regional population (Ferreira, 2019). In industrial urbanity (Lefebvre, *ibid.*), the regional space is integrated into the logic of industrial consumption – of resources and space. Thus, the urban fabric, which spreads across the territory, transforms behavioral patterns, including those of what was previously understood as rural, with a way of life and productive activities traditionally linked to the peasantry, which now incorporates, as an end and a means, industry and highways. In this context, the opposition between urban and rural, whether in concrete space or in the space of representation, dissolves, and its interpretation becomes imprecise, thereby creating simultaneities, with their encounters and oppositions (*id., ibid.*), which create new typologies and, also, the demand for specific and original theoretical-methodological treatments.

In this conflictual context of hegemonic domination, Monte-Mór (1994, p. 8) emphasized the need for *extended urbanization* to correspond to *extended naturalization*. Although still embryonic, this concept-idea highlights the importance of recognizing the existence of alternative paths that, despite being often made invisible, reveal, in the present, records of the past urban, with its complexity and possibilities for the coexistence of people – and their institutions – with nature. In the same vein, Cardoso (2021a; 2021b) and Fernandes *et al.* (2023) discuss the need to understand, valorize, and regain the natural urban, highlighting its presence and materiality in what, according to Fernandes *et al.* (*ibid.*, p. 5), consists of the *natural-historical urban*, present in urban territorial systems which, as heirs to the traditional ways of life of the Amazon, are organized and articulated according to the dynamics of the biome, establishing spatial arrangements that stand outside the dichotomous definitions of urban and rural.

According to Gomes *et al.* (2017), Cardoso (2021a; 2021b), Vicente (2022), and Cardoso and Cardoso (2022), these territorial systems may be observed in the Amazonian peri-urban area – this peripheral space, as yet not fully assimilated by the industrial urban, constitutes itself as a hybrid territory that exposes a real possibility of coexistence with the forest. Intensely inhabited by indigenous peoples, quilombolas, and native peasants, the *extended peri-urban*, according to Cardoso (2021b, p. 36), is configured as a vector of the resistance and re-existence (Porto-Gonçalves, 2005) of the *natural-historical urban*, occurring spatially as a result

of articulations between villages, settlements, and communities around cities, which establish an intense network of exchanges, mediated by the development of production chains based on the biome. These territorial arrangements represent a territory of coexistence between the industrial urban and the *natural-historical urban* and prompt us to necessarily question the long-held doubts regarding the supposed incompatibility between urbanization and nature, or, even, regarding the permanence and potential of *extended naturalization* in the contemporary Amazon.

Importantly, even though they stand as vectors of resistance, simultaneous processes of peripheralization (Nakano, 2011; Miranda; Moraes, 2011) act on these territories. The first is revealed around and beyond cities, where the *extended peri-urban* continues in dispute. The other, slightly broader in scope, reflects the general context of the municipalities in this region. Their urban centers, the core of urbanization, exemplify an incomplete urbanization process (Santos, 2009) driven by economic interests and directed toward global demands, recognized by Nakano (*ibid.*) and Miranda and Moraes (*ibid.*) as *peri-urban* municipalities, which, according to Becker (2013, p. 12), manifest the territorial, political, and economic expressions of an *urban frontier*. Both processes are marked by inequality and the predatory action of capital, which, in addition to exclusion and precariousness, cause the destruction of ecosystems and biodiversity (Nakano, *ibid.*). In the context of a globalized economy, the economic dynamics of the peri-urban – territorial or political-economic – have little adherence. However, this does not signify that it is without its own dynamics (*id., ibid.*). In the Amazon, this dynamic, based on endogeneity and the product chains of sociobiodiversity, presents high permeability and is hugely influenced by regional markets (Costa, 2019; Costa *et al.*, 2021; 2022; Silva, 2017; Silva *et al.*, 2022), in which the peri-urban areas act as a support base and mediator for the relationship between the economy and nature (Cardoso, 2021a; 2021b). This socio-territorial context underscores the need to recognize the strategic role of the peri-urban in shaping new meanings for the Amazonian urban reality, compelling us to develop new policies prioritizing both regional socioeconomic development and ecological balance.

Among the technical-scientific-institutional initiatives for identifying the urban complexity and diversity in Brazil, the Brazilian Institute of Geography and Statistics (IBGE) recently (2023) launched a methodological proposal to categorize the situations of the census tracts, seeking to reflect the evolving understanding of urban and rural spaces. It emphasizes the need for sensitive sociospatial readings that are able to capture the heterogeneity of contemporary territorial arrangements (IBGE, 2023b). In addition to proposing new urban and rural categories, this

innovative approach recognizes natural spaces as a distinct category, with the aim of highlighting preserved areas and the potential to inform public territorial management policies. In order to develop a robust typology, which is capable of distinguishing between categories, their intermediate subtypes, and provide an understanding of the different levels of human action in transforming the landscape, it was necessary to carry out a joint analysis of several variables that could provide information on population density, landscape characteristics and labor occupation. The resulting cartographies represent a significant theoretical and methodological advancement in understanding urban and rural landscapes in Brazil. They also highlight a growing interest, both scientific and institutional, in recognizing urban space as a *continuum*, based on theoretical-conceptual improvement and the evolution of analysis techniques.

Aiming to contribute to and advance this construction, with the support of formal representational elements, this article seeks to explore a methodological alternative that enables the instrumentalization of recognizing a space that has been only partially transformed, is hybrid and full of possibilities. In order to provide inter-census analysis, the work is based on the eight existing IBGE urban and rural categories and, initially, provides for the construction of an urban gradient that is able to analyze the trajectories of human settlements and the representation of the *sociospatial dimension* of a complex, extensive *urban weft*. From another standpoint, considering urbanization as a process that emerges and flourishes within the forest, with rivers acting as a central element in the formation of many cities, the recognition of this *urban weft* takes on a second dimension as its backcloth: the *dimension of nature*, represented by the presence of forest and rivers in the classes associated with the urban gradient, predefined and spatially recognized. Lastly, to complement the data and map analyses, a discussion on the results is woven together with information gathered during field expeditions. Thus, different languages and scales of observation complement the discussions on the proposed cartographies.

It is hoped that an integrated analysis of the sociospatial and environmental data associated with the field perceptions will contribute to the collective effort of deconstructing the ambiguous and contradictory understanding of the urban-rural relationship, still maintained in master plans, and which favors land use conversion and the destructuring of the native spatial arrangement. Thus, the *extended peri-urban* is considered an important record for recognizing and qualifying the *urban weft* – the urban space of interweaving temporalities and the material representation of the simultaneous processes of *extended urbanization* and *extended naturalization* in the context of the contemporary Amazon.

Thus, this *weft* emerges in a conceptual amalgam with the *weft* of the peoples of the forest (Cardoso, 2021a), which refers to the *extended peri-urban* (Cardoso, 2021b, p. 36). This reinforces the existence of a *weft* formed around cities constituted by communities and their areas of influence, perceived as a *territory of possibilities* for the permanence, in the sense of something that exists and resists over time, and the reproduction of the *natural-historical urban.* In the proposed adaptation, the *urban weft* is based on another territorial unit, the census tracts, and also considers the urban core, the cities, as a reference of the transformed space, the logistical, political and economic center of *extended urbanization*.

In conclusion, it is anticipated that this research may yield elements and discussions that will aid in formulating an answer to the following question: How can we identify spaces within the *urban weft* where the *natural-historical urban* has the greatest potential for preservation and evolution? Starting from a guiding thread woven through various scientific and institutional studies and collective efforts, by understanding "what it is" and "how" the urbanization process must be conducted in a context of sociobiodiversity, this study seeks to contribute to this discussion by providing a sociospatial representation for the Amazonian *urban weft* in the state of Pará. By proposing a methodology that broadens the formal, hegemonic view of space, it aims to bring visibility to the *extended peri-urban* and, thus, underscore the importance of studying Amazonian urbanization through approaches that are capable of detecting, without hierarchizing, the different trajectories at play.

1. Study area

The Amazon embodies immense diversity, and urbanization in this territory should be based on recognizing its pluralities. Within this context of a richly diverse territory, subject to intense and recurring pressures of colonization, the state of Pará stands out due to, among other factors, its dynamic demographic landscape. Between 2000 and 2022, the population of Pará grew at an average annual rate of 1.41%, while in Brazil as a whole, during the same period, this growth was 0.89% (IBGE, 2000a; 2023a). This rapid population growth was also reflected in urban areas, with a 41.3% increase in the urban population between 2000 (4,116,378 inhabitants) and 2022 (5,891,320 inhabitants)[2]. A leap in density that, while it replicates the national pattern, on other scales, it reveals its peculiarities.

2. Total population in urban sectors (situations 1, 2, and 3) in the mesh of the preliminary results of the 2022 Demographic Census (IBGE, 2024).

The state of Pará presents a complex economy, with economic activities ranging from the service sector to extractivism, mining and timber, and agriculture, with a focus on the expansion of soybean monoculture in the northeastern, southern and western regions of the state (Fapespa, 2016; 2023; Barros *et al.*, 2020). The evolution of this agro-industrial production model has occurred in a disarticulated manner and, in most cases, at the expense of preserving nature. Deforestation rates in the state rank first in the Legal Amazon, reaching accumulated deforestation rates of 166,000 km² in 2022 (approximately 14% of the state's total area) (National Institute for Space Research – INPE, 2023). On the other hand, Pará is the state with the second largest number of conservation units in the region (67) (ISA, 2023), which indicates its capacity to form a nature-based economy (Costa, 2012; Silva, 2017; Silva *et al.*, 2022), thereby guiding the focus toward the possibilities of transforming the economic bases and the hegemony of sociobiodiversity-based matrices.

The second largest state in Brazil in area, with 1,245,870 km², Pará is also outstanding for its socioeconomic and spatial heterogeneity, presenting both dynamic and stagnant regions within a reality of broad inter- and intra-municipal differences. With the aim of promoting regional development and economic, social, and cultural integration, Pará was divided into integration regions. Marked by particularities, they represent groupings of municipalities with similarities in the historical process of occupation, spatial repertoires, socioeconomic characteristics, and geographical proximity, and play a fundamental role in configuring scenarios for territorial planning purposes. On the other hand, the limitations of the scale, which hide the complexity of the relationships that occur in the territory and reveal the diversity in the ways of living, being, and existing in the Amazon, must also be recognized. That said, in addition to the general analysis focused on the state of Pará, three integration regions (IRs) with similar historical-geographical contexts and distinct trajectories of urban consolidation were selected for a detailed analysis of the results, to assist in the process of capturing inter-regional particularities (Figure 1). These are:

(i) Baixo Amazonas [Lower Amazon] Integration Region: Composed of thirteen municipalities (Alenquer, Almeirim, Belterra, Curuá, Faro, Juruti, Mojuí dos Campos, Monte Alegre, Óbidos, Oriximiná, Prainha, Santarém, and Terra Santa) and with a total population of 785,818 (IBGE, 2023a), this IR covers 315,853 km² of territorial extension and an urban area that occupies around 0.1% of the territory (IBGE, 2021). Located in the northwestern portion of the state, the region is bathed by the Amazon and Tapajós rivers and intersected by three major highways, particularly the BR-163 (Cuiabá-Santarém). The region has been occupied for centuries, in most municipalities since the seventeenth century, with human

settlements that emerged and developed in historically occupied indigenous sites, along the banks of rivers (Pará, 2021). Among the municipalities in the region, Santarém, today and during the large and small cycles of resource exploration, stands out as a logistical hub for the circulation of people and goods. Currently, the region's productive structure is under pressure and increasingly dependent on the growing implementation of mining projects and the expansion of agribusiness (Côrtes; D'Antona, 2012; Sauer, 2018).

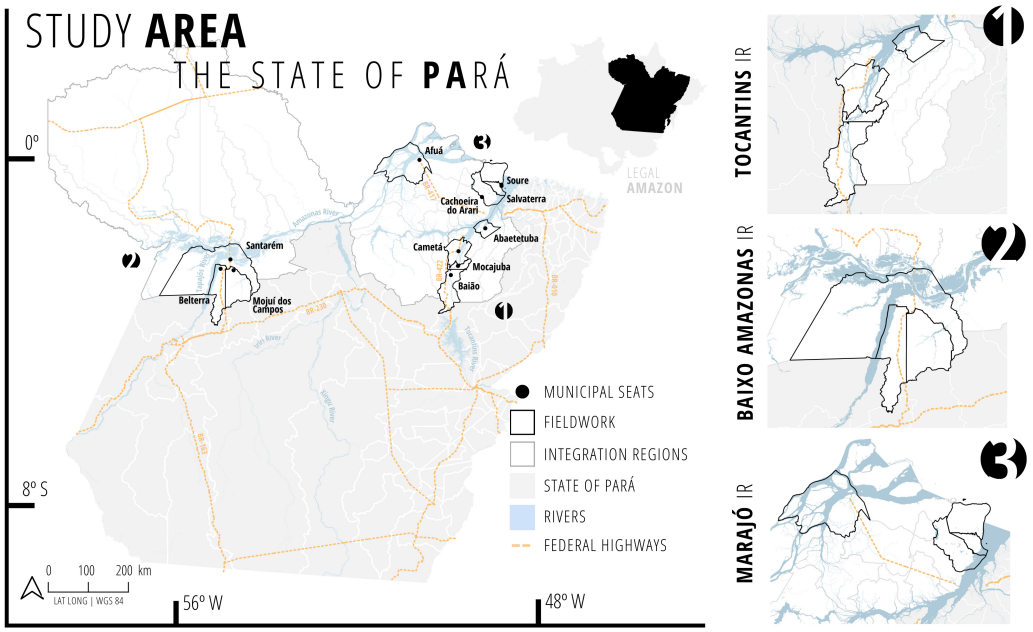


Figure 1. Study Area

(ii) Marajó Integration Region: Composed of sixteen municipalities (Afuá, Anajás, Bagre, Breves, Cachoeira do Arari, Chaves, Curralinho, Gurupá, Melgaço, Muaná, Oeiras do Pará, Ponta de Pedras, Portel, Salvaterra, Santa Cruz do Arari, São Sebastião da Boa Vista e Soure) and with a total population of 593,822 (IBGE, 2023a), this IR covers 106,661 km² of territorial extension and an urban area that occupies around 0.1% of the territory (IBGE, 2021). This region is the meeting point for the waters of two large hydrographic basins: the Amazon and the Tocantins-Araguaia Rivers, which flow into the Atlantic Ocean and form a region full of small islands. Thus, they configure a territory with a particular landscape and complex ethnic composition, resulting from an occupation process that has been transformed according to the influence of different cultures over time. Despite its historical-geographical complexity and indigenous resistance, the "labyrinth of rivers" has also been affected by the colonial domination process, marked by

cultural delegitimization, the illusion of dominion over nature, land expropriation, subjugation, and violence (Dias, 2016). In addition to the economic activities that shaped the overall land use patterns across the Amazon, water buffalo herds were introduced to the Marajó Island at the end of the nineteenth century, and currently represents one of the main sources of income for some of the region's municipalities, such as Soure, Ponta de Pedras, and Cachoeira do Arari (Costa *et al.*, 2012). Timber extraction, fishing, and açaí, cassava, and palm heart management are also significant economic activities in Marajó (Gonçalves *et al.*, 2016; Costa *et al.*, *ibid.*), in addition to rice cultivation, which positions the region as the state's largest producer (Fapespa, 2023). However, this also coincides with certain challenges such as agrarian conflicts and negative impacts on both health and the environment due to the overuse of pesticides (Nazaré *et al.*, 2022). Established in floodplain areas or flooded fields, the Marajó IR is primarily composed of small towns with less than 21,000 inhabitants. The unique characteristics of these settlements foster urban spaces intricately linked to the surrounding landscape (Costa *et al.*, 2023).

(iii) Tocantins Integration Region: Composed of ten municipalities (Abaetetuba, Acará, Baião, Barcarena, Cametá, Igarapé-Miri, Limoeiro do Ajuru, Mocajuba, Moju and Tailândia) and with a total population of 805,178 (IBGE, 2023a), this IR covers 31,988 km² of territorial extension and an urban area that occupies about 1.2% of the territory (IBGE, 2021). Located in Northeastern Pará, the state's oldest colonization frontier (Cordeiro; Arbage; Schwartz, 2017), the region is bathed by the Tocantins River and crossed by the PA-150 roadway (Goianésia do Pará-Marabá). Rivers have played a central role in shaping the history of all the municipalities, except Tailândia. These rivers have provided both floodplain and terra firma areas, which have been instrumental in the development of these locations (Bastos *et al.*; 2010; Piraux; Soares; Simões, 2017). This sociospatial configuration has directly influenced the development and evolution of human settlements and their productive activities. Extractivism, small-scale agriculture, and agroforestry systems are the predominant land uses that reflect this influence (Souza *et al.*, 2021). Currently, the Tocantins IR, similar to other regions, exhibits complex territorial dynamics, which form a sociospatial mosaic resulting from different conflicting rationalities: one associated with the riverine logic, which embodies a strong connection between the population and nature, and another linked to immigrants, which emerged after the construction of the highway, associated with projects of agricultural expansion and timber extraction (Bastos *et al.*, *ibid.*).

The results of this step are also discussed based on observational data collected during fieldwork carried out by the authors and collaborators from the Laboratório de investigação em Sistemas Socioambientais [Laboratory for

Research on Socioenvironmental Systems] (LiSS), at INPE, and the Laboratório de Estudo de Cidades da Universidade do Vale do Paraíba [Laboratory for Urban Studies at the University of the Paraíba Valley] (UNIVAP) in 2022 and 2023. Among the three regions visited, eleven municipalities were chosen for the collection of field information: (i) in the Tocantins IR, the municipalities of Abaetetuba, Baião, Cametá, and Mocajuba; (ii) in the Baixo Amazonas IR, the municipalities that make up the Santarém Metropolitan Region[3], Belterra, Mojuí dos Campos, and Santarém; and (iii) in the Marajó IR, the municipalities of Afuá, Cachoeira do Arari, Salvaterra, and Soure (Figure 1). The choice of these regions and municipalities is justified by the availability of time-series socioeconomic and spatial data accumulated over years of fieldwork by researchers, scholarship holders, and post-graduate students linked to LiSS research projects (Escada *et al.*, 2009; 2013; 2017; Dal'Asta *et al.*, 2011; 2014; 2016; Amaral *et al.*, 2012; Affonso *et al.*, 2016; 2016; Souza *et al.*, 2021).

2. Methodology

2.1 Socioespatial dimension

Defining the urban gradient is based on the interpretation, compatibility, and regrouping of the official IBGE classes of situations of the census tracts (IBGE, 2000b; 2010; 2021). Traditionally divided into eight classes, urban and rural, in 2021, these situations underwent a conceptual and methodological review in order to establish more precise names and definitions. The interpretation and regrouping for constructing the urban gradient were grounded in the definitions and scope of the original classes. The objective was to broaden their overall understanding, encompassing the urban form that emerges and becomes established on diverse territories, in a forest biome, revealed within unnamed or unrecognized sociospatial repertoires. Table 1 presents an overall conceptual definition of each situation, with its respective changes over time (2000, 2010, and 2021). Based on the official definition, it was possible to propose a regrouping in order to help define the urban gradient. This included the urban, representing the consolidation process of the industrial urban across the territory, and three additional intermediate classes, serving as a formal representation of the multiple narratives and trajectories that describe the Amazonian peri-urban, the space bearer of possibilities, not yet completely transformed and/or subjected to the logic of capitalist occupation and

3. Created by State Complementary Law No. 79 (Pará, 2012). PARÁ. Complementary Law No. 079, of January 17, 2012, creates the Santarém Metropolitan Region based on § 2º of art. 50 of the State Constitution and gives other provisions. Diário Oficial do Estado do Pará [Official Gazette for the State of Pará]: Belém, Jan 18, 2012.

transformation. Subsequently, based on the theoretical-conceptual path drawn up by Cardoso (2021b) and the definitions of the IBGE situations (Table 1), the classes of the urban gradient were then conceptually defined as follows.

		SITUATION	DESCRIPTION
URB URBAN	1	**Urban area with high building density [2]**	An area legally defined as urban and characterized by a high housing density, subdivisions, buildings, streets, intense human occupation and transformations resulting from urban development; *and those designated for urban expansion[1].*
	3	**Urban center[2]** (Isolated urban area and Rural agglomeration from an urban extension)	An area defined and named by municipal law, and separated from the municipal or district seats by a rural area or other legal limit; and settlements located in an area outside the urban perimeter, but developed through the expansion of a city or town. *Such settlements may be made up of already inhabited subdivisions, housing complexes, agglomerations of so-called subnormal housing or centers developed around industrial, commercial or service establishments[1].*
PERI 1 PERI-URBAN 1	2	**Urban area with low building density[2]**	An area legally defined as urban, but characterized by predominantly rural occupation, presenting a large area of land with low housing and construction density, *such as urban expansion processes, deactivated green areas, etc[2].*
PERI 2 PERI-URBAN 2	5	Rural agglomeration **Village**	This is an isolated rural agglomeration with no private or business character, i.e., it is not linked to one single land owner (agricultural company, industry, mill/powerplant, agricultural establishments, etc.) in which residents carry out primary economic activities (extractivism and agriculture) and tertiary (equipment and services) or even secondary (industry) economic activities, either inside or outside the agglomeration.
	7	Rural agglomeration **Settlement[2]**	This is an isolated rural agglomeration that, either in whole or part, has no urban services or equipment that would define it as a village, and which is also not linked to a single owner.
PERI 3 PERI-URBAN 3	6	Rural agglomeration **Center**	This is an isolated agglomeration linked to a single land owner, with or without the services or equipment that would define it as a village, and has a private or business character as a defining characteristic.
	8	**Rural area[2]**	An area outside the urban perimeter, exclusively in areas of rural agglomeration, *characterized by the dispersion of households and agricultural establishments[2].*

(1) altered or included in 2010; (2) altered or included in 2021.

Table 1. Proposal for regrouping the classes to compose the urban gradient based on the official definitions of the census tract class situations
Source: IBGE (2000b; 2010; 2021). Software: Qgis.

i. urban, represents a more advanced urbanization process, characterized by a clear delimitation of the built-up area and the provision of infrastructure and services; with a low possibility of land management from the perspective of – and for – a sociobiodiversity economy;
ii. peri-urban 1, represents a poorly consolidated urbanization process, i.e., with a low construction and housing density; characterized by serving as an area for real estate speculation and urban expansion;
iii. peri-urban 2, represents a poorly consolidated urbanization process, with low construction and housing density and the possibility of a simultaneous reproduction of living and production territories;

iv. peri-urban 3, represents an incipient urbanization process, where, as a priority, there are no human settlements and/or has a private or business character (associated with a single owner). Open areas and natural vegetation predominate.

Building on a formal geospatial representation base, the defined classes were reinterpreted in order to compose an urban gradient, which seeks to enhance its capacity for a sociospatial understanding and indicate the potentials for recognizing the *extended peri-urban*. Once established, the general definitions of the gradient classes are used to regroup the original IBGE class situations (Table 1), which facilitates the interpretation and final classification of the urban gradient.

2.1.1 Trajectory analysis

The following step involves attributing the census meshes and their associated information to a standardized 1 km² spatial cell, based on the tracts with situations that indicate nuclei of occupancy (situations 1, 2, 3 (4), 5, 6 and 7). The grid size selection reflects the average area (1.36 km²) of urban tracts (situations 1, 2 and 3) in the 2021 census mesh. The grid cell was created based on the sectors of interest in 2000, 2010 and 2021, merged to form a single base. Delimiting the *urban weft* is based on tracts with nuclei of occupancy, since there is a concentration of the population in these areas. However, it is understood that it is also necessary to capture the dynamics of the surroundings, generally consisting of vegetation and productive areas, and forming connecting corridors between the different locations. With this in mind, on the merged base, a 5 km buffer zone was established, which, according to Cardoso (2021b), represents the average area of influence and interaction between the human settlements. This constitutes a methodological strategy for composing a sociospatial continuum that considers different types and intensities of uses within the composition of the *urban weft*.

Because it is a region with small areas of human settlements, tracts with nuclei of occupancy replicate this pattern and are often smaller than the size of a grid cell (1 km²). In view of this, the class situation was aggregated in the cellular grid using the operator of the "class with the greatest intersection area " in two stages: (i) from the original databases with all sectors; and (ii) from the databases containing only the sectors in situations that indicate nuclei of occupancy. Thus, the effect of the operator that privileges sectors with larger areas can be corrected by the second operation, so as to avoid invisibility in the process of changing the unit of analysis.

The situation attributed to each cell in the three census periods (2000, 2010 and 2021) considered in this study was assessed in an integrated, non-comparative manner. Thus, the incompatibilities arising from the evolution of data collection and production techniques are reduced, while the temporal dimension is simultaneously inserted into observing the changes in the situation over time. Depending on the stability (with no transition) and the transitions in the trajectories, as well as the initial, final and recurring situation, each cell was then identified as belonging to either the *urban*, *peri-urban 1*, *peri-urban 2* or *peri-urban 3* class (Table 2), in view of the regrouping of the previously defined situations (Table 1). Therefore, the classification of the urban gradient integrates the definitions of the class situations established by the IBGE (Table 1), with their temporal evolution, into a continuous spatial representation which, although associated with the census limits, is independent of their historical differences.

	TRAJECTORY ANALYSIS
URB **URB**AN	Trajectories with no transition from situations **1** and **3**; or for which at least two years have been situations 1, 2 or 3, whereby the last year was situation 1 or 3.
PERI 1 **PERI**-URBAN **1**	Trajectories with no transition from situation **2**; or for which at least two years have been situations 1, 2 or 3, whereby the last year was situation 2; or for which two years have been situations 5, 6,7 or 8, with a transition to situation 1, 2 or 3 in the last year.
PERI 2 **PERI**-URBAN **2**	Trajectories with no transition from situations **5** and **7**; or for which at least two years have been situations 5, 6, 7 or 8, whereby the last year was situation 5 or 7; or for which two years have been situations 1, 2 or 3, with a transition to situation 5, 6, 7 or 8 in the last year.
PERI 3 **PERI**-URBAN 3	Trajectories with no transition from situations **6** and **8**; or for which at least two years have been situations 5, 6, 7 or 8, whereby the last year was situation 6 or 8.

Table 2. Classification criteria for the urban gradient considering the situations and the evolution of the trajectories

Source: Own elaboration.

Field-collected data were used to discuss the results observed for the three analyzed regions. Thus, 30 to 40 points were chosen for each region, divided among the four classes of the urban gradient. For each point, the complexity of the urban infrastructure was observed, that is to say, the existence of elements that characterize the degree to which the urban industrial fabric was established in the territory, such as the presence of varied and diversified commerce, asphalt, reduced lots, provision of infrastructure and services, such as health centers, schools, street lighting, pavements, transportation and waste treatment, in addition to the

presence of vegetation on the street and in the lots and their respective types. This information helped to characterize the urban gradient and identify similarities and particularities between the analyzed regions. The analysis of the results was conducted with the aim of identifying the composition and characteristics of the sociospatial dimension of the *urban weft* for the state of Pará. Subsequently, the particular results for each region were discussed, adopting the field observations and photos as complementary material.

3. The nature dimension

The presence of rivers and forest is a key element for recognizing evidence regarding the permanence of Amazonian urban technologies that pre-exist colonization (old and new) and the introduction of large capital and industrialization into the region. Efforts to obtain other interpretations of the territory depend on understanding the importance of that which is intertwined between what is typically understood as urban and rural. It is within these intermediary spaces, where the city and the forest touch, that conflicts over land and its resources develop and, simultaneously, spatialities materialize that manifest the permanence of the *natural-historical urban*. Thus, recognizing *territories of possibilities* depends not only on their spatial identification in an urban gradient, but also on an understanding of where, inside this gradient, nature presents itself as a means and an end for the production and reproduction of life.

With this purpose, data concerning the primary forest and water bodies mapped in the Projeto de Monitoramento do Desmatamento na Amazônia Legal por Satélite [Legal Amazon Deforestation Monitoring Project by Satellite] (PRODES Amazônia) in 2021 (INPE, 2022) were aggregated to the same cells defined for the analysis of the urban gradient, computing the percentage of area for each class. In this operation, each cell receives a decimal value between 0 and 1, indicating how much of the cell area is occupied by the primary forest class and the hydrographic classes (Figure 2a). To assess the presence of natural elements among the classes of the urban gradient, the sum of the two classes of land cover, forest and rivers, is calculated, and the result is presented in intervals, composing categories, which are: <20%, or, no predominant natural resources, indicating areas intensely transformed by urbanization; (ii) from 20% to 50%, indicating areas that present natural resources, although not predominantly; (iii) from 50% to 99%, or, with predominant natural resources, indicating areas in which more than half of the territory is covered by forest or rivers, but also by other uses, emphasizing the presence of human action in processes involving space production; and (iv) 100%, or preserved, indicating areas completely covered by forests and/or rivers (Figure 2b).

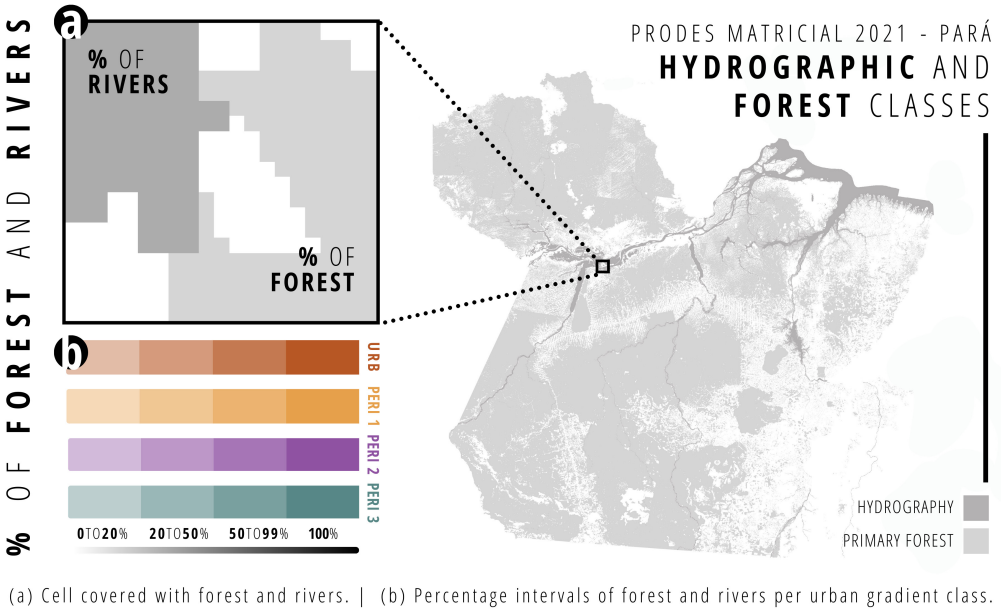


Figure 2. Methodological stages for composing the nature dimension
Source: INPE (2021). Software: QGis.

Mirroring the *sociospatial dimension*, the results analysis adopted a two-stage approach. The first examined the broader context for the state of Pará, and then the three analyzed integration regions, allowing the spatial identification of areas with more or less possibilities for the social reproduction of an urban lifestyle aligned with the cycles of nature. It also highlighted places where strategies to strengthen relations between the urban base and the resources of regional biodiversity either exist or may be created.

4. Results

The dynamics of transition between the class situations over time, or trajectory analysis, as a mediating element of the sociospatial dimension of the *urban weft* identified 125 different trajectories, including those with situation 9 (water bodies) in 2021, not considered for the composition of the gradient classes. Among the identified trajectories, 24 composed the *urban* class, 44 were in the *peri-urban 1 class*, 26 were part of the *peri-urban 2 class*, and 21 in the *peri-urban 3 class*. In terms of relative area, it was observed that, of the total 155,703 classified cells, 1.7% belonged to the *urban class*, 2.1% to the *peri-urban 1 class*, 3.6% to the *peri-urban 2 class* and 89% to the *peri-urban 3 class* (Figure 3b).

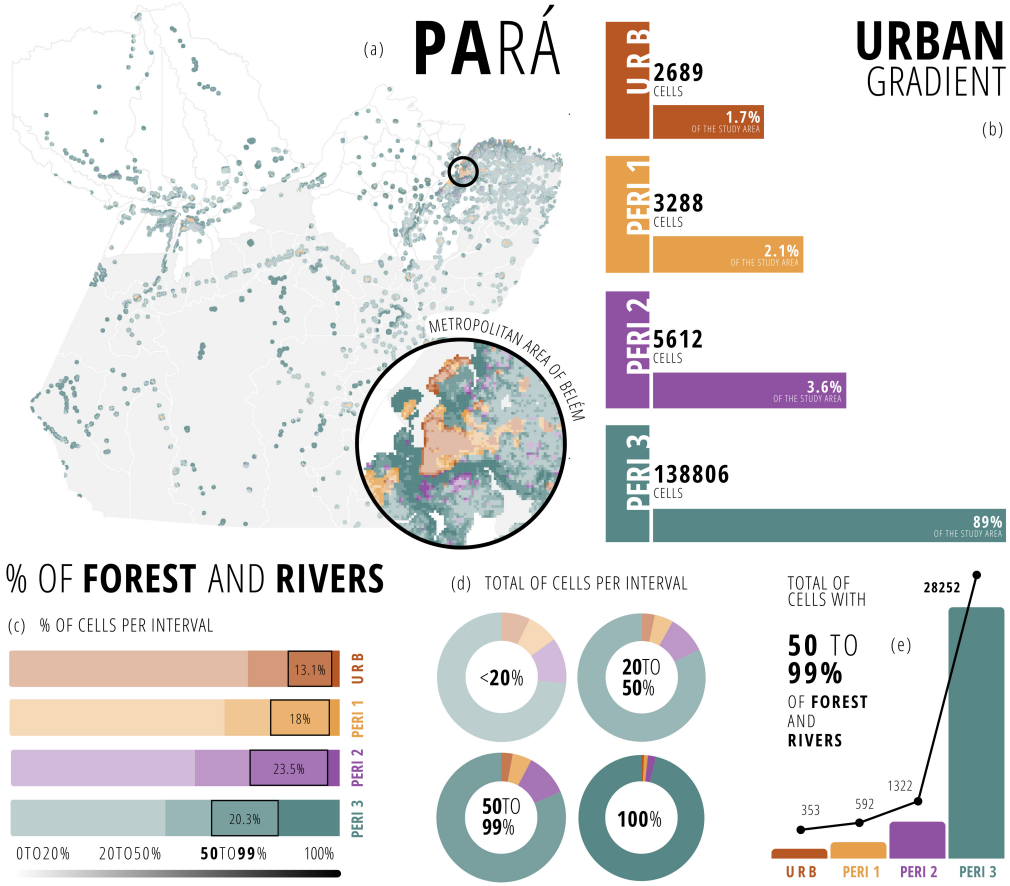


Figure 3. The sociospatial dimension (urban gradient) and the nature dimension (percentage of forest and rivers) of the *urban weft* in the state of Pará

Source: IBGE (2000b; 2010; 2021); INPE (2022). Software: QGis.

The proposed methodology for delineating, or recognizing, the *urban weft*, not only captured the presence of an extensive, connected *urban fabric* (Figure 3a), but also revealed a significant 40-fold increase (from 3,648 km² to 155,703 km²) in an area identified as urban, according to the 2021 census sector classification. This result underscores the methodology's ability to provide a more comprehensive understanding of the reality, thereby expanding the spatial perception of urbanization in the Amazonian territory, and, as a consequence, the possibility of planning these spaces. Furthermore, the resulting cartography emphasized that the change in perspective for reinterpreting the formal bases of spatial representation is capable of revealing the significant potential of the peri-urban in the composition of the *urban weft* in the state of Pará Amazon. This highlights the importance of understanding and including these spaces into the region's urban development and territorial planning agendas.

The analysis of the *nature dimension*, i.e., the percentage of forest and rivers across the classes of the urban gradient, identified that the *peri-urban 2* and *peri-urban 3* classes present the highest number of cells with forest and river coverage ranging between 50% and 99%, in relative (Figure 3c) and absolute (Figure 3e) terms, respectively. Notably, as well as presenting the highest number of cells, *peri-urban 3* also concentrates open areas and natural vegetation areas and presents the highest number of cells with 100% of its areas covered with forest and rivers (Figure 3d). However, according to the definitions of the gradient classes, it is in the *peri-urban 2 class*, which presents a percentage interval of forest and rivers from 50% to 99%, that it would be possible to concentrate the greatest potential for the materiality of the *natural-historical urban*, in which biodiversity and natural cycles are associated with ways of living and producing. In general, a reduction is observed in the number of cells with a predominance of forest and rivers (more than 50%) as we move along the urban gradient, which indicates the hegemony, at the state level, of an urbanization model disconnected from nature conservation. Moreover, in all classes of the gradient, with emphasis on the urban class, there is a predominance of cells presenting less than 20% of forest and rivers (Figure 3c).

The first analyzed region, the Tocantins IR, aligns with the overall pattern observed in the state of Pará regarding cell distribution across classes. However, a higher presence of *peri-urban 1* and *peri-urban 2* is evident (Figure 4b), indicating the presence of human settlements in the region's *urban weft* that exhibit a less consolidated urbanization process. Field observations further revealed three particular characteristics that diverge from expectations. First, the lot size varied regardless of the class. It was anticipated that spaces more heavily influenced by urban-industrial logic would have smaller lots due to increased demand and land value. Second, vegetation, including both forest and agricultural species, persisted across all gradient classes. Notably, the açaí berry was present everywhere, with higher concentrations further away from the urban centers. This suggests a strong connection between the *urban weft* and the region's traditional production and food habits. The last peculiarity observed refers to new urban infrastructure works in areas of the *peri-urban 1 class* – places with a low occupation rate, recently asphalted, with public lighting. Interestingly, this infrastructure was absent in some supposedly more developed, urban-classified areas.

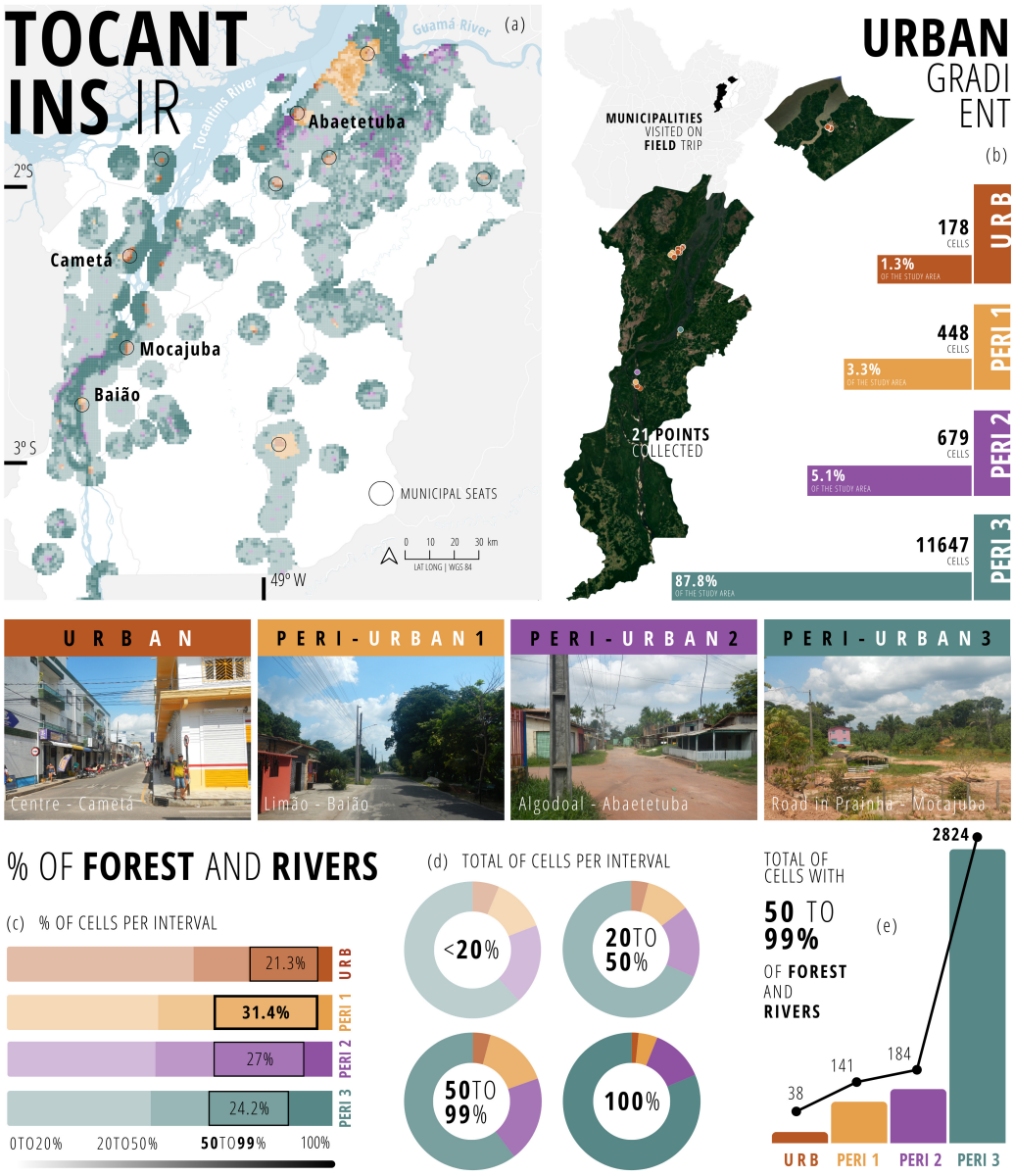


Figure 4. The sociospatial dimension (urban gradient) and the nature dimension (percentage of forest and rivers) of the *urban weft* in the Tocantins IR

Source: IBGE (2000b; 2010; 2021); INPE (2022). Software: QGis

Photographs: Laboratório de investigação em Sistemas Socioambientais (LiSS-INPE), 2022.

When incorporating the environmental data – forest and rivers – as indicators of the *nature dimension*, it may be observed that the *peri-urban 1 class* presents the highest proportion of cells with 50-99% of forest and river cover (Figure 4c), while the *peri-urban 3 class* presents the highest number of cells in this range (Figure 4e). Visualizing these results spatially (Figure 4a and Annex 1) helps to pinpoint the locations where the relationship between urbanization and nature deserves

closer attention. While the *peri-urban 1 class* shows a higher presence, *peri-urban 2* concentrates a percentage of forest and rivers of between 50% and 99%, primarily on the floodplains. As described by Almeida (2010), it is in the floodplain areas that "the river floods life" highlighting the potential of *peri-urban 2* in the context of the Tocantins IR. In this region, along the banks of the Tocantins and Guamá rivers, the economy is based on peasantry and sociobiodiversity, in which the production of açaí and buriti berries constitute the economic bases, and navigation is the primary mode of transport and commerce, connecting these communities to (and with) the city (Almeida, 2010).

The cells with a predominance of forest and rivers in the *peri-urban 1 class* are concentrated in the peripheral areas of the urban center of Barcarena, the municipal seat of one of the main company towns in the Amazon: Vila dos Cabanos, implanted in the late 1970s to house workers from the Alunorte complex. Carmo and Costa (2016) documented and discussed the disorderly growth of informal occupations which began in 2000. In view of this, an urban fringe area may be observed that, despite maintaining its preserved nature, has come under pressure. Consistent with expectations, the analysis of cell distribution across forest and river percentages reveals the urban class as the most prominent, with less than 20% (Figure 4c). This finding aligns with the characteristics of industrial urbanization, where extensive transformation dominates the landscape.

The second analyzed region, the Baixo Amazonas IR, presents an urban gradient pattern consistent with that observed for the state of Pará and for the Tocantins IR, i.e., increasing cell numbers along the urban gradient (*urban*, *peri-urban 1*, *peri-urban 2* and *peri-urban 3*) (Figure 5b). However, the Baixo Amazonas IR stands out due a significantly higher concentration of cells within the *peri-urban 3 class* in relation to the total. This indicates a more extensive presence of areas still with an incipient urbanization process, characterized by sparse human settlements and limited access to urban infrastructure (Figure 5b). Similar to the Tocantins IR, field observations revealed a variation in the complexity of the urban infrastructure across the gradient classes, with the *urban* class exhibiting a greater concentration of public facilities, commerce, and services. Additionally, lot sizes varied across the visited areas. In the specific case of Belterra, this finding may be related to the context of a planned urban space designed as a model city, featuring spacious houses, productive backyards, and land without walls (Rebêlo *et al.*, 2019).

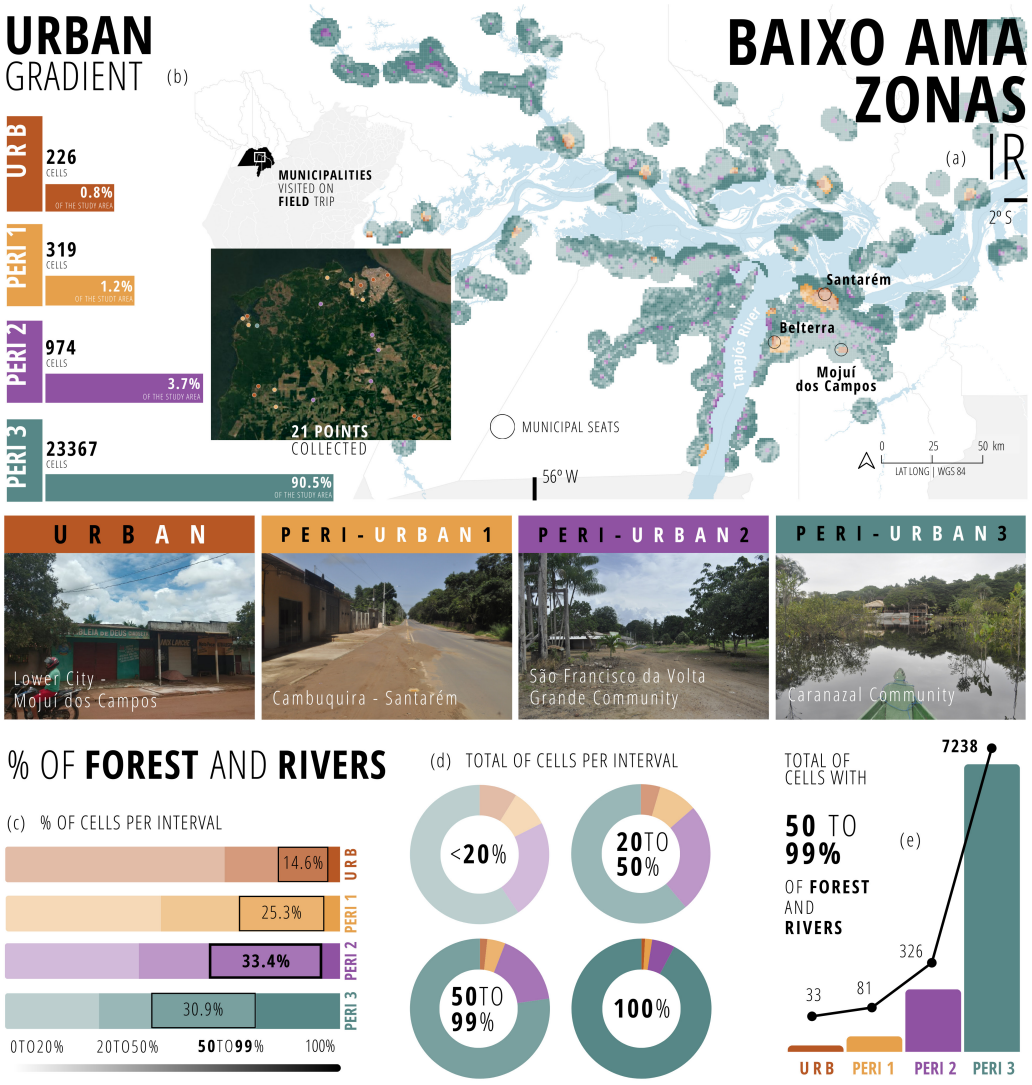


Figure 5. The sociospatial dimension (urban gradient) and the nature dimension (percentage of forest and rivers) in the *urban weft* of the Baixo Amazonas IR

Source: IBGE (2000b; 2010; 2021); INPE (2022). Software: Qgis.

Photographs: Laboratório de investigação em Sistemas Socioambientais (LiSS-INPE), 2023.

In relation to the presence of vegetation on the streets and lots, the *peri-urban 2* and *peri-urban 3* classes, as expected, presented a higher proportion of vegetation, evidenced by the presence of small farms and groves. Similar to the state as a whole, this pattern suggests the reproduction of an urbanization model disconnected from the cycles of nature, which concentrates infrastructure and services in consolidated urban spaces with vectors of resistance to a harmonious relationship between urbanization and nature in transitional, yet intensely pressured, spaces. Similar to the Tocantins IR, the Baixo Amazonas IR also revealed the existence of public urban infrastructure works in areas of the *peri-urban 1 class*, with a low

occupation rate. These observations echo Becker's (2004) argument regarding the city's transformation into a logistical base for State intervention, a process in which the public machine is used as a way to manage and facilitate real estate speculation throughout the territory.

The analysis of the *nature dimension* identified that the *peri-urban 2 class* presented the highest proportion of cells containing between 50% and 99% of forest and rivers (Figure 5c), and the *peri-urban 3* with the highest number of cells within this interval (Figure 5e). These cells are primarily concentrated in riverine areas, along the banks of the Tapajós and Arapiuns rivers (Figure 5a and Annex 2). In this region, the organization of the *urban weft* is facilitated by the flow, rhythm, and dynamics of the rivers, and according to Cardoso and Cardoso (2022), manages to resist thanks to the immobilization of public lands through institutional arrangements, which to some extent maintain a level of protection for the population from the numerous growing pressures and conflicts present across the region. Thus, the case of the Lago Grande Settlement Project in the municipality of Santarém is particularly outstanding, which, despite being under-represented in the results of the urban gradient, covers an extensive territory with more than 144 articulated communities, which live from sustainable land management and are under threat of losing their territory in an intense conflict with agents associated with real estate speculation and mining activities in the region (Porto; Pacheco; Leroy, 2013). In addition, as in the Tocantins IR, the Baixo Amazonas IR highlights the urban class as that which concentrates the largest number of cells with less than 20% of forest and rivers (Figure 5c), which demonstrates that the pressure and influence of the urbanization model submitted to the industrial logic of transformation of space and relations with nature manifests itself, at different levels, in different contexts and scales of analysis.

In the third region analyzed, the Marajó IR, the results and observed dynamics deviate somewhat from those observed in the other integration regions. The geographical location and landscape characteristics are directly reflected in the dynamics of how the human settlements have formed and evolved within this territory, resulting in highly specific spatialities and a unique urban-nature relationship. Consequently, unlike the other regions, the Marajó IR exhibits a more balanced frequency of cells across the *urban*, *peri-urban 1* and *peri-urban 2* classes. Notably, the total number of cells in the *peri-urban 1 class* is lower than in the *urban* (Figure 6b). It is important to acknowledge that, for this region, the methodology was unable to fully capture the extensive *urban weft* that connects the numerous communities to one another and to the surrounding nature (Figure 6a and Annex 3). The work of Bibas (2018), focusing on a cross-section of the municipality of

Afuá, provides a valuable discussion and illustration of this reality. The territory is characterized by a multitude of small communities that collectively form an extensive *urban weft*, which exists and resists beyond the official delineations of what is officially captured as urban in this territory.

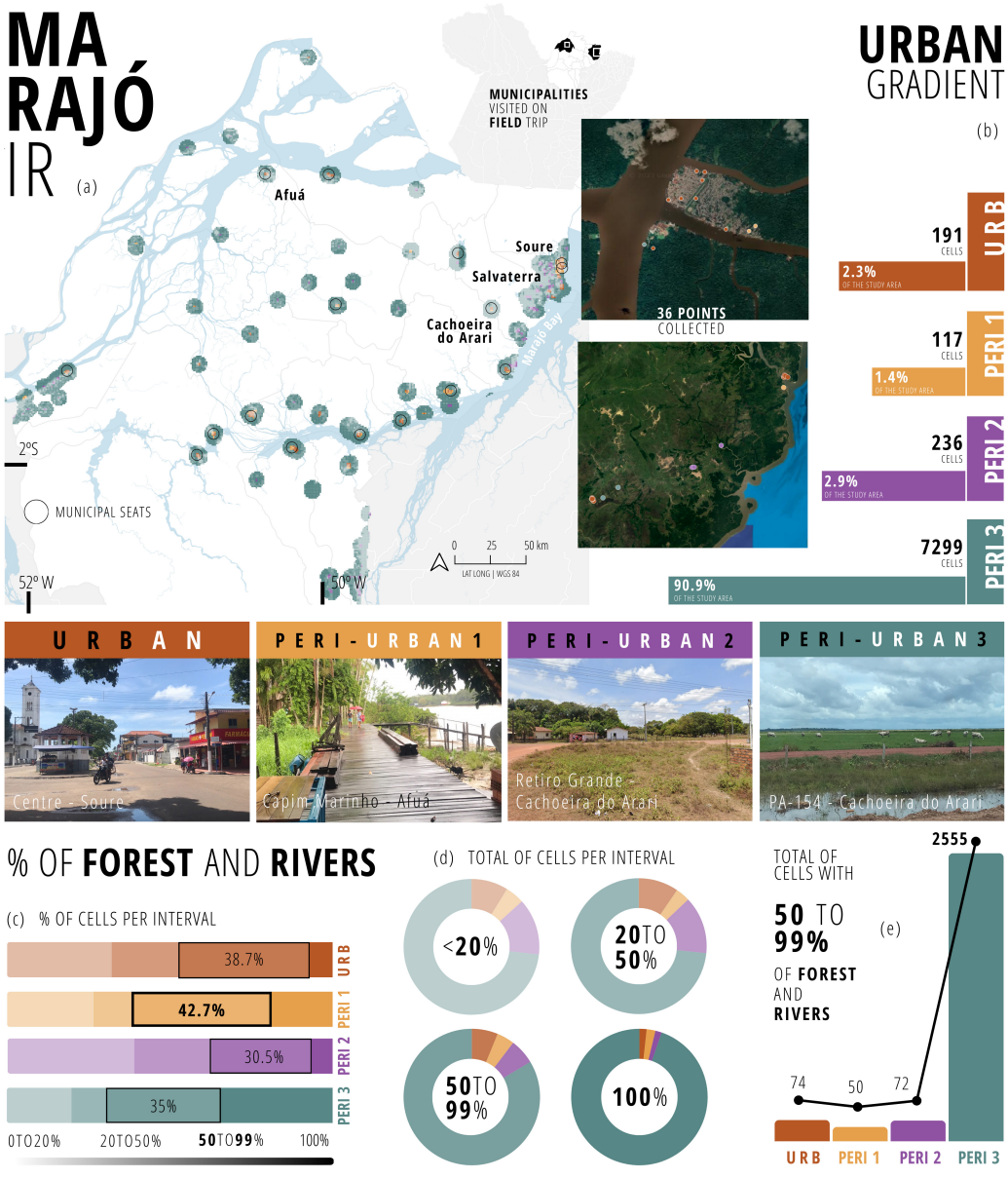


Figure 6. The sociospatial dimension (urban gradient) and the nature dimension (percentage of forest and rivers) in the *urban weft* of the Marajó RI

Source: IBGE (2000b; 2010; 2021); (INPE, 2022). Software: Qgis.

Photographs: Laboratório de investigação em Sistemas Socioambientais (LiSS-INPE) and Laboratório de Estudo de Cidades (Univap), 2023.

Despite the prominence of the *urban class* in the gradient results (Figure 6b), as in other Amazonian regions, urbanization in Marajó has been intense, yet incomplete, lacking improvements in infrastructure and basic services. This urbanization process, driven by economic dynamics that favor certain spaces to the detriment of others, has resulted in situations such as those observed in the municipalities during field visits: inadequate solid waste collection and treatment, limited access to drinking water and improper effluent disposal. In addition, analyzing field data for the Marajó IR highlights the difficulty in distinguishing between classes at the visited points. The areas of the *urban class*, with more consolidated urbanization, primarily located in the municipal seats, despite concentrating public facilities and urban infrastructure, also exhibit hybrid spatialities, including the presence of empty spaces, lots of varying sizes and productive backyards.

In relation to the presence of vegetation, field observations identified a distinction between the *urban* and *peri-urban 1* classes and the *peri-urban 2* and *peri-urban 3* classes. For the former, the presence of forest and agricultural crops was evident both in and outside the lots, while the latter exhibited another type of landscape, very particular to this region, composed of flooded fields, observed at the points collected in Cachoeira do Arari, Salvaterra and Soure. Additionally, the Marajó savanna (Amaral *et al.*, 2019) was present at the points of Afuá, characterized by great biodiversity and endemic species. The analysis of the *nature dimension*, as in the Tocantins IR, revealed that the *urban*, *peri-urban 1* and *peri-urban 2* classes, with particular emphasis on the second, shared similar frequencies of cells with forest and river percentages of between 50% and 99% (Figure 6c). This suggests the presence of nature integrated within different urban infrastructure contexts. However, unlike the other regions, the *peri-urban 2 class* exhibited the highest frequency of cells with a forest and river percentage of less than 20%, followed closely by the *urban class*. This finding aligns with the field observations, where flooded fields and floodplain areas dominated the *peri-urban 2 class*. These phytophysiognomies are not captured by the Prodes forest classification.

In a comparative analysis between the regions, a deconstruction of the dichotomous perception of space revealed the hybrid, complex character of the Amazonian urban landscape. This analysis exposed singularities that manifest according to the different social-territorial contexts and scales of analysis. Responses to the inclusion of environmental data were particularly helpful in revealing different trajectories of urbanization processes and their distinct ways of relating to nature, represented by the presence and permanence of the forest and rivers in the urban gradient. Furthermore, the analysis of the *urban weft* for

the state demonstrated a reduction in the number of cells with a percentage of forest and rivers of between 50% and 99% as the gradient evolves. This pattern demonstrates the existence of an ongoing process that views the forest as a source of resources, rather than as a material base for a development model aligned with the symbolic, environmental, and functional meanings of the rivers and the forest. On the other hand, in the analysis for the integration regions, it is possible to observe some particularities with the potential to unfold into opportunities. While the pattern of the gradual loss of cells with a predominance of natural resources is reproduced in most regions, the distribution of these cells across the classes occurred in a different way, highlighting the fact that a change in scale reveals the presence of nature within the varying contexts of urban infrastructure.

Final considerations

The lack of understanding the specificities and complexities of the Amazonian urban landscape renders a large portion of this territory invisible. This limited knowledge, which prioritizes urban trajectories aligned with the demands and goals of industrial capitalism, excludes a significant portion of the human settlements that occupy a substantial area of the *urban weft*, and are fundamental for designing urban development agendas and territorial planning in the context of the urbanization-nature relationship within a forest biome. This narrow view restricts the implementation of solutions based on other contexts, which are not applicable to such a complex and heterogeneous urban reality.

As a way of contributing to its spatial recognition, the first step towards socio-environmental and socioeconomic recognition, the methodology proposed in this article has successfully represented the delimitation of an *urban weft* in the state of Pará Amazon onto a geographical space. However, it is important to emphasize its limitations, exposed in the discrepancies between the created cartographies and the actual spatial arrangements. This highlights the need to connect with information produced at a local level, which is able to break through these invisibilities and consequently provide more precise guidance on the regional urban reality. Furthermore, incorporating environmental data, measured by the percentage of forest and rivers, which are crucial elements in the context of urbanization that arises and evolves within a forest biome, enabled the inclusion of a *nature dimension* for the state of Pará and the integration regions. This directs our attention towards territories with varying possibilities of reproducing a *natural-historical urban* landscape.

The two-scale analysis revealed that what is observed at the state level manifests differently across regional realities. This finding points to the multiple

layers of complexity within Amazonian urbanization, which must be understood as a multifaceted process that extends far beyond the perception of development solely based on the presence of industries, highways, and buildings. In contrast, urbanization in the Amazon showcases the coexistence of various competing narratives, underlining the need for a more comprehensive understanding, which, grounded in a decolonial perspective, should be capable of recognizing, highlighting, and strengthening the region's potentialities.

References

AFFONSO, A. G. *et al. As comunidades ribeirinhas do Baixo Tapajós (PA)*: infraestrutura, mobilidade, serviços socioambientais e conectividade. São José dos Campos: Inpe, 2016. 150 p. (Relatório de Campo).

ALMEIDA, R. Amazônia, Pará e o mundo das águas do Baixo Tocantins. *Estudos Avançados*, 24(68), p. 291-298, 2010.

AMARAL, D. D. *et al.* Identificação dos subtipos de savanas na Amazônia oriental (Pará e Amapá, Brasil) com uma chave dicotômica de individualização. *Boletim do Museu Paraense Emílio Goeldi-Ciências Naturais*, v. 14, n. 2, p. 183-195, 2019.

AMARAL, S. *et al. "Tem fofoca na currutela"*. Núcleos urbanizados e uso da terra de Alta Floresta (MT) ao Crepurizão (PA) na Transgarimpeira. São José dos Campos: Inpe, 2012. 58 p. (Relatório de Campo).

AMATI, M. *Green belts*: A twentieth-century planning experiment. In: AMATI, M. (ed.). Urban green belts in the twenty-first century. London: New York: Routledge, 2016. p. 1-17.

BARROS, M. J. B. *et al.* Fronteira agrícola e conflitos territoriais nas Amazônias Brasileiras: a expansão do agronegócio da soja e seus efeitos no planalto de Santarém, Pará-Amazônia-Brasil. *Ciência Geográfica*, Bauru, v. 24, n. 2, p. 893-911, 2020.

BASTOS, A. P. V. *et al.* Economia e sociedade na região do Tocantins, Pará. *Papers do NAEA*, 19(1), 2010. (*Paper* 259).

BECKER, B. K. *Amazônia – Geopolítica na virada do III milênio*. Rio de Janeiro: Garamond, 2004.

BIBAS, L. B. *O espaço tradicional em contexto periférico, inadequações e tensões entre visões de mundo*: o caso de Afuá. 2018. Dissertação (Mestrado) – Programa de Pós-graduação em Arquitetura e Urbanismo, Universidade Federal do Pará, Belém, 2018.

CARDOSO, A. C. D. A trama dos povos da floresta: Amazônia para além do verde. *Revista da Universidade Federal de Minas Gerais*, v. 28, n. 3, p. 57-87, 2021a.

_____. Que contribuições virão da Amazônia brasileira para o urbanismo do século XXI? *Thésis*, Rio de Janeiro, v. 6, n. 11, p. 36-53, 2021b.

CARDOSO, A. C. D.; CARDOSO, C. L. Atlas (e glossário) de estruturas híbridas produzidas pela urbanização da Amazônia Oriental. Desafios. *Revista Interdisciplinar da Universidade Federal do Tocantins*, v. 3, n. esp., 2022.

CARMO, M. B. S.; COSTA, S. M. F. Os paradoxos entre os urbanos no município de Barcarena, Pará. *urbe. Revista Brasileira de Gestão Urbana*, v. 8, p. 291-305, 2016.

CORDEIRO, I. M. C. C.; ARBAGE, M. J. C.; SCHWARTZ, G. Nordeste do Pará: configuração atual e aspectos identitários. *In*: CORDEIRO, I. M. C. C. *et al.* (org.). *Nordeste paraense*: panorama geral e uso sustentável das florestas secundárias. Belém: Edufra, 2017. p.19-58.

CÔRTES, J. C.; D'ANTONA, Á. O. Urbanização do rural: mobilidade populacional e dinâmica do uso da terra em Santarém, Brasil. *In*: CONGRESSO ASOCIACIÓN LATINOAMERICANA DE POBLACIÓN, 5., 2012, Montevideo. *Anais* [...]. Montevideo: Alap, 2012.

COSTA, F. de A. *Formação rural extrativista na Amazônia*: os desafios do desenvolvimento capitalista (1720-1970). Belém: NAEA, 2012.

_____. *A brief economic history of the Amazon (1720-1970)*. Newcastle upon Tyne: Cambridge Scholars Publishing, 2019.

_____. *et al. Bioeconomia da sociobiodiversidade no estado do Pará*. Brasília, DF: The Nature Conservancy (TNC Brasil): Banco Interamericano de Desenvolvimento (BID), Natura, IDBTN-2264, 2021.

_____. *et al. Bioeconomy for the Amazon*: concepts, limits, and trends for a proper definition of the tropical forest biome. São Paulo: WRI Brasil, 2022.

COSTA, S. M. F. *et al.* Pequenas cidades do estuário do rio Amazonas: fluxo econômico, crescimento urbano e as novas velhas urbanidades da pequena cidade de Ponta de Pedras. *REDES: Revista do Desenvolvimento Regional*, v. 17, n. 2, p. 56-74, 2012.

_____. *et al.* De lugares a cidades: a formação do urbano na Ilha de Marajó, PA, e as temporalidades. *In*: ENCONTRO NACIONAL DA ASSOCIAÇÃO NACIONAL DE PÓS-GRADUAÇÃO E PESQUISA EM PLANEJAMENTO URBANO E REGIONAL, 20., 2023, Belém. *Anais* [...]. Belém: Enanpur, 2023. Tema: ANPUR 40 anos: novos tempos, novos desafios em um Brasil diverso.

DAL'ASTA, A. P. *et al. Núcleos de ocupação humana e usos da terra entre Santarém e Novo Progresso, ao longo da BR-163 (PA)*. São José dos Campos: Inpe, 2011. 52 p. (Relatório de Campo).

_____. *As comunidades de terra firme do sudoeste do Pará*: população, infraestrutura, serviços, uso da terra e conectividades. São José dos Campos: Inpe, 2014. 96 p. (Relatório de Campo).

_____. *Instituições, as feiras e os produtores*: diferentes olhares das (inter)relações entre a cidade e o campo no sudoeste paraense. São José dos Campos: Inpe, 2016. (Relatório de Campo).

DIAS, J. S. *"Confuso e intrincado labirinto"*: fronteira, território e poder na Ilha Grande de Joanes (séculos XVII e XVIII). 2016. Tese (Doutorado em História) – Universidade Federal do Pará, Belém, 2016.

ESCADA, M. I. S. *et al. Levantamento do uso e cobertura da terra e da rede de infraestrutura no distrito florestal da BR-163*. São José dos Campos: Inpe, 2009. 52 p. (Relatório de Campo).

_____. *Infraestrutura, serviços e conectividade das comunidades ribeirinhas do Arapiuns, PA*. São José dos Campos: Inpe, 2013. 121 p. (Relatório de Campo).

ESCADA, M. I. S. *et al*. *Caracterização das comunidades entre Uruará e Anapu, na área de influência da Transamazônica (BR-230)*. São José dos Campos: Inpe, 2017. (Relatório de Campo).

FAPESPA. Fundação Amazônia de Amparo a Estudos e Pesquisas do Pará. *Estimativas e projeções do PIB paraense 2014-2020*. Belém: Fapespa, 2016. 15p.

_____. *Perfil socioeconômico e ambiental do estado do Pará e regiões de integração 2024-2027*. Belém: Fapespa, 2023.

FERNANDES, D. A. *et al*. A questão urbana nos projetos em disputa para uma bioeconomia da Amazônia contemporânea. *In*: ENCONTRO NACIONAL DA ASSOCIAÇÃO NACIONAL DE PÓS-GRADUAÇÃO E PESQUISA EM PLANEJAMENTO URBANO E REGIONAL, 20., 2023, Belém. *Anais* [...]. Belém: Enanpur, 2023. Tema: ANPUR 40 anos: novos tempos, novos desafios em um Brasil diverso. Available at: https://anpur.org.br/wp-content/uploads/2023/07/sl-04.pdf. Accessed on: August 10, 2023.

FERREIRA, A. E. De M. *Sustentabilidade urbana e qualidade de vida*: desafios a serem consolidados na Região Metropolitana de Santarém – PA. 2019. Tese (Doutorado em Ciências Ambientais) – Instituto de Geociências da Universidade Federal do Pará, Belém, 2019. p. 158.

GOMES, T. V. *et al*. Santarém (PA): um caso de espaço metropolitano sob múltiplas determinações. *Cadernos Metrópole*, v. 19, p. 891-918, 2017.

GONÇALVES, A. C. O. *et al*. Marajó. In: ALVES, F. (org.). *A função socioambiental do patrimônio da União na Amazônia*. Brasília, DF: Ipea, 2016. 359 p.

IBGE. Instituto Brasileiro de Geografia e Estatística. *Dados estatísticos do Censo 2000*. Rio de Janeiro: IBGE, 2000a.

_____. *Malha de setores censitários de 2000*. 2000b.

_____. *Malha de Setores Censitários de 2010*. Rio de Janeiro: IBGE, 2010.

_____. *Malha de setores censitários de 2021*. 2021.

_____. *População e domicílios. Primeiros resultados Censo 2022*. 2023a.

_____. *Proposta de categorização de espaços urbano, rurais e da natureza*. 2023b. 174p.

_____. *Agregados por setores censitários – resultados preliminares*: população e domicílios. Censo 2022. Rio de Janeiro: IBGE, 2024.

INPE. Instituto Nacional de Pesquisas Espaciais. *PRODES Matricial 2021*. 2022. Available at: http://terrabrasilis.dpi.inpe.br. Accessed on: September 20, 2022.

_____. *Taxa de desmatamento de 2022*. São José dos Campos: Inpe, 2023. Available at: http://terrabrasilis.dpi.inpe.br. Accessed on: August 25, 2023.

ISA. Instituto Socioambiental. *Painel de Dados das Unidades de Conservação do Brasil*. São Paulo: ISA, 2023. Available at: https://uc.socioambiental.org/pt-br/paineldedados. Accessed on: October 10, 2023.

LEFEBVRE, H. *A Revolução Urbana*. Belo Horizonte: Ed. da UFMG, 1999 [1970].

_____. *Espaço e política*. Belo Horizonte: Ed. da UFMG, 2008 [1976].

MIRANDA, L.; MORAES, D. Municípios periurbanos e reforma urbana: desconstruindo conceitos para construir políticas espaciais mais integradas. *Revista Trimestral de Debate da Fase*, ano 35, n. 123, p. 10-16, 2011.

MONTE-MÓR, R. L. Urbanização extensiva e lógicas de povoamento: um olhar ambiental. *In*: SANTOS, M. et. al. (org.). *Território, globalização e fragmentação*. São Paulo: Hucitec: Anpur, 1994. p. 169-181.

NAKANO, K. Desenvolvimento urbano e territorial em municípios periurbanos. *Revista Trimestral de Debate da Fase*, ano 35, n. 123, p. 4-9, 2011.

NAZARÉ, M. L. *et al*. Fatores de risco para a saúde humana e ambiental, decorrentes do uso de agrotóxicos na monocultura de arroz irrigado na ilha do Marajó – PA. *Revista Científica Multidisciplinar Núcleo do Conhecimento*, ano 7, ed. 3, v. 4, p. 114-132, 2022.

PARÁ. *Revisão do plano plurianual 2020-2023. Biênio 2022-2023*. Belém: Governo do Estado, 2021. v. 1. Available at: https://seplad.pa.gov.br/revisao-do-ppa-2022-2023/. Accessed on: November 20, 2023.

PIRAUX, M.; SOARES, D. A. S.; SIMÕES, A. A diversidade socioespacial do Território Baixo Tocantins e impactos na agricultura familiar. *In*: SIMÕES, A.; BENASSULY, M. (org.). *Na várzea e na terra firme*: transformações socioambientais e reinvenções camponesas. Belém: NUMA/UFPA, 2017. p. 77-114.

PORTO, M. F.; PACHECO, T.; LEROY, J. P. (org.). *Injustiça ambiental e saúde no Brasil*: o mapa de conflitos. Rio de Janeiro: Fiocruz, 2013.

PORTO-GONÇALVES, C. W. *Amazônia, amazônias*. São Paulo: Contexto, 2005.

QGIS.org. *QGIS Geographic Information System*. QGIS Association, 2024. http://www.qgis.org.

REBÊLO, A. G. M. *et al*. Quintais agroflorestais urbanos em Belterra, PA: importância ecológica e econômica. *Revista Terceira Margem Amazônia*, v. 4, n. 12, 2019.

SANTOS, M. *A urbanização brasileira*. 5. ed. São Paulo: Edusp, 2009.

SAUER, S. Soy expansion into the agricultural frontiers of the Brazilian Amazon: The agribusiness economy and its social and environmental conflicts. *Land Use Policy*, 79, p. 326-338, 2018.

SILVA, H. *Socialização da natureza e alternativas de desenvolvimento na Amazônia Brasileira*. 2017. Tese (Doutorado em Economia) – Universidade Federal de Minas Gerais, Belo Horizonte, 2017.

_____. *et al*. *Biodiversidade e economia urbana na Amazônia*. São Paulo: FEA, 2022. (Nota de Política Econômica, 026).

SOUZA, A. R. *et al*. *Paisagens e usos da terra em núcleos populacionais e estabelecimentos rurais da Região do Baixo Tocantins – PA*. São José dos Campos: Inpe, 2021. (Relatório de Campo).

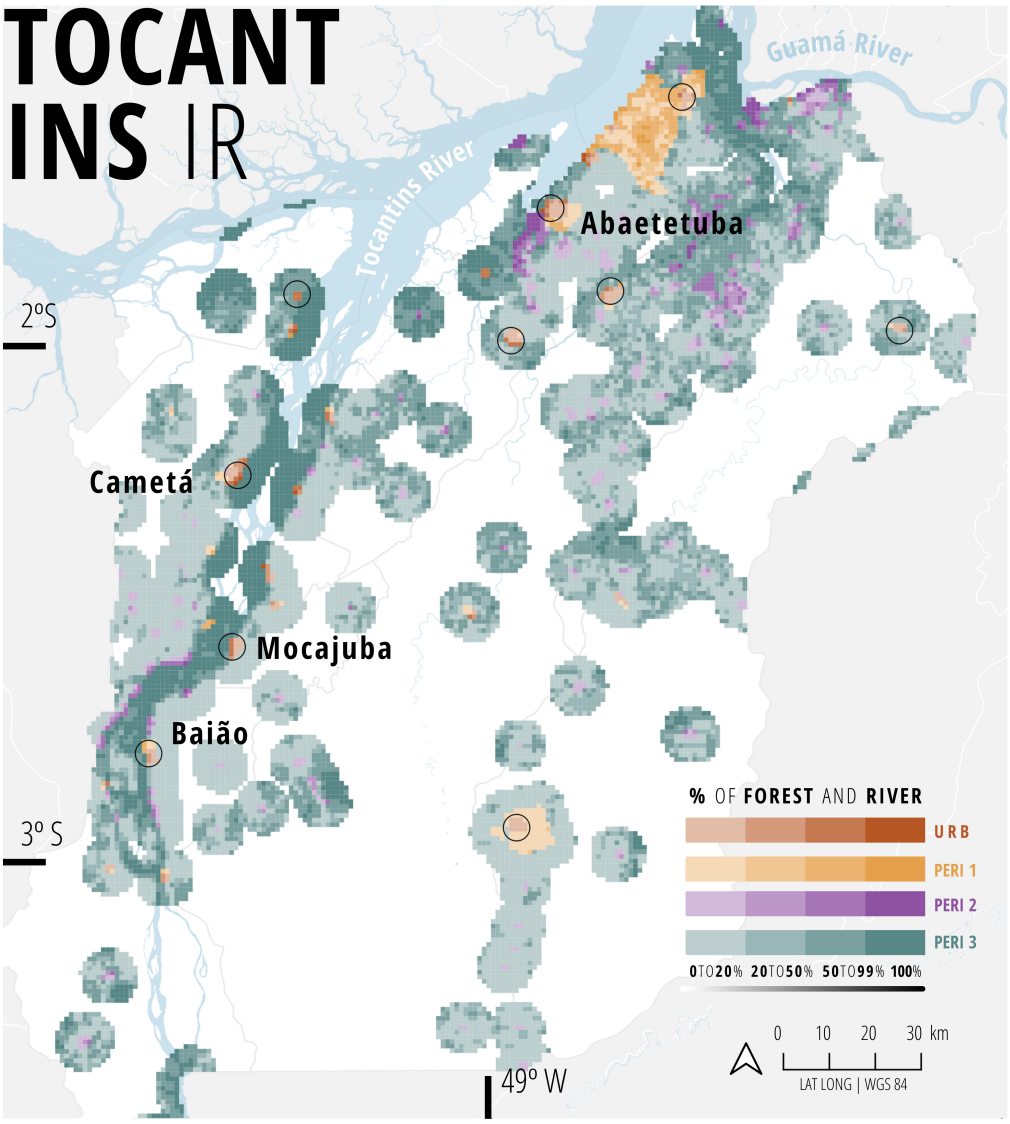
VICENTE, L. R. *O espaço periurbano de Belém (PA) entre transformações, resistências e re-existências*. 2022. 182 f. Dissertação (Mestrado em Arquitetura e Urbanismo) – Instituto de Tecnologia, Universidade Federal do Pará, Belém, 2022.

Photograph collections

Laboratório de Investigação em Sistemas Socioambientais (LiSS-Inpe).

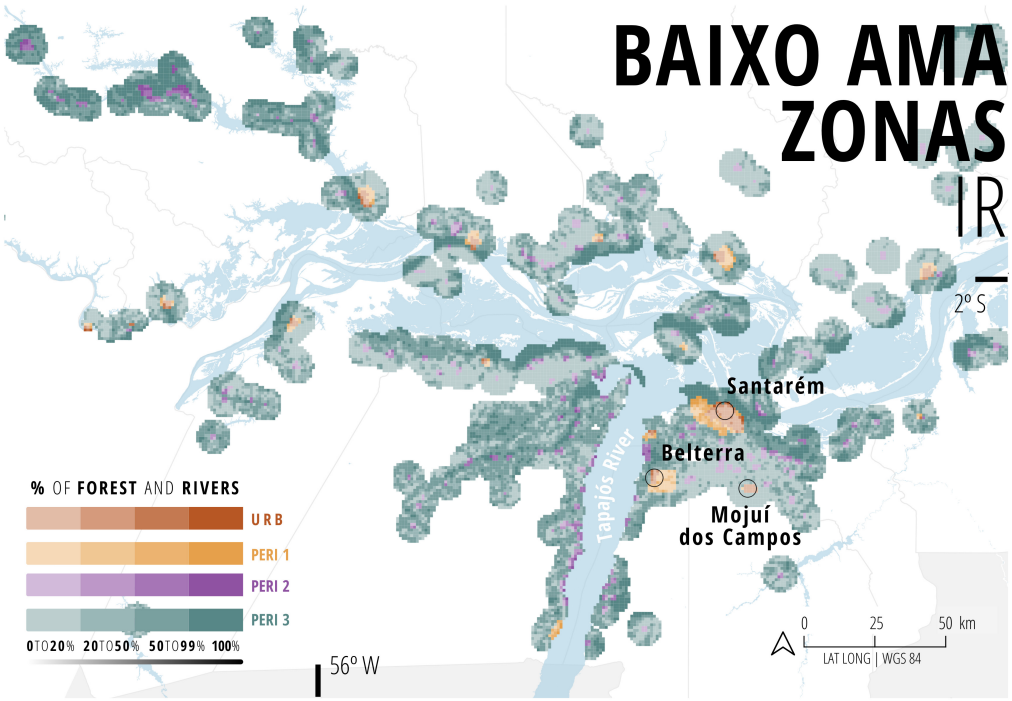
Laboratório de Estudo de Cidades (Univap), 2023.

Annex

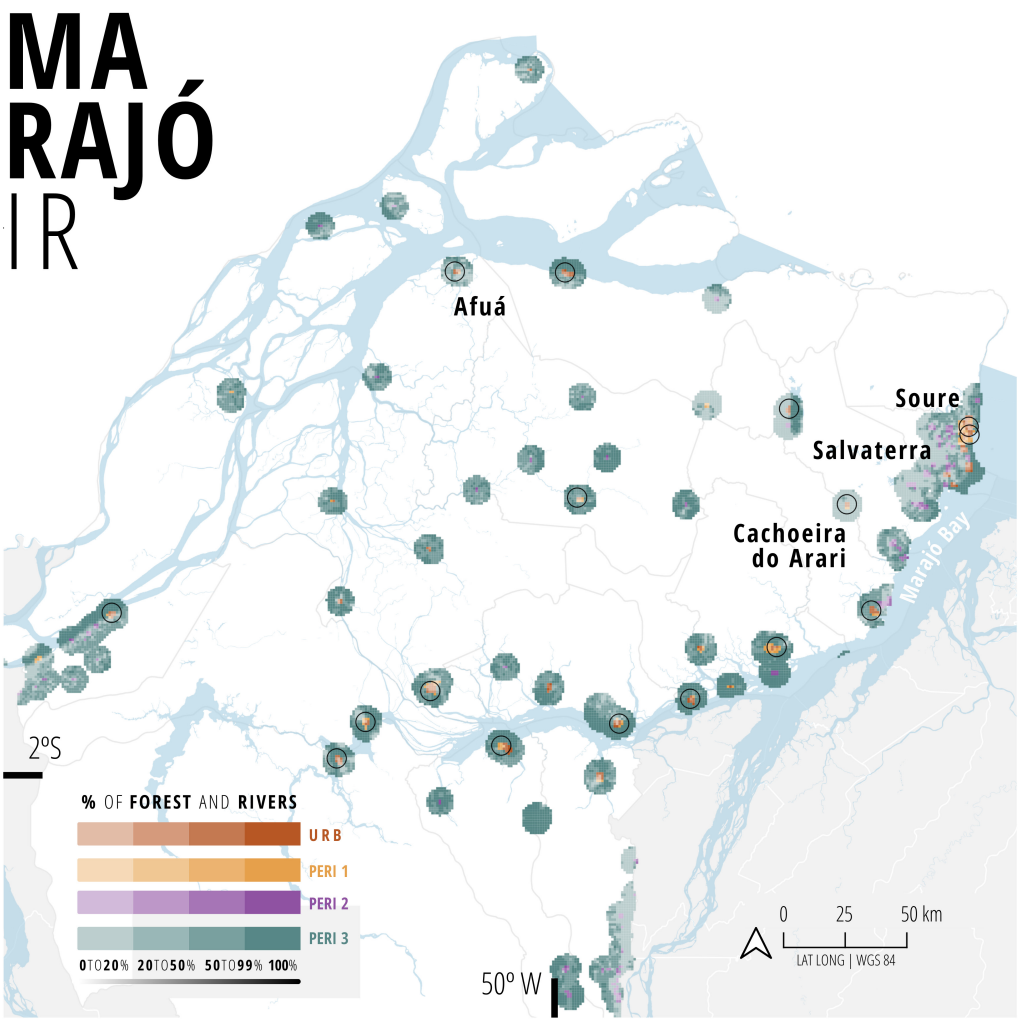


Appendix 1. Urban weft in the Tocantins IR

Source: IBGE (2000b; 2010; 2021); INPE (2022). Software: QGis.



Appendix 2. Urban weft in the Baixo Amazonas IR
Source: IBGE (2000b; 2010; 2021); INPE (2022). Software: QGis.



Appendix 3. Urban weft in the Marajó IR

Source: IBGE (2000b; 2010; 2021); INPE (2022). Software: QGis.

Renata Maciel Ribeiro

Graduated in Environmental Science from the Universidade Federal Fluminense (UFF); holds a master's degree in Remote Sensing from the Instituto Nacional de Pesquisas Espaciais (INPE) and a doctorate in Earth System Science from the same institution, and is a researcher at the Laboratório de investigação em Sistemas Socioambientais (LiSS-INPE).

Email: renata.ribeiro@inpe.br

ORCID: 0000-0003-3081-4446

Authorship contribution: conception, data curation, formal analysis, investigation, methodology and writing – first draft.

Amanda Estefânia De Melo Ferreira

Graduated in Agronomy from the Universidade Federal do Pará (UFPA); holds a master's degree and doctorate in Environmental Sciences from the same institution. She is an adjunct professor at the Formação Interdisciplinar e Intercultural at the Universidade Federal do Oeste do Pará (UFOPA) and leader of the Grupo de Estudos e Atividades Socioambientais (GEASA) at this same institution.

Email: amanda.ferreira@ufopa.edu.br

ORCID: 0000-0002-2840-3069

Authorship contribution: data curation, investigation and writing – review and editing.

Ana Cláudia Duarte Cardoso

Graduated in Architecture and Urbanism from the Universidade Federal do Pará (UFPA); holds a master's degree in Urban Planning from the Universidade of Brasília (UnB), and a doctorate in Architecture from the Oxford Brookes University, United Kingdom. She is an associate professor at the Faculty of Architecture and Urbanism at UFPA and a research productivity fellow with CNPq.

Email: aclaudiacardoso@gmail.com

ORCID: 0000-0002-1866-453X

Authorship contribution: conception, investigation and writing – review and editing.

Antônio Miguel Vieira Monteiro

Graduated in Electrical Engineering from the Universidade Federal do Espírito Santo (Ufes); holds a master's degree Applied Computing from the Instituto Nacional de Pesquisas Espaciais (INPE) and a PhD in Electronic Engineering and Computor Science/ Control from the University of Sussex, United Kingdom. He is a sênior researcher at INPE and coordinator of the Laboratório de investigação em Sistemas Socioambientais (LiSS-INPE).

Email: miguel.monteiro@inpe.br

ORCID: 0000-0003-1477-1749

Authorship contribution: methodology, investigation, supervision and writing – review and editing.

Ana Paula Dal'Asta

Graduated and master's degree in Geography from the Universidade Federal de Santa Maria (UFSM); holds a doctorate in Remote Sensing from the Instituto Nacional de Pesquisas Espaciais (INPE) and a resercher at the Laboratório de investigação em Sistemas Socioambientais (LiSS-INPE).

Email: apdalasta@gmail.com

ORCID: 0000-0002-1286-9067

Authorship contribution: data curation, investigation and writing – review and editing.

Monique Bruna Silva Carmo

Graduated in Geography from the Universidade do Vale do Paraíba (Univap); holds a master's degree and doctorate in Urban and Regional Planning from the same institution, and a research internship at Indiana University – ACT (Anthropological Center

for Training and Research), and a post-doc from the Instituto Nacional de Pesquisas Espaciais (INPE) and is an associate researcher at Casel (Center for the Analysis of Social-Ecological Landscapes) (Indiana University) and Laboratório de Estudo das Cidades (Univap).

Email: moniquebruna@ymail.com

ORCID: 0000-0003-2743-5883

Authorship contribution: data curation, investigation and writing – review and editing.

Silvana Amaral

Graduated in Ecology from the Universidade Estadual Paulista de Rio Claro (Unesp); holds a master's degree in Remote Sensing from the Instituto Nacional de Pesquisas Espaciais (INPE) and a doctorate in Space Engineering/Information from the Universidade de São Paulo (Poli/USP). She is a researcher at INPE and coordinator of the Laboratório de investigação em Sistemas Socioambientais (LiSS-INPE).

Email: silvana.amaral@inpe.br

ORCID: 0000-0003-4314-7291

Authorship contribution: methodology, investigation, supervision and writing – review and editing.

Submitted: November 21, 2023.

Approved: April 3, 2024.

How to cite: RIBEIRO, R. M.; FERREIRA, A. E. de M.; CARDOSO, A. C. D.; MONTEIRO, A. M. V.; DAL' ASTA, A. P.; CARMO, M. B. S.; AMARAL, S. The Amazon urban weft: a methodological proposal for recognizing a territory of possibilities. *Revista brasileira de estudos urbanos e regionais*. V. 26, E202433en, 2024. https://doi.org/10.22296/2317-1529.rbeur.202433en.