

Open Data for Urban Research - Final Report

Keeping people safe from landslides: risks and relocation policies in M'Boi Mirim, São Paulo

Introduction

The following maps estimate the disaster risk of landslides for the informal dwellers in of M'Boi Mirim, third most populated regional prefecture¹ in the South region of the city of São Paulo with 560 000 inhabitants. M'Boi Mirim is a vulnerable region due to the heavy rainfalls, topographic characteristics and the lack of infrastructure. Moreover, Brazil defined in 2001² special zones called ZEIS (*Zonas Especiais de Interesse Social*), which are meant to promote social housing and restructure favelas into formal settlements. The reports aims to explore, using concerned open data from the municipality, the possibility for the local planning authorities to relocate the populations settled in risk-affected areas, and provide an estimation of the number of residents that concerned.

Results: the section explains the results on the maps and tables attached

Firstly, by matching population density and risk areas we can see that most of vulnerable areas are located within high density, which calls for more information about the type of occupation of these areas. The information of the map is illustrated through quantitative data from Table 1, which shows that 10.47% of M'Boi Mirim residents live in a risk area.

The second map presents the density of population at risk in favelas and the perimeter of favelas without risk and confirms that favelas are physically more susceptible to be located in dangerous areas. Here, the numerical estimations of Table 1 complement this information by showing that indeed the exposition to landslide risks are more found in favelas, in which favela dwellers account for 65% of the total population in risk in the area.

The third map aims at estimating the number of people in the zones exposed to the highest levels of risks that could be more urgently relocated to formal housing inside ZEIS, if the public authorities took responsibility for implementing a plan to care for the victims of environmental risks in the prefecture. It can be illustrated through quantitative data from Table 2 and Table 3. Indeed, from the map we can see that the zones affected by the highest levels of landslide risks are not situated far from ZEIS, and from the tables we can see that the amount of 59,036 people affected by the risk are possibly relocatable to ZEIS, which we estimated could host 64,681 inhabitants in Housing of Social Interest (HIS) and 11,769 Housing of Popular Market (HMP). Considering that HIS is devoted to low-income families, as well as to residents of irregular and precarious housing settlements or derived from them, all 38,442 favela dwellers in all four levels of risk could indeed be relocated to a social housing on

¹ São Paulo is subdivided into 32 regional prefectures

² The National Law that defined the ZEIS is called 'Estatuto das Cidades'

the surroundings. As for the other 20,594 inhabitants in risk living outside favelas, those with family income of less than three minimum wages can be relocated to social housing too and those between three and ten minimum wages can be relocated to popular market housing. Consequently, our predictions of possible relocation were validated through the maps and population estimations, revealing a large margin between the potential of ZEIS and the demand from landslide risk.

Data Analysis

Source: The data used in this report comes from the [GeoSampa website](#), the official open database of the City of São Paulo which offers a great amount of maps, figures, shape files and metadata. The data is collected by the inter-american SIRGAS institute (Sistema de Referencia Geocéntrico para Las Américas).

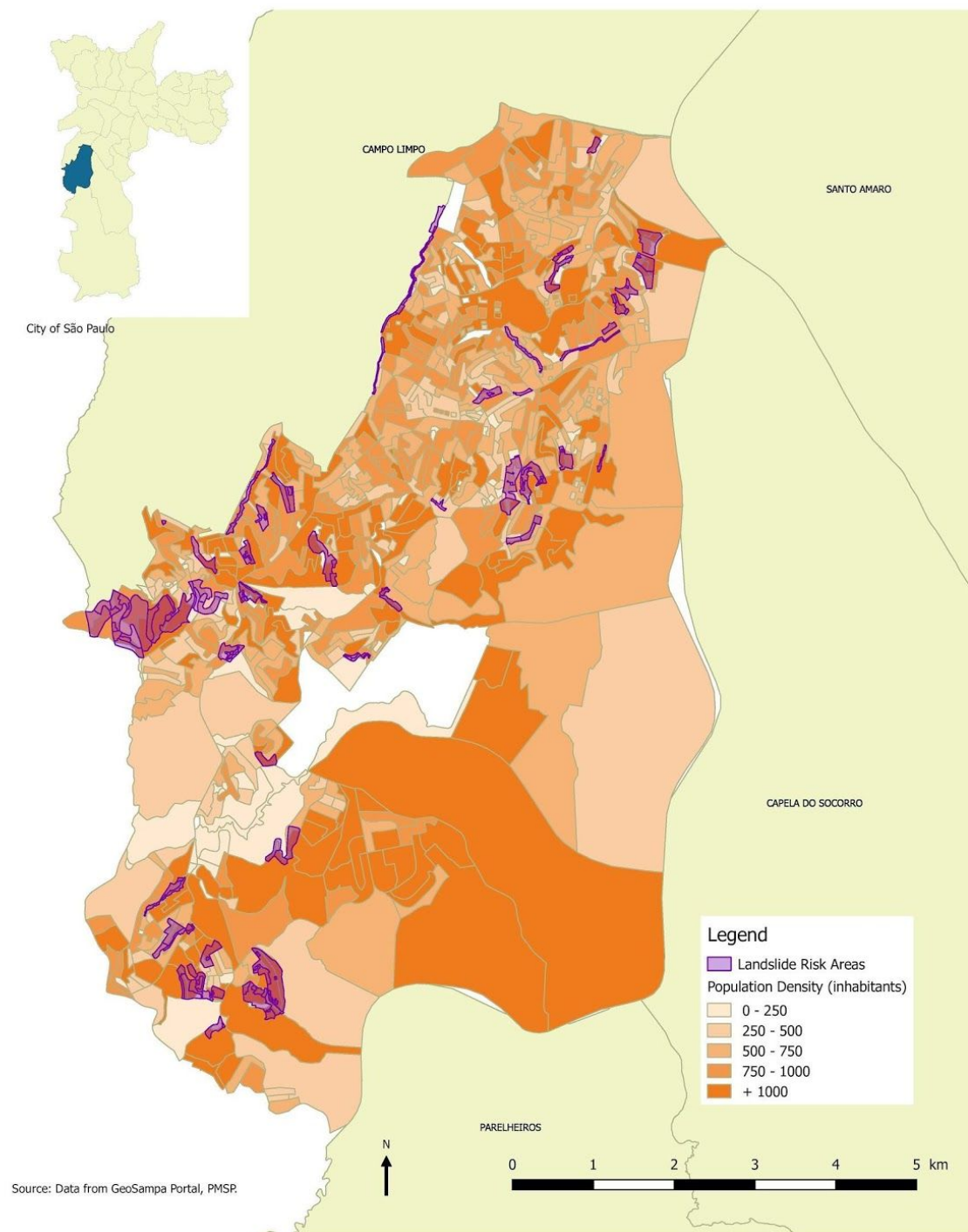
Quality and scope: Relying on an official source we can be relatively confident regarding the quality of these data. However, it can always be argued that in some parts of the city, especially the poorest, the censuses might be outdated or incomplete, many buildings and lands may be unreferenced and thus our calculations would be rendered imprecise or irrelevant. Even so, for the purpose of this exercise we have been able to cross reference multiple attribute tables in order to obtain results.

Granularity: Datasets are characterized with the high granularity providing the rather detailed information on risk areas, informal settlements and population density.

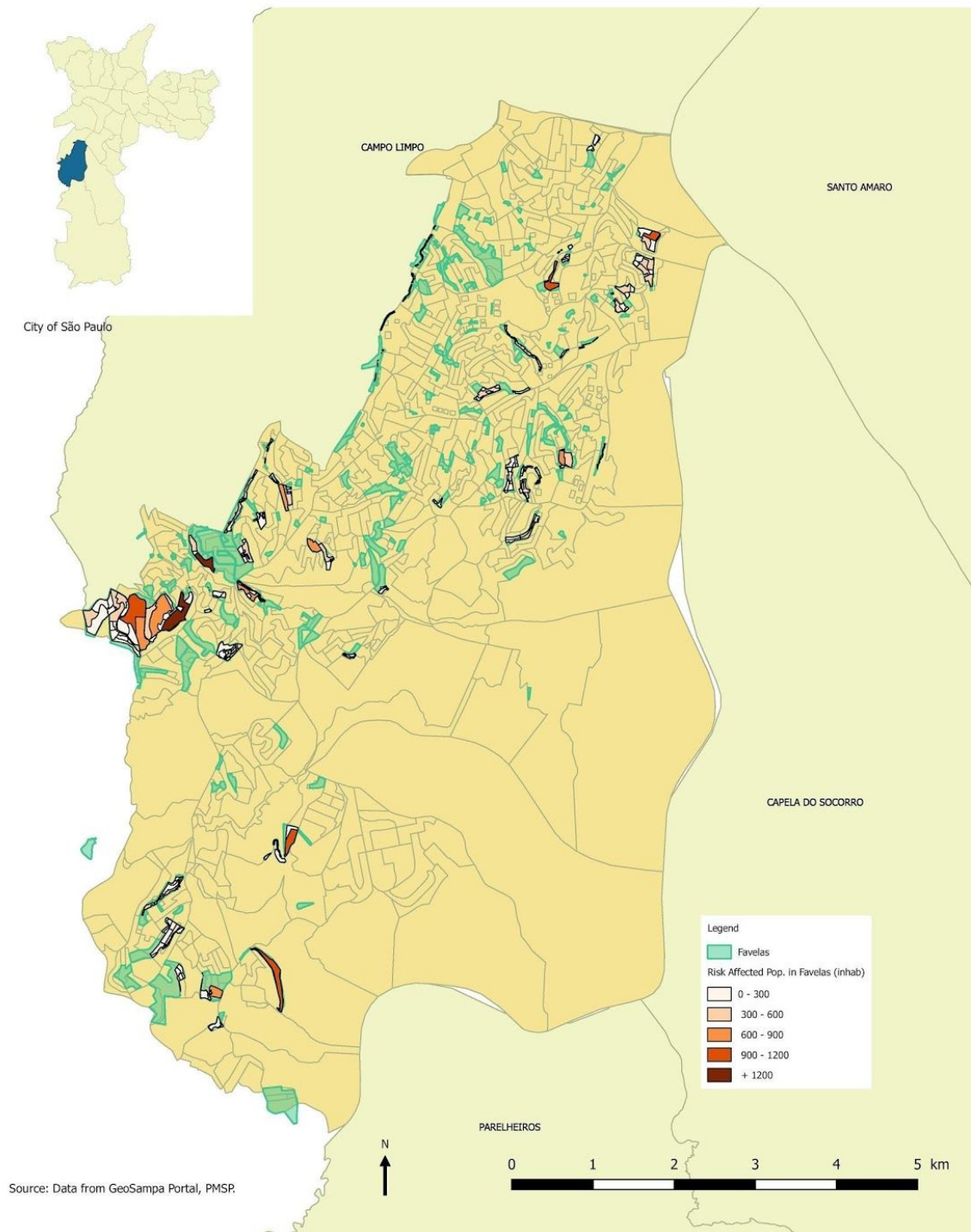
Limits: In order to differentiate the general population exposed to risk from the population exposed in the favelas and then the levels of risk faced by the dwellers, we had to intersect several times the census and risk layers of information and operate multiple selections in order to estimate the final number of favela residents (assuming a homogeneous distribution of population), because the original attribute tables of the layers were not providing enough figures. This process was the only possible way to account for all the favela dwellers because no actual census exists of those informal areas.

Maps and Tables

Map 01 - Population Density and Landslide Risk Prefecture M'Boi Mirim, São Paulo



Map 02 - Landslide Risk in Favelas Prefecture M'Boi Mirim, São Paulo



Map 03 - Levels of Landslide Risk and ZEIS Prefecture M'Boi Mirim, São Paulo

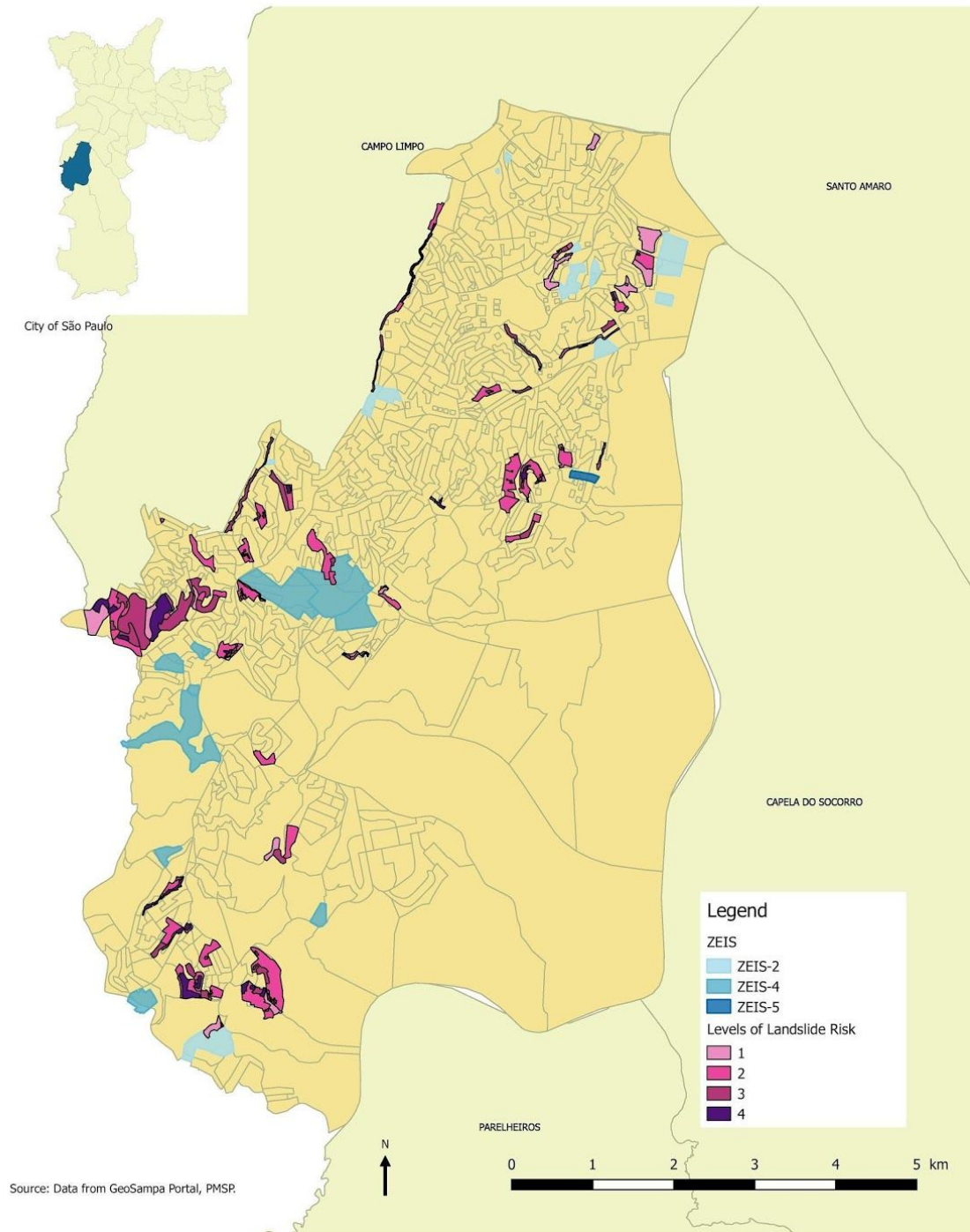


Table 1. Population and Risks in M'Boi Mirim

Population and Risks in M'Boi Mirim			
Total population	563,936 inhabitants	100%	-
Population in favelas	105,634 inhabitants	18.73%	-
Population in risk	59,036 inhabitants	10.47%	100%
Population in favelas in risk	38,442 inhabitants	6.82%	65.12%

Table 2. Population by risk levels in M'Boi Mirim

Population by risk levels in M'Boi Mirim		
Population in risk	59,036 inhabitants	100%
Risk level 01	9,293	15.74%
Risk level 02	32,014	54.23%
Risk level 03	13,106	22.20%
Risk level 04	4,623	7.83%

Table 3. Special Areas of Social Interest (ZEIS) in M'Boi Mirim

Special Areas of Social Interest (ZEIS) in M'Boi Mirim					
		Area for HIS		Area for HMP	
ZEIS 2	553,695.04 m2	80%	442,956.03 m2	20%	110,739.01 m2
ZEIS 4	1,349,487.32 m2	80%	1,079,589.86 m2	20%	269,897.46 m2
ZEIS 5	29,146.5 m2	60%	17,487.90 m2	40%	11,658.60 m2
Total	1,932,328.86 m2	100%	1,540,033.79 m2	100%	392,295.07 m2
Size of housing units		50 m2		70 m2	
Number of people per unit		3		3	
Number of people that could be relocated ³		64,681 inhabitants		11,769 inhabitants	

³ Taking into account only 70% of the total ZEIS area in order to discount roads and other public areas.

Sources

Documentation on ZEIS:

http://www.fau.usp.br/deprojeto/labhab/biblioteca/produtos/aceso_solo_zeis.pdf

<https://www.prefeitura.sp.gov.br/cidade/secretarias/upload/licenciamentos/zeisplanodiretor.pdf>

Geo Sampa portal presenting all the São Paulo open data:

<http://geosampa.prefeitura.sp.gov.br/PaginasPublicas/SBC.aspx>

Information on environmental risks in Brazil and São Paulo:

<https://jairwpr.files.wordpress.com/2013/04/pesquisa-a-percepc3a7c3a3o-do-cidadc3a3o-da-cidade-do-rio-de-janeiro-sobre-acidentes-climc3a1ticos.pdf>