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Geographical distribution of traditional rural neighborhoods and their connection to biodiversity in São Paulo state, Brazil

Distribuição geográfica dos bairros rurais tradicionais e sua conexão com a biodiversidade no estado de São Paulo, Brasil

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ABSTRACT: In recent decades, traditional communities have assumed a prominent role in international debates on sustainable development, especially as maintainers of practices and knowledge about wild and agricultural biodiversity. Thus, information about their territories is of fundamental importance for planning and implementing public policies suitable for maintaining and valorizing the traditional way of life. The research aimed to identify and map areas with the occurrence of traditional rural neighborhoods in the state of São Paulo and understand their relationship with natural vegetation and areas of interest to biodiversity conservation. The work was conducted based on secondary data, using the method of content analysis from a geographic approach with a territorial and cultural focus, as well as geoprocessing techniques. One hundred eighty-eight rural neighborhoods of interest were identified, 36 were officially recognized as territories of quilombo remnant communities, and 152 were classified as i) having strong evidence of traditionality, ii) having evidence of traditionality, and iii) having low evidence of traditionality. A close relationship between the possible coverage area of traditional territories and biodiversity was identified.

Keywords: territorial planning; public policies; caipira culture; traditional communities; biodiversity.

RESUMO: Comunidades tradicionais, nas últimas décadas, assumem papel de destaque nos debates internacionais sobre desenvolvimento sustentável, especialmente como mantenedoras de práticas e saberes sobre a biodiversidade selvagem e agrícola. Assim, as informações sobre seus territórios são de fundamental importância ao planejamento e à implementação de políticas públicas adequadas à manutenção e valorização do modo de vida tradicional. A pesquisa teve por objetivo identificar e mapear áreas com a ocorrência de bairros rurais tradicionais no estado de São Paulo e compreender a relação destes com a vegetação natural e áreas de interesse à conservação da biodiversidade. O trabalho foi realizado a partir de dados secundários, utilizando-se o método de análise de conteúdo, segundo um enfoque geográfico de abordagem territorial e cultural e técnicas de geoprocessamento. Foram levantados 188 bairros rurais de interesse, 36 reconhecidos oficialmente como territórios de comunidades remanescentes de quilombos e 152 classificados como: i) com forte indício de tradicionalidade; ii) com indício de tradicionalidade e iii) pouco indício de tradicionalidade. Identificou-se uma estreita relação entre a possível área de abrangência dos territórios tradicionais e biodiversidade.

Palavras-chave: planejamento territorial; políticas públicas; cultura caipira; comunidades tradicionais; hotspots de biodiversidade.

1. Introduction

Sustainable development has been at the center of political debates and agendas for decades, especially since 1987, with the publication of the "Our Common Future" report by the World Commission on Environment and Development, as part of a reflection and maturation process that began in 1972 with the United Nations (UN) Conference on the Human Environment in Stockholm. Since then, criticism of the hegemonic economic and social development model has deepened, and it has come to be seen as a threat to nature and the future survival of humanity.

In this process, there is a gradual and increasingly refined scientific and political recognition of the vulnerability and importance of indigenous peoples and local communities that maintain traditional ways of life, whose knowledge has been considered key to tackling the social and environmental issues facing humanity today, such as biodiversity loss, food security, adaptation to climate change and the design of more sustainable food systems (see, for example, Altieri & Toledo, 2011; Toledo & Barrera-Bassols, 2015; Lomba *et al*., 2020; Rist *et al*., 2020).

From this perspective, the protection and rehabilitation of agricultural landscapes and traditional production systems have become relevant and represent a major scientific (Jackson *et al*., 2005; Pacicco et *al*., 2018) and governmental challenge worldwide (Fischer *et al*., 2012; Rist *et* al., 2020).

Enormous progress has been made in exactly 50 years since Stockholm as a result of intense debates held in global forums and a succession of documents that have made public the political and scientific commitment of the various nations and spelled out the objectives, goals, principles, and political guidelines to be adopted in order to achieve an ethical transformation in the society-nature relationship and, consequently, the establishment of an alternative development model that could comprise a fairer, economically viable society living in harmony with nature. The main documents include those shown in Figure 1 and the various national and international standards resulting from this long process.

In the Strategic Plan for Biodiversity - 2011 to 2020, the period established as the United Nations Decade for Biodiversity, specifically about indige-

nous and local communities, it was established as a target that traditional knowledge, innovations, and practices, relevant to the conservation and sustainable use of biological diversity and customary use of biological resources, would be respected by the end of this period.

However, in 2022, we are faced with an alarming picture. The latest evaluation report of the Strategic Plan for Biodiversity showed that none have been fully achieved of the 20 targets set (known as the Aichi targets) (SCDB, 2020). This scenario directly affects compliance with the 2030 Agenda for Sustainable Development since achieving all the goals therein is directly related to compliance with any of the biodiversity targets (SCDB, 2017).

Considering that knowledge about the geographical distribution of traditional communities is a priority and a prerequisite for scientific and territorial planning, it is an integral part of efforts towards sustainability. Based on the assumption that there is a close link between traditional territories and biodiversity, this research aimed to identify and map areas where traditional (non-indigenous) rural communities may occur in the state of São Paulo, as well as to understand their interface with native vegetation and with areas indicated as priorities for

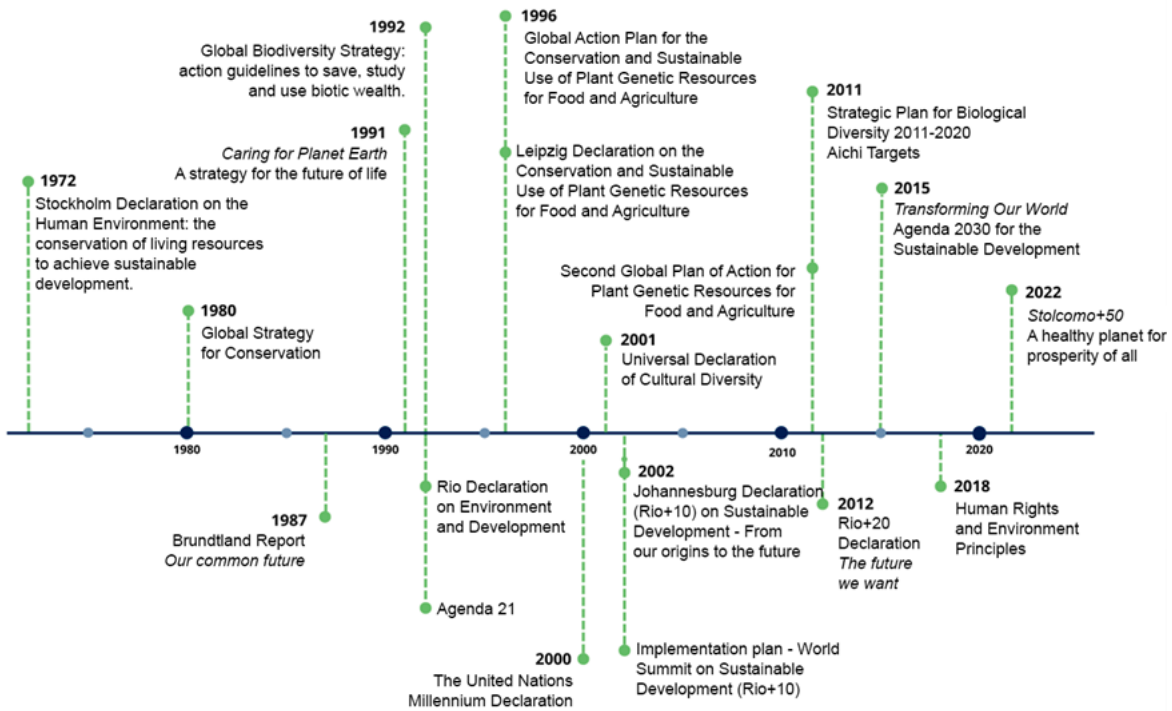


FIGURE 1 - Chronology of the main international documents guiding sustainable development policies.
SOURCE: organization and own elaboration (2022).

nature conservation or already legally protected in the form of conservation units (CUs).[1]

2. Material and method

2.1. The state of São Paulo and its traditional communities

Located in the southeastern region of Brazil, São Paulo has 645 municipalities and is divided into 22 Water Resources Management Units (UGRHI) with their corresponding sub-basins (Figure 2) (SIMA, 2022). It is the most populous state in the country (IBGE, 2021) and has the largest share of the national Gross Domestic Product (IBGE, 2019).

Due to the economic model adopted, the state of São Paulo retains little of its original vegetation, especially in the interior, which has seen its two biomes, the Cerrado and the Atlantic Forest, drastically reduced, the latter concentrated in the coastal regions and the Serra da Mantiqueira (São Paulo, 1998).

With an area of 248,219,485 km², São Paulo was originally covered by 32.7% Cerrado and 67.3% Atlantic Forest, which today correspond to 3.0% and 32.6% of its original area, respectively, and together cover 22.9% of the state's total area (IF, 2020).

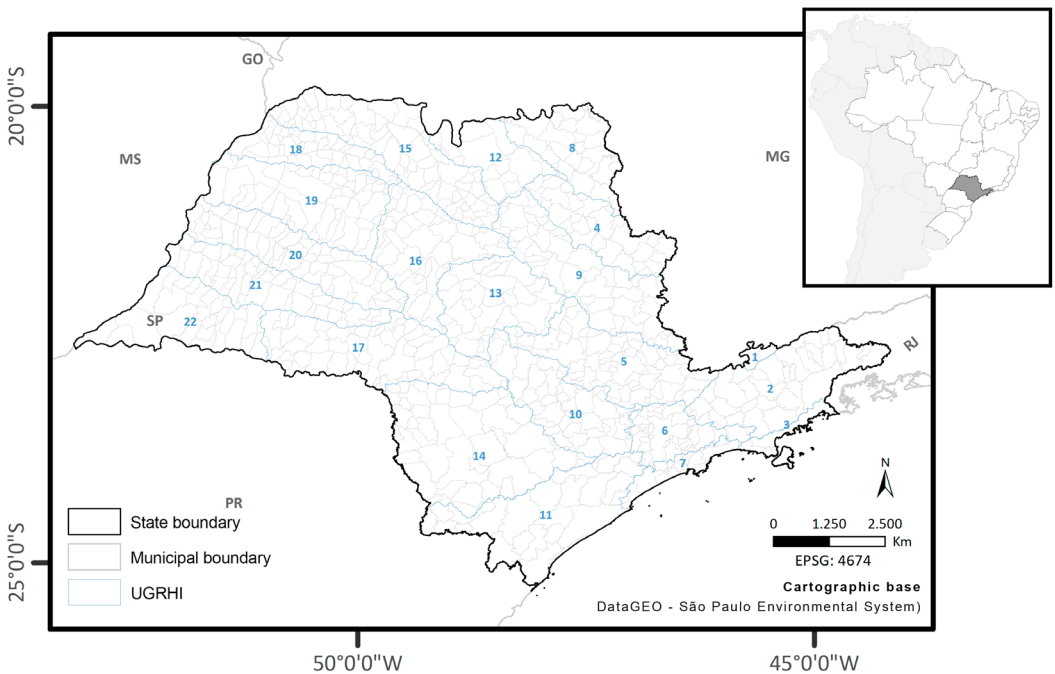


FIGURE 2 - Location map of the study area.
SOURCE: organization and own elaboration (2022).

[1] This terminology was legally instituted in Brazil as a correspondence to the IUCN (International Union for Conservation of Nature) protected areas.

The coffee plantation, which began in the 19th century, devastated much of the natural landscape. In addition, over the decades, migratory processes, the implementation of new economic activities, and urban expansion intensified the predatory effects, representing the main causes of forest fragmentation (São Paulo, 1998).

The march of coffee also had profound repercussions on the cultural landscape and rural lifestyle; old traditions were lost, and the countryside was abandoned. In addition to the socio-economic factors mentioned above, the strong influence of scientific progress, farming techniques, and industry development also contributed to this transformation (Diégues Júnior, 1960).

The traditional communities of São Paulo are linked to the *caipira* culture, and their formation dates back to the beginning of the colonization of Brazil (Candido, 2003). Once widespread throughout the state (Queiroz, 1973a), it is now restricted, resisting the economic and social transformations imposed by the hegemonic development pattern and often ignored or subjected to public policies inappropriate for valuing traditional knowledge and way of life (Santiago, 2010; Andrade *et al*., 2019; Santiago & Herculiani, 2020).

The past characterization of *caipira* production systems in their connection with the state's natural environments is limited and geographically restricted. However, the existing ones indicate the particularities and diversity that originally made them up. Depending on the proximity and economic complementarity established with the forest, the river, or the sea, Petrone (1961) and Queiroz (1969), in their studies in the southern region of the state, distinguished the following types of agrarian systems, consequently, characterized the *caipiras* themselves: *capuavas*, *ribeirinhos*, and *praianos* (*caiçaras*). Schmidt (1946), considering the geomorphological location in relation to the maritime slope of the of Serra do Mar and the geographical area where the manufacture of corn flour and manioc was predominant, distinguished them into *serra acima* and *serra abaixo*.

It should be clarified that the term *caipira* designates a way of being and a life typical of rural men and refers exclusively to cultural, not ethnic, aspects (Candido, 2003). However, the ethnic origin is one of the most relevant for characterizing the *caipira*, given its strong indigenous cultural heritage (Petrone, 1995) and the bases and Luso-Christian origin, which culturally permeated both the spiritual and material aspects (Diégues Júnior, 1960).

The rural neighborhoods correspond to the characteristic settlement unit of the *caipira* (Candido, 2003) and were, in the past, the seat of the processes of acculturation and adaptation between the Portuguese, indigenous, and African civilizations. Thus, they were and still are, when traditional, the bearers of the *caipira* civilization (Queiroz, 1973a).

It was through the neighborhood that the *caipira* developed forms of ecological and social balance, to which he clung "[...] as an expression of his reason for being, as a type of culture and sociability" (Candido, 2003, p. 107); a way of life that was defined by the satisfaction of the minimum needs of existence (Candido, 2003).

2.2. Theoretical-methodological considerations and research procedures

Adopting a quantitative-qualitative methodological option, the research was oriented according

to a geographic focus, with a territorial approach (Haesbaert, 1999; 2004; Saquet, 2009; 2011), emphasizing the cultural dimension (Claval, 1999).

Data was collected using bibliographic research, especially electronic materials, as well as available printed materials of a scientific, technical-scientific nature, produced between 1996 and 2016; the survey was updated until 2020, after the conclusion of the research, exclusively about the neighborhoods initially surveyed.

The information was analyzed and interpreted using the content analysis method (Bardin, 1977), guided by categories or analytical axes, which served as a parameter to distinguish the main features of the traditional way of life and *caipira* culture (Table 1), organized and tested by other authors in field research (Santiago & Freire Neto, 2013), based on classic references. These references and others included here, were the basis for the analytical process of this research: Schmidt (1946), Müller (1951), Müller (1956), Schmidt (1958), Schmidt (1959), Diégues Júnior (1960), Queiroz (1973a; 1973b), Wolf (1976), Moura (1978), Shanin (1979), Brandão (1983), Shanin (1983), Moura (1986), Woortmann (1990), Petrone (1995), Woortmann (1995), Candido (2003) and Woortmann (2004).

A previously structured analysis form was generated for each job and neighborhood according to the socio-cultural parameters considered. In the first case, for analytical breakdown; in the second, for systematizing and integrating the data collected.

It should be emphasized that, in keeping with the theoretical-methodological orientation adopted, the analyses were based on a historical and integrative perspective to take into account environmental aspects, social relations beyond the neighborhood, cultural adaptations, and exogenous pressures that generated transformations in one or other socio-cultural characteristic, thus reducing the risk of incurring the error of a reductionist and static reading of the territory and culture and, with this, previously disregarding groups potentially endowed with knowledge and practices linked to the traditional way of life.

From this perspective, works before the stipulated survey period were consulted when necessary and, if available, used historical information about the ancestral link with the land or the traditional way of life.

The location of the neighborhoods was based on the georeferencing of the data from bibliographic research, including field descriptions; in both cases, the Topographic Maps of the State of São Paulo - 1:50.000 (IBGE/IGG-SP) were consulted to refine the points. The data processing and mapping procedures were done using ArcGis-ESRI® *software*, using the SIRGAS 2000 Geographic Coordinate System and Datum.

To determine the proximity of neighborhoods to areas of conservation interest, a maximum limit of 10 km was adopted.

3. Results and discussion

After pre-analysis, 383 scientific and technical--scientific papers from different areas of knowledge were selected and analyzed, as well as consultations with topographical maps and official thematic maps, making a total of 347 neighborhoods surveyed. Of these neighborhoods, 159 were discarded because they were unrelated to the traditional rural way of life.

Of the 188 neighborhoods selected as being of interest to the research, 36 refer to territories

TABLE 1 - Parameters used to analyze the work and systematize the information on the rural neighborhoods surveyed.

Socio-cultural parameters	Inherent traits of traditional caipira communities
Ethnic and cultural origin	Portuguese, Indigenous, with or without an African element
Legal relationship with the land	Communal ownership
Unit of social and geographical organization	Rural neighborhood
Temporal link with the land	Ancestral land, historical ties to the neighborhood where they live, surrounding neighborhoods, and other neighborhoods within the municipality or neighboring municipalities
Economy	Economy Semi-closed household: significant autonomy in the production of necessary goods (food, housing, etc.), self-employment, family labor, and help from the side (joint effort – mutirão); production primarily for the family and a small surplus for sale
Cultivation and manufacturing techniques and tools	Simple and in the community's domain
Marriage union	Accentuated family and territorial endogamy
Social life	Based on religious activities (originally Catholic) and solidarity (the mutirão, the main purpose is to help with farming).

SOURCE: Santiago & Freire Neto (2013).

officially recognized as quilombo remnants. Although already mapped and guided by public policies, these were considered in this study because they are of central importance to the integrated analysis of the distribution and connection of the territories of traditional *caipira* culture in the state, which is also linked.

After analysis, the other 152 rural neighborhoods were grouped into three categories, as follows:

1) neighborhoods with strong signs of traditionality (56);

2) neighborhoods with signs of traditionality (84);

3) neighborhoods with few signs of traditionality (12).

The neighborhoods categorized also include some of those whose communities appear on the state's list of Quilombo remnants (ITESP, 2019) but whose anthropological studies have been archived or are at any stage in the process of analysis and official recognition, so they have been kept in the list of rural neighborhoods with some indication of traditionality.

About category 1, all the bibliographies consulted provided sufficient data to classify the neighborhoods as traditional. However, we chose to categorize them as "with strong signs of traditionality", considering the length of time that has elapsed since the works were consulted - almost half of them were published in the 2000s and early 2010s - and the strong and constant vectors of pressure that have been affecting all traditional rural neighborhoods over the last few decades, capable of altering their territoriality in a short space of time. Some examples

identified were: the sale or abandonment of land, which drastically emptied or extinguished several neighborhoods in Ibiúna (Santiago, 2018) and São José do Barreiro (Zuquim, 2002), or even the sharp advance of urbanization, which occurred in Vila de Picinguaba, in Ubatuba (Ângelo, 1992; Raimundo, 2008), in the Pedrinhas neighbourhood, on Ilha Cumprida (Hanazaki, 2001; Suzuki *et al.,* 2010; Santos, 2012) and São Paulo Bagre in Cananéia (Hanazaki, 2001; Suzuki *et al.*, 2010).

Still, regarding the classification of neighborhoods should be noted that the classification into the last two categories was justified by the limited availability of data or the socio-economic transformations that have occurred.

The historical and ancestral link to the land; communal use; reciprocal and kinship relations; the domestic economy and technology (planting, processing and manufacturing techniques; machinery, buildings, and utensils) were the parameters that most favored identifying traits associated with the traditional way of life. Special mention should be made of the *mutirão*, a practice of mutual help between relatives/neighbors, which is distinguished by its festive character in various work opportunities and which is configured as a structuring element of the *caipira* economy and sociability[2] (Müller, 1951; Queiroz, 1973a; 1973b; Brandão, 1983; Candido, 2003), and as such, brings together values (nucleating and interrelated) that define the traditional way of life: "land, work, family" (Woortmann, 1990), "God, man, land" (Woortmann, 2004), constituting itself as a strategy of social egalitarianism, reciprocity and the maintenance of autonomy within the neighborhood or a group of neighborhoods; traits which are shared indistinctly by traditional rural communities from different cultures (Sahlins, 1970; Shanin, 1979; 1983).

These parameters bring together the elements that, according to Claval (1999), make up culture: environmental and social knowledge, techniques, and know-how, as well as the sphere of values. Sufficiently and appropriately, these elements also describe the traditional rural neighborhood, which, like any territory, is a product and producer of identity, thus making up the "being" of each social group (Haesbaert, 1999), a concept that corroborates Candido's (2003) position when he attributes to the neighborhood the forms of equilibrium elaborated by the *caipira* as an expression of being and type of culture.

In all the neighborhoods, adaptations and transformations were observed, particularly in the economy, at different times, intensities, and combinations due to the various socio-economic and environmental dynamics that each region of the state went through in the various historical periods. Generally speaking, the transformations took place mainly between the 1940s and 1950s, when a new logic of development was established in São Paulo and throughout Brazil, promoting profound changes (Santos, 1993).

In this context, even the neighborhoods that have received the same categorization differ greatly, each with its singularities and ways of being part of the *caipira* culture.

The limitations established by the methodology, which concern not only the gaps in information about the neighborhoods surveyed (including their

[2] Galvão (1945) recounts the occurrence of this practice of mutual aid not only in Brazil, but also in European countries, including Portugal, and in Central America, specifically in the Dominican Republic.

location and territorial extension) but also the possible gaps about other traditional rural neighborhoods not covered by the bibliography analyzed, reinforced the importance of relativizing the frameworks made in each category, as well as the need to carry out a more comprehensive analysis of the distribution of these territories.

Thus, considering that the networks or relationships of reciprocity and kinship that make up the traditional territory go beyond the boundaries of the neighborhood (Moura, 1978; Candido, 2003; Santiago & Freire Neto, 2013; Santiago, 2010; 2013) and taking as a reference the case of neighborhoods that are proven to be interconnected in the Ribeira Valley (ITESP, 2000; Santana, 2008; Miranda & Hanazaki, 2008; Carvalho & Schmitt, 2012), in the Juquiá-Guaçu Basin (Santiago & Freire Neto, 2013) and the Bocaina *sertão* (Zuquim, 2002), a 20 km radius (*buffer*) was adopted for all the neighborhoods surveyed, from which an area of territorial coverage was established that supposedly corresponds to the projection of territoriality.

It should be clarified that the 20 km *buffer* was established taking into account a significant retreat from the territorial limits and the projection of the historically known *caipira* territoriality on a scale above the traditional rural neighborhood, as seen in the cases mentioned above, so as not to overestimate the area of interconnection of the remaining traditional neighborhoods.

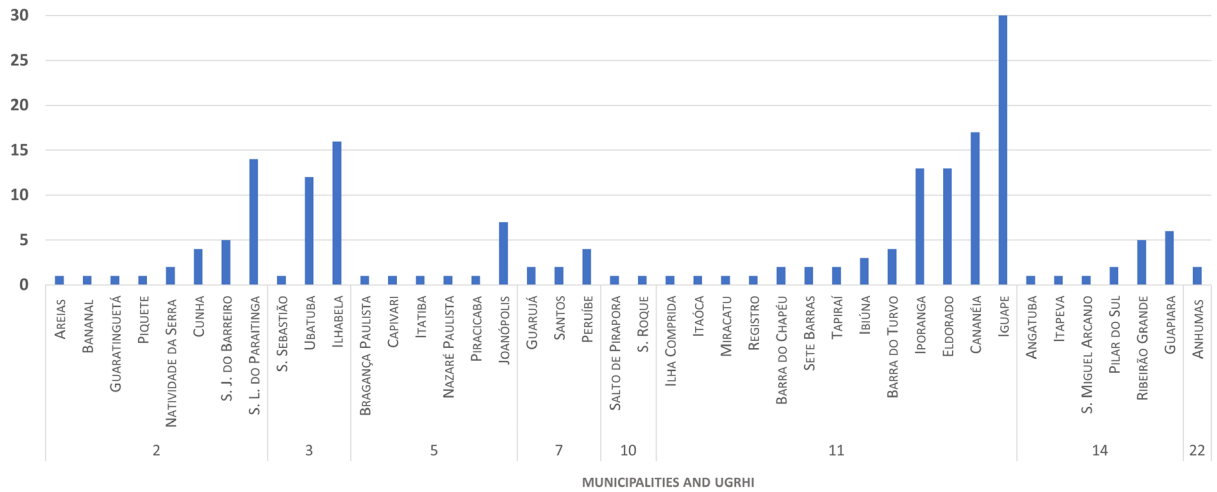
The *buffers* thus served as a methodological resource to mitigate the lack of information on the location of the neighborhoods surveyed and, at the same time, to define an area of interest; they also helped the context analysis in order to more clearly visualize the spatial correlation between the different neighborhoods surveyed and even between them and the remaining vegetation, as will be seen later.

The 188 rural neighborhoods surveyed (including the remaining *quilombos*) are distributed across 45 municipalities and eight Water Resources Management Units. The coastal basins (UGRHI 3, 7, 11), together with the Paraíba do Sul basin (UGRHI 2), concentrate the largest number of neighborhoods, 156, totaling 82.98% (Figure 3).

When analyzing the correlation between municipalities, natural vegetation, and the occurrence of neighborhoods, it can be seen that 131 neighborhoods (69.68%) are located in municipalities with native vegetation cover above 60%. Of these, 109 (57.97%) were in municipalities with more than 80% vegetation (Table 2).

There is an extremely disproportionate distribution when considering the relationship between neighborhoods and each biome. Only two of the 188 neighborhoods are in the Cerrado biome, both in UGRHI 14 - Alto Paranapanema, in municipalities whose natural vegetation does not exceed 21%. Ten neighborhoods are in Ecological Tension - Cerrado and Atlantic Forest contact zones. Of these, four are in UGRHI 14 - Alto Paranapanema, four in UGRHI 11 - Ribeira do Iguape, one in UGRHI 10 - Tietê/Sorocaba, and one in UGRHI 5 - Piracicaba/Capivari/Jundiaí, in municipalities with disparate natural vegetation cover of between 15.5% and 90.9%.

Although it is important to remember, the neighborhoods were surveyed using secondary data - which means that the analysis of their distribution represents, first and foremost, the distribution of the knowledge produced so far - one aspect that draws attention when considering the 20 km *buffer*, is how a large part of the neighborhoods are connected, regardless of the classification they fall into, forming



UGRHI: 2 – Paraíba do Sul; 3 – Litoral Norte; 5 – Piracicaba/Capivari/Jundiaí; 7 – Baixada Santista; 10 – Tietê/Sorocaba; 11 – Ribeira de Iguape e Litoral Sul; 14 – Alto Paranapanema; 22 – Pontal do Paranapanema.

FIGURE 3 - Distribution of neighborhoods by municipality and by watershed.
SOURCE: organization and own elaboration (2022).

TABLE 2 - Correspondence between the vegetation cover classes where the municipalities fall, the occurrence of neighborhoods, and the UGRHIs in which they are located.

Coverage Classes Native Plant	Number of municipalities	Number of neighborhoods	UGRHI
> 80%	10	109	3; 7; 11
60% – 80%	7	22	2; 7; 11; 14
40% – 60%	11	19	2; 5; 7; 10; 11; 14
20% – 40%	11	34	2; 5; 10; 14
0% – 20%	3	4	5; 22

SOURCE: organization and own elaboration (2022).

"patches" that demarcate possible coverage areas for traditional rural neighborhoods.

As can be seen in Figure 4, there are "patches" of greater or lesser extent, more or less dense, which overlap or interconnect fragments of native vegetation, especially in the Atlantic Forest biome, where 73.96% of the neighborhoods are located and also the largest continuum of native vegetation. Similarly, there is a dilution of the "patches" in the landscape as you move towards the state's interior, where vegetation's greatest devastation and fragmentation have occurred, affecting both the Cerrado and the Atlantic Forest.

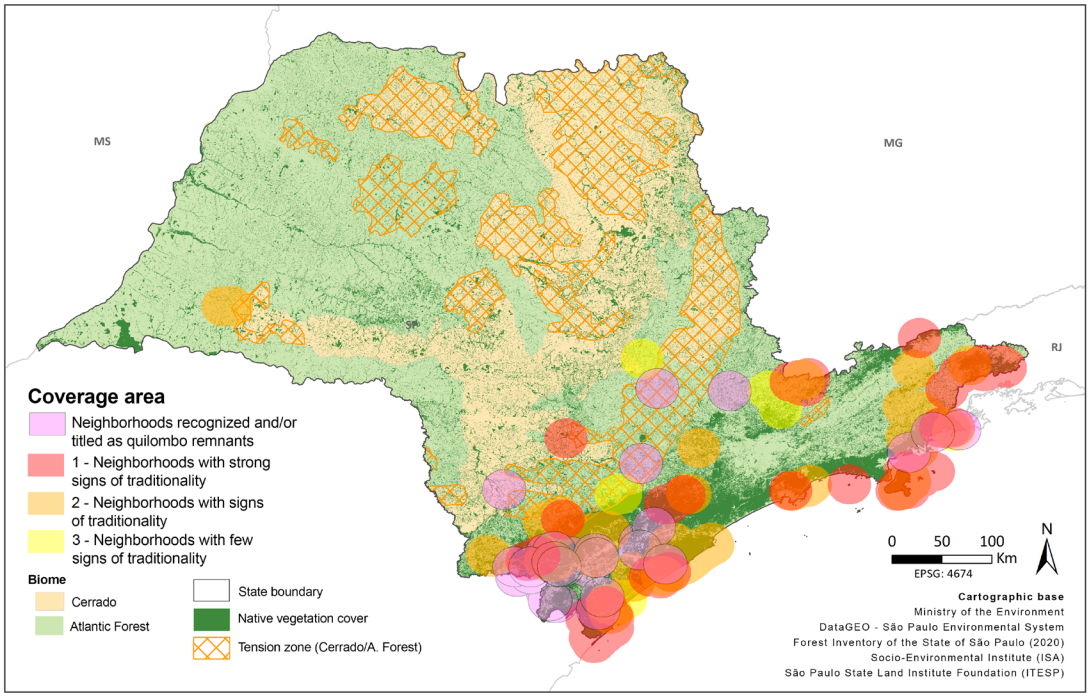


FIGURE 4 - Map of biomes and the possible coverage area of traditional rural neighborhoods.
SOURCE: organization and own elaboration (2022).

About conservation units (CUs), 164 of the neighborhoods surveyed (87%) have some proximity to them. Forty neighborhoods and another 65 within a radius of 10 km or less were identified as being part of integral protection CUs. Within the sustainable use CUs are 59 neighborhoods, making 99 within CUs of one group and the other.

Five neighborhoods were identified in areas indicated as priorities for creating integral protection CUs, which are also included among those close to CUs that have already been established.

Figure 5 shows the interconnection between the "patches" of areas of possible traditional occurrence and the different areas of importance for nature conservation.

From all the perspectives analyzed, there is a high degree of convergence between the distribution of remaining native vegetation and the occurrence of traditional rural neighborhoods. This is an expected conjunction, given that traditional production systems are associated with a combination of practices for using natural resources, which generate many products throughout the year to satisfy most of the family's basic needs with maximum autonomy (Toledo & Barrera-Bassols, 2015).

The authors emphasize that each "local culture interacts with its local ecosystem and with the combination of landscapes and the respective biodiversities contained in them [...]." this interaction results in a rich biocultural memory that involves a whole his-

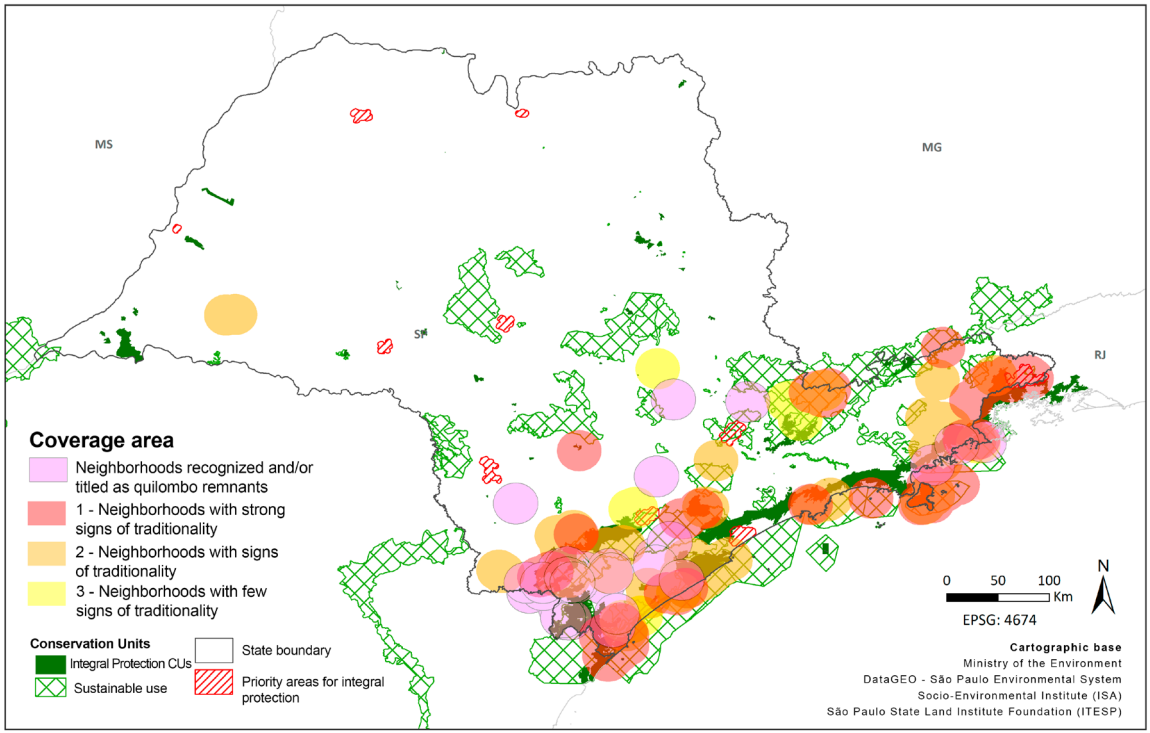


FIGURE 5 - Map of CUs and possible areas of occurrence of traditional rural neighborhoods.
SOURCE: organization and own elaboration (2022).

torical process of accumulation and transmission of knowledge (Toledo & Barrera-Bassols, 2015, p. 40).

A few cases stand out when examining the relationship between neighborhoods, traditional production systems, biomes, and their respective vegetation remnants.

As you can see, the Cerrado has been practically decimated in São Paulo, and the CUs created in it are small in size. The only two neighborhoods surveyed in this biome - Leite (classified as "with a strong indication of traditionality) and Jaó (quilombo remnant lands) are located in municipalities (Angatuba and Itapeva) whose native vegetation cover does not exceed 21%. Although they are set in a matrix with very few vegetation fragments, the landscape of these neighborhoods remains associated with them.

The Leite neighborhood borders the Angatuba Ecological Station, which covers an area of 1,394.15 hectares (ha). Although Jaó is not located at a distance of 10 km or less from any CU, it lies between three areas of interest for nature conservation, two already legally protected and one indicated as a priority for the creation of an integral protection ecu, about 24 km from the latter (with still hypothetical limits and territorial extension) and, approximately 25 km from the ecological stations of Itaberá, with 180 ha, and Itapeva, with 106.77 ha, in this case covering less territory than the district of Jaó, which has 165.57

ha, itself containing remnants of native vegetation and associated wildlife (Marques, 2012).

Leite and Jaó are rural farming neighborhoods strongly linked to traditional *caipira* culture. However, once biodiverse and associated with simple traditional technology, their production systems have undergone significant transformations, although subsistence plantations are still maintained (Carmo *et al*., 2016; Toricelli, 2018).

In the Leite neighborhood, as Toricelli (2018) observed, the economy is strongly linked to cattle and eucalyptus cultivation. The sale of land and the evasion of younger people put the continuity of *caipira* traditions in the neighborhood at risk. This is an endogamous territory where kinship relations still prevail, probably extending to immediately surrounding rural neighborhoods.

In Jaó, Carmo *et al*. (2016) observed the insertion of mechanization and chemical inputs, the purchase of seeds, the reduction of agricultural diversity, and the decrease in food security. Marques (2012) highlighted the preponderance of soybean cultivation. Considering what the first authors reported, they identified government incentive actions linked to the transition to organic cultivation, which were unsuccessful.

In the Atlantic Forest biome, on the other hand, preserved production systems of unparalleled importance to the maintenance of agrobiodiversity were identified - specifically in the Ribeira Valley, in densely vegetated areas and where the projections of territoriality (20 km *buffer*) also overlap in several layers - most likely expressing the strong maintenance of what Candido (2003) identified as an ecological-social phenomenon, characterized by the relationships between neighborhoods, which make up and strengthen the balance strategies (social and ecological) developed by the *caipira*, which, it should be remembered, comprise the expression of their own culture.

In the area mentioned above, the set of existing production systems, known as the "Traditional Quilombola Agricultural System of the Ribeira Valley" (strongly influenced by indigenous know-how), covers the neighborhoods of Morro Seco, Mandira, Poça, Pedro Cubas, Pedro Cubas de Cima, Sapatu, André Lopes, Ivaporunduva, Galvão, Abobral, São Pedro, Piririca, Nhunguara, Porto Velho, Bombas, Pilões, Maria Rosa, Praia Grande and Cangume, was formally recognized as Brazilian cultural heritage in 2018. Among the cultivars managed in the gardens, the most numerous are rice - 23 varieties, cassava - 22, beans - 21, and corn - 12 (Andrade & Kishimoto, 2017; Andrade *et al*., 2019).

As part of the Quilombola Traditional Productive System, the diversity of useful species managed from the forest (wood, taquaras, and lianas) and local knowledge associated with the material culture that supports the agricultural system, giving rise to various tools, structures, and machinery needed for cultivation, harvesting, transportation and processing of crop products, should be highlighted (Andrade & Kishimoto, 2017).

The recognition of agrobiodiversity in these quilombola territories is emblematic. It draws attention to the importance of the other traditional production systems remaining in the state of São Paulo, which are extremely neglected.

In this sense, other cases identified deserve to be highlighted in the Atlantic Forest biome due to their cultural persistence; the uniqueness of their production systems, associated with diverse geomorphological and phytophysiognomic conditions; and the vulnerability to which they are subject -

particularly because their ancestral territories are under strict environmental legislation, facing serious difficulties in maintaining their production systems - a problem also faced by quilombo remnants who already have their territories legally secured and even have their agricultural systems recognized (Andrade *et al.*, 2019). Other neighborhoods include those located in the Ilha do Cardoso State Park (Gadelha, 2008; Carvalho & Schmitt, 2012); the Lagamar de Cananéia State Park (Martins, 2017); the Serra do Mar Environmental Protection Area and the Jurupará State Park (Santiago & Freire Neto, 2013).

In this way, albeit through preliminary data, considering the information available for the neighborhoods surveyed, it is possible to identify the correlation between the state of conservation of the biome (based on fragmentation and the percentage of remaining vegetation) and the maintenance of traditional production practices and systems - guardians of agrobiodiversity and associated knowledge, in line with the provisions of Attwood *et al*. (2017).

For the author, wild and agricultural biodiversity are often juxtaposed at different scales and biomes and threatened by similar processes (Attwood *et al*., 2017).

From the perspective of wild biodiversity and agrobiodiversity *hotspots*, Pironon *et al.* (2020) note that they, too, are partially overlapping and subject to many common threats. However, they point out that the geographical complexities have been little investigated.

The pressures and socio-economic transformations identified in all the neighborhoods surveyed, with greater or lesser intensity, indicate that agrobiodiversity, manifested by the different production systems, is seriously threatened in São Paulo, possibly more so than wild biodiversity. Suppose it is not included, respecting its specificities, in territorial planning and management strategies for biodiversity conservation. In that case, the productive systems and traditional knowledge that survive, for the most part, tend to disappear, either through the abandonment of the land by younger people, the replacement of cultivated techniques and species, the disuse of those extracted from nature, or even the adoption of other economic strategies to the detriment of agricultural and extractive activities, which increasingly make it less possible for communities to survive with dignity.

As Jackson *et al.* (2005) argue, it is necessary to conserve biodiversity and the knowledge associated with traditional agroecosystems so that they can be available to solve current and future agricultural problems and so that the human societies that depend on their cultural services are supported. The failure to recognize the important role of biodiversity in agricultural landscapes, the authors continue, indicates that little attention has been paid to the risks associated with the loss of the valuable ecosystem services they provide.

Pironon *et al.* (2020), discussing the ways to achieve a better understanding and preservation of global *hotspots* of useful plant diversity, in addition to those cultivated, mention the importance of exploring the relationship between wild biodiversity *hotspots* and regions with high levels of agrobiodiversity, in order to expand the long list of neglected and underutilized species that contribute to the provision of a wide range of cultural, supporting and regulating ecosystem services. The authors also highlight the frequent overlap between biodiversity *hotspots*, useful plants, and cultural diversity.

From another perspective, Solymosi (2011) argues for the need to systematically identify and study traditional cultural landscapes, which are hi-

ghly neglected in Europe, to protect them. It refers to cultural landscape *hotspots* to designate regions of integrated, traditional, rare, or unique agricultural systems with associated values such as agricultural biodiversity, knowledge systems, food security, livelihoods, and cultural significance. Analogous to biodiversity *hotspots*, cultural landscape *hotspots* would be those where exceptional concentrations of endemic elements decrease dramatically.

In order to establish a common base of criteria for identifying cultural landscape *hotspots*, the author proposes the following indicators:

i) isolation (in terms of location, infrastructure, politics, economics and culture);

ii) incidence in areas with difficult conditions for agriculture; and,

iii) the presence of inhabitants with a cultural and ethnic identity distinct from the national majority.

The first two indicators presented by Solymosi (2011) can be added to cartographic analyses, allowing the results presented here to be refined in a second stage of the research and areas with a greater chance of cultural persistence to be selected.

The convergence between cultural and biological (natural and agricultural) diversity leads us to the important discussion about the paradigm that involves territorial policies, which include nature conservation, strongly associated with the institution of legally protected natural areas, or units of conservation in Brazilian terminology, and the relevance of delving into them a little more here.

Undoubtedly valuable as a strategy to contain degradation, the CUs, it should be noted, are the result of urban-industrial logic (Diegues, 2001) and are therefore immersed in Eurocentric rationality[3] and colonial heritage, which are revealed in the guarantee of the interests of hegemonic society, in the authoritarianism of the state and the disregard for territories and traditional knowledge about the use and management of natural resources; which persist even after the establishment of a legal system that allows communities to remain in certain CUs (Santiago, 2014).

Negligence and disrespect towards traditional communities in the process of creating and managing conservation units reproduced, and continues to reproduce, a renewed version of the state's developmental and expansionist policy, which opened the 20th century strongly instrumented by science, whose goal was to dominate nature and civilize the São Paulo *sertão*, occupied by indigenous people and *caipira* and considered to be a place of backwardness and barbarism, in a process that delegitimized their values, knowledge and cultural experiences (Arruda, 2000).

Extensive coffee cultivation expanded and reached previously isolated indigenous pockets and old *caipira* settlements, taking everything with it (Ribeiro, 1995). It also laid the economic and structural foundations for intensifying the industrialization process (Prado Júnior, 1999), the logic of which came to prevail between the 1940s and 1950s and can be translated as a complex social process that boosted relations and activated urbanization, including the formation of a national market, the installation of

[3] On Eurocentric rationality, see Quijano (2005).

infrastructure and the expansion of consumption (Santos, 1993).

When we compare the data from the last population census in 2010 with that of 1950 (IBGE, 2019), we can see that São Paulo's rural population has fallen from 47.40% to 4.06%. In absolute numbers, it had become more than two and a half times smaller than 60 years earlier, when the state's total population represented less than a third of the current total population.

Historical contextualization is necessary in order to gauge, on the one hand, the impact that urban-industrial rationality - introduced into conservation and territorial development policies - had and still has on the material and cultural reproduction of traditional rural neighborhoods, which were widespread throughout the state in the past, and, on the other, to reflect on the relevance and contribution of the cultural capital of the *caipira* communities, which have persisted over time and space, to the management of biodiversity and the achievement of sustainability in the face of today's complex social and environmental challenges.

According to Berkes (2005a, p. 52), cultural capital refers to "the factors that endow human societies with the means and adaptations necessary to deal with the natural environment and to actively modify it," covering how people view nature, values, ethics, religion, and culturally transmitted knowledge. Institutions aimed at appropriating resources and mediating the society-nature relationship, often invisible to conventional analysis, are part of cultural capital (Berkes, 2005a). They can be defined as a set of rules in use whose function is, in a given area, to prohibit, allow, or demand some action or result (Ostrom, 1990).

Of the works analyzed in this research, two case studies, one in the Marujá neighborhood and the other in the Paulo neighborhood, located in areas of very old *caipira* occupation dating back to the first centuries of colonization, are clear examples of the existence and functioning of independent, totally invisible traditional institutions, linked to a regime of communal appropriation, through which the communities of these neighborhoods have managed their resources and conflicts throughout history; coherently with what has been described by Ostrom (1990); Gadgil & Berkes (1991); Berkes *et al*. (2000) and Berkes (2005a).

In Marujá, located in the Ilha do Cardoso State Park, Silva (2000), when studying traditional mullet fishing, identified that, regardless of legal restrictions, residents maintain active agreements historically instituted by their ancestors to regulate and monitor access to fishing resources. The coastal space, commonly used for an extension of five kilometers, is divided into three parts (or fishing zones), locally known as *coastal tensions*, defined according to the greater or lesser resource supply and duly demarcated. Access is carried out by consensus, in rotation by three fishing teams, with a maximum of five people who alternate. Failure to comply with agreements entails informal and socially discriminatory sanctions. Roles, hierarchies, and sharing rules are also established within each team.

According to Silva (2000), a traditional spatial order in Marujá is unrecognized and distinct from the established legal order, which governs different forms of appropriation and use of the land, water, and other natural resources.

In the Paulo neighborhood, a typical traditional rural neighborhood in colonial Brazil, located in

the Jurupará State Park, in a more comprehensive study on the process of territorialization and *caipira* territoriality, Santiago (2010; 2013) showed that the traditional territory is planned and managed, including zones of use and the definition of reserve areas; it has command, hierarchies, and norms in place, strongly based on interdependent principles of union, reciprocity, and autonomy; the latter understood, according to Dematteis (2007, p. 09), as "the capacity for self-government of territorial relations, internal and external. 09), as the "capacity for self--government of territorial relations, both internal and external, and for self-projection of a development centered on these relations".

The principles above also govern the strong neighborly and kinship relations between neighborhoods, established in their common practices, spaces, and natural resources, within the *sertão*, between those who call themselves *natives*, a territorial and social identity that delimits and includes those from within, who recognize themselves as equals. Thus, the *sertão* is made up of juxtaposed, embedded territories (Santiago, 2010; 2013), housing, according to the notion coined by Berkes (2005b), institutions that can be characterized as trans-scalar, connected in space and at an organizational level, since the *sertão* is also commanded.

At the neighborhood level, the norms identified range from those related to maintaining the integrity of territorial heritage, which define the use and transmission of land between generations and within the same generation, to those that guide the management of flora and fauna species (illegal after state restrictions), as well as simple norms of general conduct and ethical principles, for example: not to cut or kill more than is necessary; not to kill any animal in the breeding season; to hunt only for food; to cut from the forest only what you are going to use; to use the appropriate wood for each purpose and to cut or harvest at the right moon, guaranteeing the durability of the resource; to burn only the section that is going to be used for farming. In all situations, the rules are interspersed with knowledge about reproduction, the life cycle, and ecological requirements of the species, and under the surveillance of supernatural beings (Santiago, 2010; 2013).

The use of each species was regulated according to its specific characteristics. For the juçara palm (*Euterpe edulis*), which was abundant in the *sertão* until the government effectively took over management of the area, management rules among residents were adapted to its uses, especially for food (palm hearts) and construction (rafters to support the roof). In the first case, it was cut when the plant reached between 8 and 10 years of age, which means between two and four fruitings. When the palm tree was used to build roofs, it had to be mature and have the necessary characteristics for its intended purpose, which occurred when it was at least 20 years old. The palm heart trade was only carried out when farming was low and was considered a form of saving, a reserve for emergencies. The maintenance of many seed-producing plants guaranteed the abundance of the palm and plenty of food for many animals (Santiago, 2010; 2013).

The comparative assessment of forest cover in the area covered by the neighborhood showed that even during a period of socio-productive disruption, in which farmers adopted forest exploitation for 18 years as their main economic activity due to the loss of the market for agricultural products and the high demand for wood and charcoal in the city of São Paulo, the same extent of the forest was maintained from the beginning to the end of the exploitation

cycle, i.e., 78%. The area set aside for the forest reserve was untouched. The proportion was repeated very closely on a larger scale, considering all the many neighborhoods (all involved in forestry) that made up the *sertão*, declared a State Reserve, given the magnitude of the water resources and forest remnants that existed there and, later, a State Park (Santiago, 2019).

In response to the external vectors of pressure that have been imposed over the decades, economic, demographic, political, and religious adaptive strategies have been identified and activated in moments of conflict and readjustment to reality, the aim of which was not only to reduce the pressure on the use of resources but also to find forms of socio-cultural adaptation to keep the family together and in their position as strong and respectable *sitiantes* (traditional farmers) in the *sertão* (Santiago, 2018).

It is important to note that after the creation of the Park, the exploitation of the juçara palm (*Euterpe edulis*), a key mutualist species threatened with extinction due to high commercial demand for culinary applications and illegal exploitation, became the target of conflict and power struggles between the state, residents and outsiders who freely entered the neighborhood boundaries for illegal extraction (Santiago, 2018), configuring, as Berkes (2005a) points out, a situation of free access, of land without an owner, resulting from the conversion of former communally managed forests to state management.

As Gadgil & Berkes (1991) warn, a monolithic vision of modern nature management is swallowing up traditional systems. Moreover, there are many examples where replacing refined, complex communal systems well adapted to the local context by government or private management has led to the depletion of natural resources and environmental degradation (Berkes, 2005a). In addition, the rules imposed by public policies, which assume that the appropriators of common resources are incompetent to manage natural resources, can destroy local institutional capacity (Ostrom, 1990).

Probably the first self-aware Brazilian, half-indigenous, heir to the millennia-old knowledge accumulated by the indigenous people and their techniques for adapting to the rainforest (Ribeiro, 1995), the traditional *caipira*, integrated over the centuries into the different natural ecosystems, shaping and at the same time being shaped by them, has established himself through an ecological and social balance (Candido, 2003), which has allowed him to manage natural resources and maintain the supply of ecosystem services (Santiago & Herculiani, 2020), as well as resisting all kinds of adversity, even the overwhelming territorial policies of the past and present.

Thus, traditional *caipira* territories are resilient socio-ecological systems, understood as those that can "absorb disturbances and to train themselves for self-organization, learning and adaptation" (Berkes, 2005b, p. 296); managed by "[...] a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment.", which define what can be called Traditional Ecological Knowledge (Berkes *et al.*, 2000, p. 1252).

For Gadgil & Berkes (1991), conserving the associated cultural and biological diversity and the diversity of traditional resource management practices and systems is part of the task of rethinking and reconstructing a science of resource management that is better adapted to meet the needs of ecological sustainability and the people who use the resources.

The cases described, in which we can observe the efficiency and persistence of communal institutions and rules for managing natural resources, both overlapping with conservation units established in the 1970s, reinforce the argument that the convergence between areas of importance for biodiversity conservation and traditional territories, identified in this study, is not a coincidence and that the cultural capital possibly still harbored by them is of fundamental importance for the sustainable management of biodiversity and a source of inspiration for outlining a new ethic in the society-nature relationship.

4. Final considerations

The theoretical-methodological approach adopted has enabled important progress to be made in identifying the traditional territories of São Paulo and understanding how they are interrelated with each other, with the remaining native vegetation, and with the areas of interest for nature conservation in the Cerrado and Atlantic Forest biomes - biodiversity *hotspots*.

Many works (on various topics, areas of study, and perspectives of analysis) and scattered data were gathered and systematized, resulting in a significant survey of neighborhoods of interest and the respective mapping of areas where the traditional way of life may occur.

The complexity of the socio-economic transformation and adaptation processes identified and the gaps in more precise or up-to-date information inherent in a study based on secondary data posed challenges regarding the spatial delimitation of the areas of interest and the classification of the various rural neighborhoods as traditional. These shortcomings could be mitigated by estimating the projection of territoriality, which, methodologically based on both the theoretical framework and the cartographic analysis of the information provided by the survey, allowed for a more comprehensive and integrated spatial analysis of the data, translated into "patches" of possible traditional occurrence.

There was a high degree of convergence between the distribution of the remaining native vegetation and the areas where the neighborhoods occur, as well as a correlation between the state of conservation of the biome, the number of neighborhoods, and the maintenance of traditional production practices and systems. It was also possible to identify the existence and persistence of communal institutions that regulate the use of natural resources in the territories, highlighting and reinforcing the argument that the convergence between areas of importance for biodiversity conservation and traditional territories is not a coincidence and that the *caipira* territories have been configured throughout history as highly integrated socio-ecological systems.

The unique importance of traditional rural neighborhoods as guardians of biodiversity (wild and agricultural) and associated knowledge; the large number of neighborhoods identified in this research and the existing information gaps, including, quite possibly, other neighborhoods that have not yet been studied, require field research efforts that exceed the capacity to carry them out with due urgency, given the speed of today's socio-economic transformations in rural areas and the magnitude of the challenges both to stem the loss of biodiversity and ecosystem services and to achieve the sustainability goals set for 2030 minimally.

Research is therefore needed to refine the results presented here, adding other elements of cartographic analysis aimed at prioritizing research areas in the field, for example, through cultural landscape indicators that make it possible to select areas with a greater chance of cultural persistence.

The challenge in the field is to develop research for the characterization of traditional socio-ecological systems, seeking to cover the greatest possible representation of rural neighborhoods by specific ecological environments, with a focus on the cultural capital harbored, the identification and characterization of agrobiodiverse production systems and an understanding of the main vectors of pressure that threaten them.

In both the Cerrado and the Atlantic Forest, in different ways, there is still a pressing need to focus research and territorial planning efforts on the integrated conservation of wild and agricultural biological diversity, which inextricably includes cultural diversity.

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