BETWEEN ALLEYS AND HOPE: EXPERIENCING THE RESILIENCE OF SANTA LUZIA

https://doi.org/10.56238/sevened2024.037-070

Valmor Cerqueira Pazos[1], Edeilce Aparecida Santos Buzar[2], João da Costa Pantoja[3], Cristiane Guinancio[4], Erika Stella Silva Menezes[5], Marcus Vinicius da Silva Jorge[6], Erick Alexandre Silva Vilela[7] and Liza Maria Souza de Andrade[8].

ABSTRACT

This study explores the community of Santa Luzia, located in Brasilia, Brazil, as an emblematic example of the intersection between socio-environmental challenges and agro-ecological resilience. The community faces inadequate urban infrastructure, with unpaved roads and a lack of basic sanitation, resulting in precarious housing that is vulnerable to environmental adversities. Despite these adverse conditions, the community is remarkable for its ability to adapt and innovate in the face of scarce resources and institutional neglect. The practice of agroecology has emerged as a sustainable solution to combat food insecurity and promote biodiversity, potentially strengthening the community's autonomy and contributing to ecological balance. The environmental analysis revealed a complex interaction between urban challenges and sustainability, emphasizing the need for more effective urban planning. The study proposes specific interventions, including the development of an agro-ecological corridor to sustainably integrate residential areas with the surrounding environment. This planning aims not only to improve residents' quality of life, but also to strengthen the community's environmental resilience, highlighting the fundamental importance of community participation and innovation for a sustainable future.

Keywords: Social vulnerability. Disorganized occupation. Basic sanitation. Land regularization.

[1] University of Brasília, Brasília, Brazil
[2] University of Brasília, Brasília, Brazil
[3] University of Brasília, Brasília, Brazil
[4] University of Brasília, Brasília, Brazil
[5] University of Brasília, Brasília, Brazil
[6] University of Brasília, Brasília, Brazil
[7] University of Brasília, Brasília, Brazil
[8] University of Brasília, Brasília, Brazil

INTRODUCTION

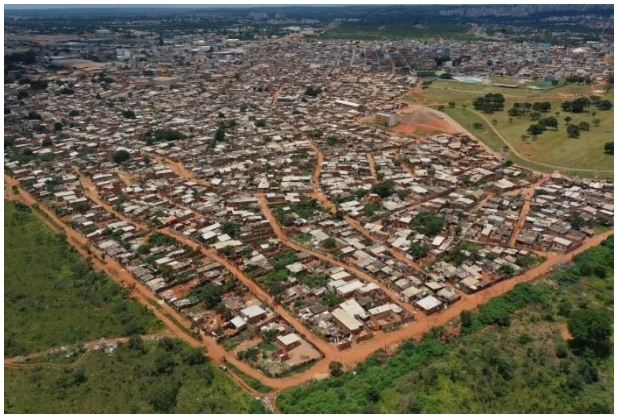
Vila Santa Luzia, also referred to as Chácara Santa Luzia or simply Santa Luzia, emerged in 2002 and faces serious challenges related to social, environmental and health vulnerability. The area is marked by geographical marginalization, disorderly land occupation and unregulated property subdivision practices. Currently, the population of approximately 16,000 lives in inadequate housing and without access to basic sanitation infrastructure. The situation is even more critical due to the community's proximity to the deactivated Brasília landfill, which intensifies the problems that already exist. The complexity of the scenario is amplified by the issue of land regularization, a delicate issue given the tension that arises due to the Vila's location in the vicinity of one of the Federal District's most important conservation areas, the Brasília National Park.

According to Andrade [1], Santa Luzia is experiencing the “peripherization of the periphery”, which means that residents live in extremely precarious conditions, aggravated by the constant threats of removal due to its location, with the government justifying the contamination of the soil due to the Estrutural garbage dump and the risk of degradation of the Brasilia National Park.

Vila Santa Luzia emerged as an extension of Estrutural, a neighborhood that recently underwent a regularization process. However, Vila Santa Luzia, due to its location adjacent to the Brasilia National Park, remains in an irregular situation and is the subject of legal litigation due to possible risks to the park, setting the stage for a complex socio-environmental and health conflict.

The socio-environmental and health conflict under analysis manifests itself in the tension between the quest of the residents of Santa Luzia (Figure 1) for the recognition and realization of fundamental human rights and the need to reconcile these rights with the preservation of the environment. This dilemma is deeply rooted in the Brazilian legal framework, notably in the Federal Constitution, the Organic Law of the Federal District and other relevant legislation, outlining a complex scenario of disputes and negotiations.

Figure. 1 - View of the Santa Luzia area. Source: Valmor Pazos, 2023.



In this context, this micro-project emerges as a strategic intervention aimed at the pressing needs of the Santa Luzia community. Specifically, it aims to address the structural challenges that negatively impact residents' quality of life, proposing to identify and implement viable and sustainable solutions that can significantly improve local infrastructure. With a scope that ranges from the rehabilitation of deteriorated public roads to the optimization of water supply and basic sanitation systems, this micro-project aims to develop an integrated plan that addresses the multiple dimensions of local infrastructure, thus fostering the holistic and sustainable development of the region.

Furthermore, by laying the foundations for a brighter future in Santa Luzia, this micro-project recognizes infrastructure not only as a response to the population's basic needs, but also as a critical vector for sustainable economic growth, the continuous improvement of quality of life and the strengthening of the community's social fabric. Thus, through the implementation of comprehensive and integrated infrastructure solutions, the aim is not only to meet the immediate demands of the population, but also to promote community development that is inclusive, resilient and aligned with the principles of sustainability and social justice.

METHODOLOGY

In order to achieve the proposed objectives, the research was structured into three distinct phases. Initially, the first phase consisted of aerial surveying and photogrammetry, using a drone, in order to acquire accurate and up-to-date geospatial data. In the second stage, a comprehensive bibliographical survey was conducted, which included a review of the relevant literature on the topics that most impact the condition of Santa Luzia, such as the state of urban infrastructure, environmental analysis and the topic of agroecology for the region. Finally, the third phase focused on producing a map of possible solutions for Santa Luzia, based on the information obtained in the previous stages. This step-by-step

approach enabled a systematic and complete analysis, contributing to a more in-depth and grounded understanding of the problem under study.

The aerial survey and photogrammetry were carried out using a drone, an Unmanned Aerial Vehicle (UAV) in Brazil, as stipulated by the relevant legislation (Air Information Circular AIC N 21/10). According to ANAC [4], a UAV is any aircraft designed to operate without a pilot on board. To carry out the aerial survey and photogrammetry, it was necessary to draw up a specific flight plan for the region (Figure 2), using the Drone Link software.

Figure 2. Santa Luzia Flight Plan. Source: Valmor Pazos, 2023.

The primary data, generally made up of photographs, elevation angles and support points in the field, was processed until results were obtained such as the Digital Surface Model (DSM), Digital Terrain Model (DTM) and Point Cloud and Orthomosaic (NPO), generating three-dimensional spatial data to be used in GIS applications, documentation of cultural heritage and production of visual effects, as well as indirect measurements of objects at various scales [5]. The primary data collected in the first phase was processed using Agisoft Metashape software, which generated the orthomosaic (Figure 3) used to analyze the area.

Figure 3. orthomosaic of Santa Luzia, Federal District, Brazil. Source: Valmor Pazos, 2023.

This orthomosaic was generated, capturing the precise division between Santa Luzia and the National Park. Its purpose is to clearly and visually illustrate the territorial restrictions imposed on the Santa Luzia area in relation to the National Park. This cartographic work highlights not only the physical border, but also emphasizes the importance and delimitation of environmental conservation zones, highlighting the commitment to preserving biodiversity and the unique ecosystems present in this region.

The second stage of the study consisted of surveying and analyzing existing articles, periodicals, dissertations, theses, books, legislation and official documents. This stage had the character of a theoretical and historical review of the theme addressed in this study.

In the third phase, the visual infrastructure improvement plan is proposed, which consists of guidelines for architectural and urban improvements that could favor the protection of the National Park through the implementation of the agro-ecological corridor, among other solutions specified in section 4 of this study.

EVALUATION OF THE CASE STUDY

SURVEY OF URBAN INFRASTRUCTURE

Disordered population growth in cities often results in the occupation of areas unsuitable for housing, such as steep slopes, valley bottoms, squares, viaducts, among others. Zmitrowicz [6], when analyzing the structuring of urban space, argues that economic growth, together with social development, causes an increase in migration, leading to concentrated population growth and, consequently, a shortage of housing. To respond the demand for housing, the urban area expands, often followed by a lack of infrastructure due to the scarcity of resources for city management. In this scenario, slums, tenements and precarious housing on the outskirts of the city emerge; generally consisting of one or more buildings constructed on urban lots, with precarious access to and use of unbuilt spaces,

inappropriate sanitary facilities, circulation problems and poor infrastructure. This can result in water contamination due to poor sanitation conditions, leading to health problems.

A detailed analysis of the area known as Vila Santa Luzia (Figure 4) reveals a reality in which urban planning adopts an informal form, characterized by the irregular layout of housing and notable spatial heterogeneity. This heterogeneity manifests itself through a variety of architectural styles, plot sizes and land uses, reflecting an urban development that occurred organically and autonomously, in the absence of structured urbanization guidelines. This spontaneous growth translates into significant spatial diversity within the community, where different areas have evolved under different influences and needs, resulting in a rich tapestry of urban environments.

Figure 4. View of the central area of Santa Luzia. Source: Valmor Pazos, 2023.

The access roads to Vila Santa Luzia, most of which are unpaved, stand out as a symbol of the community's vulnerability to adverse weather conditions. This characteristic makes the roads susceptible to becoming impassable after episodes of heavy rain, which in turn seriously compromises the mobility of residents, as well as access to essential and emergency services. The situation highlights the urgent need for infrastructure interventions that can improve the community's resilience to such environmental and social challenges.

The region is significantly lacking in essential infrastructure, with a notorious deficiency in basic sanitation systems. It can be seen that the houses are architecturally and materially diverse, reflecting the autonomy of the residents in the construction of their homes and highlighting the economic differences between them. In addition, the scarcity of green areas and the scarcity of trees compromise not only air quality, but also the well-being of the population, which is deprived of spaces for recreation and contact with nature, essential elements for maintaining an ecologically balanced environment.

Although some residences try to mitigate this shortfall with small vegetable gardens and the planting of trees, these initiatives are insufficient to offset the general lack of vegetation in Santa Luzia, a situation that worsens even with the proximity of the National

Park, where greenery is more abundant. The environmental challenges are accentuated by the area's inadequate drainage, which increases the risk of flooding, especially due to the topographical configuration that places the houses at a lower elevation in relation to the roads. This layout increases the vulnerability of homes to rainfall events, aggravating already precarious living conditions. The housing density reveals a dense community where, despite the possibility of strong social ties, residents live in extremely precarious conditions, facing constant threats of eviction.

These threats are justified by the government on the grounds of soil contamination, a direct consequence of the proximity to the Estrutural garbage dump, and the potential risk of environmental degradation that the occupation imposes on the Brasília National Park. These government justifications place residents in a position of continuous uncertainty and tension, oscillating between the struggle for recognition and the defense against forced displacement, highlighting the complexity of the socio-environmental conflicts that mark the region.

ENVIRONMENTAL CHALLENGES AND POTENTIAL SOLUTIONS IN SANTA LUZIA: AN INTEGRATED ANALYSIS

The environmental issue of space in the Santa Luzia region is complex and multifaceted, marked by significant challenges and a dynamic interaction between human development and the environment. The first and most obvious environmental issue is the lack of green infrastructure. The scarcity of green areas and afforestation in the region not only compromises air quality, but also negatively impacts local biodiversity and the well-being of residents. Green spaces are crucial to the ecological health of any urban area, providing benefits such as reducing pollution, improving the microclimate and providing spaces for leisure and relaxation for the community.

Green infrastructure plays a key role in promoting the climate resilience of cities, while contributing to the creation of healthier environments and improving local quality of life. This is due to the various environmental services that these infrastructures offer, such as regulating the microclimate, managing rainwater, reducing greenhouse gas emissions, among others. They also provide social benefits, such as strengthening social cohesion [7].

In addition, its proximity to Brasília National Park (Figure 5) raises questions of environmental conservation. While the park offers a natural counterpoint to urbanization, the pressure exerted by urban sprawl and the lack of adequate regulation in Vila Santa Luzia threatens the integrity of this important ecosystem. The situation is exacerbated by the presence of the former Estrutural garbage dump, which raises concerns about soil and

groundwater contamination, affecting the quality of life of residents and the health of the surrounding ecosystem.

Figure. 5 - View of Santa Luzia and Brasilia National Park. Source: Valmor Pazos, 2023.

In addition, the informal occupation of Santa Luzia is situated in the watershed of the headwaters of the Córrego Cabeceira do Acampamento, a location that defines the urban ecosystem of the area. In response to the pressure exerted by the Public Prosecutor's Office of the Federal District and Territories, which points to an increase in environmental impacts, the Federal District government is committed to relocating the occupants through a 3.2 km long linear social housing project, as a mitigating measure.

However, according to Rezende [8], Santa Luzia is not primarily responsible for the environmental degradation of the watershed, which contradicts the state's argument for removing the community because of the damage caused to water resources and local biodiversity. This highlights the importance of debating the possible permanence of the community in the area.

Faced with these challenges, Santa Luzia presents itself as a vibrant and dynamic community, whose infrastructure challenges directly affect the quality of life of its residents. With a constantly growing population, it becomes essential to address infrastructure issues to ensure a safe, healthy and prosperous environment for all residents.

Land irregularities and disordered growth also contribute to environmental problems. Without proper planning, development in the region occurs haphazardly and often to the detriment of the environment. This results in problems such as inadequate waste management, a lack of efficient drainage systems and the degradation of natural areas, which can lead to environmental disasters such as flooding and soil erosion.

Additionally, the reality of precarious housing in Santa Luzia highlights the issue of the environmental vulnerability of residents. Houses built without adequate consideration for

safety and sustainability standards are more susceptible to environmental damage, such as flooding and landslides, especially in risk areas.

In synthesis, the environmental situation in Santa Luzia is an intricate web of urban and ecological challenges. It requires a holistic approach that considers both the need to improve urban infrastructure and the living conditions of residents and the preservation of the surrounding natural environment, balancing human development with ecological sustainability.

AGROECOLOGY IN SANTA LUZIA: CHALLENGES AND POTENTIAL FOR SUSTAINABLE DEVELOPMENT WITH NATURE-BASED SOLUTIONS

According to Wolf, Rauf and Hamel [9], Nature-Based Solutions (NBS) are “actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems that address social, economic and environmental challenges in an effective and adaptive manner while providing human well-being, ecosystem services, resilience and biodiversity benefits” [10].

The researchers found examples of six different types of SbN already implemented in informal settlements in the Southeast Asian region: constructed wetlands, open green spaces, community gardens, street trees, rehabilitation of riparian or waterside vegetation and infiltration devices. Community gardens were the most frequently used solutions, followed by waterfront revegetation projects. Constructed wetlands were applied in informal settlements in Indonesia, Fiji and Vietnam under the RISE (Revitalizing Informal Settlements and Their Environments) program. Researchers and practitioners collaborated with residents to co-design wastewater treatment systems. These systems use a range of components, including biofilters, septic tanks and surface and subsurface wetlands, to collect and treat wastewater locally in the informal settlements.

In Brazil, the research started with studies carried out by Andrade [11] on spatial patterns and ecological infrastructure techniques in the urban environment, in order to achieve water-sensitive urban design. Studies were carried out using technical data sheets produced by the EPA's (Environmental Protection Agency) “Water-Sensitive Urban Design” Program [12], 2008, as well as on “Smart Growth: good practices for managing water resources and densities”, the “Water for a sustainable world” report. This research was part of the construction of the manual “Designing with Water: Spatial Patterns and Techniques for Ecological Infrastructure” and so far includes 52 patterns, coordinated by Professor Liza Andrade.

In the Santa Luzia region, agroecology is emerging as a fundamental practice, not only for food resilience and nutritional security, but also as a pillar of sustainability and environmental conservation. Growing food in small gardens enables residents to partially meet their food needs, promoting a more diverse and healthy diet. This direct approach to food production also plays a crucial role in preserving local biodiversity and contributing to the maintenance of soil and water resources, especially important in areas facing severe environmental challenges.

Mireya et al. [13] point out that the 1st National Meeting of Agroecology emphasized the importance of a “model of sustainable and democratic rural development”, in which agroecology plays a key role as an approach and strategic component. This alternative model of rural development, which seeks to be both sustainable and democratic, serves as the political basis for agroecological mobilization.

The research group led by Mireya and Cavanesi [13] aims to disseminate knowledge about agroecology and its relevance to society. In 2024, they founded ERA: Rural Extension and Agroecology. The rural extension and agroecology research group at UnB (Figure 6) highlights the importance of the agroecology chain of equivalence (Figure 7).

Figure 6. ERA Group - Rural Extension and Agroecology Research Group at UnB (2024). Source: ERA Group, 2024.

Figure 7. Chain of equivalences and importance of Agroecology. Source: Bittencourt, 2019.

Eduardo Sevilla Guzmán [14] addresses a rural development approach when he states that Agroecology constitutes the field of knowledge that promotes the ecological management of natural resources, through forms of collective social action that present alternatives to the current crisis of modernity.

Agroecology is not limited to agricultural practices; it encompasses a significant educational dimension, increasing environmental awareness among residents. Through it, residents learn about sustainable practices and the importance of a balanced relationship between humanity and nature. This educational aspect is vital for building a more informed and ecologically aware community.

In addition to its environmental and educational benefits, agroecology in Santa Luzia is an instrument of empowerment and local development. By providing skills and knowledge about food cultivation, it enables greater self-sufficiency and can even open up avenues for income generation. This is especially relevant in areas with limited economic opportunities.

These agroecological practices are also an effective strategy for dealing with the effects of climate change. They promote climate resilience through crop diversification and improved soil water retention, which are crucial for adaptation in areas vulnerable to extreme weather events.

A notable aspect of agroecology in the region is its focus on resource reuse and recycling. In a context of limited resources, the creative use of materials and waste not only reduces implementation costs but also reduces the environmental impact of agricultural practices.

However, despite the numerous benefits, agroecology in Santa Luzia faces significant challenges. Issues such as the lack of suitable land for cultivation, resource scarcity, and the need for technical training in efficient and sustainable agricultural practices are barriers that need to be overcome in order to maximize the potential of agroecology in

the region. Therefore, for agroecology to fully reach its transformative potential, it is essential that there is support, training and adequate allocation of resources.

PROPOSAL FOR REFLECTIONS AND PATHS IN SEARCH OF THE EVOLUTION OF URBAN INFRASTRUCTURE

Investing in urban infrastructure improvements is a key strategy for transforming Santa Luzia into an example of a modern, sustainable, and inclusive city. The development of structural projects that address essential needs in transportation, basic sanitation, energy supply, communications, and revitalization of public spaces not only enhances urban functionality and aesthetics, but also significantly promotes the well-being and quality of life of citizens.

In the Integrated Plan: Housing and Agroecological Corridor (Figure 8) proposes the creation of an agroecological corridor, designed to function as an effective buffer zone in the protection of the Brasília National Park. This proposal aims to harmonize the coexistence between housing areas and the environment, promoting biodiversity conservation and sustainable development. The agroecological corridor is designed to offer multiple benefits, including the preservation of habitats, the promotion of sustainable agriculture, and the creation of a natural barrier that minimizes the negative impacts of human activities in the park.

Figure 8. Integrated Plan: Housing and Agroecological Corridor. Source: Valmor Pazos, 2024.

This innovative approach not only strengthens environmental protection, but also fosters a more balanced and sustainable relationship between urban and natural spaces. The implementation of this agroecological corridor represents a significant step towards integrated environmental management, ensuring the conservation of nature while meeting the needs of the local community.

For Santa Luzia to achieve this goal, it is essential that urban infrastructure planning is carried out in an integrated manner, considering the interconnection between different

areas and the long-term impact of each project. This implies a holistic approach that takes into account not only technical aspects, but also social, economic and environmental ones, ensuring sustainable solutions that meet the present and future needs of the population.

Community participation in the planning and implementation process of these improvements is another crucial pillar. Involving the inhabitants of Santa Luzia in decision-making ensures that projects reflect the real needs of the population, in addition to fostering a sense of belonging and collective responsibility for the city. This can be achieved through public consultations, workshops and digital platforms for civic engagement, promoting participatory and transparent governance.

Focusing on sustainable solutions, as we propose in the Infrastructure Improvement Visual Plan (Figure 9), is equally important. Adopting green technologies, promoting energy efficiency, and prioritizing public transportation and non-motorized means of transportation are examples of practices that contribute to urban resilience. In addition, creating green areas and public spaces that encourage social interaction and outdoor recreation improves air quality and contributes to the physical and mental health of residents.

Figure 9. Visual Infrastructure Improvement Plan. Source: Valmor Pazos, 2024.

Elevated Walkways: Elevated structures that allow people to move above the level of potential flooding, ensuring the mobility and safety of the community during periods of heavy rain.

Rainwater Management Areas: Spaces designated for the control and direction of rainwater, reducing the risk of flooding and improving local water management.

Community Gardens: Areas dedicated to the cultivation of plants and food by the community, which in addition to providing sustenance, also contribute to the management of stormwater and the creation of green spaces.

Natural Buffer Zones: Strips of native vegetation, which we call agroecological corridors, and green spaces between the housing area and the natural surroundings, functioning as barriers to protect biodiversity and prevent uncontrolled urban expansion.

Simple Housing Improvements: Updates and repairs to existing homes that improve the quality of life of residents at no great cost, using local materials and sustainable techniques.

Therefore, it is imperative that local authorities, businesses and the wider Santa Luzia community continually collaborate and invest in urban infrastructure improvements. This multidisciplinary collaboration is key to overcoming existing challenges and ensuring a vibrant, prosperous and sustainable urban future for all its habitants. By adopting a strategic and inclusive vision, we can transform Santa Luzia into a model of a smart and resilient city, prepared to prosper in the decades to come.

CONCLUSION

Improvements to urban infrastructure play a vital role in the transformation and ongoing development of cities around the world, including Santa Luzia. Such investments aim not only to enhance the physical functionality of the urban environment, but also to foster a more inclusive, sustainable and resilient environment for its habitants. In Santa Luzia, these improvements are essential to addressing contemporary urban challenges, covering critical areas such as transportation, water and sanitation, energy, communications and public spaces.

In terms of transport, Santa Luzia benefits from investments in road infrastructure, expansion of public transport networks, cycle paths and accessible sidewalks. These initiatives not only improve urban mobility, but also reduce congestion and pollutant emissions, promoting a more active and healthy lifestyle. The modernization of public transportation systems, in particular, offers a sustainable alternative to the excessive use of private vehicles, helping the city to reduce its carbon footprint.

In relation to water and sanitation, Santa Luzia is committed to universal access to safe drinking water and adequate wastewater treatment. Investments in water supply networks and treatment systems are vital to prevent diseases and improve public health, highlighting the importance of this infrastructure for the quality of life in the city.

In the field of energy, Santa Luzia seeks to modernize and diversify energy sources, with an increasing focus on renewable solutions. The transition to clean energy sources not only supports environmental sustainability, but also places the city at the forefront of the fight against climate change.

The expansion and modernization of telecommunications networks are essential for Santa Luzia, promoting digital connectivity and inclusion in all spheres of urban life. Access

to high-speed internet and a robust communications infrastructure are fundamental for economic development, education and access to digital public services.

In addition, public spaces in Santa Luzia are valued as centers of social cohesion and community interaction. Investments in parks, squares and leisure areas not only enrich the urban fabric, but also promote the well-being and quality of life of citizens, strengthening community bonds.

In conclusion, urban infrastructure investment is essential to build a more inclusive, sustainable and resilient Santa Luzia. By prioritizing projects that meet needs in transportation, water, energy, communications and public spaces, Santa Luzia can overcome contemporary challenges and create an environment conducive to economic growth, social equity and a quality life for all its habitants.

THANKS

The authors would like to thank the University of Brasília (UnB) for serving as a setting for great academic inspiration, LabRAC - Laboratory for the Rehabilitation of the Built Environment, LaSUS - Laboratory for Sustainability Applied to Architecture and Urbanism, and Laboratório Periférico - Sociotechnical Consulting, for the encouragement and opportunity to develop research aimed at the recovery and improvement of buildings and cities, always focusing on the benefit of the population. We also thank the Research Support Foundation of the Federal District (FAPDF) for the financial support, encouragement and promotion of the research.

REFERENCES

1. L. M. S. Andrade, J. A. F. Lenoir, S. F. Portugal, A. R. Fialho, Revista Paranoá, *Santa Luzia Resiste,* 4 (2021)

2. S. C. Cohen et al. *Habitação saudável e biossegurança: estratégias de análise dos fatores de risco em ambientes construídos.* Saúde em Debate, Rio de Janeiro, 43, n. 123, p. 1194-1204 (2019).

3. F. A. Lima, S. Lima, *Construindo cidades saudáveis: a instrumentalização de políticas públicas intersetoriais em saúde a partir do Planejamento Estratégico Situacional*. Saúde e Sociedade, São Paulo, 29, n. 2, p. 1-20 (2020).

4. ANAC. Regulamento Brasileiro da Aviação Civil Especial. RBAC nº94 – Requisitos Gerais para Aeronaves Não Tripuladas de Uso Civil. Brasília, mai. 2017. Available: << http://www.anac.gov.br/assuntos/legislacao/legislacao-1/rbha-e-rbac/rbac/rbac-e-94-emd00/@@display-file/arquivo_norma/RBACE94EMD00.pdf>> Access: 13 mar. 2024

5. L. S. Silva, V. A. G. Zanoni, V. C. Pazos, L. M. A. Santos, T. R. P. Jucá, *Fotogrametria com imagens adquiridas com drone: do plano de voo ao modelo 3D.* Editora LaSUS FAU – Universidade de Brasília, Brasília (2022)

6. Zmitrowicz(2002)

7. Gehrels et al (2016)

8. V. S. Resende, L. M. Souza de Andrade, S. E. Rodrigues, P. P. Pereira, N. S. Lemos, *O ecossistema urbano da ocupação Santa Luzia: Análise dos impactos por técnicas de geoprocessamento e proposição de Soluções baseadas na Natureza.* Paranoá, 13(26), 219–240. Available: https://doi.org/10.18830/issn.1679-0944.n26.2020.15. Acesso em: 09/04/2024

9. E. Wolf, H. A. Ralf, P. Hamel, *Nature-based solutions in informal settlements: a systematic review of projects.* In: Southeast Asian and Pacific countries, Environmental Science & Policy, 145, 275-285 (2023)

10. Assembléia das Nações Unidas para o Ambiente (2022)

11. L. M. S. Andrade, *Conexão dos Padrões Espaciais dos Ecossistemas Urbanos: A construção de um método com enfoque transdisciplinar para o processo de desenho urbano sensível à água no nível da comunidade e o no nível da paisagem.* (PhD Thesis), FAU/UnB, Brasília (2014)

12. J. P. Wsud, R. Adamowicz, F. J. Ferguson, B. Tony. Tony, W. Tony, *Liveability and The Water Sensitive City,* Science Policy Partnership for Water Sensitive Cities. Cooperative Research Centre for Water Sensitive Cities, Melbourne, Australia (2012).

13. M. E. V. Perafán, S. Sauer, A. Z. Leite, F. C. Canavesi, M. L. Ávila, *Desenvolvimento territorial, sistemas agroalimentares e agricultura familiar.* 2. ed. [E-book]. São Leopoldo, RS: Oikos (2022)

14. E. S. Guzmán, *Agroecologia: manejo ecológico dos recursos naturais e alternativas à crise de modernidade*.Available:https://www.embrapa.br/agencia-de-informacao-tecnologica/tematicas/agricultura-e-meio-ambiente/politicas/agroecologia.Access: 13/03/2024