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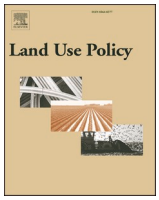

Urban agriculture in Brazil: Possibilities and challenges for Santarém, eastern Amazonia

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ABSTRACT

Public policies implemented by the Brazilian government for the promotion of urban agriculture were examined. Urban agriculture contributes to combatting problems related to food security and environmental issues in cities. In Brazil, the Ministry of Social Development initiated the elaboration of a policy to support urban agriculture, having listened to different segments of society. Moreover, the Brazilian Senate intends to establish the National Policy of Urban Agriculture. A pilot project for a city in Amazonia considers the urban farmer's socio-economic vulnerability, gender equity, rational use of urban land, technical assistance, and environmental education. The urban agriculture policy in Brazil represents a significant advance in sustainable cities and explores the potential to be applied to urban vacant land and its contribution to food production, inclusion, and social justice.

1. Introduction

In 2025, more than half of the populations of developing countries will be urban (FAO, 2012). The rapid concentration of people in Brazilian cities is being driven by economic opportunity and a massive influx of rural dwellers seeking to escape poverty and insecurity and has caused complications for the governance of urban settlements. On the socio-economic side, we have large vulnerable populations of socially excluded people, young and unemployed, inequality in income distribution and healthcare, and food problems (Tornaghi, 2017). With regard to the environmental issue, rapid urbanization resulted in considerable land degradation and soil sealing, the heat island effect, air pollution, decreased biodiversity, and risks to human health (Moore et al., 2003). Despite the Brazilian reality, the complexity of these obstacles tends to be a severe problem for the present and the future. An increasing number of cities are adopting policies aimed at resource efficiency and adaptation to climate change (Satterthwaite, 2011). Some cities are starting to restore the natural river ecosystem, increasing soil permeability to prevent floods and mitigate the urban heat island by applying a range of different nature-based solutions at different locations (Blau et al., 2018; Majidi et al., 2019).

Public policies on urban agriculture must be created and continuously updated to alleviate or eliminate major urban problems, such as food production and supply. Miccoli et al. (2016) suggest that without strong policies for sustainability, it will be impossible to feed the world's population or guarantee the protection and conservation of natural resources for future generations. To alleviate these difficulties and reduce social, economic, and environmental problems, urban governors foster the creation and maintenance of public green spaces.

The current urbanism trend in many cities across the world is urban agriculture (Panagopoulos et al., 2016); meanwhile, Brazil's administrative barriers and bureaucratic bottlenecks create obstacles to healthy green solutions and smart cities. In developed countries, the concept of smart cities is usually associated with urban planning for a resilient and self-sufficient "green city", designed for social, economic, and environmental sustainability (Barthel and Isenthal, 2013). It requires high-tech eco-architecture, green walkways for pedestrian and bicycle mobility, and a zero-waste circular economy. A resilient city considers appropriate physical infrastructure in order to be better prepared for the environmental, social, and economic challenges that come with unexpected significant changes (Panagopoulos et al., 2018). In regard to green spaces, urban agriculture areas are emphasized as functional spaces for soil conservation, carbon sequestration, and food production in urban centres. They contribute significantly to the carbon-neutral cities in urban metabolism analyses (Zazo-Moratalla et al., 2019). Urban metabolism is a concept simulating the production, distribution, intake, digestion, and absorption of nutrition, material, energy, and other resources within cities. Urban agriculture is considered a

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regenerative urban development practice aimed at decreasing cities' ecological footprint (Brown et al., 2018).

Broto et al. (2013), in studying the reality of a city on the African continent, showed that an urban development plan should have a strategy to promote urban agriculture activities, with the aim of contributing to climate change adaptation and food security. In Latin America, Bellenda et al. (2018) and Feito (2018) show that urban and periurban food production contributes to improving people's quality of life by providing fresh food. Urban agriculture can bring pride to its practitioners by providing well-being as opposed to the prevailing market logic; it can also generate pleasure, inspire positive emotions, and allow people to relax and forget moments of daily problems and encourage coexistence with individuals who also value nature (Comassetto et al., 2013). The most obvious benefits of urban agriculture are related to food production close to the consumer (Lovell, 2010).

When talking about production and food security in the urban space, it favours the development of a fairer urban environment, because according to Burdine and Taylor (2018), the act of producing and consuming healthy foods arouses concerns about social justice, equitable access to healthy foods, and control over the production and distribution of such foods in the cities. In the urban space, agriculture involves several social actors from different socio-economic profiles, reflecting the diversity of the work base and capital in urban areas (Bon et al., 2010). Additionally, the aim is that it should contribute to food security and reducing poverty, which can be significant, especially in low-income countries (Badami and Ramankutty, 2015), thus greater effort is required on the part of authorities to expand urban agriculture activities (Rezai et al., 2016).

Brazil is among the world's largest agriculture producers (Pereira et al., 2012); meanwhile, almost all Brazil's agricultural production comes from rural areas. Thus it is necessary to discuss and plan the production of food in the urban space as well. Recently, the Brazilian government initiated actions to promote urban agriculture through the Ministry of Social Development, mainly in schools and community areas (Alves et al., 2019). Meanwhile, Brazil's political, social, economic, motivational, and land use-related barriers to urban agriculture implementation on a larger scale need to be investigated.

The objective of this paper was to examine public policies implemented by the Brazilian government and proposed bills for promoting urban agriculture in Brazil. The municipal policy for urban agriculture in Santarém, eastern Amazonia, and recommended actions to support this activity were also considered.

2. Methodology

This article is an essay on public policies for urban agriculture in Brazil. The intention is to present and explain ideas so that the authors can refer to the literature and highlight their opinions on the matter at hand (Burley, 2018). In terms of methodological procedure, we started from a qualitative approach supported by the scientific literature (Sena, 2009), observing urban agriculture experiences in Brazil and the Amazon, using Web of Science and Google Scholar's indexing bases. Secondly, we consulted laws (Brasil, 2019), bills (Sicon, 2019), and urban agriculture programmes in Brazil, using the indexer term "urban agriculture" (in Portuguese, as these are Brazilian norms and programmes).

Finally, we described contributions made to creating an urban agriculture support programme for Santarém, Pará, located in eastern Amazonia, based on our differences in lived sociocultural realities, which Chala and Chapetón (2012) suggest are very important for creating essays.

Brazil has 5570 municipalities, with an estimated 203,062,512 inhabitants in 2022 (IBGE, 2022), and 84.4% are in urban areas (IBGE, 2018). The eastern Amazonia ecoregion is located primarily between the Amazon, Xingu, and Tocantins rivers in Brazil. The landscape is relatively flat, with flooded plains and many small rivers transecting the region. Biodiversity is high within this region, although not as high as in other areas of Amazonia. Elevation ranges from sea level on the Amazon river to 400 m in the southern uplands in the Serra dos Carajás with an annual rainfall of about 2000–3000 mm. Urban development extends from the Amazonian cities of Santarém, São Felix do Xingu, Porto de Moz, Oeiras do Pará, and Gurupá. Extensive deforestation and intensive land degradation due to commercial logging operations also provide inroads to the interior through this region, where cattle ranches and agricultural projects are later established (Oliveira, 2008; Souza et al., 2003). Anthropogenic fire is a major threat to the environment in terms of habitat loss.

3. Urban agriculture in Brazil

Urban agriculture includes the cultivation of multiple crops throughout the year in urban and periurban spaces through horticultural activities (Mok et al., 2014). The production of food in urban areas is an ancient activity. However, since the second half of the 1990 s, urban agriculture has revealed its importance on the national scene, as it has targeted actions based on the premises of sustainable development (Costa et al., 2015).

Urban and periurban agriculture contribute to combatting the hunger and poverty issues of a large proportion of people living in these areas, including the need to produce food for excluded populations, which is a matter of political debate (Monteiro, 2002) because the public space is an area where the poor compete for resources and economic opportunities (Abelman, 2015), demonstrating aspects related to environmental injustices.

Socio-economic problems can contribute to unplanned use and occupation in urban and periurban areas. These occupations are related to the state's low capacity to provide housing to families in situations of socio-economic vulnerability in cities. The number of families in these situations increased with the arrival of families from rural communities in urban centres. According to Pereira et al. (2022), this displacement has different motivations, which vary among individuals and their families, and is also associated with different aspects, especially the search for better working and educational conditions.

In the Amazon region, in northern Brazil, in light of the sizeable migratory flow to this region, WinklerPrins and Souza (2005) suggest that actions in favour of urban agriculture can help people coming to urban centres not to distance themselves from relations with the land while still conserving the new environments.

In this sense, the promotion of urban agriculture is an important strategy for producing food and reducing hunger, as well as for generating income and reducing extreme poverty. Urban agriculture has greater potential when vulnerable families have, or have had, relationships with rural areas and agricultural activities. The use of idle areas can minimize social problems and support urban territorial planning. The National Council for Food and Nutritional Security (2004) points out that public authorities can invest in the planned occupation of idle areas in urban spaces, implementing participatory projects of this type of agriculture, and reducing real estate speculation and environmental degradation.The municipal government has started backing urban agriculture to support food and nutritional security, encouraging community participation, educational actions, and the use of agroecological methods (Rocha and Lessa, 2009). The political will can be decisive for promoting urban agriculture, as in Belo Horizonte, where the local government has developed a food security programme and inclusive socio-economic development (FAO, 2014).

Urban areas, whether public or private, can be spaces for the production of food of plant or animal origin. When reporting the experience of agroecological urban agriculture activities in a municipality of São Paulo state, Ribeiro et al. (2015) show that social participation is fundamental for people to realize collective achievements. These authors also report the interaction between urban farmers, non-governmental organizations, community leaders, residents, civil

society representatives, and local government.

As regards the use of urban green spaces in Brazil, Madaleno (2002) points out that the humid climate promotes the cultivation of food plants in public green areas and the backyards of houses, with medicinal plants, fruit, and even animals. Cultivation in residential areas is a growing practice across the world and comprises various agricultural systems with locally consumed products (Medeiros et al., 2019). Urban backyards are examples of residential crop growing and can assume multiple meanings for private and collective life. The Amazon in particular boasts a people's culture, contributing to the development of the domestic economy, and reducing the urban heat island effect (Tourinho and Silva, 2016).

Cultivation in residential areas can also establish links between urban and rural spaces, allowing for product exchange and germplasm flow, strengthening social networks between people from both spaces (WinklerPrins, 2002), and valuing women's work (Lara et al., 2019; Madaleno, 2000), which still needs to be visible, recognized, and channelled to boost the economy (Delgado, 2017).

Agricultural production originating from private or public urban spaces can contribute to generating income by commercializing what is produced. In this sense, Wandscheer and Medeiros (2012) show that local particularities must be considered, respecting autonomy in production and the possibility of being linked to markets. With the COVID-19 pandemic, many people living in cities began to want to consume more local products (including seasonal products), seeking to reduce transport distances (Torre and Fonseca, 2023). These authors also show that there are trends in the behaviour of urban residents who seek to have homes surrounded by green or agricultural areas, making them less dependent on the logistics of food supply in large cities.

Initiatives such as conditional income transfer programmes (e.g. the Bolsa Família programme), implemented by the federal government, can reduce food insecurity, but they are not enough on their own (Medeiros et al., 2019). For the authors, this programme constituted a partial strategy for sustainable urban development, requiring new research that considers the social, economic, and environmental impacts of managing these areas.

Notably, the success of urban agriculture may depend on organizational issues, especially at the community level, as well as political decisions in support of this activity, with planning and management contributing significantly to the cultivation of food in the urban space, which can be instrumental in reducing poverty, ensuring food security, and improving urban environmental conditions (Branco and Alcântara, 2011).

In the following section, we will address legal initiatives that encompass urban agriculture in Brazil as a measure to promote this type of agriculture, aiming at the social development of needy families, as well as better environmental conditions in urban areas.

4. Urban agriculture and legislative initiatives in Brazil

Since 2004, the Ministry of Social Development has been conducting discussions with a view to creating a national policy on urban agriculture aligned with food and nutrition security issues (Videiro-Rosa, 2011), which resulted in the National Programme for Urban and Periurban Agriculture in 2018. In the scope of the National Policy for Food and Nutrition Security (PNSAN), the Ministry of Social Development encouraged the implementation of Support Centres for Urban and Periurban Agriculture, aimed at the exchange of academic-scientific and citizen knowledge, while supporting the training, technical assistance, and support for those suffering hunger and misery (Neves et al., 2010). These authors also show that production for self-consumption was prioritized and could be combined with solidarity economy practices.

In 2012, a subcommittee linked to the Social Security and Family Commission of the Brazilian Chamber of Deputies was created in Brazil to assess the advances and challenges of public policies on food and nutrition security. Its concluding report outlined the need to support urban and periurban agriculture as they are crucial for maintaining people's physical access to food in large cities along with public food storage and distribution structures (Câmara dos Deputados, 2012).

The new Brazilian Forest Code was instituted by Law no. 12,651 in 2012, which brought an understanding of the urban green area concept. This is understood as spaces, public or private, with a predominance of native or recovered vegetation, as outlined in the Municipality's Master Plan, Urban Zoning and Land Use laws; they are unavailable for constructing houses but rather intended for recreation, leisure, the improvement of urban environmental quality, the protection of water resources, and the maintenance or improvement of landscape and cultural manifestations (Brasil, 2012). Article 25 of the new Forest Code allows the municipal government to elaborate strategies for creating and maintaining green areas. In regard to the protection of urban green areas, Lehfeld et al. (2013) point out that this Law reveals that urban green areas are of public interest. The Law indicates that the municipal government has the right of first refusal to purchase forest remnants; that they may require green areas for allotments, commercial enterprises, and infrastructure implementation; and that they may apply resources from environmental compensation to urban green areas.

In 2016, the current Multiannual Plan of Brazil (2016–2019), in its programme that deals with Food and Nutrition Security, predicted that the production of healthy and sustainable food would be expanded (objective 1155). It included as one of the initiatives "Elaboration guidelines for the orientation and organization of actions to promote urban and periurban agriculture" (Brasil, 2016). It is important to note that, as provided by Law no. 13,249/ 2016, the Multiannual Plan is a government planning instrument that defines guidelines, objectives, and targets of the federal public administration for capital expenses and others arising from them and for those related to programmes of continuing duration, to enable the implementation and management of public policies (Brasil, 2016).

In 2017, the Family Farming Crop Plan (2017–2020) also highlighted the importance of urban and periurban agriculture and that effective strategies were needed to enhance food production in urban centres in order to contribute to food security and improved nutrition for the inhabitants, and job creation in cities (Sead, 2017). Lara et al. (2019) see the above as a significant advance and suggest strengthening the programme at the national level to foster citizens' awareness of the benefits of such activity in the urban space. Thus, the National Programme for Urban and Periurban Agriculture was created under the Ministry of Social Development and the National Secretariat for Food and Nutrition Security (Brasil, 2018). This programme is regulated by Ordinance no. 467 of February 7, 2018 and is aimed at food and nutrition security, as well as the social inclusion of urban residents, especially women. Environmental education plays a significant role in this programme, encouraging social life and cultural activities related to agricultural production in urban spaces. It is also aimed at fostering production places for educational purposes in educational, health, and religious institutions, and at penal and detention facilities.

Pacheco et al. (2018) show that university extension can be strategically positive for strengthening urban agriculture. With a view to seeking practical guidelines for implementing and monitoring the initiative in a systemic way, university adult education might create partnerships with community leaders, government, and churches, among others. As regards urban farmers, the programme aims to empower these people and provide technical support on smallholder farming systems and resilience. The programme values agroecological technologies in order to stimulate the reuse and recycling of organic waste, as well as healthy eating habits. By enhancing farmers' autonomy and adaptive capacity, agroecology empowers communities as key agents of change. The programme also contributes significantly to social, educational, and production issues aimed at food and nutritional security. However, it is essential to note that green space planning issues were omitted from the programme.

Based on the experience of Buenos Aires (Argentina), Feito (2018)

shows that public policies for urban and periurban agriculture should be based on an agroecological approach, teamwork involving different social actors, based on participatory methodologies, and an interdisciplinary approach. Such procedures create trust during the implementation, assisting in taking ownership and stewardship of processes and sites. Assessing users' expectations is imperative for sustainable urban planning (Karanikola et al., 2016); meanwhile, evaluation of the participatory processes for the quality of decisions and the success of implemented social-learning strategies is still insufficient (Ferreira et al., 2020).

Contemplating educational aspects aimed at empowering urban farmers can be crucial to food production in cities. Studying the profile of urban farmers in the city of Valdivia, Chile, Cabrera Verdezoto et al. (2017) show that it is necessary to invest in capacity building and improving infrastructure conditions to increase the production and income of these farmers. According to Rego (2014), investment should be made in participatory methodologies to plan and maintain agricultural production areas in urban spaces. Coelho and Bógus (2016) add that interpersonal learning exchanges, valorization of dialogue, and the production of sociability can contribute to an emancipatory perspective of education.

In 2017, Municipal Law no. 12,620 of December 13, 2017, in the city of Londrina (Paraná), was sanctioned, which established the Municipal Policy for Urban and Periurban Agriculture (PMAUP) and created the Municipal Programme for Urban and Periurban Agriculture (AgriUrbana) of that municipality. It was a decisive action that would regulate food production in these spaces in this southern Brazilian city. This municipal Law aims to endorse solutions to social, environmental, and economic problems by promoting the local economy and quality of life, autonomy, community life, psychological health, food security, local knowledge, and gender equity (Londrina, 2017).

As for Amazonia, recently, in June 2023, the Municipal Policy to Support Urban and Periurban Agriculture of Belém was established through Ordinary Law No. 9916, of July 24, 2023 (Table 1). This city is the capital of the state of Pará, the most populous of the Amazon region, with 8116,132 people (IBGE, 2022). According to this Law, there is an expectation that the impact on workers' health and the environment should be reduced through agroecological practices. The Municipal Economy Secretariat will be responsible for coordinating this municipal policy and must prioritize the following beneficiaries: people in situations of social vulnerability and/or food and nutritional insecurity; farmers who produce collectively or communally; traditional communities; and family farmers.

Table 1
Urban agriculture policies at a Federal scale in Brazil and at a regional scale in Amazonian States and in some cities of the Brazilian Amazonia.

Instrument	Finality	Scale	Situation
Presidential Order 11,700 on 12th September 2023	Establishes the National urban and peri-urban agriculture Programme	National	Current
Law 5033 on 4th December 2019	Provides for the State policy to support urban agriculture	State of Amazonas	Current
Ordinary Law 10,824 on 5th February 2019	Provides for the State policy to support urban agriculture	State of Mato Grosso	Current
Law 10,986 on 21st December 2018	Establishes the State policy on agroecology and organic production	State of Maranhão	Current
Ordinary Law 9916 on 24th July 2023	Establishes the policy for urban and periurban agriculture in the metropolitan area of Belém	Belém, State of Pará	Current
Ordinary Bill no 1816/2022	Provides guidelines for policies to support urban agriculture	Santarém City, State of Pará	Under analysis
Law 2426 on 4th October 2017	Establishes the municipal urban agriculture program	Porto Velho, State of Rondônia	Current
Law 2224 on 16th June 2006	Municipal policy to support urban agriculture	Ananindeua, State of Pará	Current
Law 1329 on 30th September 2004	Establishes the municipal urban agriculture program	Palmas, State of Tocantins	Current
Law Nº 444, of December 1, 2003	Establishes the municipal urban agriculture program	Rondon do Pará, State of Pará	Current

The Municipal Policy to Support Urban and Periurban Agriculture of Belém, in addition to focusing on food production and environmental conservation in urban areas, strongly targets economic issues, as it highlights the following objectives: generating work, employment, and income, including the aggregation of value to products, development of cultivation, distribution, and marketing technologies; promoting family work and the work of cooperatives, associations, and other organizations in the popular and solidarity economy; promoting social inclusion; and encouraging agroecotourism (Câmara Municipal de Belém, 2023).

In the Metropolitan Region of Belém, another municipality that has legislation for urban agriculture is Ananindeua (Pará). In this city, the law provided that property with urban agriculture can fulfill the social function of property. Likewise, the State Policy to Support Urban Agriculture in the State of Amazonas and in the State of Mato Grosso also made this legal provision (Table 1). For Ondetti (2016), the property that performs the social function of property is one that uses land in a way that benefits society and is an important tool for improving popular well-being.

The State of Maranhão, which has part of its territory within the Amazon, has not established an exclusive urban agriculture policy. However, it created the State Policy for Agroecology and Organic Production of Maranhão (Peapoma) in 2018. The law that established this program defined an urban farmer as someone who practices agricultural activity in a periurban or urban environment. This program guarantees the autonomy of urban farmers who participate in the conservation and sustainable use of natural resources to maintain agrobiodiversity and social diversity.

Still in the Amazon, we highlight the case of the city of Santarém (state of Pará). The Tapajós and Amazon rivers border this city and has vast rainforest areas. The incentive for urban agriculture in Santarém is foreseen in its Master Plan, established by Municipal Law no. 20,543 on December 17, 2018 (Santarém, 2018). The Master Plan of Santarém was recently updated, and section I, which deals with agriculture and livestock, included a subsection covering urban agriculture. According to Article 23, this activity involves the production of ornamental plants, medicinal plants, vegetables, fruits, community orchards, domestic and exotic livestock, practiced by urban and periurban residents, for commercial, subsistence and recreational purposes.

In May 2022, a councillor from the city of Santarém (State of Pará) proposed a Bill (1816/2022) that provides guidelines for policies to support urban and peri-urban agriculture in this city. The project encourages agroecological technologies that maximise the recycling of energy and nutrients while minimising dependence on external inputs. If approved, the law will encourage the cultivation of species for self-consumption, using diversified systems that prioritise people in food and nutritional insecurity, or even those in conditions of social vulnerability.

Unlike the National Programme for Urban and Periurban Agriculture, Santarém's Master Plan has broader guidelines, valuing aspects related to skills and links between rural and urban spaces; thinking about issues of family production, solidarity economy, and stimulation of small enterprises; and being in line with the Federal Constitution of 1988, which provides for fulfilling the social function of urban areas. The demand for creating a national urban agriculture policy started after the Second National Conference on Food Security, held in Pernambuco in 2004. According to Moreira (2008), the theme gains strength in tandem with other political actions and movements that contemplate the need for socio-territorial transformations pertinent to metropolises.

On March 25, 2015, a bill (PL 906/2015) was presented to create the National Policy of Urban Agriculture. This bill was authored by Federal Deputy Padre João (state of Minas Gerais), and after two years in the Chamber of Deputies it was approved and in December 2017 sent to the Brazilian Senate for appreciation and approval (Official Letter no. 337/2017 / PS-GSE). In September 2017, another Senate bill was presented (PLS no. 353/2017), authored by Senator Eduardo Braga (state of Amazonas), which was a proposal to establish general rules on sustainable urban agriculture. Given that these two projects were on the same subject, the Senate filed Request no. 174, on March 22, 2019, for the two projects to proceed together. Later, the combined project went to the Committee on the Environment and to the Committee on Agrarian Reform for the final decision to be made. In August 2021, the Committee on the Environment approved the project, and since May 2023 the proposal has been with the Committee on Agrarian Reform for consideration.

It should be noted that both bills start by conceptualizing urban agriculture. The Senate project deals with sustainable urban agriculture and, for this reason, is justified by the proposer's conceptualization as being "developed in the organic production model". The projects aim to support food and nutritional security through the production and consumption of healthier foods, encouraging family work, generating income for families, enabling vacant urban spaces, promoting environmental education, valuing organic production, and recycling organic waste in agriculture.

The Senate proposal presents the instruments (called "actions" in the Chamber of Deputies proposal) to be used, especially the creation of a register of available properties; a sustainable urban agriculture information system; tax, financial, and credit incentives; government acquisition of production; technical assistance; and environmental education. The Senate proposal also recommends amending Law no. 11,326, of July 24, 2006, which deals with the National Policy of Family Farming and Rural Family Enterprises. The proposed amendment aims to include a family farmer and rural family entrepreneur, the "urban farmers who practise sustainable urban agriculture in a total cultivated area of up to 5 ha". Here it can generate theoretical/conceptual divergence between the rural and the urban because Article 3 of Law no. 11,326/ 2006 refers to activities in rural areas, and the proposal deals with the insertion of the urban farmer profile. The insertion could be made by talking about the 2006 Law "beneficiaries" (paragraph 2 of Article 3) to overcome this possible theoretical impasse.

The Law to be approved will establish concepts, objectives, rules, and instruments that will allow, through specific programmes, the stimulation and development of food production in urban spaces. The approval of a National Policy of Sustainable Urban Agriculture (the term used in both projects) will allow the executive branch to encourage urban agriculture development in Brazil, especially allowing the use of vacant parcels of urban land. Burdine and Taylor (2018) report that agricultural cultivation through urban gardens allows local governments to reduce the time and money spent on maintaining empty or idle properties.

There is a gap in the legislative proposals that explicitly encourage research and development, and university extension actions favour urban agriculture in the national territory. In fact, Bellenda et al. (2018) point out that university extension to society activities can lead to the discovery of solutions to complex problems through sharing academic knowledge and lifelong student training.

Although the Law has not yet been approved, in September 2023, the Brazilian government established the National Urban and Peri-Urban Agriculture Programme through Decree no. 11,700/2023. According to the Decree, this programme will be implemented by the Ministries of Agrarian Development and Family Agriculture; Development and Social Assistance, Family and Fight Against Hunger; Environment and Climate Change; and Labour and Employment, to promote the inclusion of urban and periurban agriculture in policies relating to the provision of public areas for production, and the granting of tax incentives (Brasil, 2023).

5. Some ideas for a municipal policy for urban agriculture in Santarém

The Law that instituted the Santarém Master Plan foresees urban agriculture actions, but the municipality still needs to regulate the matter through a specific ordinary law and regulatory decrees. While this is not dealt with by the municipal authority or the City Chamber, pilot experiments can be structured and implemented under a support system for urban agriculture, designed by the municipal government. Based on the experience and professional performance of the authors of this manuscript, the main aspects related to the strengths and weaknesses of the development of urban agriculture in the city of Santarém are listed in Fig. 1.

Actions for a pilot project on the subject in the city of Santarém were proposed given that urban green infrastructure projects must be multipurpose. According to Silva et al. (2018), such a project should be developed to restore degraded urban ecosystems and revitalize poverty-stricken neighbourhoods by increasing urban green space to improve well-being and environmental justice (Silva et al., 2018). As a first step for the Santarém context, the municipal government provides design guidelines in the current Master Plan to prepare the Municipal Programme of Urban Agriculture. A pilot experimental area for implementing and managing urban agriculture spaces is under development.

Fig. 2 shows the public areas in possession of the municipal, state, and federal governments that are viable for developing urban agriculture activities. For a pilot experience, the 22 ha Park of Santarém City is considered because it houses the environmental education school and is under the management of the city hall. According to Santos (2015), the projects developed in this area are intended to provide environmental education to students of all ages and park users. This area contains fragments of secondary forest and anthropized areas. In the past, the site was used for depositing urban waste, and with the creation of the park in 2008, the area used for depositing waste was filled in and compacted, forming the anthropized area. Through an agreement with the federal government, another space would be the 24 ha military derelict area (8th BEC) located at Moaçara Avenue, which could be developed as an urban orchard and edible gardens. A programme to support urban agriculture in Santarém could further expand the vegetable garden production of the Amazonia Regional Hospital, which according to Carvalho et al. (2018) produces fruits and vegetables for the hospital kitchen and reuses 50% of organic waste as fertilizer. Employing by-products as a substrate in urban agriculture can help mitigate the environmental impact of disposing of these wastes and reduce the pressure on natural resources (Pérez-Fernández et al., 2018).

Currently, in the city of Santarém, the owner of a property registered with the municipality must pay the Urban Property and Territorial Tax (IPTU, acronym in Portuguese). Residents who pay their tax in a single instalment by March of each year receive a 15% discount. We understand that as discounts are possible, it would also be possible for the Santarém City Council to provide incentives for urban agricultural activities, such as through the granting of exemption from this tax in unoccupied/idle areas, associated with a possible future Urban Agriculture Policy in Santarém. According to Choumert (2010), tax collection policies may allow cities to increase public investment, creating more green spaces to offset cities' burdens, while tax exemptions might lead to increased private investment in urbanization with green spaces of environmental quality.

Thus, the public authorities, when identifying idle urban areas that are of interest (sufficient size to provide work for several families, as well as a location with easy access and flow of production), can propose to the owner a concession tax exemption linked to the area being adapted and used for food production within the scope of the Santarém Urban Agriculture Policy.

An owner of an idle urban area may not see much economic advantage in just being exempt from this tax, leaving the public authority to resort to another legal instrument, that of land leasing, which

Fig. 1. Strengths (S), weaknesses (W), opportunities (O), and threats of urban agriculture in Santarém, Pará State, Brazil.
Source: The authors.

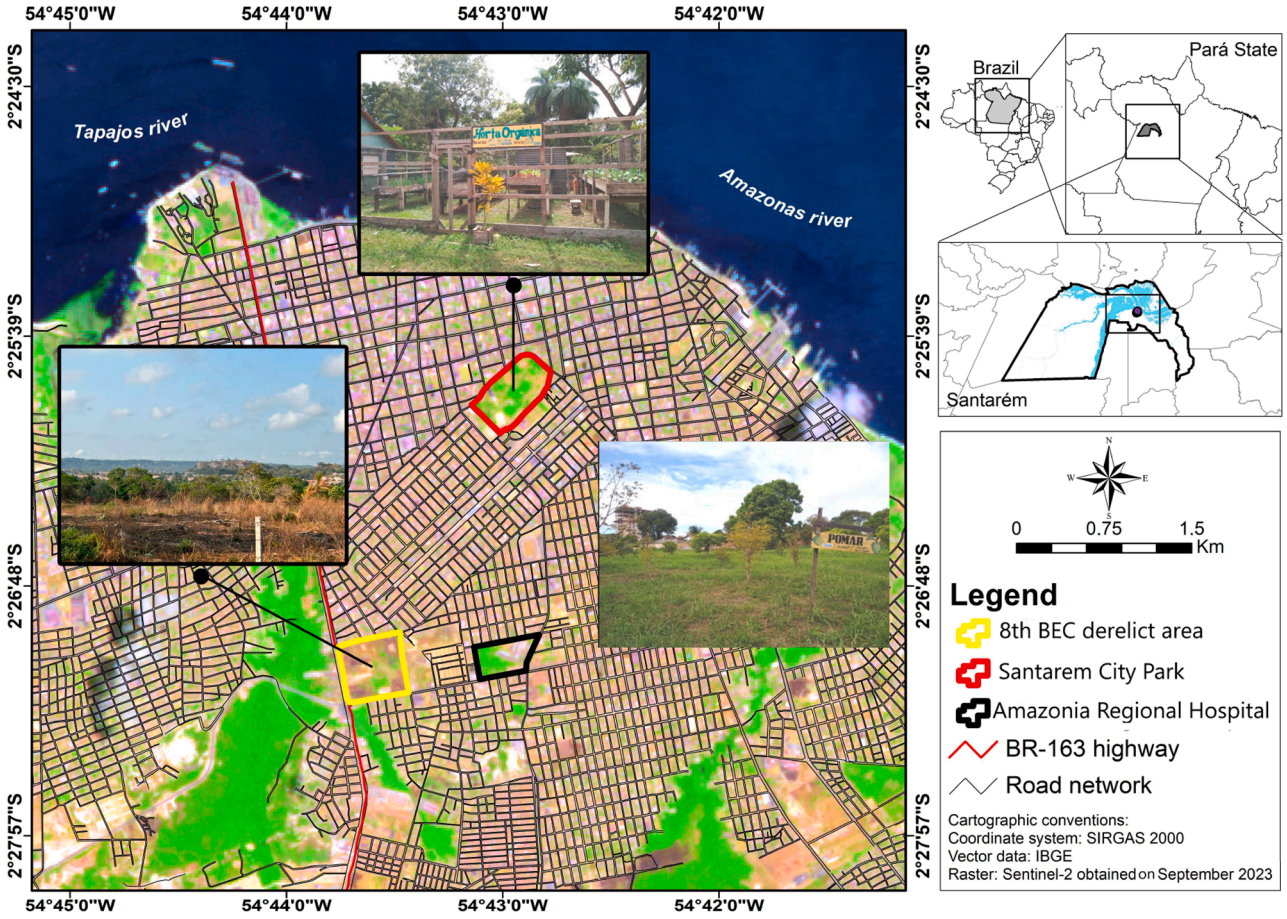

Fig. 2. Location of three suggested areas for developing urban agriculture in Santarém city. The City Park environmental education, the 8th BEC military derelict area, and the Amazonia Regional Hospital organic garden.

consists of giving the temporary right to another person to use the land through the payment of an amount agreed in the contract. In this case, a percentage of the production could be negotiated in the contract as long as vulnerable families have fair incomes.

A legal instrument for the concession of public areas, in which third parties may claim agricultural production in the urban space, should be considered in the context of specific edicts. Several Amazon cities created a legislation to support their Municipal Urban Agriculture programs through the use of idle municipal and private land temporarily ceded by their owners. In the case of Porto Velho (capital of the State of Rondônia), the agreement is the instrument for formalizing participation in the program. Palmas city, capital of state of Tocantins; and Rondon do Pará city, in the State of Pará established incentives for the implementation of organic production systems, primarily for family

urban farmers, and traditional communities in vacant land. This study agrees with Burdine and Taylor (2018) that land tenure should be a matter to be addressed in the future after establishing and consolidating government-supported urban agriculture activities.

Organic agriculture in Santarém city is highlighted through farmers' groups registered as organic by the Ministry of Agriculture. In Santarém, 21 organic producers market their products directly with consumers. The city may envisage actions to promote urban agriculture and organic food production in the city. These actions involve productive public credit; technical guidelines (the Technical Assistance and Rural Extension Company of Pará has qualified professionals, and financial investments in it would make it the main public partner for these guidelines); mobilization of acquisition of inputs of agroecological origin; training in processing, administration, marketing, and commercialization; and organic certification, among others.

Even though it is still viewed as a complex issue by society (Krikser et al., 2016), organic farming initiatives in urban spaces should be fostered and studied with a view to gaining government support (Krikser et al., 2019). Pearson (2013) shows that in order to achieve health-related goals, the government must acquire more significant political support for urban food production initiatives through organic production methods. Food production in urban areas should increasingly involve organic technologies, replacing conventional crops, and may even be a solution to optimize production in large cities (Benis and Ferrão, 2017). Organic technologies are based on the conservation of natural resources, techniques that value biological mechanisms and waste recycling, maintaining the nutrient cycle within the biological system, and improving human capacity to interconnect with the environment (Lorenz, 2015).

The most vulnerable urban families should be given preference, thus improving social and environmental justice (O'Brien et al., 2017). Therefore, it is important that a programme that supports urban agriculture always updates the registry of urban farmers in the city or metropolitan region. This registry will inform the government on which and how many families in the city are vulnerable, and what the current or previous experiences are of each family with agricultural activities, allowing skills to be visualized. In short, this registry constitutes an instrument for managing and evaluating public policy, observing the results achieved (improved quality of life, increased production of healthy foods, and generation of work and income), and the measures that can be taken for better results from an urban agriculture programme.

It should be emphasized that it is essential that women play a leading role in these programmes. Delgado (2017) and Sousa and Vieira (2022) suggest that a public policy that strengthens urban agriculture should prioritize easy access for women to land and the means of production, and contribute to their training in agricultural practices aimed at boosting food production. For Oliveira et al. (2015), women's work and strengthening local organizations' objectives can contribute to the commercialization of production from urban and periurban agriculture. Moreover, Kern and Kovesi (2018) show that to guarantee environmental justice, one of the principles to be observed is providing sufficiently good conditions for people in a given place to want to stay in this space. Thus, an urban agriculture programme should involve local farmers. The selection of an area to be destined for agricultural production in the urban space, regulated by the municipal government, must consider the access, water supply, electricity, and soil conditions, including soil physics. The water supply should be carefully monitored, especially in the dry season, when there is a high demand for this resource for irrigation (Broto et al., 2013). The funding of these activities may be of public or private origin. It may be materialized, at first, through financial resources passed on to a technical assistance institution and by paying an urban green grant to the urban farmers involved.

Financing of urban agriculture can occur through loans and housing subsidies, involving the productive environment on urban property, including vegetable gardens, or agro-processing activities in the urban area, or even through loans and subsidies to generate income and create jobs that benefit poor urban farmers, or through the creation of community banks with local currencies, such as Banco Palmas – Cidade de Fortaleza-CE (Cabannes, 2012).

One form of public resource investment is financing urban agriculture projects on behalf of farmers and accompanied by an institution providing technical assistance through the National Programme for Strengthening Family Agriculture. The diversity of funding sources, including government funding, coupled with traditional and technical knowledge, contributes to the success of agricultural production in cities (Ulug and Horlings, 2019). The actions of a municipal programme of urban agriculture should include investments in technical assistance for urban farmers' families, through which professionals will promote an educational process aimed at the real production needs in these spaces. It is up to the municipal government to establish partnerships and agreements with the public, private institutions, or non-governmental organizations to provide technical assistance within the framework of a support programme for urban agriculture. According to Boza and Jara-Rojas (2018) and Feito (2018), investments in technical assistance and rural extension services can play an essential role in agricultural productivity in urban areas.

Urban agriculture is an activity that can contribute to local development in the Amazon. However, the gaps in the scope of municipal and state support must be overcome, especially in the areas of technical assistance and support, and much of the production is still destined for the middleman due to the lack of real knowledge about producers' prices, scale, and market (Santana et al., 2017).

There should also be investment in research and development of urban agriculture actions to investigate issues related to the improvement of the quality of life of the farmers' families involved; the species to be used (plants and animals) and the possible combinations given the reality of the available spaces; improving the soil and water quality of the site; and management techniques, including plant protection and agricultural residues.

As an example of research, Rego (2014) highlights the study of composting techniques to be used in urban areas and different intercropping systems that can increase production per square metre and the productive capacity in urban soils. For Medeiros et al. (2019), research should include other factors associated with food security. For Sonnino (2009), there is still a lack of research data to help policymakers address urban food supply and land use planning issues in urban space. Urban agriculture must employ practices that are compatible with sustainable development principles, while health risks are a critical concern due to urban pollution (Specht et al., 2016).

The commercialization of production is another aspect to be addressed in urban agriculture when it is not intended for self-consumption purposes. Part of the production can be sold, and for this reason, it must be structured and supported by the commercialization channels of the urban agricultural production. Articulating purchases by supermarkets or institutions can decrease the insecurity of these farmers. According to Freddi (2015), the lack of commercialization channels might be a limiting factor for urban farmers, implying loss of income and organizational problems. This author also describes the barriers to developing urban agriculture, such as the lack of formal recognition of the activity and the urban farmer's bureaucratic bottlenecks to marketing products, the lack of articulation with commercialization programmes, and exclusion from institutional purchasing.

Among the forms of institutional purchasing, two relevant Brazilian food production policies stand out: the Food Acquisition Programme (PAA) and the National of School Feeding Programme (PNAE). The municipal government can support food production in the urban space so that these two programmes in the municipality can absorb food production. According to Dias et al. (2013), the PAA is an instrument of income guarantee and fair price support for farmers, strengthening associative and cooperative organization, and through agroecological management, generating clean and safe products with high nutritional value, forming strategic stocks that contribute to the food and

nutritional security of farmers' families and those who consume them.

In addition to institutional purchases, Freddi et al. (2014) outline a wide range of options for marketing products from urban agriculture, such as organic and traditional fairs, and direct selling from farmer to consumer, including selling baskets of products at home. These authors also report that this activity has a high expansion capacity and many possible ways of consolidating itself as a permanent and multifunctional activity on the local scale. For Krikser et al. (2019), this direct relationship between farmer and consumer is based on trust, so that for Coelho et al. (2018), consumers have information about the origin of the food purchased and who is producing it, and about production methods. The city of Quito, for example, has 14 "biofairs" that sell from organic agriculture, operating weekly in both low-income areas and wealthy neighbourhoods. In 2012, these fairs sold more than 100 tons of products, generating USD176,000 (FAO, 2014).

Municipalities located in regions where there is still a strong relationship between their inhabitants and nature must be encouraged to produce food sustainably in urban areas. Dieleman (2017) points out that urban agriculture policy must balance the different dimensions involved, such as environmental, social, economic, and symbolic, including regaining the historical roots of a given region.

6. Conclusions

Urban agriculture is an essential urban land use system in Brazil, especially for the Amazon. It contributes to climate change adaptation in cities and to food production under the principles of sustainable development. Production from vegetable cultivation and raising small animals can help combat food and nutrition security and environmental issues such as the urban metabolism of supply and the consumption of nutrition, material, energy, and other resources within cities. Urban agriculture generates income for urban farmers and strengthens the social relations between the people involved. Women's participation should be highlighted by policies and actions supporting urban agriculture, and promoting gender equity.

In Brazil, while listening to different segments of society, the construction of a National Policy of Urban Agriculture has already begun, and today it is in the form of a programme. In the Brazilian Senate, a bill is underway to establish the National Policy of Urban Agriculture. While the policy is not approved as law, the federal government recently published a Presidential Order aimed at stimulating fiscal, financial, and credit incentives, government acquisition of production, technical assistance, and food, nutritional, and environmental education. Policies supporting urban agriculture at the national or municipal level should consider and promote research and development actions with a view to filling gaps related to production limits, economic benefits, and land use.

The city of Santarém has the potential to develop urban agriculture as a nature-based solution that increases resilience and assist in climate change adaptation. The municipal government's support, might enable programmes to promote agriculture in urban space, aiming to resolve social and environmental justice issues. The municipal government should take advantage of other federal policies, such as the Food Acquisition Programme, the National School Feeding Programme, and the recently established National Urban and Peri-Urban Agriculture Programme, as an opportunity to implement and conduct its urban agriculture program, whether for the acquisition of funds or as the destination of production. Planning of urban agriculture must be coordinated by the municipal government. Therefore, the establishment of public and private partnerships is essential to initiate a municipal urban agriculture programme. Managers of this programme will need financial and human resources and political and legal support to: identify potential areas; grant incentives to owners to provide space; identify and register urban farmers; empower and train farmers; grant credit as initial capital, aimed at purchasing agricultural inputs and implements; and provide technical assistance, from preparing the area to marketing.

CRediT authorship contribution statement

Vieira Thiago Almeida: Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Panagopoulos Thomas:** Writing – review & editing, Writing – original draft, Visualization, Investigation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

Data will be made available on request.

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