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Occupation of Environmentally Fragile Areas and Risks to the Community: Minimum Criteria to Guarantee Safe and Healthy Housing

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Ocupação de áreas de fragilidade ambiental e riscos à comunidade: critérios mínimos para garantir segurança e salubridade à moradia

RESUMO

Objetivo Analisar a ocupação de áreas de fragilidade ambiental por assentamentos informais e propor critérios mínimos de ocupação que garantam segurança e salubridade, conciliando o direito à moradia segura com a proteção ambiental.

Metodologia Baseou-se em revisão bibliográfica na parte teórica do artigo. Para o estudo de caso, foram analisados documentos de políticas urbanas vigentes. A análise interdisciplinar, realizada em ferramentas de geoprocessamento, se baseou na sobreposição das zonas de erosão, contaminação do solo, perda de recarga de aquífero e áreas de habitação.

Originalidade/Relevância Preenche uma lacuna sobre a integração entre a as dimensões ambientais e urbanísticas voltadas a orientação de projetos urbanos de regularização fundiária onde seja possível a população identificar de forma clara as razões de fixação e ou realocação.

Resultados A adoção de critérios mínimos de ocupação, com base em dados de risco, demonstrou a possibilidade de mitigar riscos socioambientais sem deslocar moradores. As medidas propostas previnem danos sociais e garantem soluções sustentáveis para a população local.

Contribuições Teóricas/Metodológicas Destaca a importância de integrar aspectos ambientais em planos de regularização fundiária. Metodologicamente, o uso de geoprocessamento serve como uma ferramenta eficaz para criar resultados baseados em evidências visuais, que orientam mais claramente as decisões urbanísticas em áreas vulneráveis.

Contribuições Sociais e Ambientais Apresenta soluções que garantem moradia segura para populações de baixa renda em áreas de risco e propõe medidas para preservar recursos naturais, equilibrando direitos humanos e proteção ambiental.

PALAVRAS-CHAVE: Áreas de risco. Critérios ambientais de ocupação. Assentamentos informais.

Occupation of Environmentally Fragile Areas and Risks to the Community: Minimum Criteria to Guarantee Safe and Healthy Housing

ABSTRACT

Objective To analyse the occupation of environmentally fragile areas of informal settlements and to propose minimum occupation criteria that guarantee safety and health, reconciling the right to safe housing with environmental protection.

Methodology The theoretical part of the article was based on a bibliographical review. For the case study, urban policy documents were analysed. The interdisciplinary analysis, carried out using geoprocessing tools, was based on the overlap of erosion zones, soil contamination, loss of aquifer recharge and housing areas.

Originality/Relevance It fills a gap in the integration of environmental and urban planning dimensions aimed at guiding urban land regularisation projects where the population can clearly identify the reasons for settling and/or relocating.

Results The adoption of minimum occupation criteria, based on risk data, demonstrated the possibility of mitigating socio-environmental risks without displacing residents. The proposed measures prevent social damage and guarantee sustainable solutions for the local population.

Theoretical/Methodological Contributions Highlights the importance of integrating environmental aspects into land regularisation plans. Methodologically, the use of geoprocessing serves as an effective tool for creating results based on visual evidence, which more clearly guide urban planning decisions in vulnerable areas.

Social and Environmental Contributions Presents solutions that guarantee safe housing for low-income populations in risk areas and proposes measures to preserve natural resources, balancing human rights and environmental protection.

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KEYWORDS: Risk areas. Environmental criteria for occupation. Informal settlements.

Ocupación de áreas de fragilidad ambiental y riesgos para la comunidad: criterios mínimos para garantizar seguridad y salubridad en la vivienda

RESUMEN

Objetivo Analizar la ocupación de áreas de fragilidad ambiental por asentamientos informales y proponer criterios mínimos de ocupación que garanticen la seguridad y la salud, conciliando el derecho a una vivienda segura con la protección del medio ambiente.

Metodología La parte teórica del artículo se basó en una revisión bibliográfica. Para el estudio de caso, se analizaron documentos de política urbana actuales. El análisis interdisciplinar, realizado mediante herramientas de geoprocesamiento, se basó en la superposición de zonas de erosión, contaminación del suelo, pérdida de recarga de acuíferos y zonas de viviendas.

Originalidad/Relevancia Cubre una laguna en la integración de las dimensiones medioambiental y urbanística destinada a orientar los proyectos de regularización del suelo urbano en los que la población puede identificar claramente las razones para asentarse y/o reubicarse.

Resultados La adopción de criterios mínimos de ocupación, basados en datos de riesgo, demostró la posibilidad de mitigar los riesgos socioambientales sin desplazar a los residentes. Las medidas propuestas evitan daños sociales y garantizan soluciones sostenibles para la población local.

Aportaciones teóricas/metodológicas Destaca la importancia de integrar los aspectos medioambientales en los planes de regularización del suelo. Metodológicamente, el uso del geoprocesamiento sirve como herramienta eficaz para crear resultados basados en evidencias visuales, que orientan con mayor claridad las decisiones urbanísticas en zonas vulnerables.

Contribuciones sociales y medioambientales Presenta soluciones que garantizan viviendas seguras para las poblaciones de bajos ingresos en zonas de riesgo y propone medidas para preservar los recursos naturales, equilibrando los derechos humanos y la protección del medio ambiente.

PALABRAS CLAVE: Zonas de riesgo. Criterios ambientales de ocupación. Asentamientos informales.

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1 INTRODUCTION

Two-thirds of Latin America's population lives in cities where their urbanization passes rapid but at the same time precarious growth. Informal settlements remain one of the major issues in Latin America. Noteworthy, socio-economic strategies of this region have their own characteristics and deserve to be analyzed to define the priorities for investment, given the aspects involved are of different dimensions.

This work examines the relationship between environmental fragility and risk areas with the aim of suggesting more effective urban interventions for informal settlements. Specifically, it analyzes how physical environmental conditions impact the safety and health of housing, and how, in the face of climate change, those conditions lead to increased vulnerability for both populations and ecosystems.

The document "The Challenge of Slums - Global Report on Human Settlements 2003" (UN, 2003) defines the term “informal settlement” by analyzing three dimensions: 1) physical condition; 2) legal condition; and 3) socioeconomic condition. The indicators used for identification were: 1) access to water and sewage infrastructure; 2) housing quality; 3) overcrowding; and 4) insecure residential status. Many times, informal settlements in Brazil are situated in environmentally fragile areas leading to safety and health risks, as well as impacts on the ecosystem (Bezerra; Chaer, 2012). The economic and social damage is due to the sum of the conditions of the physical environment, aggravated by the lack of sanitary infrastructure and the practice of self-building.

Notably, in Brazil, urbanized areas have nearly tripled in size over the past 38 years, according to *Mapa Biomas* (2023), with a 5.127 million people, or 7.8% of the population, living in irregular housing (IBGE, 2022). Despite this ever-growing problem, it can be said that there is an accumulation of at least three decades of studies on the subject (Fernandes, 2006; Veyret, 2007; Cerri; Nogueira, 2011; Maricato, 2011; Rolnik, 2006), which define the main causes and solutions across different dimensions: (i) land; (ii) urban planning; (iii) environmental; (iv) socioeconomic, among others. What is lacking, then, are more effective actions, some of a technical nature and many of a political nature.

According to the National Housing Plan (PlanHab) (BRASIL, 2010), informal settlements are defined by illegal land ownership, insufficient or absent infrastructure, irregular occupation, lack of access to services, and precarious housing. This aligns with the UN's concept and further emphasizes the focus on physical planning, where urban and environmental aspects are closely interconnected.

However, in response to the improvement of irregular settlements, regularization projects (*projetos de regularização*) often underestimate territorial specificities and as previously mentioned, tend to adopt solutions that replicate traditional urban planning models, which are incompatible with the social and environmental conditions of these areas. Conventional urban planning principles are based on the premise that land designated for urbanization must meet certain criteria, such as soil stability, slope, permeability, and resistance, while also preserving ecosystem services for both people and nature. Yet, as Ribas (2003) points out, typical urbanization process for informal settlements is the opposite of traditional urban

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planning. Instead of following the usual sequence : infrastructure implementation, construction, and then occupation, these settlements often begin with occupation, followed by the gradual introduction of infrastructure, and finally efforts to integrate them with established urban areas.

This inverted logic of urban settlement necessitates conducting studies on those areas, aiming to reconcile the population's right to settle with the right to housing in an environmentally safe space, both jurisdictions guaranteed by the Brazilian Federal Constitution.

2 DEFINING CONCEPTUAL FRAMEWORK AND CRITERIA FOR INFORMAL SETTLEMENTS

The study of environmental factors influencing the selection of areas for urbanization is benchmarked by McHarg's 1969 work, along with earlier practical contributions by Olmsted (1822–1903). McHarg's work, however, remains the foundation for contemporary studies that integrate nature conservation with human settlement. To assess land-use capacity and environmental sustainability his method utilizes remote sensing and organizes data into "layers of information," including hydrological data, aquifer physiography, surface hydrology, soil characteristics, and vegetation.

The extensive development of risk mapping studies in Brazil is similarly rooted in this approach, serving as a key reference for the subject of this article. It is crucial to determine the specific characteristics that define environmental fragility in a given area and how this fragility contributes to the risk, particularly in the context of urban occupation. This understanding forms the primary criteria for determining whether to sustain or relocate a particular occupation in an informal settlement.

2.1 Environmental fragility and urbanization

Environmental fragility or vulnerability is linked to a system's susceptibility to intervention or alteration (Sporl, 2015, p.24). The concept of fragility corresponds to an integrated analysis of the environment, which aims to reconcile the interactions and dynamics of variables such as climate, soil, relief and others, in the face of anthropogenic activities (Ross, 1994; Santos; Ross, 2001; Crepani et. al., 2001). It is assumed that there is no single factor or variable that causes system degradation, there are several processes that happen at a given period. It is common when one factor triggers the activation of the others resulting in the instability of the whole environmental system.

To gain a comprehensive insight into the process of land occupation, it is essential to establish clear priorities. In this context, Weil and Pires Neto (2007) and Spörl (2007) draw on the most common process that typically contributes to socio-environmental risks in informal settlement areas: erosion. This event frequently results in landslides, flooding, and the contamination of watercourses by sediment displaced from the soil. The erosion is contingent upon several factors, including the terrain, particularly in relation to slope steepness, deforestation, and the scale of the deterioration. On steeper slopes, the acceleration of surface runoff intensifies erosion (Bertoni, 1959; Mota, 2003; Valladares et al., 2012). As described by Weil and Pires Neto (2007), erosion can be understood as a synergistic phenomenon, whereby

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the interplay of various factors, including climate, lithology, topography, soil characteristics, vegetation cover, and land use, contribute to its occurrence.

It is important to note that the primary source of accelerated erosion stems from traditional urbanization patterns, which alter the natural characteristics of the soil through unnecessary deforestation and the creation of large impermeable surfaces. Soil permeability plays a crucial role in preventing erosion. According to Valladares et al. (2012), soil attributes such as granulometry, structure, and surface horizon aggregation not only affect erosion susceptibility but also influence the soil's capacity for water infiltration and retention.

Additionally, Mota (2003) highlights that one of the primary impacts of urbanization is the alteration of vegetation cover: "(...) vegetation is the most important factor in controlling erosion, mainly because it constitutes a physical barrier to the transport of material; it provides a more solid structure to the soil; it increases the porosity of the soil and, therefore, its capacity to absorb water. Soil transport is greatly reduced in areas where the land is covered by trees or grass."

To sum it all up, when analyzing areas with steep slopes, priority should be given to assessing soil resistance and permeability to effectively manage erosion and safeguard aquifer recharge, both of which can be impacted by urban occupation.

2.2 Risk areas and urbanization

As evidenced in specialized literature, risk is a complex notion. In his 2006 publication, Cerri presents the following conceptual formula: The concept of risk can be defined as the product of probability and consequence. In other words, risk can be expressed as $R = P \times C$, where R represents risk, P denotes probability or the likelihood of a destructive process occurring, and C signifies the social and/or economic consequences. A risk area is defined as an environmentally fragile area that is subject to pressures arising from urbanization without adequate infrastructure due to the socially vulnerable conditions of the resident population (Dauphiné, 2001; Veyret, 2007). Consequently, risk emerges from the convergence of environmental fragility and social vulnerability. Accordingly, risk areas can be defined as locations where these two factors meet (Veyret, 2007).

Risk areas in informal settlements have a detrimental impact on both the population and the environment. Mitigating interventions can serve two key purposes: firstly, to guarantee environmental restoration, and secondly, to prevent socio-economic damage. The term "socio-environmental risk" is particularly applicable to informal settlements, as it effectively encapsulates the interdependence between environmental and social risks.

In recent decades, advancements in risk and fragility mapping have been driven by remote sensing, which, as noted by Ross and Petronzio (2011), plays a pivotal role in environmental studies. Considering the available technological possibilities, risk mapping—though inherently complex when addressing the various aspects of the physical environment—can still be simplified by focusing on the key factors that pose the greatest risks to public safety and health. Accordingly, in order to identify the environmental fragility that is most likely to contribute to socio-environmental threats in informal settlements, it is essential to consider the following key risks:

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(1) risk of soil loss through erosion or risk of water erosion (slope and risk of accelerated rainwater runoff);

(2) risk of subsoil contamination;

(3) risk of loss of aquifer recharge and flood risk.

To demonstrate the efficacy of selecting these three factors, we present the findings of a study conducted in a land regularization area in the Federal District, specifically the satellite city of São Sebastião.

3 ASSESSMENTS OF FRAGILITIES AND POTENTIAL RISKS IN A LAND REGULARIZATION AREA: MORRO DA CRUZ II, FEDERAL DISTRICT

The Territorial Planning Plan for the Federal District (PDOT/2009), established by Complementary Law No. 803 of April 25, 2009, designates informal settlement areas as Social Interest Regularization Areas (*ARIS*). This designation allows for the possibility of land regularization, provided that environmental feasibility studies are conducted prior to the commencement of urban planning studies. In the São Sebastião Administrative Region (AR), there are three locations that meet this definition: Morro da Cruz II, Vila do Boa, and Capão Comprido.

The Morro da Cruz II area was selected for analysis due to its size and the presence of a stream, which exacerbates its environmental fragility. This distinguishes it from other areas, while also allowing for the evaluation of both population safety and health, as well as the protection of key aspects of the area's biophysical integrity. The area in question encompasses 480 hectares and has been occupied by a low-income population, specifically families with an income of up to three minimum wages.

The study is primarily concentrated around key physical constraints, namely topography, pedology (the study of soil types), vegetation, and geology, as these factors are of paramount importance in the assessment of potential risks. The subsequent analysis identified critical risks as: (i) soil erosion due to slope and accelerated rainwater runoff; (ii) subsoil contamination; (iii) aquifer recharge loss; and (iv) flooding.

The statistical and physical/environmental data were obtained from official documents published by the Federal Government of Brasília, including the Territorial Planning Master Plan (*PDOT*), the Environmental Impact Study (*EIA-RIMA*), the Urban Territorial Study (*ETU*), the Urban Planning Guidelines (*DIUR*), and the Local Master Plans (PDL). It is noteworthy that the Ecological Economic Zoning of the Federal District (*ZEE-DF*) constituted a principal source of environmental and socio-economic data for this study.

4 RESULTS

In accordance with the established framework, the analysis proceeded to examine additional factors, including areas with slopes more than 30%, deficiencies in infrastructure (including drainage), reduced or absent vegetation, and permeable surfaces. These conditions increase the risk of erosion, which in turn poses potential threats to households in the studied areas.

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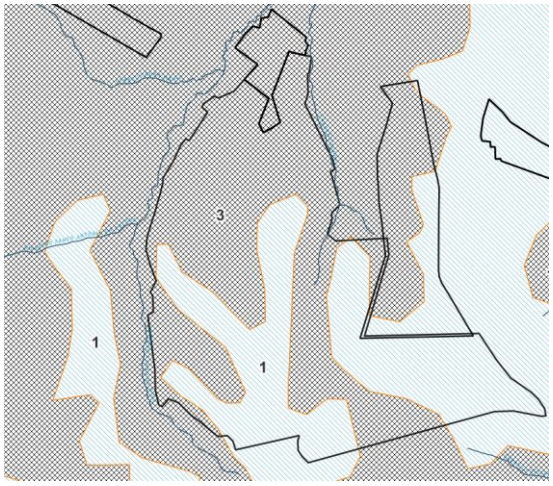
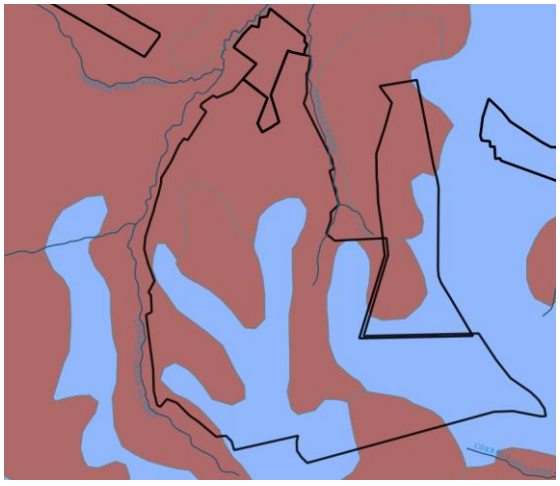
The results, in alignment with the *ZEE-DF*, indicate that the Morro da Cruz II polygon is situated within areas of medium (56.25%) and very low (43.75%) risk for aquifer recharge loss, as well as areas of high (56.5%) and very low (43.4%) risk for subsoil contamination, as illustrated in the maps in Figure 1a and 1b respectively. Regarding vegetation, the area is characterized by a cover comprising 24.7% of native vegetation, with 44 hectares of natural vegetation and 75 hectares of cultivated vegetation, resulting in a total vegetative cover of 119 hectares, as illustrated in Figure 1e.

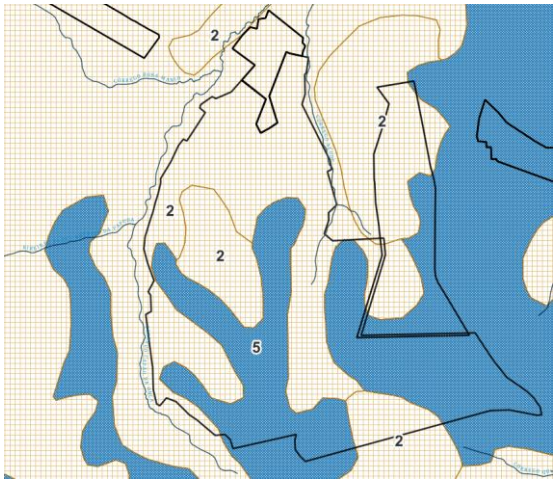
Figure 1 - Comparative analysis of the *ETU* (Environmental Territory Urban Studies, Federal Government of Brasilia) zones with the physical-environmental restrictions of Morro da Cruz II (Economic-Ecological Zoning)



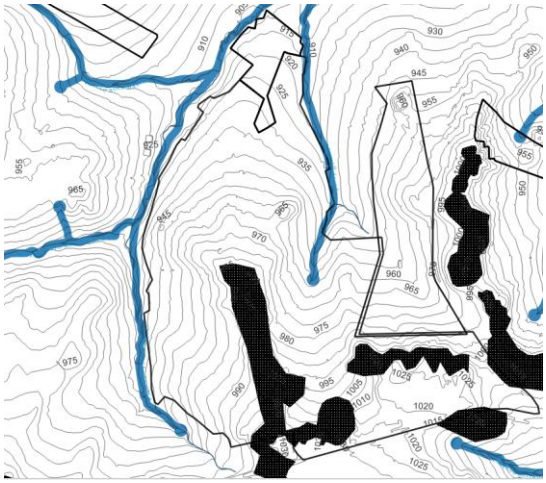
a) Map of the risk of loss of aquifer recharge.
1. Very low (43.75%) 2. Low
3. Medium (56.25%) 4. High
5. Very high



b) Subsoil contamination risk map
High (56.5%)
Very low (43.4%)



c) Risk of soil loss by erosion map.
1. Very low
2. Low (43.75%)
3. Medium
4. High
5. Very high (56.25%)



d)Map of App inserted and slope >30%
Areas with a slope > 30%
Permanent Preservation Areas (PPAs) for water resources

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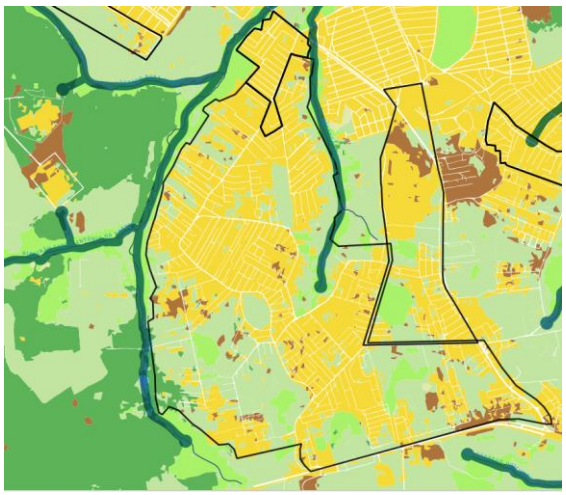

e) Map of built-up and open areas

Built-up area (75%)

Road system

Vegetation (25%)

Exposed soil

f) Overlay map of the maps with the various physical-environmental restrictions

Áreas com declividade > 30%

Permanent Preservation Areas

Built-up area

Vegetation

Exposed soil

High risk of subsoil contamination and medium risk of loss of aquifer recharge

High Risk of soil loss due to erosion

Source: Image based on Seduh, 2022; Geoportal.br, 2022; and ZEE-DF, 2019.

Regarding the risk of soil loss due to erosion, it can be observed that approximately 43.75% of the area is situated at a very high-risk level, while approximately 56.25% is at a low risk level (Figure 1c). The very high soil loss is predominantly observed in areas with more pronounced topographical features, as illustrated in the map of APPs with slopes more than 30%. (Figure 1d, 1f) (Law 5.344/2014; IBRAM/GEINF, 2018; Law 6269/2019; ETU 02/2021[1]).

1 The following technical documents were considered for analysis: (i) Urban Territorial Study of the Morro da Cruz II Region - ETU 02/2021. Technical Part 02/2021-SEDUH/SEGEST/SUDEC/COGEST/DIRUR; (ii) IBRAM/GEINF Environmental Diagnosis - SEI Process No. 00390-00000566/2018-12; (iii) São Bartolomeu APA Management Plan, approved by Law No. 5,344 of May 19, 2014; (iv) Ecological Economic Zoning - ZEE/DF, Law No. 6,269 of January 29, 2019.

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Table 1- Summary of the environmental assessment of the Morro da Cruz I and II polygonal area.

Risk Type	High Risk	Medium Risk	Low risk
Loss of aquifer recharge	56.25%	-	43.75 %
Soil contamination	56,5%	-	43.4%
Risk of erosion	43.75%	-	56.25 %
Inserted in APP	Area of APP on the northeast and northwest borders that is highly susceptible to flooding.		
Slope >30%	There are areas with a slope greater than 30% marked on map 8		
Area occupied	75% of the polygonal area or 361 hectares		

Source: Produced by the authors based on the studies.

Another map, the Map of Permanent Protection Areas (*APP*) (Figure 1d) and slopes greater than 30% (Figure 1d), illustrates the presence of areas located on the northeast and northwest borders of the polygon where there are greater areas susceptible to flooding. Consequently, the Morro da Cruz II polygonal area is characterized by a significant proportion of its territory exhibiting medium and high levels of environmental vulnerability, as evidenced by the overlay map of the physical-environmental restrictions maps (Figure 1f). This map presents a comprehensive visual representation of the various environmental constraints, including the risks of landslides and flooding, as well as the potential impact of high soil sealing on aquifer recharge.

It was determined that certain buildings within the study area are situated in high-risk zones and, as a result, are no longer viable. The issues will be addressed in the following section. However, it should be noted that a number of restrictive conditions have been identified in the study area. These include the following: (i) 43.4% of the polygonal area is at high risk of erosion; (ii) 0.5% is designated as a Permanent Preservation Area (*APP*) containing water resources; (iii) 10% of the area has slopes exceeding 30%; and (iv) 56.5% is characterized by areas at high risk of soil contamination and moderate risk to aquifer recharge.

Of note is that there are significant differences between the study previously conducted by the Federal District's Secretary of State for Urban Development and Housing (SEDUH) – ETU – and the one carried out in this research. The latter study reveals the presence of risk areas that were overlooked in the SEDUH study and, conversely, areas suitable for development that were not identified. This is evident in the ETU 02/2021 zoning map (Figure 2a), in which the overlay was based precisely on the indications from the physical-environmental restrictions zoning map (Figure 2b). Conversely, the government's proposal would result in an increased number of people being displaced from their homes without ensuring the adequate preservation of the APPs.

Regarding its occupancy guidelines, the *PDOT/2009* stipulates an average population density of 50 to 150 inhabitants per hectare, a threshold already surpassed by the existing development. The area currently has 361 hectares of built-up land, representing 75% of the total polygonal area, as depicted in the map of built-up and vacant areas (Figure 1e). Some of these

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developed areas are located in high-risk zones, as shown in the overlay map of physical-environmental restrictions (Figure 1f).

Figure 2 - Comparative analysis of the ETU zones with the physical-environmental restrictions of Morro da Cruz II

a) Zoning map *ETU 02/2021*
Zone A: Single-family residential use. Density between 50 and 150 inhabitants/ha
Zone B: Single and multi-family residential, mixed use, commercial, service provision, institutional and small industrial uses compatible with the residential scale. Density between 15 and 50 inhabitants/ha.
Zone C: Creation of green areas and ecological parks.

b) Zoning map of physical and environmental restrictions
Zone A: High risk of subsoil contamination, medium risk of loss of aquifer recharge (56.5% of the polygonal area)
Zone B: High risk of soil loss due to erosion (43.4% of the polygon).
Zone C: Slope greater than 30% (10% of the polygon)

Source: The authors based on sources from Seduh, 2022; Geoportal.br; and ZEE, 2019.

4.1 Considerations on land regularization areas and their highest occupation risks

The study highlights that 628 buildings must be cleared from zones with the steepest slopes and along the edges of the APPs to meet the basic requirement of relocating the population from high-risk areas (Figure 3). As a priority, these 628 dwellings could be relocated to areas within the polygonal zone or the São Sebastião region that are suitable for residential development. It should also be considered that plots with houses built in the immediate vicinity of areas with a slope more than 30% should have specific urban planning parameters, including an increase in the soil permeability rate.

Figure 3 - Housing in risk areas in Morro da Cruz II

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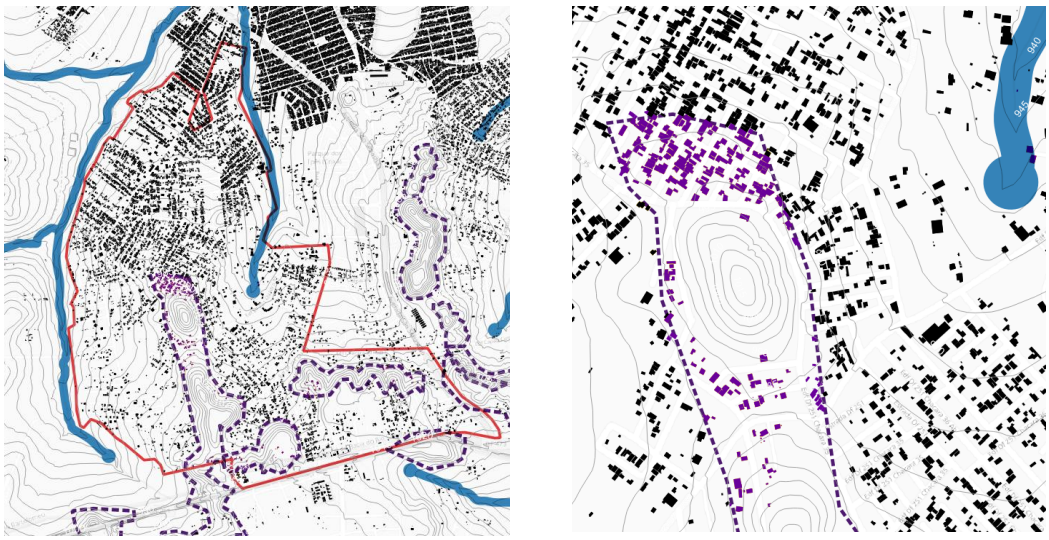

Map of dwellings in risk areas: areas with a slope > 30% (628 dwellings, 10% of the polygon)

Households in areas with slopes >30%

Maps Housing in areas at high risk of erosion (3012 dwellings 43.4% of the polygon, 270 units are installed in areas of slope and erosion)

Households in erosion areas

Maps Housing in areas of high risk of subsoil contamination and medium risk of loss of aquifer recharge (7,713 dwellings, 56.5% of the polygon, 416 units are installed in areas of slope and risk of subsoil contamination)

Households in areas at high risk of subsoil contamination and medium risk of loss of aquifer recharge

Source: The authors based on sources from Seduh, 2022; Geoportal.br; and ZEE, 2019.

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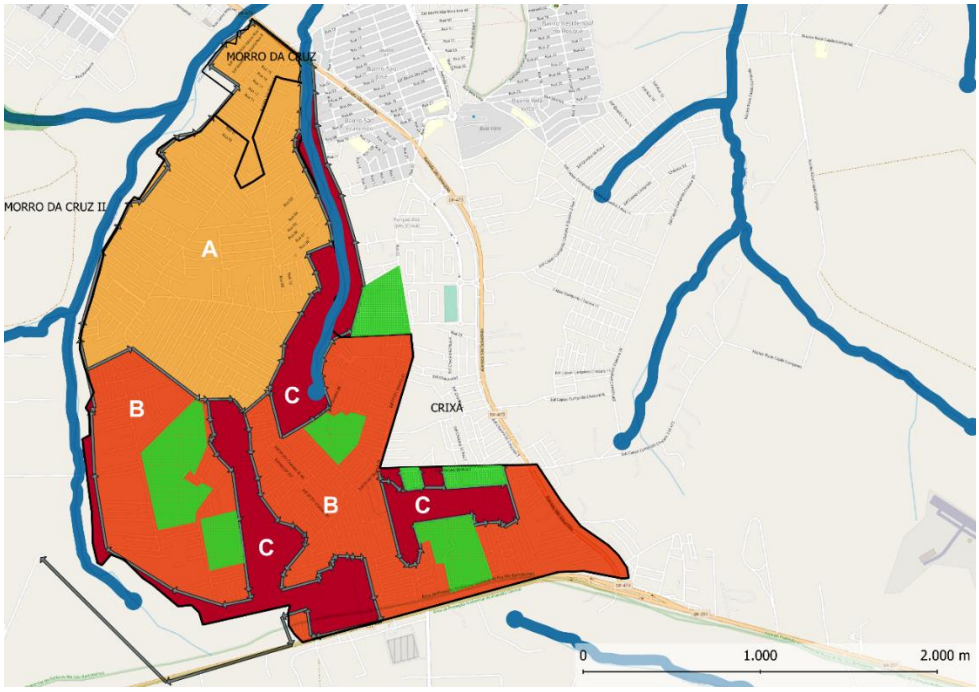
4.2 Basic guidelines for carrying out occupation plans.

To enhance the safety of the Morro da Cruz II area, various risk factors were overlaid, yielding the zoning presented in Figure 4. Adjustments were made to align the physical-environmental data with the existing road network. This approach is valuable not only for urban planners in defining the occupation plan but also for shaping the population's understanding of which areas are suitable for development and which are not.

Figure 4 - Zoning proposal for the Morro da Cruz II area



LEGEND

Wateresources APP

Institutional uses

Zones:

A - Mixed use - area that is currently more densely occupied and requires investment due to its medium risk of loss of aquifer recharge and high risk of soil contamination; controlling waterproofing is the main mitigating measure to be adopted. Suggested density: 50 to 150 inhabitants/ha.

B - Farm and institutional use - an area that is less occupied today and should have larger plots and institutional and/or green areas, Risk of erosion, steep slopes, reserve areas for water infiltration. Suggested density: 15 to 50 inhabitants per hectare.

C - Removal of the population. Leisure use - areas with high slopes > 30%, APP areas.

Source: The authors based on the studies.

5. CONCLUSION

After analyzing the environmental constraints that pose risks to the community's settlement and considering the existing urban characteristics of the area, we proposed a zoning system of land uses in accordance with the environmental restrictions. Based on the risk level,

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it becomes more practical to recommend varying degrees of plot occupation and density, as well as to identify priority locations for urban facilities, recreational spaces, and institutional areas. The latter should preferably be allocated in areas with some environmental vulnerability, both in terms of their typology (lower plot occupancy rate) and in terms of the state's capacity to carry out works in accordance with risk restrictions.

It is important to note that housing can be accommodated in both low- and high-density areas, as well as other land uses, depending on the specific urban planning parameters. Zoning should consider different degrees of permeability as well as built-up load to ensure aquifer recharge These criteria would serve as the foundation for the urban planning project, guiding the establishment of urban standards such as density, occupancy rate, permeability rate, vegetation coverage, and other key parameters.

As far as infrastructure is concerned, the need to set up sanitation systems and coordinate the road system between areas of the city should be taken into account. This would encourage greater mobility in the city, facilitating access to existing public facilities, as well as making it easier to find jobs.

In conclusion, it is suggested that a study like this could, in the case of the Federal District, support further the development of Urban Territorial Studies (ETU). In letter, urban planning parameters—such as permitted land uses within the polygon, basic and maximum utilization coefficients, maximum building height, and minimum permeability rate—would complement the guidelines set forth in the Master Plan.

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DECLARAÇÃO DE CONFLITOS DE INTERESSE

Nós, **Maria do Carmo de Lima Bezerra, Nadezhda Bobyleva, Cristina Maria Correia de Mello**, declaro(amos) que o manuscrito intitulado "**Ocupação de áreas de fragilidade ambiental e riscos à comunidade: critérios mínimos para garantir segurança e salubridade à moradia**":

1. **Vínculos Financeiros**: Apoio financeiro do DPI da Universidade de Brasília
2. **Relações Profissionais**: Nenhuma relação profissional relevante ao conteúdo deste manuscrito foi estabelecida.
3. **Conflitos Pessoais**: Nenhum conflito pessoal relacionado ao conteúdo foi identificado.