

## Mapping riverside communities in Tefé – Amazonas – Brazil

*Mapeo de comunidades ribereñas en Tefé - Amazonas – Brasil*

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### ABSTRACT

In the scientific literature, geospatial data on riverside communities located in Tarará Island, in the municipality of Tefé, State of Amazonas, Brazil, are scarce. The unevenness of mapping and updating information about these communities makes them invisible on official maps and generates uncertainty about their toponyms. This article presents the mapping and toponyms of these riverside communities. The methodology foundations comprise Crowdsourcing and Voluntary Geographic Information (VGI). The procedures were research, collection and analysis of cartographic data on toponyms, mapped through the OpenStreetMap Platform, and data collection in the field. The results indicate that the communities are no longer invisible in several free databases in Brazil and that, despite the discrepancies between the toponyms data in several documents, allowed the names of the 14 riverside communities located in the island to be validated.

**KEYWORDS:** IGV, Crowdsourcing, OpenStreetMap, Toponyms.

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## RESUMEN

En la literatura científica hay pocos datos geoespaciales sobre las comunidades ribereñas situadas en la isla de Tarará, en el municipio de Tefé, Estado de Amazonas, Brasil. La precariedad de la cartografía y la actualización de la información sobre estas comunidades las hace invisibles en los mapas oficiales y genera incertidumbres sobre sus topónimos. En este artículo, presentamos la cartografía y los topónimos de estas comunidades ribereñas. Los fundamentos metodológicos fueron el crowdsourcing y la información geográfica voluntaria (VGI). Los procedimientos fueron la investigación, la adquisición y el análisis de datos cartográficos y toponímicos, la cartografía a través de la plataforma OpenStreetMap y la recogida de datos sobre el terreno. Los resultados indican que las comunidades ya no son invisibles en varias bases de datos libres de Brasil y que, a pesar de las discrepancias entre los datos de los topónimos en varios documentos, fue posible validar los nombres de las 14 comunidades ribereñas ubicadas en la Isla.

**PALABRAS CLAVE:** IGV, Crowdsourcing, OpenStreetMap, Topónimos.

## *Mapeamento de comunidades ribeirinhas em Tefé – Amazonas –Brasil*

## RESUMO

Na literatura científica há poucos dados geoespaciais sobre as comunidades ribeirinhas localizadas na Ilha Tarará, no município de Tefé, Estado do Amazonas, Brasil. A precariedade de mapeamento e de atualização de informações sobre estas comunidades as torna invisíveis nos mapas oficiais e geram incertezas sobre seus topônimos. Neste artigo, apresenta-se o mapeamento e os topônimos das referidas comunidades ribeirinhas. Os fundamentos metodológicos foram do Crowdsourcing e da Informação Geográfica Voluntária (IGV). Os procedimentos foram pesquisa, aquisição e análise de dados cartográficos e sobre os topônimos, mapeamento por meio da Plataforma OpenStreetMap e coleta de dados em campo. Os resultados indicam que as comunidades não são mais invisíveis em diversos bancos de dados gratuitos no Brasil e que, apesar das discrepâncias entre os dados dos topônimos em diversos documentos, foi possível validar os nomes das 14 comunidades ribeirinhas localizadas na Ilha.

**PALAVRAS CHAVE:** IGV, Crowdsourcing, OpenStreetMap, Topônimos.

## *Cartographie des communautés riveraines de la Rivière Tefé - Amazonas - Brésil*

## RÉSUMÉ

Dans la littérature scientifique, il existe peu de données géospatiales sur les communautés riveraines situées sur l'île de Tarará, dans la municipalité de Tefé, État d'Amazonas, Brésil. La précarité de la cartographie et de la mise à jour des informations sur ces communautés les rend invisibles sur les cartes officielles et génère des incertitudes quant à leur toponymie. Dans cet article, nous présentons la cartographie et les toponymes de ces communautés riveraines. Les fondements méthodologiques étaient le crowdsourcing et l'information géographique volontaire (VGI). Les procédures ont consisté en la recherche, l'acquisition et l'analyse de données cartographiques et de toponymes, la cartographie via la plateforme OpenStreetMap et la collecte de données sur le terrain. Les résultats indiquent que les communautés ne sont plus invisibles dans plusieurs bases de données gratuites au Brésil et que, malgré les divergences entre les données des toponymes dans plusieurs documents, il a été possible de valider les noms des 14 communautés riveraines situées sur l'île.

**MOTS-CLÉ:** IGV, Crowdsourcing, OpenStreetMap, Toponymes.

## *Mappatura delle comunità fluviali in Tefé - Amazzonia – Brasile*

## ASTRATTO

Nella letteratura scientifica ci sono pochi dati geospaziali sulle comunità fluviali situate sull'isola di Tarará, nel comune di Tefé, Stato di Amazonas, Brasile. La precarietà della mappatura e dell'aggiornamento delle informazioni su queste comunità le rende invisibili sulle mappe ufficiali e genera incertezze sui loro toponimi. In questo articolo presentiamo la mappatura e i toponimi di queste comunità fluviali. Le basi metodologiche sono state il crowdsourcing e l'informazione geografica volontaria (VGI). Le procedure sono state la ricerca, l'acquisizione e l'analisi dei dati cartografici e dei toponimi, la mappatura attraverso la piattaforma OpenStreetMap e la raccolta dei dati sul campo. I risultati indicano che le comunità non sono più invisibili in diversi database gratuiti in Brasile e che, nonostante le discrepanze tra i dati dei toponimi in diversi documenti, è stato possibile convalidare i nomi delle 14 comunità fluviali situate sull'Isola.

**PAROLE CHIAVE:** IGV, Crowdsourcing, OpenStreetMap, Toponimi.

## Introduction

The Amazon Biome occupies an area of 4,196,943 km<sup>2</sup>, drained by vast river basins, covered by the largest tropical forest in the world. This entire landscape harbors a high biological diversity and is the realm of a rich ethnic-cultural variety, resulting from processes of colonization and miscegenation<sup>1</sup>.

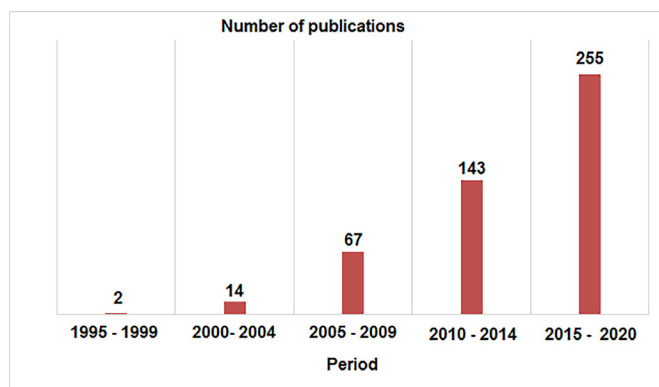
Amongst the social groups that constitute the Amazon sites, riverside communities are worth mentioning: populations descended from indigenous peoples, Brazilian northeasterners, and other migrants, whose territoriality and ways of life are conditioned to the hydrological regime of rivers and lakes. Their symbolic, cultural, and social relationships with these natural elements are strong.

These populations survive from fishing, hunting, family farming, plant extractivism, handicraft production and subsidies from Federal Government social programs. Such populations lack basic services and consumer goods (e.g., sanitation, education, electricity, etc.), which are often focused in urban areas. Access to these areas is made by waterways, in displacements with risks that are typical of the region and that can last from a few minutes until days of navigation<sup>2</sup>, which is done in poor small boats.

Every scenario mentioned above implies severe inequalities and other social discrepancies among the riverside people. To make matters worse, there is a cartographic blackout of these communities: Figure 1 illustrates a virtual search Google Scholar in the five-year period from 1995 to 2020, containing the words *cartografia* (cartography), *mapeamento* (mapping), *ribeirinho* (riverside person) and *comunidade* (community). It is possible evidence of the absence of initiatives to map riverside spaces recorded in the literature. Only after the five-year period from 2005 to 2010, there was an increase in the number of publications, which is the same period of expansion of Earth observation missions, whose products follow an open data policy.

The cartographic invisibility of the riverside people can be understood from the perspective of socio-spatial and economic marginalization, both of which neglect them within the framework of society. In order to understand the context of this discussion, which is beyond the scope of this study, Fernandes and Moser<sup>3</sup> present

Figure 1. Number of studies in Portuguese indexed in *Google Scholar*, from 1995 to 2020, containing the four words: *cartografia*, *mapeamento*, *ribeirinho* and *comunidade*



Source: own elaboration.

a critical theoretical essay on the socio-historical formation of the Amazon, highlighting the (non) place occupied by riverside communities and the placement of the Amazon region in the globalized world.

From the technical perspective of mapping, there are several factors that contribute to cartographic invisibility. The riverside populations present a wide demographic distribution across the enormous Amazonian surface. This creates a methodological challenge, since it is a phenomenon of regional distribution, with cartographic visibility at the local scale (scale up to 1:25,000)<sup>4</sup>.

These are satellite images that support thematic surveys and inventories of earth surface phenomena. Despite the growing amount of free satellite images of the Amazon region, the resolution of many of these pictures does not allow the location and outlining<sup>5</sup> of many of the communities. This happens because riverside buildings have an average of 70 m<sup>2</sup>, which requires the use of data with spatial resolutions smaller than 10 m. However, the free images available have spatial resolutions equal to or greater than 10 m.

The unaffordable costs of high spatial resolution images per unit of pictured area contribute to constrain the mapping of communities due to the size of the Amazon territory and the number of images needed to cover its entire area<sup>6</sup>. Furthermore, the riverside buildings follow an isolated spatial arrangement amidst the monotony of the forested landscape, making the detection process by photo interpretation or automatic pattern recognition quite difficult.

<sup>1</sup> Fernandes & Moser, 2021.

<sup>2</sup> Gama et al. 2018.

<sup>3</sup> Fernandes & Moser, 2021.

<sup>4</sup> IBGE, 1999.

<sup>5</sup> Here, "detection" is understood as indicating an occurrence and "delineation" as extracting the contour.

<sup>6</sup> Mascarello et al., 2018.

This scenario helps to explain the fact that the spatial distribution of these communities throughout the Amazon territory is still unknown, invisible not only in cartographic products, but also in public policies that should assist these populations. In short, information on the location (x, y) of riverside communities and their correct toponymy<sup>7</sup> can be useful to:

- Territorial planning considering local actors;
- The elaboration of public policies that are more connected to the real needs of the populations;
- Management and provision of public services (health, education, etc.);
- Territorial symbolic appropriation for the construction of identity and geographic memory;
- As a tool for territorial legitimation by invisible populations, among others.

The OpenStreetMap (OSM) platform appears as promising for the mapping of riverside communities, since it offers a wide territorial coverage of high-resolution images, allowing visibility on a local cartographic scale to regional geographic phenomena. The platform is constantly updated and voluntarily edited under an open license<sup>8</sup>, which encourages social and collaborative mapping initiatives.

Junior<sup>9</sup> outlines the importance of social cartography as a tool for maintaining cultural identities in riverside territories, understanding them as a stage for conflicts. As for collaborative mapping, Panek and Netek<sup>10</sup> mention it as an important resource to ensure that spatial data on different locations are available to everyone, regardless of the position they occupy within the current power structure.

The hypothesis of this study is that from the collaborative mapping by photointerpretation of high-resolution data available from OSM and the analysis of toponyms in secondary documents, it is possible to mitigate the Amazon riverside invisibility on maps. To test the hypothesis, the riverside communities adopted as a pilot area were the ones in the Tarará Island (*Ilha de Tarará*), located in the main channel of the Solimões River, municipality of Tefé, state of Amazonas, Brazil. In the scientific literature there is little information

about the island and its communities, the same occurs in official cartographic documents.

The methodological procedures of this study were: survey and analysis of cartographic data and secondary data on the toponyms of the communities, mapping of riverside communities by photointerpretation in the OSM, data collection in the field, and validation. As a result, the study presents the mapping of the riverside communities of Tarará Island (*Ilha do Tarará*): location (x, y) and toponymy of the locations.

It is assumed that collaborative mapping or Volunteered Geographic Information (VGI) is a World Wide Web (Web) phenomenon related to the voluntary engagement of individuals or organizations, often not specialized, in the creation or improvement of geographic information<sup>11</sup>. The accuracy of the information generated is heterogeneous, but it can be satisfactory for many applications<sup>12</sup>. In the specialized literature, the term Crowdsourcing is also related to the words “collaborative mapping” and VGI. Thus, it is important to clarify the relationship between these terms, which are briefly presented in the next section.

## Collaborative Mapping and definitions

This study followed the perspectives of Crowdsourcing and Voluntary Geographic Information (VGI) or collaborative mapping, as it is known in Brazil. The term has its roots in the English language; therefore the terminology is used to characterize groups that come together, either face-to-face or online, to solve problems<sup>13</sup>. The methodology can be applied in several areas, for example, in the access to collective intelligence to reduce company costs<sup>14</sup>. In the case of gatherings for the production or improvement of geographic information, Goodchild<sup>15</sup> defined it as VGI.

In the classification of Crowdsourcing, the exact geographic or organizational proximity does not exist, nonetheless, there is the technological one from an online platform, in which knowledge of social and historical relations of a region is not necessary<sup>16</sup>. Figure 2 summarizes the different categories of proximity relationships in Crowdsourcing.

<sup>7</sup> Toponymy can be understood as the linguistic and/or historical study of geographical names. A correct toponymy is important for referential orientation of places, providing information that cannot be represented only by symbols.

<sup>8</sup> Haklay & Weber, 2008.

<sup>9</sup> Junior, 2020.

<sup>10</sup> Panek & Netek, 2019.

<sup>11</sup> Goodchild, 2007.

<sup>12</sup> Goodchild, 2007; Touya et al., 2017; Machado & Camboim, 2019.

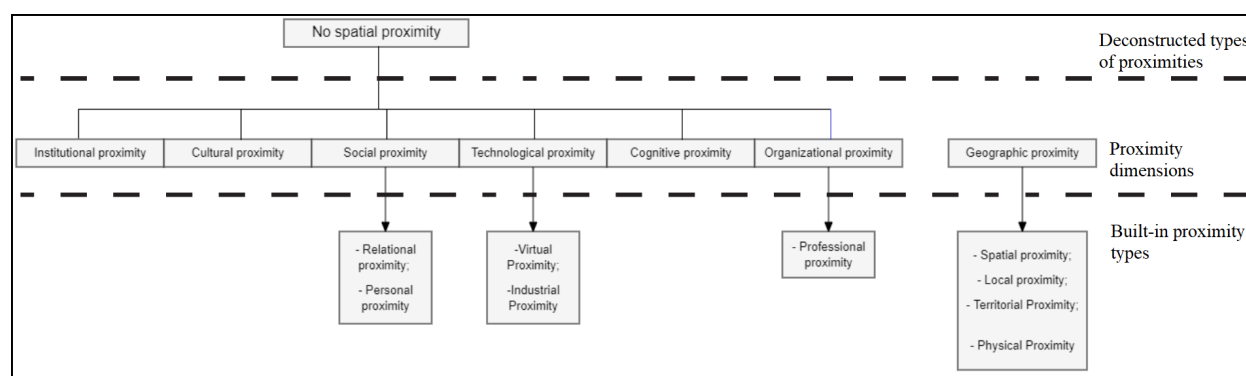
<sup>13</sup> Howe, 2006. Sieber & Haklay, 2015.

<sup>14</sup> Pedersen et al., 2013.

<sup>15</sup> Goodchild, 2007.

<sup>16</sup> Howe, 2006. Knobens & Oerlemans, 2006. Nascimento, Heber, & Luft, 2013.

Figure 2. Proximity dimensions



Source: adapted by Knobens and Oerlemans<sup>17</sup>.

As far as the creation of geographic and cartographic data is concerned, Crowdsourcing is applied to Voluntary Geographic Information to voluntarily map and share information<sup>18</sup>. In this study, we will use the term collaborative mapping to refer to the generation of voluntary spatial information data.

Collaborative mapping in platforms for the making of cartographic data such as OSM has shown significant results and the potential for using its data as reference mapping is investigated by several researchers<sup>19</sup>. Martins Junior *et al.*<sup>20</sup> discuss the construction of a voluntary database to map gas stations in the city of Rio de Janeiro and its surroundings and their inset in the OSM, in addition, they present reflections on collaborative mapping to optimize the updating of the cartographic bases and expanding social participation in this process, as well as the uses of collectively produced data are still sensitive to National Mapping Agencies.

Gracie<sup>21</sup> used collaborative mapping to build and organize a unifying panel with Covid-19 data focusing on the visibilities of the peripheral territories (*Favelas*, Portuguese for shanty towns) of the municipality of Rio de Janeiro, state of Rio de Janeiro, Brazil.

Young *et al.*<sup>22</sup> developed research using collaborative mapping called Advancing Library Visibility in Africa (ALVA) to examine the relationship between library audiences and sustainable development across Sub-Saharan Africa. Other examples are found in publications by Goodchild<sup>23</sup>, Folger<sup>24</sup>, Bravo<sup>25</sup>, among others.

Despite the potential of collaborative mapping including its low cost, constant and fast updates (*real-time* or *near real-time*), possibility of integration with other technologies, among others, there is much discussion about the downsides of its use. Among them are the heterogeneity of the data, their reliability, differences in the scale of the mappings, among other factors that can jeopardize their usability<sup>26</sup>.

## Material and Methods

### Study Area

The pilot area of this study is Tarará Island, whose central is called *Ilha do Panamim* (Panamim Island), to the north of which is the *Ilhota do Panamim* (Panamim Islet), to the south, *Paraná do Panamim* and to the southeast, *Paraná do Curabatú*. The island is located in the municipality of Tefé and is located in the Amazonian plain unit, in the downstream vicinity of the junction of the Japurá River with the Solimões River (Figure 3).

The *Rio Solimões* (River Solimões) has its headwaters in the Andes Mountain Range, from where most of the suspended sediments that are deposited along its course come, especially in its medium-low course. The natural dynamics of the hydrography alters the landscape and forces riverside communities to migrate. The buildings are mostly made of wood, which makes it possible to dismantle and rebuild them in another location.

The livelihood of the riverside communities is based on the cultivation of yuca/manioc, vegetables and fruits, in addition to fishing and the manufacture of flour. The surplus is sold at the fair and at the municipal market in the city of Tefé<sup>27</sup>. During the dry season, food

<sup>17</sup> Knobens & Oerlemans, 2006, p. 74.

<sup>18</sup> See *et al.* 2016. Ooms, Maeyer & Fack, 2013. Bravo & Sluter, 2018.

<sup>19</sup> Machado & Camboim, 2019. Goodchild, 2007. See *et al.* 2016.

<sup>20</sup> Martins Junior, *et al.* 2016.

<sup>21</sup> Gracie *et al.* 2021.

<sup>22</sup> Young *et al.* 2021.

<sup>23</sup> Goodchild, 2007.

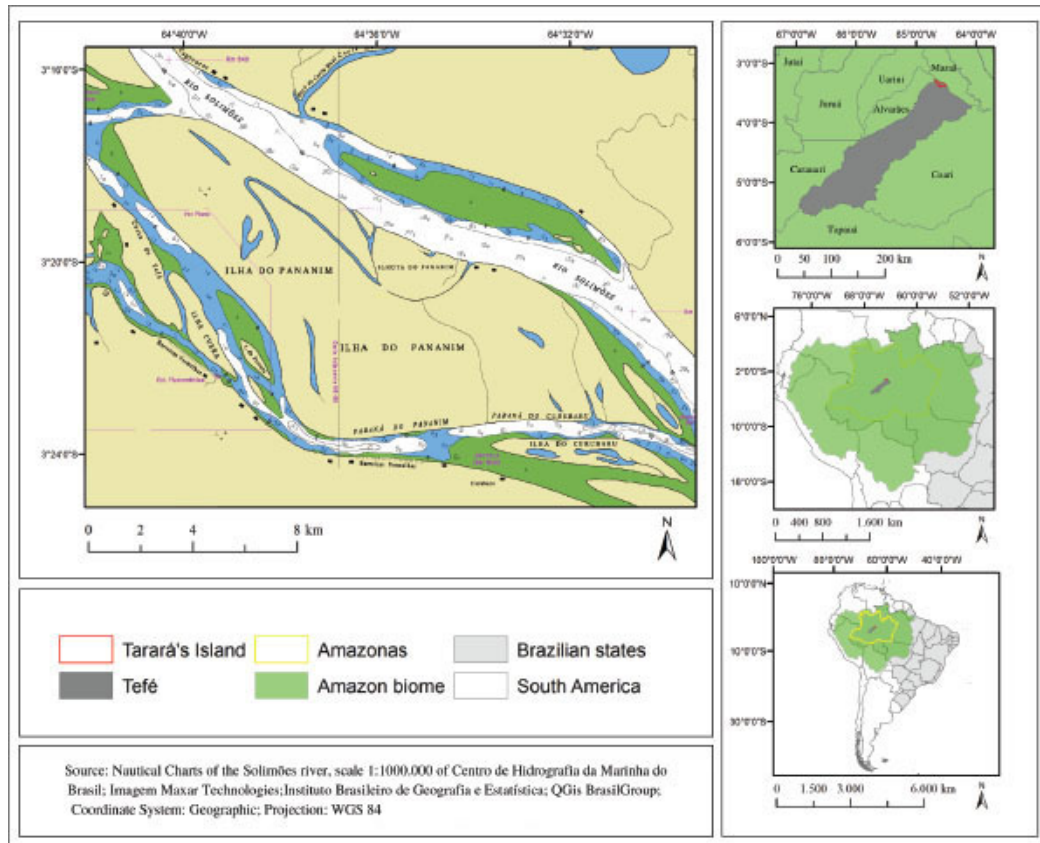
<sup>24</sup> Folger, 2009.

<sup>25</sup> Bravo *et al.* 2015.

<sup>26</sup> Panek & Netek, 2019.

<sup>27</sup> Santos, 2020.

Figure 3. Location of Tarará Island



Source: own elaboration.

is grown directly on the ground and in the wet season, the cultivation is carried out in suspended beds, built with wood.

The riverside and indigenous people use small boats as their main means of transport<sup>28</sup>. Water seasonality determines the routine of communities since causes variation in the distances between buildings and river banks. In floods, the waters cover the soil and crops and reach the level of buildings. Access and transport in this period are easier because the travel time by boats decreases. In the dry season, however, with a lower river level, communities face challenges in transport, access to water for drinking and personal hygiene<sup>29</sup>. Distances between buildings and rivers increase. The water that supplies the communities comes from the rivers and does not receive any treatment. Whenever possible, residents buy drinking water and ice in Tefé<sup>30</sup>. The steep slopes (Figure 4a) are exposed, making it difficult to move and collect water to supply households (figure 4b).

There is no sewage system and, in some buildings, there are rudimentary cesspools with small wooden constructions, close to the homes. In many places, there is a small raft built with wood that serves as support for mooring boats and for daily duties such as bathing, washing clothes and household items (Figure 5).

Energy is supplied by the Federal Government's *Electricity for Everyone* program through Amazonas Energia and by diesel generators. The communication system by internet and mobile phones is virtually non-existent.

Elementary School is offered in the communities and High School and the health service (exams and medical appointments) are offered in the city of Tefé. Medical assistance in the communities is provided by the River and Riverside Family Health Basic Units. Some communities have resident community health agents who provide basic and first aid care and there are communities that have an ambulance boat to transport patients to the city of Tefé, in urgent and emergency cases<sup>31</sup>.

<sup>28</sup> Cardozo, Diniz & Szlafsztain, 2022.

<sup>29</sup> Moura et al. 2015.

<sup>30</sup> Santos, 2020.

<sup>31</sup> Santos, 2020.

Figure 4. a) Dry period and b) Flood period



Source: author's own collection.

Figure 5. Small support raft for daily activities in of São Luiz do Macari communities in Tarará Island



Source: authors' own archive.

## Methodological procedures

The procedures used to map the riverside communities were: (1) survey of cartographic data and secondary data on the toponyms of the communities, (2) collaborative mapping of riverside communities by photo interpretation in the OSM and recording of toponymy, and (3) collection of fieldwork data.

The surveys of cartographic data and information about the toponyms of the communities were executed on the platforms of the Brazilian Institute of Geography and Statistics (IBGE), Google Earth and OpenStreet-Map, as well as on the websites of the Department of Education of the municipality of Tefé, the Brazilian Hydrographic Service, in the databases of the Brazilian Digital Library of Theses and Dissertations (BDTD) and the *Scientific Electronic Library Online-SciELO*. For this study, vector bases were also analyzed on villages in

the municipality and Tefé from the Mamirauá Institute for Sustainable Development, the Municipality and the Civil Defense.

The riverside communities in the municipality of Tefé were mapped by collaborators who connected through the OSM platform and performed the vectorization of the communities from the perspectives of collaborative mapping. The “Mapping of Amazon Riverside Villages in the North of the Municipality of Tefé – AM” was registered on *Tasking Manager* and published with guidelines for mapping communities. This platform was developed by the Humanitarian Team OSM and allows the systematic division of the area to be mapped into quadrants, so there is no overlapping of mapping tasks. It also enables the issuance of reports on the process, such as the number of participants involved and the progress of the mapped area. As guidelines for employees, each building in the communities

was requested to be represented by a polygon and to be labeled “building”. In OSM, ontologically, buildings are related to any covered construction, usually delimited by walls, with the purpose of housing human activities.

In 2022, two fieldworks were performed, one in February and another in May. The first fieldwork was intended to make a general recognition of the area. The second fieldwork aimed at collecting data on the toponyms of the communities. The latter had the logistical support of the *Defesa Civil do Município de Tefé* (Civil Defense of Tefé), the *Instituto de Desenvolvimento da Amazônia* (IDAM) (Amazon Development Institute), the *Instituto Mamirauá de Desenvolvimento Sustentável* (Mamirauá Institute for Sustainable Development) and the *Centro de Estudos Superiores de Tefé da Universidade do Estado do Amazonas* (Tefé Higher Studies Center of the University of the State of Amazonas). The field procedures were photographic records, including drone view pictures, interview with residents, notes in field book, and collection of secondary data with the *Defesa Civil do Município de Tefé* (Civil Defense of Tefé).

The truth value of the data (location of communities and toponymy) was verified based on the cross-reference of information collected in the field with secondary data, mentioned at the beginning of this section.

## Results

The survey of cartographic data in official agencies indicated the invisibility on the maps of riverside communities, located in the Tarará Island. In the census grid of the municipality of Tefé, prepared by IBGE<sup>32</sup>, there is a division of the area of the municipality into urban and rural, but without information on the riverside communities, referring to their locations and toponyms. On the basis of the OSM, it was found that there are locations by points and with the nomenclatures of four riverside communities, *Santa Maria*, *Glória*, *Boará* and *Boarazinho*, based on data from the IBGE Census<sup>33</sup> (Figure 6).

The precariousness of the IBGE Census data<sup>34</sup> may be related to the difficulties in updating the mapping of the Brazilian territory due to the high costs and little investment by the Federal, State and City governments

in actions to update data, as well as the perils and costs to collect data in riverside communities further away from the urban center of Tefé.

The riverside communities *Santa Maria*, *Glória*, *Boará* and *Boarazinho* are more reachable than the others in Tarará Island, due to their nearness to the urban center of Tefé. During the flood period, it is possible to sail to the Solimões River through the *Furo da Boa Vista* (Boa Vista Hole), which connects the Tefé lake to the river. The trip is shorter and cheaper during this period, but no less dangerous due to the natural hydrological dynamics that can increase the intensity of the *banzeiros* (waves in Lake Tefé) and the *rebojos* (circular movement from the river bottom to the surface), as well as the amount of tree trunks in the waters of the rivers, which can cause accidents, among others. The difficulties are even bigger due to the lack of financial resources to expand the technical team, so they have better vessels and aid to pay for fuel and communications systems.

In the Map Biomas and Google Maps databases, no information was found about the toponyms of the communities and the representations of the buildings. In the scientific literature there are two publications with information about the toponyms of the communities in the island. Santos<sup>35</sup> states that on Tarará Island there are twelve communities: *Luz Crescente*, *Boarazinho*, *Boará*, *Glória*, *Santa Maria*, *Santa Cruz*, *São Francisco do Piranhã*, *São Francisco do Aratamã*, *São Luís do Macari*, *Novo Porto Novo*, *Nova Esperança do Arauri* and *Santa Clara*, but without citing the source of this information.

The communities mentioned by Santos<sup>36</sup> in line with the information on the map prepared by the Municipal Production and Supply Department (SEMPA) presented in the publication by Silva and Valdez<sup>37</sup>, are shown in Figure 7.

The *Instituto Mamirauá de Desenvolvimento Sustentável* (Mamirauá Institute for Sustainable Development) database contains nine communities that are mentioned by Santos<sup>38</sup> and are represented on the map prepared by SEMPA. The communities that are not represented on the Institute’s database are: *Luz Crescente*, *Nova Esperança Arauri*, *Novo Porto* and *São Luiz do Macari* (Figure 8).

At the fair in the city of Tefé, residents of the communities said they were not sure of the geographic locations of the communities, but the names were correct, with the exception of the *Novo Porto* community,

<sup>32</sup> IBGE, 2020.

<sup>33</sup> IBGE, 2010.

<sup>34</sup> IBGE, 2010.

<sup>35</sup> Santos, 2020.

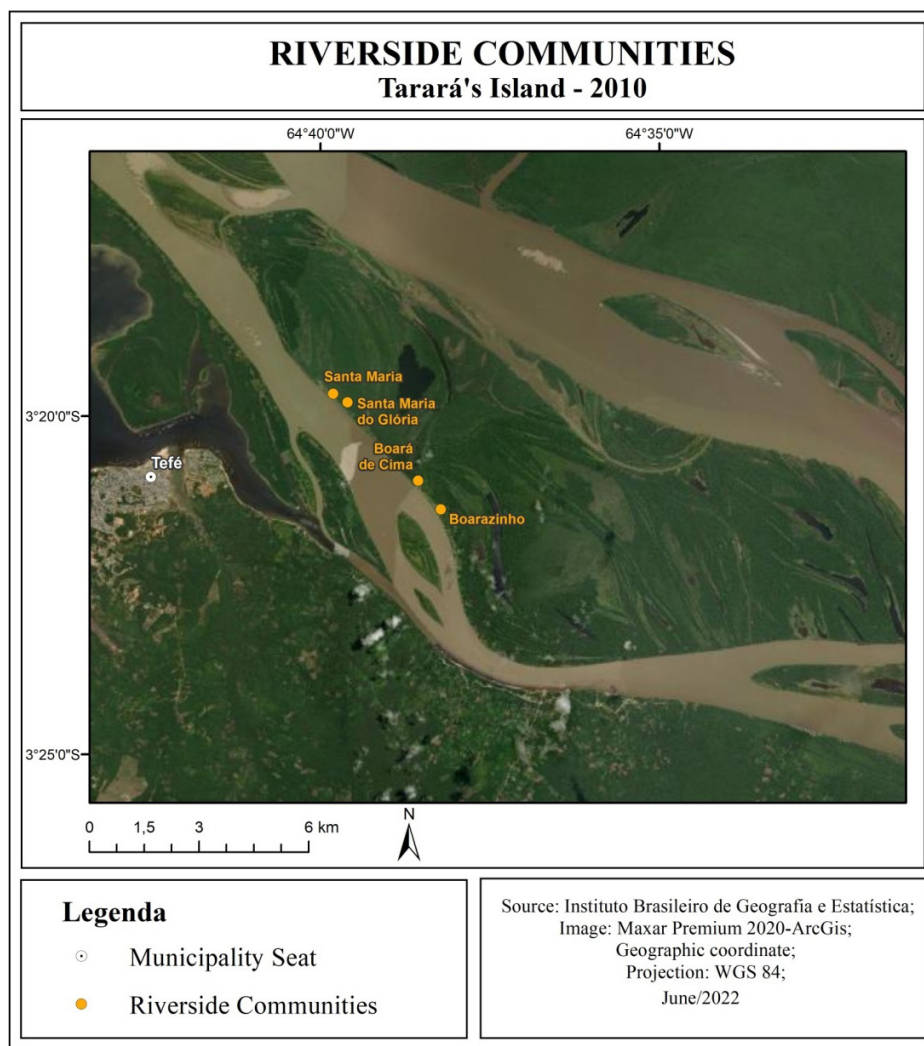
<sup>36</sup> Santos, 2020.

<sup>37</sup> Silva & Valdez, 2017.

<sup>38</sup> Santos, 2020.

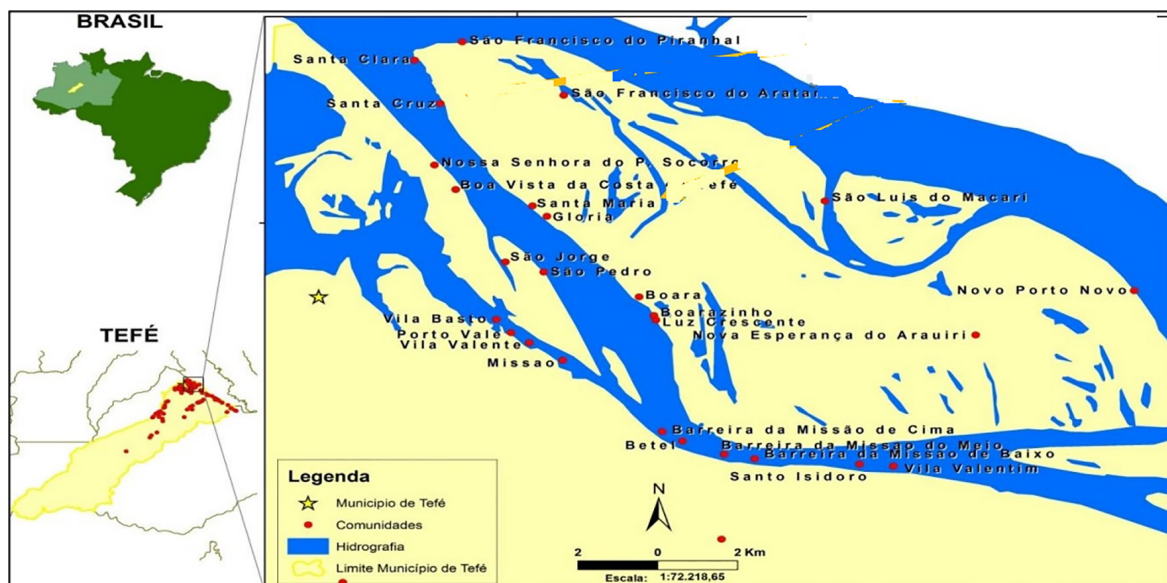


Figure 6. Communities located based on IBGE information



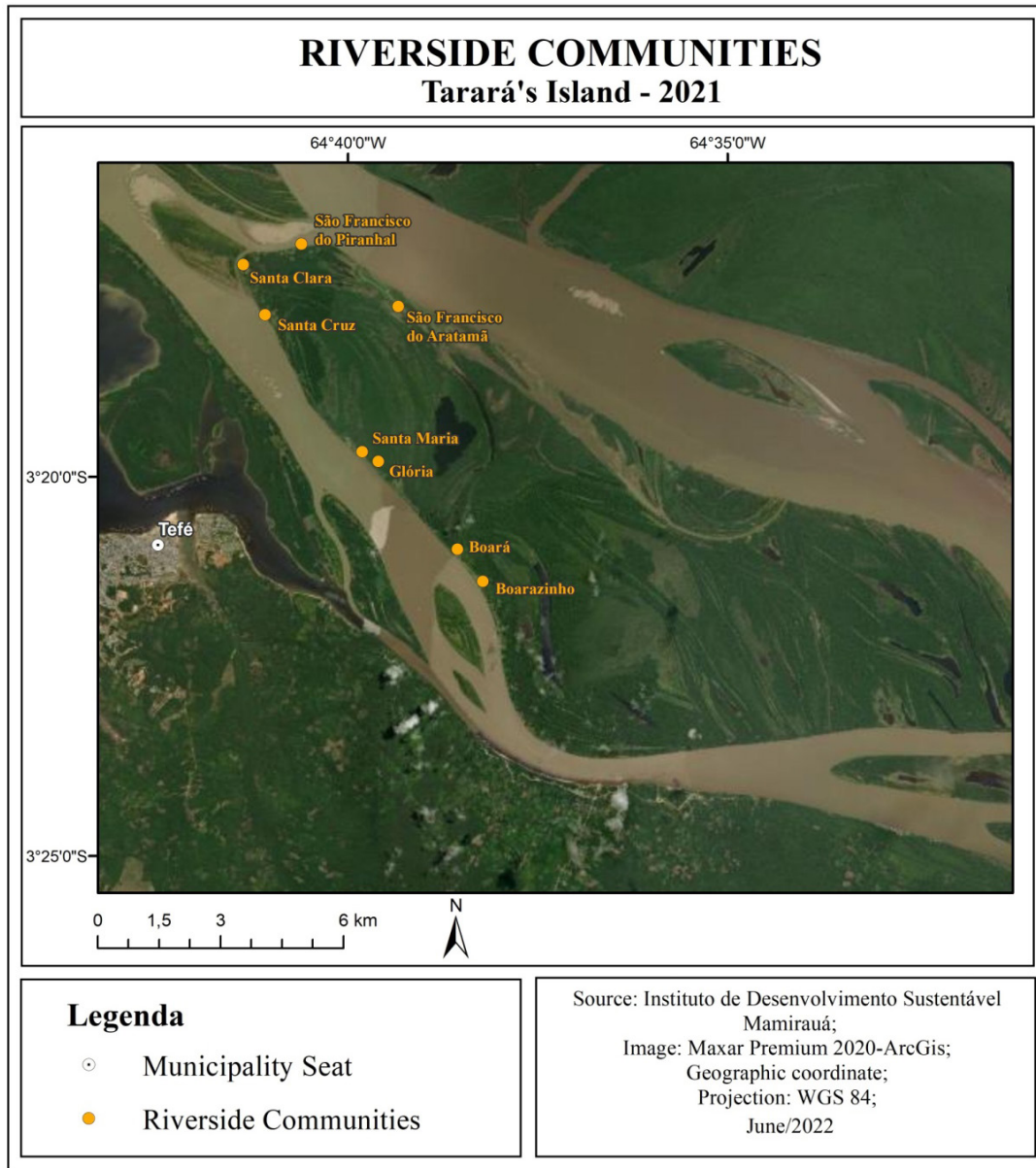
Source: Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics).

Figure 7. Map of the Municipal Production and Supply



Source: Silva and Valdez (2017, p. 4).

Figure 8. Communities on the *Instituto Mamirauá de Desenvolvimento Sustentável* (Mamirauá Institute for Sustainable Development)



Source: *Instituto Mamirauá de Desenvolvimento Sustentável* (Mamirauá Institute for Sustainable Development).

whose correct name is *Novo Porto Novo*. According to reports from residents, the spatial dimension of the island and the precarious internet in Tefé make it impossible to access information from each community, and the further away from the city of Tefé, the scarcer the information<sup>39</sup>.

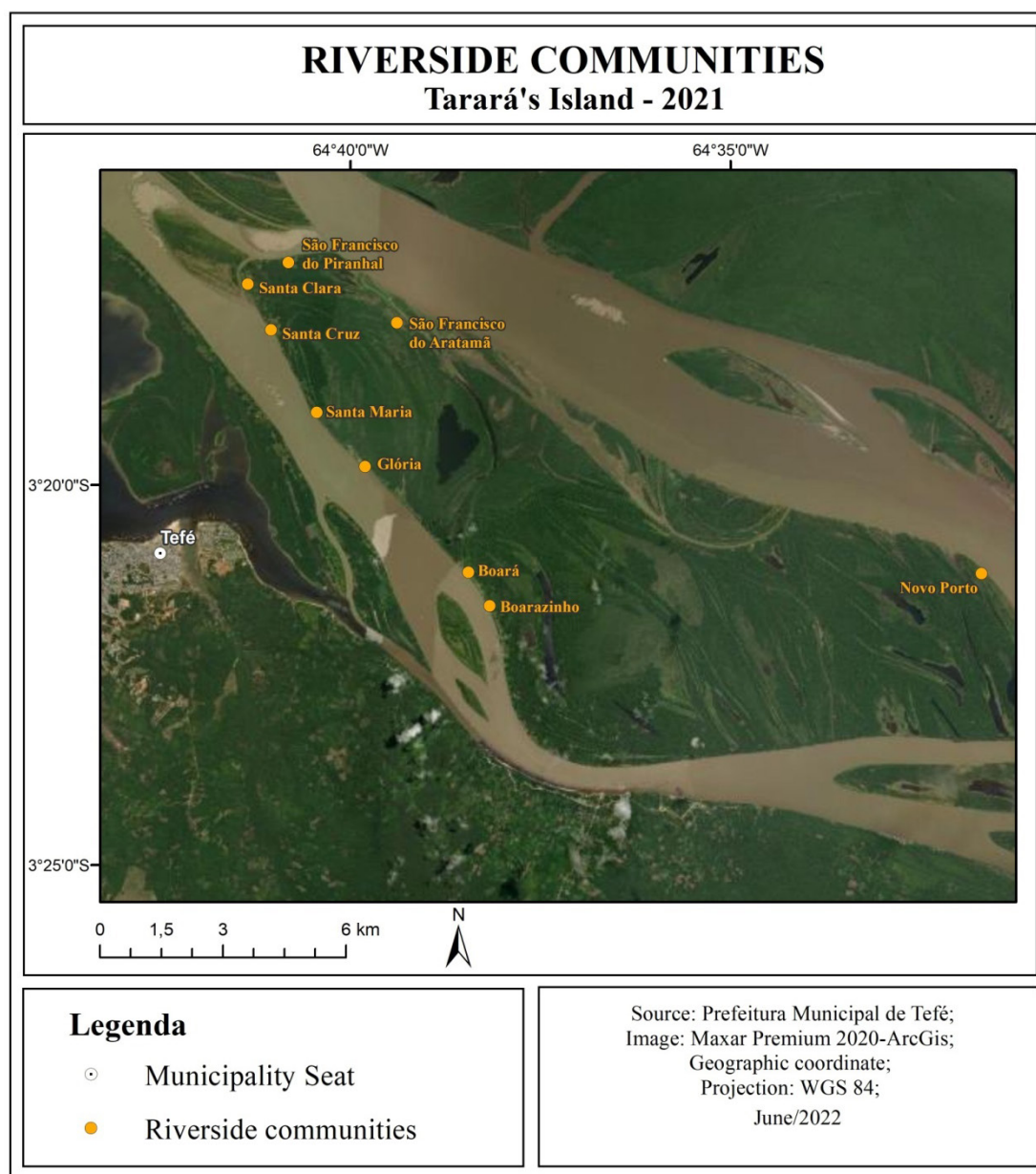
In the database of the Municipality of Tefé, nine communities are represented (Figure 9). Compared to the Mamirauá base, the community of *Novo Porto* appears in this base.

The *Defesa Civil do Município de Tefé* database has information on 14 communities, but one called *Ilha do Felipão* (Felipão Island) has no information about its location and therefore it was not spatialized. Other differences between the *Defesa Civil* database and the data collected in the other mentioned databases are: the existence of the *São Conrado* community, the division of the *Boará* community between *Boará de Cima* and *Boará do Meio*, the location in two places of the *São Luiz do Macari* community and the non-existence of the *Novo Porto Novo* community (Figure 10).

In the fieldwork, information on the location of the *São Luiz do Macari* community was validated in two

<sup>39</sup> The interviews were performed by a researcher who is from the area, whose name shall be entered in the event of the acceptance of this paper.

Figure 9. Communities according to the Municipality of Tefé



Source: Municipality of Tefé.

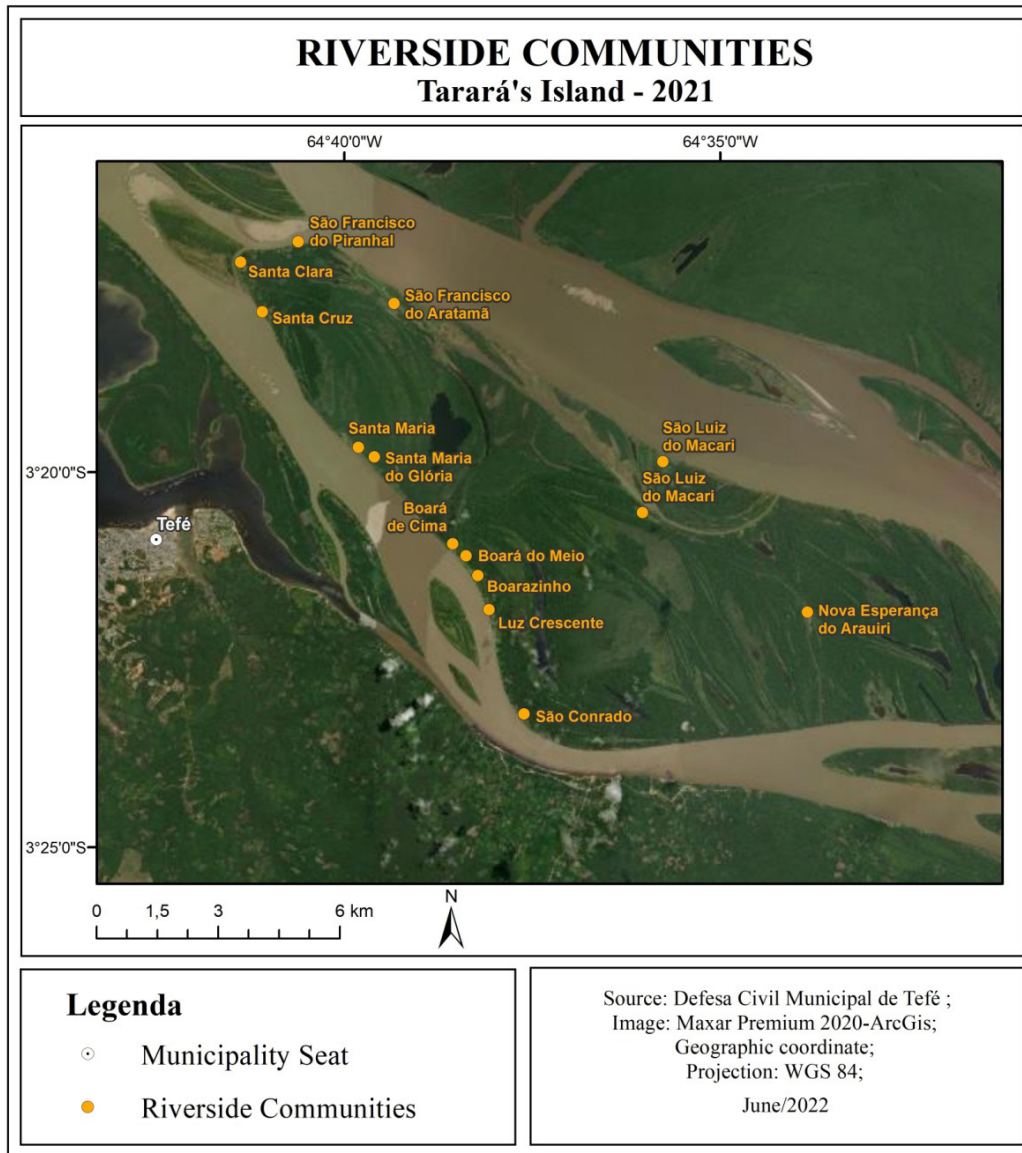
locations. According to the *Defesa Civil*, the *Novo Porto Novo* community has moved, but there is no information to where. This fact was confirmed by the residents of the *São Luiz do Macari* Community and through the comparative analysis of Maxar satellite images from the years 2017 and 2021. In the image of the year 2021, the riverside community “Novo Porto Novo” or according to other “Novo Porto” bases are no longer in place (Figure 11).

In addition to these bases, the sheet 01MM 1304203 was verified, which integrates the collection of Municipal Maps generated in a semi-automated way, from the IBGE's Municipal Digital Mesh<sup>40</sup>. Although the sheet

<sup>40</sup> IBGE, 2021.

warns that the map is exclusive to the Institute's collection and statistics activities, it was considered in the research because it contains toponyms of the riverside communities located in the island: *Comunidade Macari*, which according to other databases is known as *São Luiz do Macari*; *São Francisco do Aratamã* Community, which receives the name *São Francisco do Aratamã* in other bases and by the population; Location of *Piranhã*, known as *São Francisco do Piranhã*; *Santa Clara* Community; *Santa Cruz*; *Santa Maria* Community; *Glória*, also known as *Santa Maria do Glória*; *Boará* Community and two more points with the name *Boará*, which based on data from the Civil Defense of Tefé is divided into *Boará de Cima* (Upstream *Boará*) and *Boará do Meio* (Midstream *Boará*);

Figure 10. Location of communities in the island according to the data recorded by the *Defesa Civil de Tefé* (Civil Defense of Tefé)



Source: *Defesa Civil de Tefé* (Civil Defense of Tefé).

*Boarazinho*; *Vila Valente*, which is in the same geographic location as *São Conrado*, according to the coordinates provided by the Civil Defense. In the letter four indigenous villages are represented, they are: *Novo Porto Novo* Indigenous Village, which according to field data no longer exists; *Kanata-Aeitu* Indigenous Village; *Boarazinho* Indigenous Village and *Nova Esperança* Indigenous Village, whose location is the same as the *Nova Esperança do Arauiri* community.

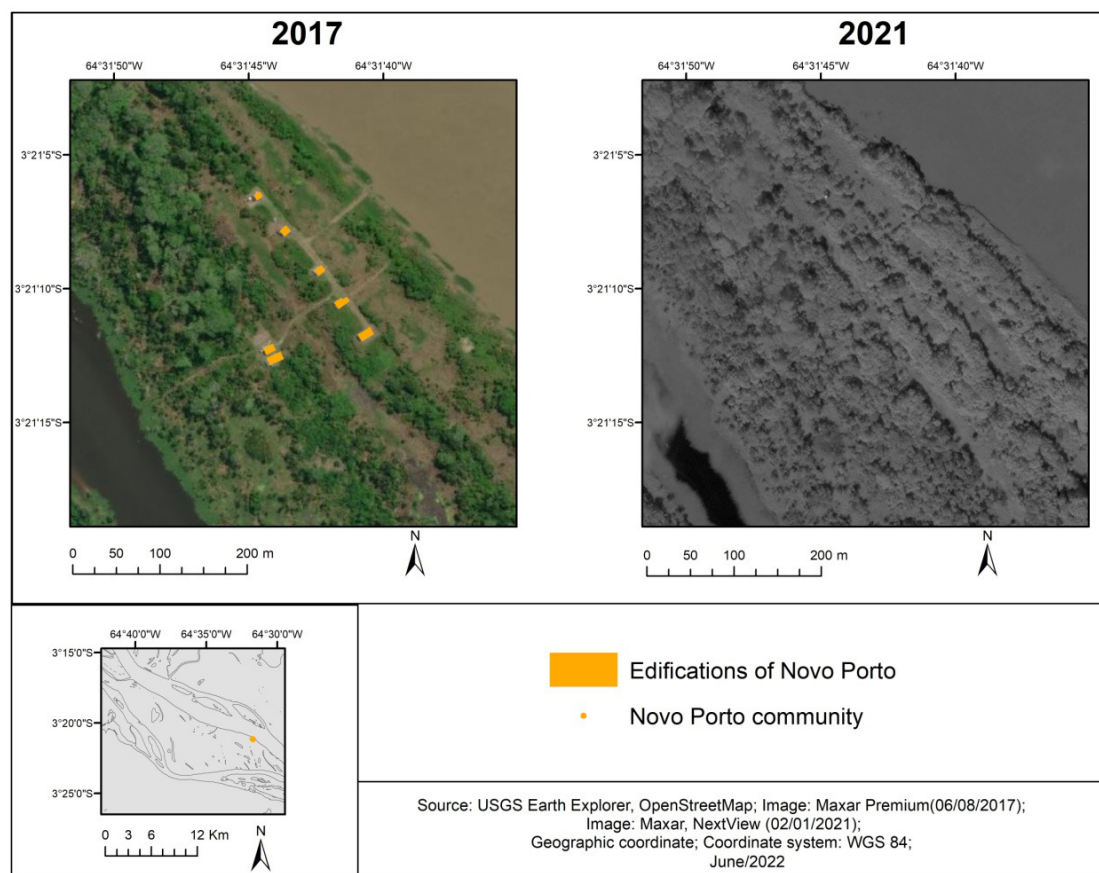
From the data and analysis presented, the information of the toponyms on the OSM Platform was validated, and despite the constant updating of information and images, it was found that the information is outdated, as it still has buildings in the community of *Novo*

*Porto* and the buildings of the *São Luiz do Macari* community are not distributed into two locations.

For the data entry in the platform, from the fundamentals and procedures of Crowdsourcing, 352 buildings located in the island of Tarará were vectorized. In addition to buildings belonging to communities, there are isolated buildings (single building), which are occupied by families who do not identify with communities or choose to live far away. Data collected from the Civil Defense indicates that there are 349 families on the island.

The OSM Platform is part of the basis of several free databases in Brazil and therefore the invisibility of communities was reduced from the development of the

Figure 11. Comparison of the Novo Porto Novo community in the years 2017 and 2020



Source: own elaboration.

reported research. Table 1 illustrates on which basis it is possible to see communities.

Table 1. Examples of sites that use the OpenStreetMap

Mapbiomas Brasil	<a href="https://mapbiomas.org/">https://mapbiomas.org/</a>
Mapcarta	<a href="https://mapcarta.com/pt/">https://mapcarta.com/pt/</a>
Infraestrutura Nacional de Dados Espaciais - INDE	<a href="https://www.inde.gov.br/">https://www.inde.gov.br/</a>
Centro de Sensoriamento Remoto-UFMG	<a href="https://maps.csr.ufmg.br/">https://maps.csr.ufmg.br/</a>
United Nations	<a href="https://wiki.openstreetmap.org/wiki/Unite_Maps_Initiative/UN_Mappers">https://wiki.openstreetmap.org/wiki/Unite_Maps_Initiative/UN_Mappers</a>
Doctors without Borders	<a href="https://www.msf.org.br/noticias/msf-lanca-aplicativo-para-que-publico-poss-ajudar-enviar-cuidados-medicos-para-vulneraveis">https://www.msf.org.br/noticias/msf-lanca-aplicativo-para-que-publico-poss-ajudar-enviar-cuidados-medicos-para-vulneraveis</a>

Source: Author's own elaboration.

In the fieldwork in the community of São Luiz do Macari, it was observed that there is already internet at the school, mobile signal in some places and for certain operators, so in the near future, the communities themselves will be able to enter information and mappings

in the OSM aligned with their realities. Places that have already gone through this mapping phase, for example in Nepal<sup>41</sup>, show that after that, local agents who live in the place, through OSM notes, tend to enter information and share local knowledge about geographic objects.

### Final considerations

Due to the dimension, the mobility and financial difficulties, the coverage and technical limitation of data, many phenomena in the Amazon region present challenges to be represented. In relation to the cartographic invisibility of the riverside people, this can be understood from the perspective of marginalization within the current power structures and from the perspective of the technical limitations linked to the tasks that involve the inventory and cartographic representation of terrestrial surface phenomena.

<sup>41</sup> Poiani et al. 2016.

The OSM platform becomes promising, as it offers a wide territorial coverage of high-resolution images and allows this local visibility to regional phenomena. The methodology for mapping these communities, using the fundamentals of Crowdsourcing and IGV, proved to be efficient since in a short period of time it was possible to map the riverside communities and buildings on *Ilha Tarará* (Tarará Island).

The analysis showed that the OSM platform provides cartographic visibility to riverside communities, as sites with official cartographic databases use it. This makes these data available and free, in addition to offering countless potential for their use by researchers, public authorities, non-governmental organizations and others.

Also, from this study, the truth value of information related to the number of buildings in each community and their toponyms was verified and the presence of these features was verified within important platforms that use OpenStreetMap as a basis. Therefore, it is possible to conclude that the methodology can be applied to grant visibility to communities even in regional mappings and the data made available within the OSM can be used in different scopes and in different researches for local development.

In this way, it is concluded that the proposed hypothesis was proven because from the collaborative mapping by photo interpretation of high-resolution data available from the OSM and the analysis of toponyms in secondary documents, it was possible to mitigate the riverside invisibility in the pilot area composed by the riverside communities on the Tarará Island.

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