

Collaborative Cartography Making Riparian Communities Visible in Tefé, Amazonas, Brazil

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Abstract

The authors explore the invisibility of riparian communities along the river channels of the Amazon basin and the utility of collaborative mapping as a methodology for increasing their visibility on publicly available maps with the objective of contributing to the recording of their history and presenting a collaborative cartographic product that can be useful for guaranteeing territorial rights and support the creation of public policies more suited to the riverside realities. These efforts carried out by the YouthMappers chapter at the Universidade Federal de São João del Rei and Centro de Estudos Superiores de Tefé - Universidade do Estado do Amazonas support SDG 15 – Life on Land and SDG 16 – Peace and Justice and Strong Institutions.



Keywords

Land · Justice · Invisibility · Riparian communities · Collaborative cartography · Brazil · Amazonia

1 Introduction

The native peoples and riparian communities, who live on the banks of the river channels of the immense Amazon basin, govern their way of life according to the hydrological and geomorphological dynamics of the place, oftentimes intensified by the effects of El Niño and La Niña (Piedade et al. 2005). Along the Middle Solimões River, many of the riparian communities lack records about their ancestral knowledge, cultures, territories, etc. This is because the riverside dwellers transmit their knowledge and stories orally and, although this is a legitimate source of

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information, as it is immaterial, it can be lost in time (De Magalhães Lima and Ferreira Alencar 2001).

The riparian population is scattered throughout the vast Amazonian landscape, that is, it is a regional phenomenon. However, it is the local scale that gives exposure to riparian geographic spaces due to their reduced dimensions. All of this constitutes challenges for a regional cartography of this phenomenon and contributes to the imprecise knowledge about their real spatial distribution. The invisibility of these communities in official cartographic or reference documents limits them from the right to maps that document their territories and their histories. Furthermore, it hinders the creation of adequate public policies by the State to address their needs. And it is in this context that many of the communities in the municipality of Tefé are in the central region of the Amazon (Fig. 25.1).

According to the last Demographic Census (2010), the municipality of Tefé had 89 commu-

nities with approximately 15,663 inhabitants (IBGE 2012). The socio-economy of these communities is characterized by having a peasant orientation with production aimed at meeting the needs of family consumption (Adams 2006; De Souza Costa and Coelho 2020). The communities closest to the city of Tefé and those connected by land have a larger population due to the availability of commerce, education, and health. The communities farthest from the city of Tefé use river transport and lack basic infrastructure, such as education, health, basic sanitation, etc. The further away from the urban center, the scarcer the resources and the longer it takes to travel to access them.

2 Invisible Communities

Such communities do not have reference mapping whose function is to present the location of natural, artificial features, and intangible limits in

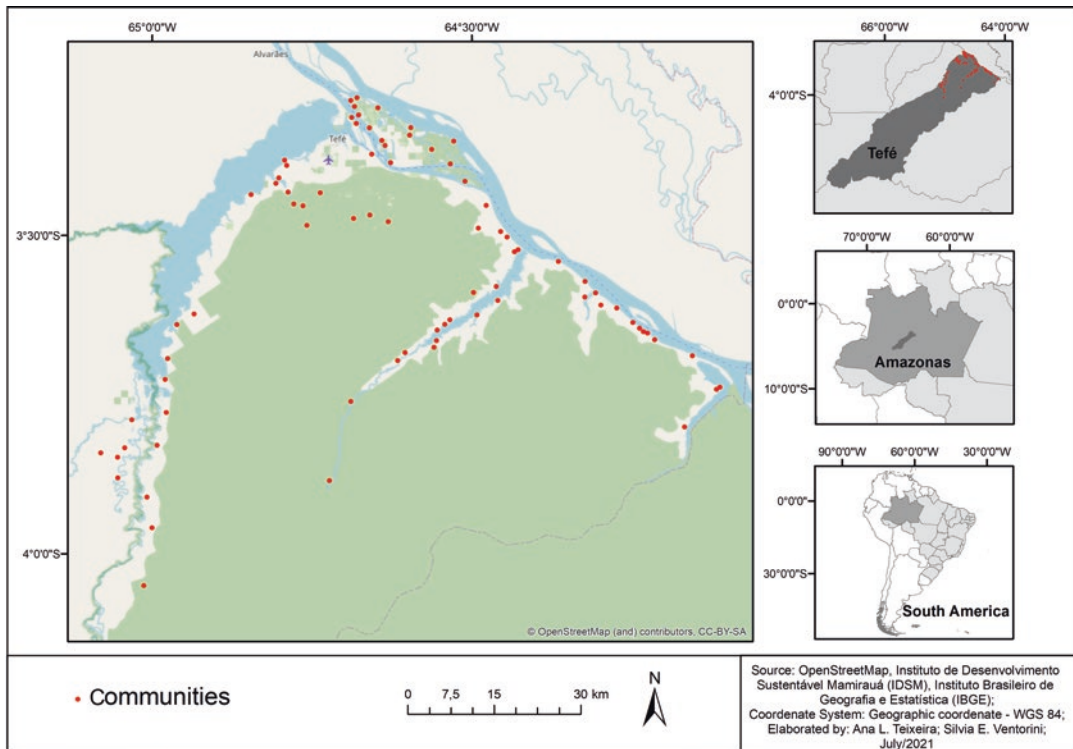


Fig. 25.1 Riparian communities are located in the municipality of Tefé, Brazil

fractions of the Earth's surface, elaborated following a Cartographic Accuracy Standard – PEC, edited by the Technical Standards of National Cartography (Machado and Camboim 2019; Oliveira 1988). This type of material constitutes one of the important elements for mapping at the local level. Oliveira et al. (2013) considers that official maps still express the interest of the powers in the dominance of knowledge of the territory and the nation. If the State and companies use mapping to legitimize actions and control the territory, making visible only what interests them, why not appropriate such instruments to document the use of the territory by traditional populations, in order to contribute to the perpetuation of their cultural practices and for their own survival (Mascarello et al. 2018)?

Sant'Anna and Young (2010) highlight the vast scientific literature that denounces territorial conflicts between the various actors that form the Amazonian framework: indigenous peoples, settlers, riverside dwellers, quilombolas,¹ land grabbers, miners, and farmers, among others. The violence generated by direct conflict results in injuries and deaths and the loss not only of land, but also of cultural, social, and identity references.

Many traditional communities struggle to guarantee their land rights, and, in this scenario, the map appears not only as a record of their locations but as an instrument that can be used to claim territorial rights (Araujo Junior 2020). Moore and Garzón (2010) describe that the maps were already part of reports and allowed the identification and proof of the traditionality of the occupation, in order to guarantee rights that were being denied in the market economy and administrative practices (Oliveira et al. 2013).

3 Increased Visibility Through Collaborative Mapping

In this context, collaborative, participatory, and social mapping emerge as alternatives to the invisibility scenario of traditional Amazonian populations. Specifically, for the mapping of riparian communities, the mappings carried out through the collaborative project OpenStreetMap (OSM) stand out as promising.

As stated earlier, the riparian dweller is a regional phenomenon, however, the scale that gives them exposure is local. In this case, the OSM platform appears as a solution, as it offers regional coverage of images that allow local analysis (images with high spatial resolution). They allow the exposure of a local phenomenon, which, later, can be transposed to a regional scale. As it is collaborative and has volunteers from all over the world, the territorial extension of the mapping is no longer a limitation.

Given this scenario, Unificar Ações e Informações Geoespaciais – UAIGeo, the YouthMappers chapter at the Universidade Federal de São João del Rei, presents an experience of collaborative mapping of riparian communities in Tefé, with the objective of mapping their spaces in the territory, contributing to the recording of their history and presenting a collaborative cartographic product that can be useful for guaranteeing territorial rights and also to support the creation of public policies more suited to the riverside realities.

3.1 Methodology

The mapping of Amazonian riparian locations in the municipality of Tefé had as initial reference a vector base of the communities' locations, provided by the Mamirauá Sustainable Development Institute, whose source is the Municipality of Tefé. From that, we verified which communities were mapped on OpenStreetMap (OSM) and Google Maps platforms. A search was made for communities in the Census Sector Network

¹Translator's note: *quilombolas* are the people of maroon communities, in the Portuguese nomenclature.

(IBGE 2012), in Higher Education Institutions and, finally, in academic publications.

With the locations available, the project *Mapping Amazonian riparian locations in the northern municipality of Tefé – AM* was registered in the Humanitarian OpenStreetMap Team (HOT) Tasking Manager and made it public so that volunteer collaborators from all over the world can map and collect organized and consistent data on the spatial distribution of communities, taking them out of the invisibility of digital maps.

At first, the vector base of reference of the riparian localities provided only the location. In the Tasking Manager project, employees were instructed to map the buildings of the communities. On OSM, buildings were marked as “buildings” which, ontologically, are related to any covered construction, usually delimited by walls, with the purpose of housing human activities. It is noteworthy that the most common buildings found in riparian communities are made of wood, due to the abundance of such material (Fig. 25.2).

We verified the accuracy of the data (name and location) based on the analysis of alphanumeric information, collected at the Mamirauá Sustainable Development Institute, data from the IBGE Demographic Census (2010), and the Department of Education (using the name and address of the schools). On OSM, the buildings in each community were quantified, considering two distinct temporal scenarios: one in 2010, based on Bing's image collection; and another in 2017, based on Maxar images.

3.2 Discussion

The vector base of reference of the riparian sites represents 72 communities. When transposing the data from this base to the OSM, a displacement was found, which was corrected during the transposition process. The location data come from a physical cartographic document of the City of Tefé. The transcription to the digital environment was made by the Mamirauá Sustainable Development Institute, by scanning, georeferencing, and punctual vectorization in a Geographic Information System (GIS).

Despite the inconsistency of the data, the map was essential to carry out the visual analysis of the communities on the OSM Platform and to define and register the project area in the HOT Tasking Manager. It is noteworthy that this was the only map found with the representation of most communities. There is no Census Sectorial Network in the communities and the Tefé City Hall and Higher Education Institutions do not have digital maps.

Analyzing OSM contributions, it was found that 16 (18%) of the 89 communities were mapped, that is, 73 communities were invisible in all sites with different themes and that use a *base map* with data from the OSM. Through the HOT Tasking Manager, 90 contributors mapped 10,780 buildings in the municipality of Tefé, in a period of approximately three months. The city of Tefé is part of the area specified in the project, hence the expressive number of buildings.

As you move away from the urban area, communities tend to decrease, for example: 49 com-



Fig. 25.2 Examples of buildings in riparian communities are characterized by proximity to water

munities are formed by less than 25 buildings, three with less than five houses, 20 with 26 to 50 houses, and 17 communities with more than 50 houses. The most densely populated communities are found in the outskirts of the city of Tefé, due to the easy access to services and resources. Another point is that the closer to the city, the higher the number of communities.

The time analysis of the number of buildings in 2010 and 2017 indicated that in the period of eight years, the communities closest to the urban center of Tefé showed an increase in the number of buildings. On the other hand, in some more distant communities, there was a reduction in the number of buildings (see Table 25.1).

Quantitative changes define a peculiar characteristic of riparian dwellers in this region: population moving between communities, detectable by the number of buildings. In the region, wooden buildings prevail, as mentioned above. When they migrate from one community to another, the riparian dwellers take their homes with them. This phenomenon is described in the work of Alencar (2010).

This movement of the population happens due to the fact that many communities, because of the natural dynamics of river erosion, commonly called “fallen lands,” are forced to move communities around, as occurred with the São Luiz do Macari community, in which the erosion quickly reached (approximately 40 m a year) the area where the community was located, destroying it. In this case, the population migrated and formed a new community elsewhere.

The research on scientific bases indicated investigations of participatory and social mapping in some communities in the researched area,

but not covering all those mapped in this research. Among these are Oliveira et al. (2013), who carried out land-use mapping in the Tefé National Forest. Mapping, therefore, is crucial to make communities visible and spatialize them. Based on it, it is already possible to identify the location and number of homes in each community, which until then were invisible, in addition to the data being free for local studies in the future.

4 Riparian Communities Seen on the Map for SDGs

The mapping activity and research analysis presented in this chapter arise from the concern when verifying the invisibility of riparian populations on digital maps. The question that guided the research was: why not take ownership of maps to document the use of territory by traditional populations, in order to contribute to the perpetuation of their cultural practices and their own survival (Mascarello et al. 2018)? Collaborative mapping on OSM through the project registration in the HOT Tasking Manager allowed volunteers from all over the world to support students and faculty at the Universidade Federal de São João del Rei map the area. Such collaboration is extremely important when local populations and the government itself do not have access to technological, financial, and human resources.

The internet system in Tefé is precarious and has a high cost for the population and the further away from the city, the more limited the signal is. The volunteer and humanitarian work from the project registered in the HOT made it possible for the communities to be visible in several Brazilian governments and international institutions databases such as the *Iniciativa para Mapeamento de Uso e Cobertura de Solo (MapBiomias)*, *Infraestrutura Nacional de Dados Espaciais (INDE)*, *Agência Nacional de Águas (ANA)*, – *Centro de Sensoriamento Remoto (CSR Maps)* da *Universidade Federal de Minas Gerais*, *Doctors Without Borders*, *World Bank Group*, *United States Agency for International Development*,

Table 25.1 Change in number of buildings

Community	Number of buildings	
	2010	2017
Flora Agrícola	105	145
Bacuri	35	53
Boa Vista	15	20
Santa Cruz	24	20
Bela Vista do Sapiá	17	9
Vila Trindade	19	15

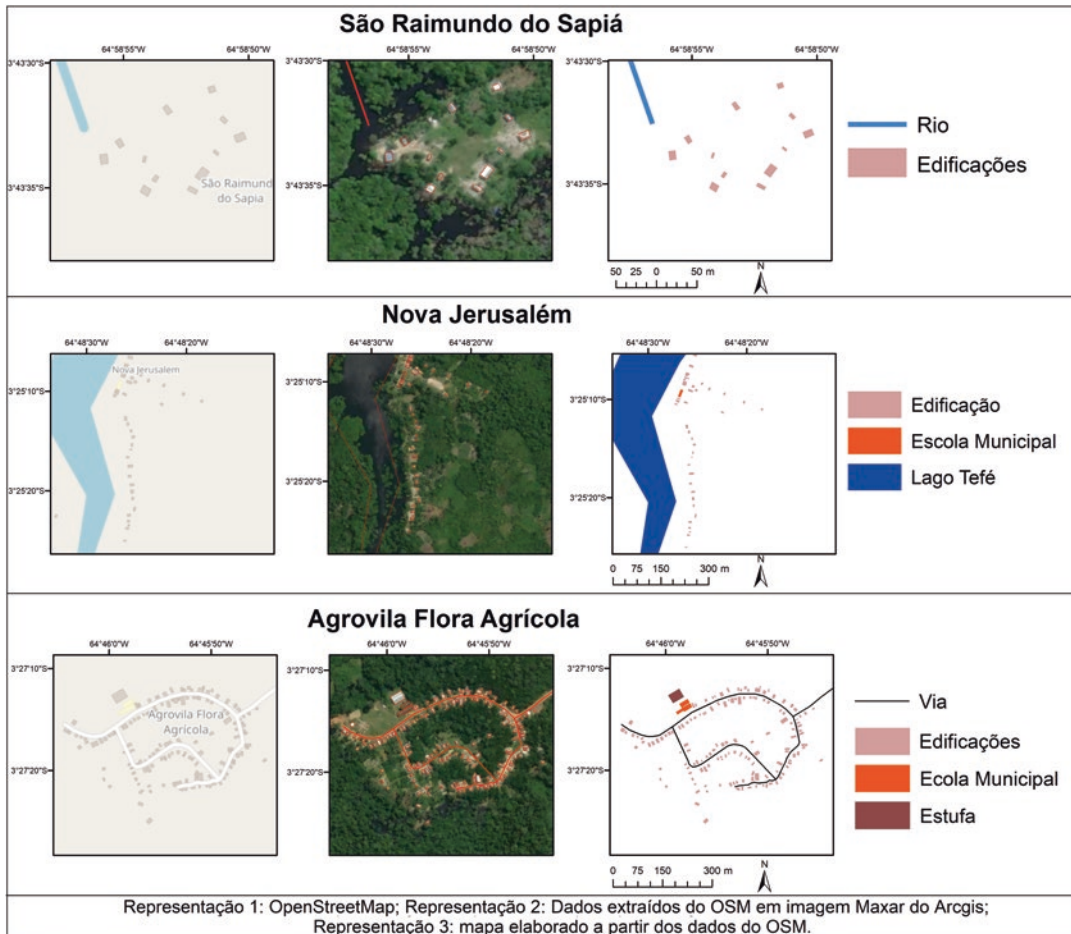


Fig. 25.3 Communities represented with OSM data enable visualization of features critical to riparian analysis

United Nations, Clinton Health Access, among others.

In addition, Geographic Information Systems have plugins that enable the visualization and download of OSM data, such as QGIS and ArcGIS, allowing researchers and professionals from different areas and sectors (public and private) to use the data to generate new mappings. Figure 25.3 illustrates examples of representations of communities that can be generated from OSM data.

Thus, it is concluded that the challenge of mapping riparian communities on a local scale gave them exposure within a regional space, and ultimately, seen for the SDGs, as well as guaranteed the right to the map.

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