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Informal Progressions
A comparative analysis of Lima and Medellin informal settlements

by
Julian David Leon Acosta

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Author's declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Latin American cities have seen significant demographic growth during the second half of the 20th century. As this expansion was unable to find a formal apparatus for its incorporation into the city, much of it was established through self-produced informal settlements. These settlements have now grown to cover 30% of Latin American cities and have become an alternative for low-income populations seeking to establish themselves within a city. The main goal of this thesis is to carry out a comparative analysis between the cities of Lima and Medellin as centers for applying various ideas and concepts concerning the development of informal settlements throughout Latin America and thus test a hypothesis regarding whether informal settlements can be a valid alternative for future urban development. Said analysis has been divided into 3 phases. The first phase consists of reviewing the past historical development of informal settlements inside these cities. A second stage is focused on studying the current conditions of such settlements by relying on an urban, socio-economic, demographic and territorial approach that aims to uncover the intersecting links between these elements and their connections to the production of the informal city. Finally, the analysis also seeks to outline future projections for possible areas of informal development by using a basic agent-based model that relies on both the data and the patterns resulting from the study undertaken. The conclusion of the analysis is that informal settlements remain one of the best alternatives for low-income people to settle in the city.

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List of Abbreviations

CAPECO: Cámara Peruana de Construcción (Peruvian Association of Construction)

COFOPRI: Organismo de formalización de propiedad informal

S/: Soles Peruanos

USD : United States Dollar

SJL: San Juan Lurigancho

VES: Villa El Salvador

VIS: Vivienda Interes Social

COP: Colombian Peso

DANE: Departamento Administrativo Nacional Estadistica (National Administrative Department of Statistics)

INEI: Instituto Nacional de Estadistica e Informatica. (National Institute of Statistics and Informatics)

PUI: Proyecto Urbano Integral

Introduction

Latin American cities experienced an intense urban densification process throughout the second half of the 20th century. During that rapid urban densification, neither the private sector nor the state government were able to provide housing solutions for this new urban population. Therefore, the majority of this surplus urban population developed their own housing solutions, far away from the constraints and regulations of both the state government and the private market, resulting in solutions considered to be "informal". The informal urban process developed within large portions of various Latin American cities (In 2014, UN Habitat observed that 24% of the urban population of Latin American lived in slums or informal settlements)[1]. Surpassing the previous Haussmann urban approach that focused on the demolition and renovation of informal communities, both architects and citizens have come to understand informality as an alternative approach to the different social, economic and architectural necessities of the contemporary city.

Such informal urban processes have often been labeled as "random or haphazard" (Arefi, 2011) yet there are patterns, internal logics and assemblies that provide structure and guidance to informal development, which may differ from those employed in formal city structures but still contain value as part of contemporary scenarios. Thus, this thesis aims to showcase the rule sets, patterns and vernacular urban strategies found during the process of developing the informal city throughout Latin America. The particular cities selected for analysis purposes are Lima in Peru and Medellin in Colombia; undertaking an individual and comparative analysis of informal settlements within these cities will provide evidence regarding the formation process of the informal urban assembly and which particularities can significantly alter or promote the development of these settlements.

1-(Latin America and the Caribbean Region | UN-Habitat, 2020)

Is it appropriate to generalize Latin American cities under their homogeneous regional qualities and therefore portray the problem with a regional or continental approach? For certain Latin American urban theorists, this would not be possible because each city has acquired a particular set of traits affecting its own generation and production. Despite the historical fact that most of them were founded as part of a series of similar colonial structures (refer to the Law of Indies -New Laws), the multiplicities affecting each city may prevent viewing them as part of a single Latin American urban process. On the other hand, another group of urban experts have endorsed the concept of a Latin American urbanization process. One of them is Samuel Jaramillo, who has mentioned that the presence of surface differences may distract from a set of underlying common values, especially those related to their similar tendencies in terms of economics and times of crisis, which cannot be seen as mere casualties. As Jaramillo states: "Reinforce again the necessity of one group reflection that can understand theoretically these realities on the right abstraction level. The expression 'Latin American Urbanization' seems to be pertinent again"[2]. Therefore, a comparative study can simultaneously serve to both select and isolate those common factors that could constitute a general framework for Latin American informal settlements and then reveal the exceptions, which serve as proof of each city's particular conditions.

Informal settlements are a complex reality, one that can be understood and analyzed from multiple points of view. First, it is important to define the theoretical framework about informal settlements. Second, the relationship between the formation and development of informal settlements and the neoliberal economy has created a barrier for new immigrants and low-income communities, restricting their access to formal housing.

2- Jaramillo, Samuel, Luis Mauricio Cuervo, and Samuel Jaramillo. 1993. Urbanización Latinoamericana. Bogotá, Colombia: ESCALA. "Se refuerza entonces la necesidad, de nuevo, de una reflexión de conjunto que logre aprehender teóricamente estas realidades en un nivel de abstracción adecuado. La expresión 'urbanización latinoamericana' parece volver a cobrar sentido"

Introduction

Informal Theoretical Framework

The theoretical concepts about informal settlements are wide and multidisciplinary, involving different approaches for each region and country. Multilateral international agencies such as the UN and the IDB (Inter-American Development Bank) tend to issue more general concepts. These entities define informal settlements as: "First, inhabitants have no security of tenure vis-à-vis the land or dwellings they inhabit. Second, the neighborhoods usually lack, or are cut off from, basic services and city infrastructure. Third, the housing may not comply with current planning and building regulations. Fourth, it can be a form of real estate speculation for all income levels of urban residents, affluent and poor"[3]. These general descriptions have established a common framework for the concept but, on some level, said descriptions are not suitable for Latin American informal settlements with their own particularities. Various Latin American authors have described their ideas about informal settlements in Latin America in a more relevant manner. For example, Duhau classifies the formal city – or, as he calls it, the "official urban order" – as a collection of laws: "A set of rules whose objective is to regulate production, organization, land appropriation forms and uses that can be developed within the city and the artefacts shaping the city in their own public and private ways"[4]. Therefore, the informal city is the urban expression of processes that do not follow the statutes of urban order, yet this does not mean there is an illegal state of affairs. Instead, as Duhau mentions, "the formal process excludes selective population and works under a set of rules as a perverse system of exclusion" [5].

One additional aspect that is pertinent to this thesis was also brought to light by Duhau: "the organization and characteristics of the public space are the result of more or less haphazard processes oriented by the manner and the circumstances in which the process of land parceling and appropriation took place"[6]. This "random process" was the result

3-2019.Unhabitat.Org.https://unhabitat.org/wp-content/uploads/2016/03/World%20Atlas%20of%20Slum%20Evolution_1.pdf.

4- Duhau, Emilio. 1998. Hábitat Popular Y Política Urbana. México: UAM, Unidad Azcapotzalco. "Es decir, se trata de reglas estatuidas destinadas a regular la producción, la organización, las formas de apropiación y los usos de la ciudad"

of multiple external factors that establish and shape the organizational structure of informal settlements. This organizational structure has been defined by economic, topographic, architectonic traits in order to characterize the informal city.

Another useful concept concerning informality is the one described by Law 13517, which is known as the informal settlement law of Peru. As many authors have stated, it has provided incentives for the development of "barriadas" or informal settlements throughout the country. The Law 13517 of Peru has been considered around the world as a piece of legislation promoting land invasion (squatters), because it posed the idea that invaded plots of land could be legalized and receive state assistance in order to build and improve said land. According to this law, the definition of an informal settlement is as follows: "Barriada: area of land owned by tax, municipal, communal or private (...) in which, by invasion and regardless of legal provisions on property, with or without municipal authorization, on lots distributed without officially approved layout plans , groups of homes of any structure, said area lacking as a whole one or more of the following services: drinking water, drainage, lighting, sidewalks, vehicular traffic routes, etc.".[7].

Informal or formal conditions are not permanent. For example, the historical process of Lima has made evident that a plot of land which was illegally acquired could be legalized over time and constructions built on said land can be transformed from temporal shacks into permanent and legal solid structures. In contrast to the above, a formal commercial unit such as the Torre David in Caracas began as a Five-star hotel and office tower yet eventually became an informal housing structure. Also, as Driant has explained, a republican house in the center of the Lima built by following all regulations could be later subdivided for use as a hostel, thus eventually the units could no longer be considered as independent and can be now be classified as an informal assembly (Driant,2015).

5- Duhau, Emilio. 1998. Hábitat Popular Y Política Urbana. México: UAM, Unidad Azcapotzalco.

6-Duhau, Emilio. 1998. Hábitat Popular Y Política Urbana. México: UAM, Unidad Azcapotzalco. "son el resultado de procesos más o menos azarosos orientados por el modo y las circunstancias en las que se produjo el proceso de parcelación y apropiación del suelo."

Introduction

Relations of tenure and legality can be understood as both circumstantial and temporal, becoming an important evidence for the patterns of informal development processes, because this process is the layout-base for millions of houses in Latin American which continue to follow the informal temporal patterns established during their informal origin.

Informal Economy

One of the explanations for the exponential grow of informal settlements in Latin America has been their affordability. It is more economical to acquire an informal unit (house, land), plus there are practical advantages in relation to the closed formal housing system. For example, one of the advantages is the possibility of developing a progressive informal construction for buildings according to the economic capacities and necessities of users, while another is based on the possibility to subdivide property for business purposes or due to family growth. One of the most controversial has been the absence of bank contracts. This point was explained by John F C Turner in his 1968 book, "The Barriada movement progressive" (Figure 1).

Continuously growing housing demand was a trend that formal housing supply could not satisfy, thus the offer price increases constantly due to said increasing demand. The formal market operates under neoliberal economic laws and so housing prices regularly increase, even though work payments have not similarly risen. Driant explained this process by using an interesting graphic that portrays the speculative process of land and property value, outside the possibilities of the active work force (Figure 2).

7-Driant, Jean-Claude. 1991. Las Barriadas De Lima. Lima: IFEA [Instituto frances de estudios andinos. pg-9

"Barriada:zona de terreno de propiedad fiscal, municipal, comunal o privada (...) en las que, por invasión y al margen de disposiciones legales sobre propiedad, con autorización municipal o sin ella, sobre lotes distribuidos sin planes de trazado oficialmente aprobados, se agrupamientos de viviendas de cualquier estructura, careciendo dicha zona en conjunto de uno o más de los siguientes servicios: agua potable, desagüe, alumbrado, veredas, vías de tránsito vehicular, etc.

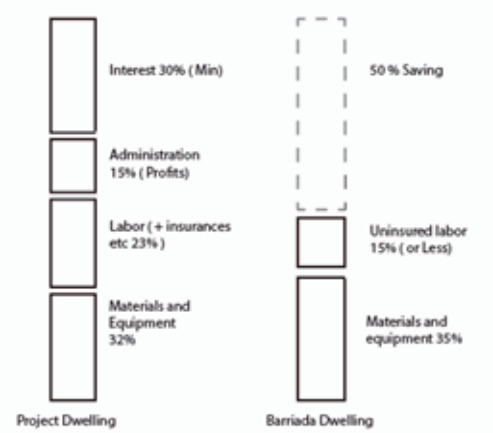


Figure 1 *William Mangin and John C. Turner, Barriada dwelling vs Project (formal) Dwelling,The Barriada movement , 1963, in Las Barriadas De Lima. Lima: . pg-08*

Year of Reference	Average Sale Price for Urban Land	Global evolution of living cost	Evalution of average Worker Salary
Año de Referencia	Precio medio de Venta de los terrenos urbanizados	Evolucion global del costo de vida	Evolucion del salario medio obrero
1940	100	100	100
1950	623	408	539
1960	3310	826	1629
1967	7110	1687	3694

Figure 2 *Driant,Jean-Claude ,Price of urban land vs Incremental Salary of average worker, 1991. in Las Barriadas De Lima. Lima: . pg-66*

This process has also been described by international authors as Mike Davis, who addresses it in the challenge of slums by stating the following: "The rise of this informal sector", he bluntly declares, "is a direct result of liberalization"[8]. Davis explains that in most cases the state was unable to fulfill the demand for housing and so state governments in several countries instead left the growing housing crisis as a neoliberal problem of speculation. As a result of this policy, there has been a shortage of formal affordable options for poor people and this condition increases the formation of informal settlements.

8- Davis, Mike. "Planet of Slums." New Perspectives Quarterly 30, no. 4 (2013): pg-175

The Peruvian economist Hernando De Soto, writing from a neoliberal economic point of view, acts as counterpoint in this discussion. De Soto proposes the idea that giving land titles to squatters and transforming the informal city into an active capital city could eventually be used within capitalist economy in order to leverage socio-economic improvement (credits). De Soto underlined a surprising set of figures to illustrate the economic potential of his idea. For example, in Peru "the value of extralegally yield rural and urban real state in Peru amounts to some $ 74 billion". [9]. Transforming this dead capital into active capital could be the solution for underdeveloped economies in South America and therefore provide improvements to the slums. As we are going to explain later, De Soto ideas were applied in Peruvian informal settlements with no evident economic benefits for the inhabitants of the settlements. This semi-utopian view, as Mike Davis states, "grows out of a nested set of epistemological fallacies[10]. Davis explains through Nine Points the real condition of informal settlements, especially remarking that the informal economy is based on exploitation of the workforce, and addresses how the Neoliberal politics of free competition, shrinkage of the public sector, lack of social contracts or job regulations have had a big effect on informal communities and, to some extent, such communities are the result of all these conditions.

Undoubtedly, the main conclusion of De Soto ideas is that Informal Settlements contain economical potential in terms of both affordability and future projections based on economic development. However, the result cannot be reduced to land tittles, as there is a network of social issues and economic relations, both of which need to be understood in order to propose an intervention within this context and for having a positive impact on the community. "Without auxiliary services and infrastructure, title alone has little meaning".[11].

9-Soto, Hernando de, 1941-. The Mystery of Capital : Why Capitalism Triumphs in the West and Fails everywhere else.

10- Davis, Mike. "Planet of Slums." New Perspectives Quarterly 30, no. 4 (2013): pg-179

11-Krueckeberg, Donald A. 2004. "The Lessons Of John Locke Or Hernando De Soto: What If Your Dreams Come True?". Housing Policy Debate 15 (1): 1-24.

The introduction seeks to generate a first approach to the concepts of the Latin American informal city that will be raised in the development of this work and to present the informal settlement as a "valid" response to the external conditions on which the city has developed. The work seeks to study these external conditions through a progressive historical, economic, territorial and urban analysis in relation to the informal settlements in the district of San Juan Lurigancho in Lima, Peru and in the city of Medellín, Colombia. Relate these conditions with informal settlements is useful to demonstrate transversal feature in these processes, patterns and similarities in the development of the cities under study.

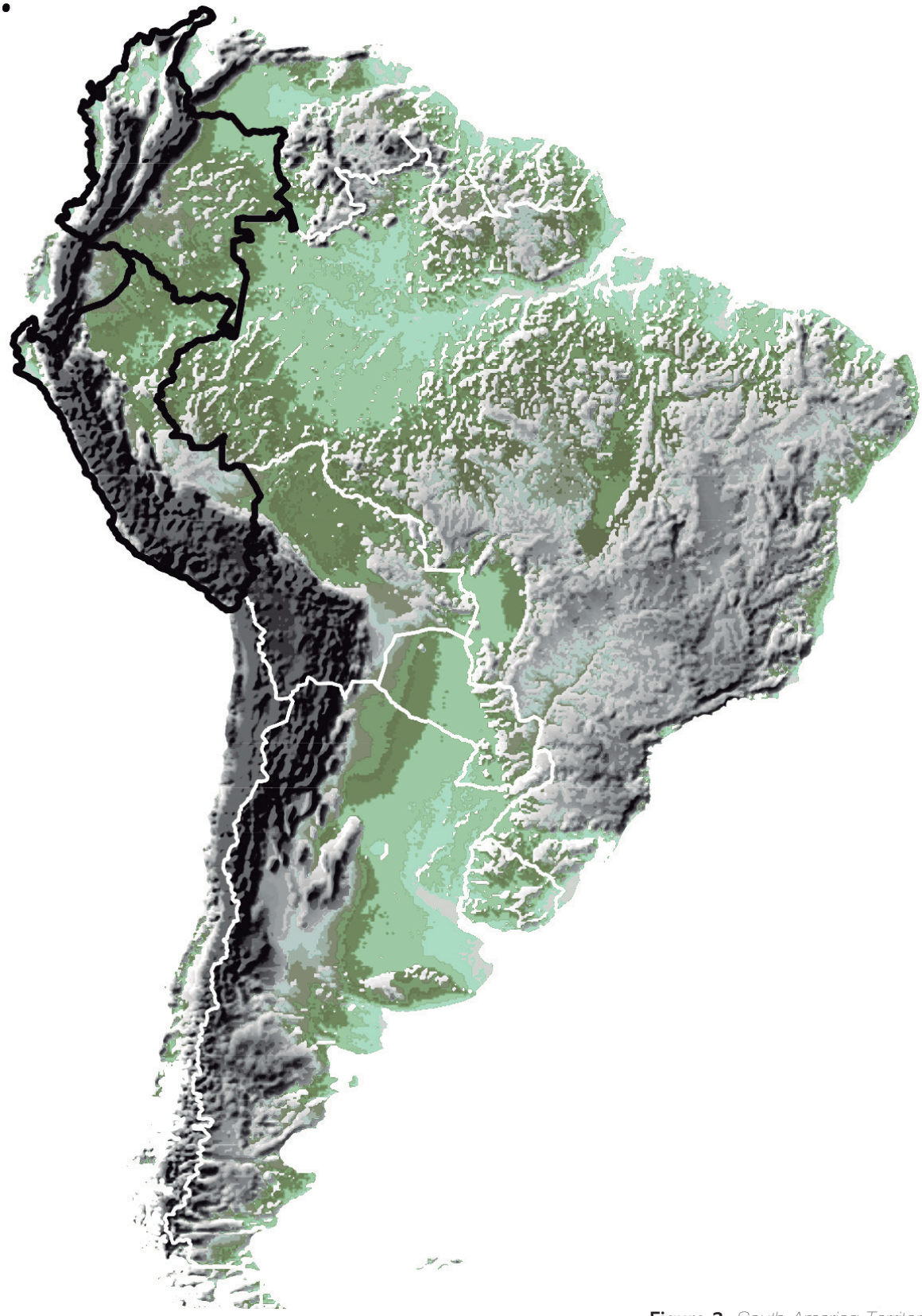


Figure 3 *South America Territory*

Figure 4 *Location of major cities Peru and Colombia*

Chapter 1

Chapter 1 -
Lima and San Juan Lurigancho

The informal settlements of Lima.

Figure 5 *Population Lima (1922-2020) (1)-Lima Population-SourcelNEI (census 1961,9172, 1981, 1993,2007,2017) 2-Population in Informal Settlements (1)-(1951-1984) Instituto de Desarrollo Urbano, CENCA. (2) INEli. Human Settlementes in Lima 1993. (3) Derecho a la vivienda o la propiedad privada? De la política pública a la informalidad urbana en el Área Metropolitana de Lima (1996-2015)*

Peru, like other countries in Latin America, has faced a short and intense transition between rural and urban life. The center of this transition was Lima, which became the destination of internal rural migrants from the rest of Peru seeking the modern and industrial life of the city and the economic benefits this represents. Lima went from 630.173 habitants in 1940 to 9.674.755 by 2020[1]. Now, Lima makes up 29,7% of Peru's population. This process has been constant in Latin American cities: Bogota grew from 330.312 people in 1938 to 7.412.566 in 2018[2], Medellin went from 168.266 inhabitants in 1940 to 2.471.253 in 2010, and Caracas started with 709.602 inhabitants back in 1950 and reached 2.082.000 by 2019[3]. Not only did the demographics increase. Within 60 years, the urban perimeter of Lima expanded from 61.625 Km^2 to 782.627 Km^2 (Figure 7). Thus, we can assume that Lima can be classified in a group of Latin American cities that experienced an intensive demographic growth and a continuous urban expansion during the second half of the 20th century.

Said demographic and urban increases within such a short time frame created new challenges for the capacities of the city and the state in order to provide housing solutions for migrants. This urban development process in Lima presents a set of particular characteristics that emphasize and validate an informal approach as a solution for both the construction and production of the city itself: government housing policies sough to address the invasion and formation of informal settlements, there was a lack of affordable formal housing for internal migrants and low-income citizens, and informal development provided benefits even in comparison with the more formal and regulated market.

1-INEI -Peru
2- DANE -Colombia
3-INE - Venezuela

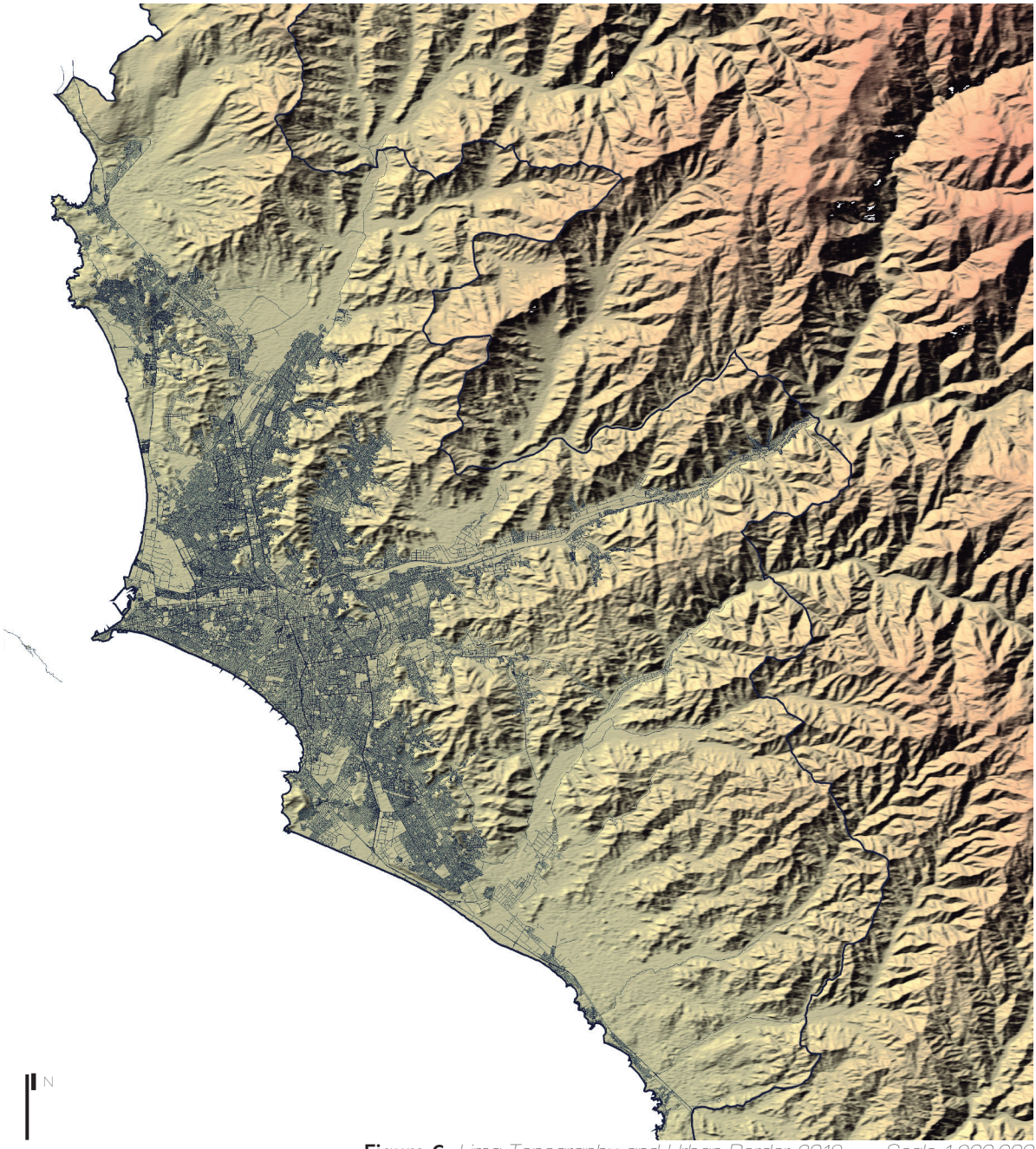


Figure 6 *Lima Topography and Urban Border 2019 - Scale 1:600.000*

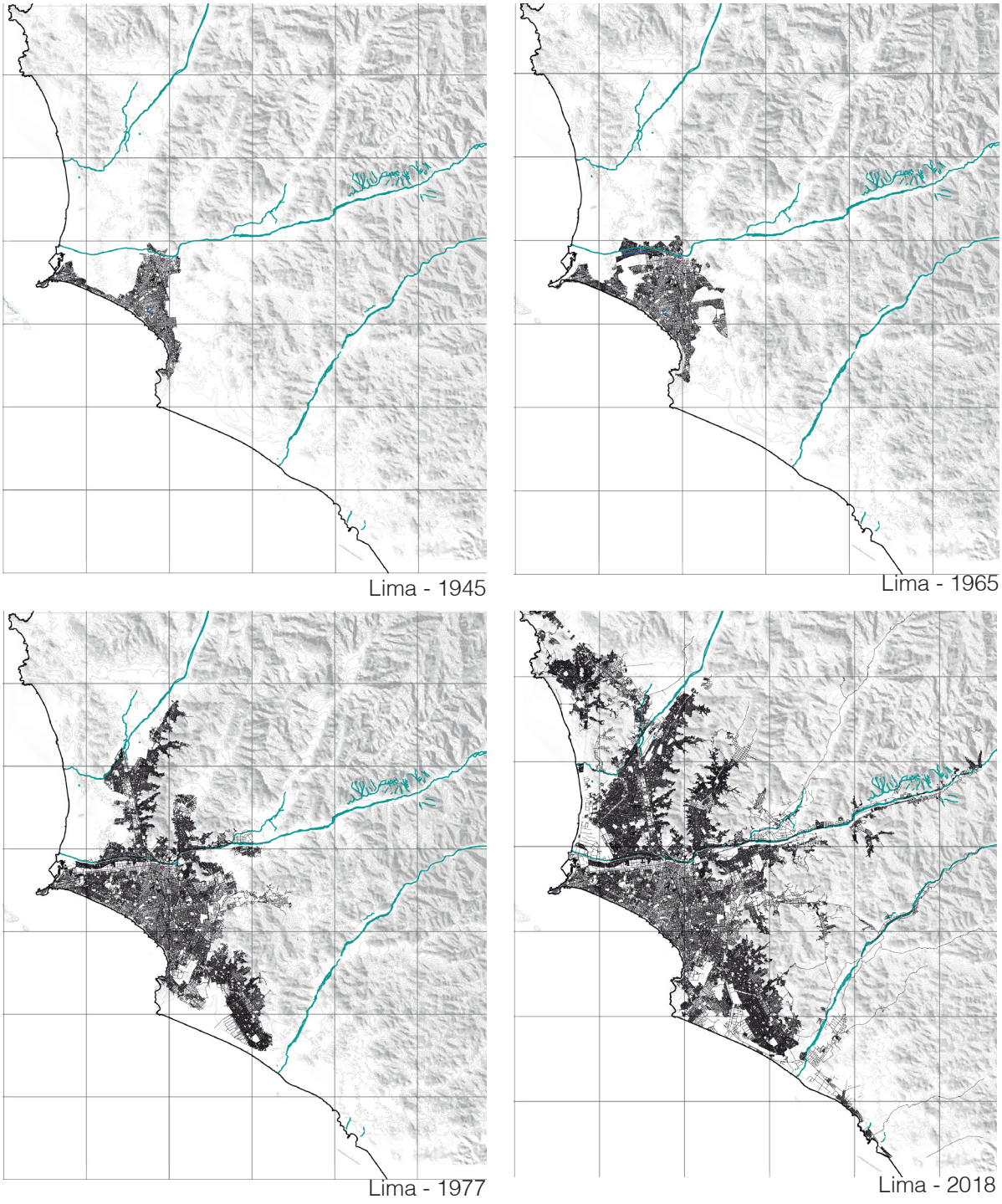


Figure 7 *Lima Urban Progression 1945-2018*

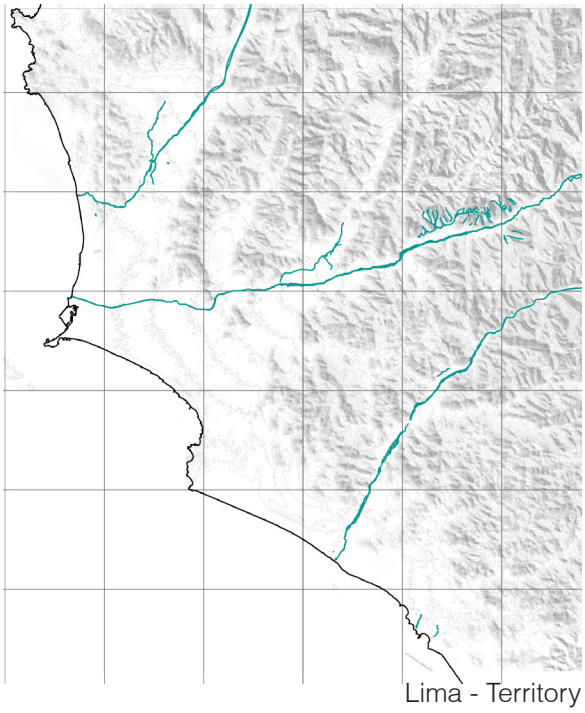


Figure 8 *Lima -Territory.* *Scale1: 750.000*

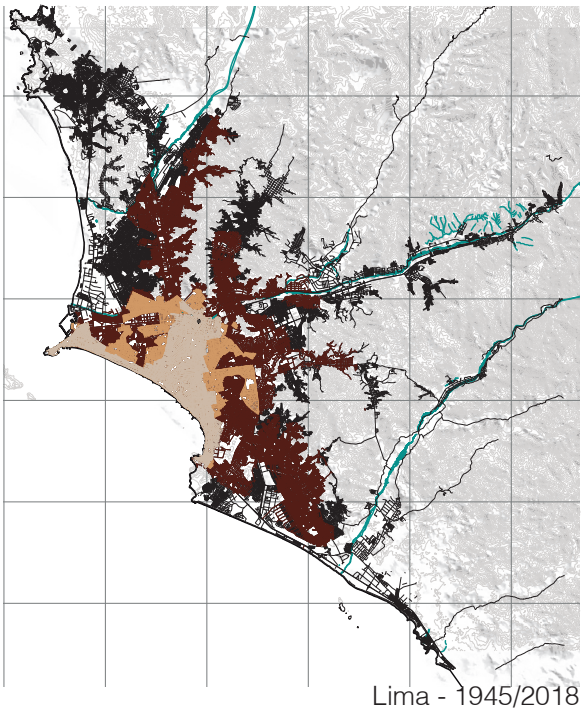


Figure 9 *Lima-Urban Land occupation (1945-2018)* *Scale1: 750.000*

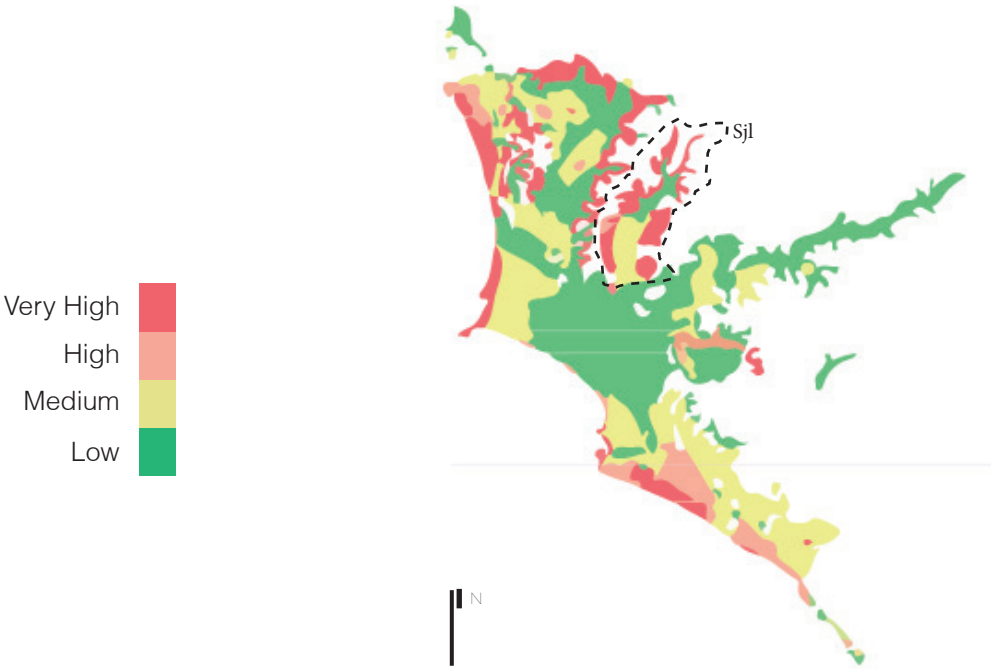


Figure 10 *Lima,Map of Seismic Areas by risk Source information: INEI Scale: 1.750.000*

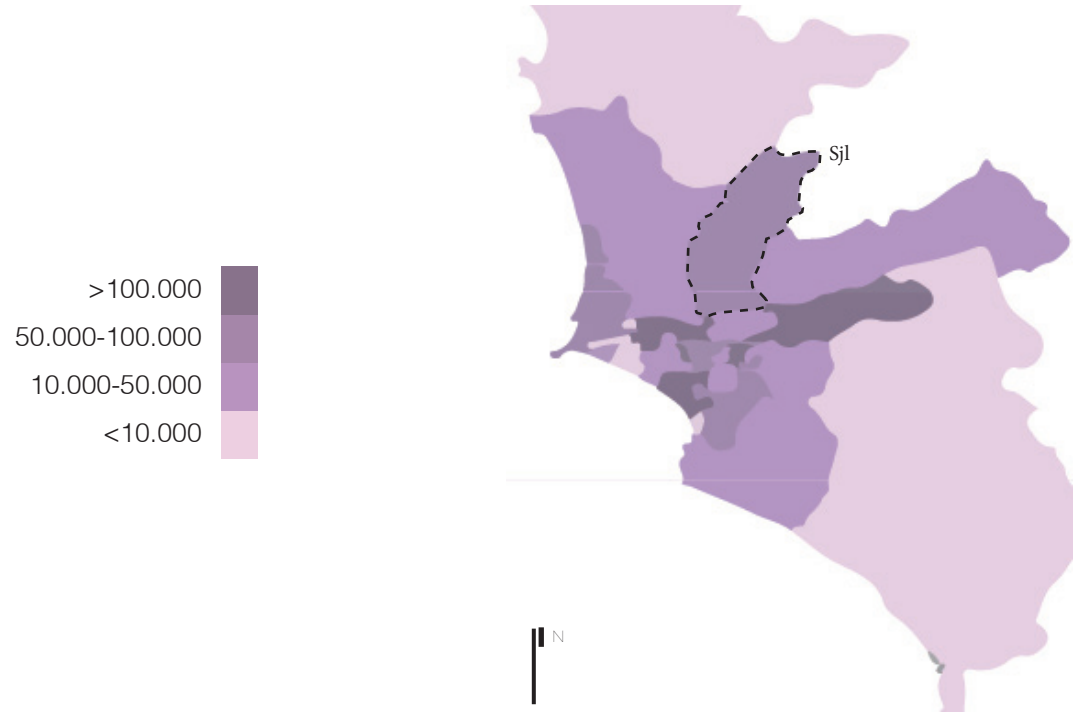


Figure 11 *Lima, Map of Spatial distribution of employment Source information: INEI Scale: 1.750.000*

Figure 12 *Lima ,Map of Extreme Poverty*
Source information: INEI Scale: 1.750.000

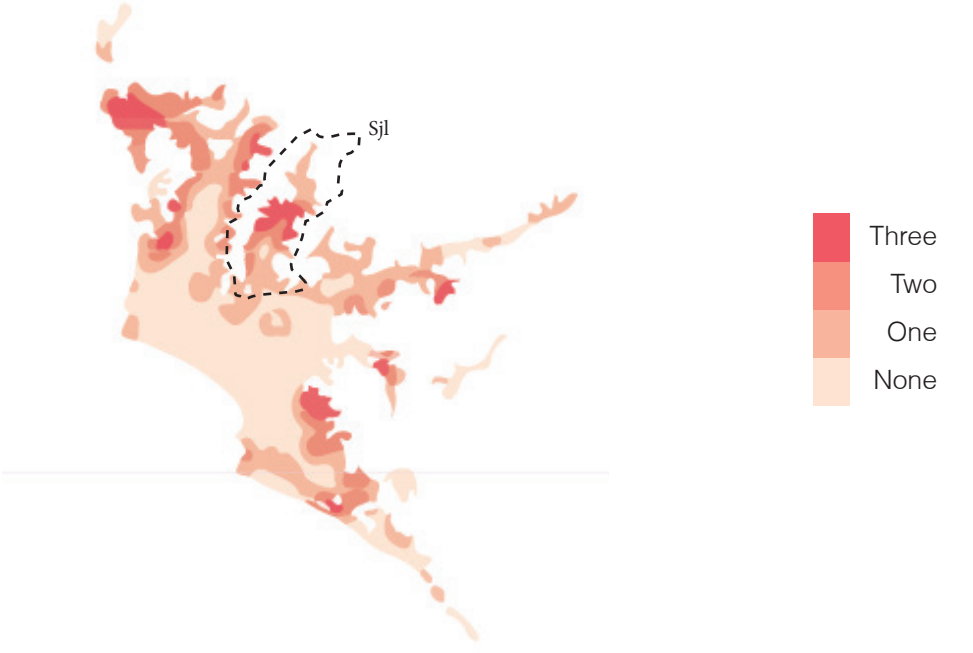


Figure 13 *Lima ,Map of Shortage of Public Services*
Source information: INEI Scale: 1.750.000

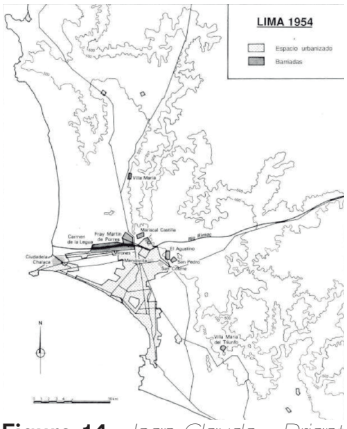


Figure 14 *Jean-Claude Driant Barriadas Lima 1954. Plano n 11, 1991, In Las Barriadas de Lima Historia e interpetacion(Lima: Desco, 1991), page 37*

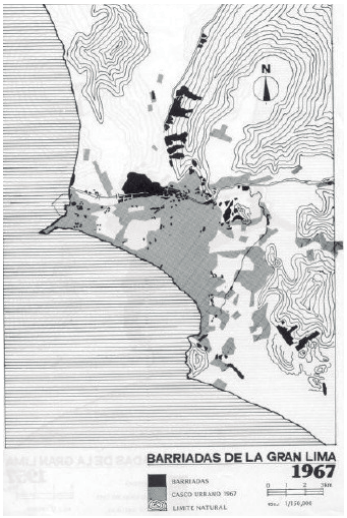


Figure 15 *J. Matos Mar, Barriadas Lima 1967. In Las Barriadas de Lima (Lima: IEP, 1977),*

Brief history of Informal settlements in Lima.

Informal settlements in Lima can trace their origin back to the decade of 1920. As Sáez Giráldez has mentioned, the first informal settlements were founded by rural migrants who did not have property and chose to gather in small groups in order to squatter public lands as well as to develop precarious housing units. The settlements produced in this decade did not constitute a consolidated urban structure. (Sáez Giráldez 2015). Between 1920 and 1930, these informal settlements started to become more organized around the city center and especially around the riverside of Rimac river. Thus, by 1940 the informal settlements of Lima were located in two preferred locations: the previously mentioned riverside of the Rimac river and the mountains surrounding the city's foundational center (Driant 2015). These two locations were the result of particular territorial and economic reasons. First, the settlements located at the border of the Rimac river faced conditions that would be risky for formal development due to river flooding or landslides, which considerably reduced the value of land in this area. Despite this threat, this area was near to factories, industrial activity and transportation routes that benefitted both workers and low-income populations that worked within the zone. Second, the location of the settlements in "Cerro San Cosme" and Agustino" can also be explained due to the low cost of land in the area (due to a steep topography) as well as because of the proximity of this region to markets such as "La Victoria" and transportation terminals(Driant 2015). These two specific locations are important, because together they will constitute almost 90 % of the informal settlements that existed before 1954 (Driant 2015).

Between 1950 and 1970, the "Barriadas" of Lima moved past their origins near the city center and extended to the flat desert lands in the Nor-

th and South of the city. Driant has provided two reasons explaining the relocation of informal settlements during this period, which took them far from the city center: the saturation of available land close to the city center and the support of the state for their relocation in public lands.

The informal settlements moved to locations in the periphery towards both the north and the south of the city, where there was farmland with limited commercial value or public lands without existing urban development. As Saez and Driant have mentioned, these conditions of the land facilitated the consolidation and success of these settlements over time. The second reason for this phenomenon was state approval for either land squatter invasions or relocation support as, in some cases, the state provided urban plans with a hierarchical order and formally defined land plots (mostly due to better topographic conditions). In fact, the informal settlements during 1955 to 1970 were characterized by regular planning outlines and a hierarchical space organization. The state found a solution for the low-income housing question by supporting informal settlements. In 1961, the government enacted Law 13517, which lent support for legalizing informal settlement. As Calderon (2014) and Saez mentioned, if the law was not explicit in supporting the informal settlements, it nevertheless created the idea that their legalization was going to happen in the future and therefore it encouraged more land squatters and a rise in informal construction (Sáez Giráldez 2015). In 1970, 47.2% of informal settlements in Lima were located in the northern and southern portions of the city (Driant 2015). Some of the Informal settlements dating to this phase were "Ciudad de Dios", "La Libertad", and "Villa Maria del triunfo".

The next phase, lasting from 1970 to 1984 and also known as the era of planned settlements, saw informal settlements emerging as part of strategic planning, which Driant has explained. Before land-invasion took place, squatter groups reviewed the legal condition of the plots they

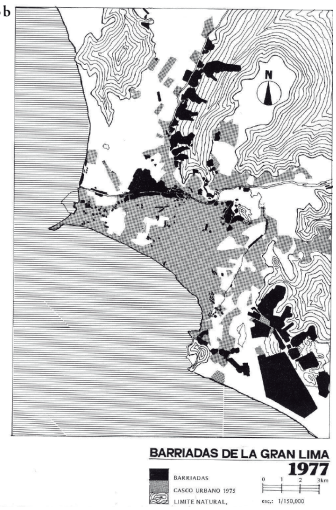


Figure 17 *J. Matos Mar ,Barriadas Lima 1977, Las Barriadas de Lima (Lima: IEP, 1977),*

Barriadas Lima (1993)

Figure 16 *1. Unceta, Pablo, Barriadas in Lima 1993. Paisaje Transversal, accessed Aug 8, 2020. https://paisajetransversal.org/2015/03/lima-proyectos-urbanos-integrales-pablo-muniz-unceta-peru-autobarrio-planificacion-urbana-planeamiento-ciudad-urbanismo/*

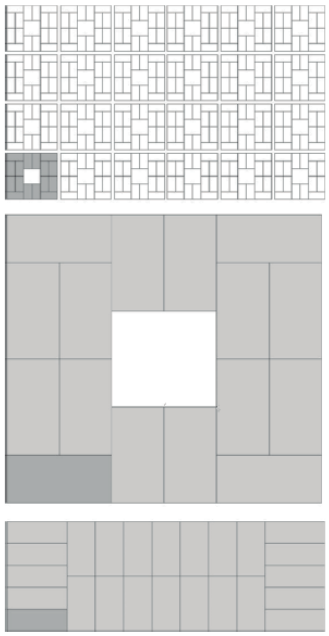


Figure 18 *1. Sáez, Elia, Villa el Salvador , Urban structure Figure 2.45, 2015, La ciudad progresiva, una lectura de los asentamientos humano en Lima(Madrid: Universidad Politecnica de Madrid, 2015), page 160*

wanted to invade, and the squatters also established a legal organization for themselves in order to guarantee further support from the state in the process (Driant 2015). The main example of an informal settlement during this period was Villa el Salvador, a "state guided settlement" that was developed in 1971 under an assisted method (Sáez Giráldez 2015).The state provided a layout plan that, based on hierarchy, defined street blocks, divided and defined the land, and also provided access to basic services such as schools, markets and churches. Despite the international public recognition received by this settlement, it represents a major problem at the time, because it was located too far from the city center. This is why the state had to establish a "Barriada", some 29 km away from the city center, where it permitted invasions as well as auto-construction. Due to this condition, the habitants of informal settlements started to search and allocate lands that were closer to the city center, considering the east area where San Juan Lurigancho (SJL) is located as one of their best options. This was a flat land with almost 2.300 hectares and it was considerably closer to the city center. By 1984, as Driant has stated, the east area of Lima became the center of informal developments. Almost 50% of new informal settlements was located in San Juan Lurigancho and San Martin by 1984. (Driant 2015)

Figure 19 *Pál Baross, Overview slum with mountains, barrios El Salvador, Lima, Peru,1975. Institute for Housing and Urban Development Studies. https://www.ihs.nl/en*

During the decade that began in 1990, settlements started to consolidate into 4 major areas: Lima South, Lima North , Lima East, and Lima Center. It is important to underline that the northern, southern and eastern areas were initially created out of informal settlements: therefore, formal planning had to operate within an already existing informal urban structure. As Sáez Giráldez mentioned, during this decade the city stopped the consolidation process around the city center and now the goal was to create new centralities within each area as satellite city centers.

From the year 2000 onward, as Sáez Giráldez has argued, suitable flat lands for auto-construction have already been filled, and now the new settlements are located in high risk territories –usually facing steep topographical conditions – that are not appropriate for construction and expose their habitants to significant threats and put them in a position of vulnerability.(Sáez Giráldez , 2015 pg.181)

Economy and informal settlements in Lima

A key part of this analysis is exploring the implications of economic and political structures for the production of informal settlements in Latin America. As I am going to explain for Lima, the supply of formal housing units for low-income population has been uneven in light of the population growth of the city during the second half of the 20th century and this condition has influenced the exponential grow of informal settlements in Lima. Based on the research of Rodriguez, and Calderon present a scenario where it is possible to conclude that the shortage of affordable housing has clearly influenced informal development.

The research undertaken by Rodriguez, "Offer of housing and land in metropolitan Lima 1940-1967 ", reveals that under a capitalist system the market will regulate any changes in the housing market. However, whenever the demand for land and housing overcomes the available supply, which happened in Lima by 1940, the market itself will be controlled by supply. Rodriguez analyzed press advertisements in Lima between 1940 -1967 that announced or publicized housing units as well as plots of land around the city. His study concluded that "between 1940-1967, informal settlements were the only housing alternative that an urban development guided by a capitalist market could offer to low income population"[4]. As he has also made evident, an increase in Lima housing prices was unrelated to the increase of construction prices or labor wages, but instead resulted from a speculative process where the value of land was artificially boosted.

The analysis presented by Rodriguez can be extrapolated further to our current time. According to CAPECO (the Peruvian board of Construction), only 2.9% of the housing unit sales in 2017 were directed to lower class income populations, while said population actually repre-

4-"durante el lapso de 1940-1967 la barriada y el tugurio son las unicas soluciones habitacionales que el desarrollo urbano guiado por la libre empresa capitalista ofrece a los grupos de bajos ingresos" (Rodriguez , 1975)

sents almost 50% of the total housing demand of Lima (CAPECO, 2017). In Lima, a low-price range housing unit circa 2017 could be classified between S/.50.000 ($14.000 USD) and S/.144.000 ($ 42.000 USD). The city's minimum wage in 2017 was S/$850 ($248 USD) , so it would be necessary to earn about 58 monthly minimum Salaries (that is, 5 years) to purchase lower price housing and 169 month minimum salaries(14 years) for the higher price housing's lower end(assuming that the totality of the salary will be spent on housing). However, only 4.42 % of the 2017 Lima housing market was actually between S/50.000 and S/144.000. Therefore, we could assume that there is still a shortage of housing supply for low income populations within the formal market and thus informal housing continues to represent an alternative to cover the gap. The disparity between formal and informal is not only restricted to housing pricing, because it is also concerned with housing size. The average size of a formal unit in East Lima is 66.2 mts2 and the average price in this sector is S/ 203.417 ($ 59.644 USD). Surprisingly, an informal housing in the same area can be produced for half of the price and double size.[5]

Calderon's text known as "Social housing policies and urban land markets in Peru" presents a similar scenario for Lima's housing market. He states that the private market has provided the housing supply for high-income sectors, while the middle-income population has relied on the private market along with subsidiary support from the state[6] and thus the satisfaction of the low-income population's housing demand has been relegated to auto-construction and informal markets. The state's decision for addressing the problem of low-income housing in Peru was based on developing legalization programs for invaded plot lands and offering subsides for self-construction based on Neoliberal economic ideas, instead of building housing projects funded by public capital(-Calderon 2011). Peru became one of the centers for the application of

5-Capeco: Costo de vivienda informal es mayor al de una formal -PerúConstruye, 2018)
6- (Calderon, 2013)

the neoliberal economic ideas of economist Hernando de Soto; De Soto states that the economic problem of informal settlements was in fact a question of transactional value, where the inhabitants of informal settlements created an immense capital consisting of informal properties and markets that were unable to become part of strictly formal markets due to a lack of official certificates of possession. Therefore, the capital generated within these informal markets was considered to be "dead capital" because it was not being available for use in the formal market through credit support nor did said capital contain any type of transactional value beside its worth within the informal market. De Soto's idea was to issue land titles for the purposes of providing guarantees to the land and building possessions of the habitants located within the informal settlements, all of this in order to include the so-called dead capital by incorporating it to the formal market system and thus it would now be able to achieve transactional value. During the administration of Peruvian president Alberto Fujimori, De Soto's concepts were applied by the government agency known as COFOPRI (Informal Property Formalization Agency)[7] . The purpose of this agency was based on issuing land titles to settlement habitants in order to regularize, organize and incorporate these settlements within the formal system. According to Calderon, the result of this policy was a massive titling process in Peru: "Between 1961 and 1996, 230,469 titles were delivered; while 722,785 more titles were awarded during the massive titling phase" (Calderon, 2011, 47-77). The outcome of this process has been widely studied, earning both positive and negative reviews from its supporters and critics. Positive analysts such as Calderon have explained and defended the idea that the land titling process served to actively benefit the credit capacities of informal settlement inhabitants, because "between 2000 and 2004 the number of credits for beneficiaries increased from 154.000 to 266.000, the resources went from 249 to 459 million dollars, and the credits with mortgage guarantees rose from 66 to 160 million US dollars". Negative

7-Organismo de formalizacion de propiedad informal (COFOPRI)

views of this process have come from critics such as Antonio Caria, who presents evidence suggesting that there is a "weak correlation between the titling process and the emission of credits"(Caria, 2007). Antonio Caria underlines the impracticality of property-based credits for multiple reasons. First, informal inhabitants fear the risk of losing their property upon being unable to pay their debts. Second, the banking sector considers that it is impractical to offer property-based credits when a given person does not have a clear method to repay the debt. Third, banks want to earn a return of their money, rather than receiving properties that may be hard to turn into active capital. Fourth, in certain cases, portions of the informal population who did not benefit from the program may be able to acquire more credits than informal inhabitants participating in the program.

Therefore, one key conclusion is that the massive title-issuing process did benefit the economy as a whole as well as the property registration system and the bureaucratic structure that was created by the state in order to manage this sizable process, but the ultimate benefits for informal habitants still remain as a matter of debate. The titling process may have slowly improved the security of informal habitants by guaranteeing their place within the city, but it didn't help to solve the underlying structural problem that caused said informality, and thus the neoliberal approach to the problem may have actually increased it.

Conclusion

As we have seen, state initiatives based on neoliberal economic strategies tend to leave housing solutions for the low-income population in their own hands. Additionally, there is an ongoing speculative process regarding urban land, which already has and will continue to increase land pricing in Peru until it may become impossible for the low-income population to settle within the city. Thus, informal settlements have be-

come an alternative (even if a problematic and not ideal one) for the low-income population, by allowing them to claim their right to live inside the city. Until the state can directly address the problem and generate an effective set of tools that will provide real housing solutions for the poorest population of Peru, it seems clear that informal settlements will continue to grow and expand into increasingly risk and critical locations, which will pose future problems for the city.

State solutions consisting of providing subsidies or legalizing informal land, both of which are based on neoliberal economic ideas, do not achieve real changes that could solve the problem of informal housing. As it was previously explained for the case of Santiago* and arguably also for cities such as Medellin and Bogota, the low-cost private housing market has already decided to migrate from the city to nearby municipalities where employment options are considerably reduced, thus opening up additional questions and limiting the options for this part of the population to ever overcome its current state of poverty.

*In the last 25 years in Chile the Ministery of Housing and Urbanism developed a social housing financing policy that has facilitated the construction of more than half a million of social houses in the country. Their owners correspond to low-income chilean families. The model has been successful in terms of the number of units produced. However, over the years, this model has shown very serious limitations in terms of the quality of life and possibilities of social coexistence tha this products offer to the residents. (Sungrayes, 2006:13)

San Juan Lurigancho, Lima

The district of San Juan Lurigancho (SJL)[8] saw one of the most dramatic population increase in Latin America during the 20th century (Sáez Giráldez 2015). SJL went from 65.000 inhabitants in 1965 to becoming the most populated district of Lima with more than 1.200.000 inhabitants. Such urban and demographic growth within a period of 60 years took place under a multiplicity of laws (n.13517), theories, books (see Housing by the People by the architect John Turner) that reinforced the idea of informality as a valid method for developing housing alternatives meant for low-income population. The district of SJL is quite significant for the purpose of a Latin American comparative analysis: it showcases a wide spectrum of different historic urban stages throughout the informal development of Lima and the intense population growth of the district has been deeply immersed in informal urban development.

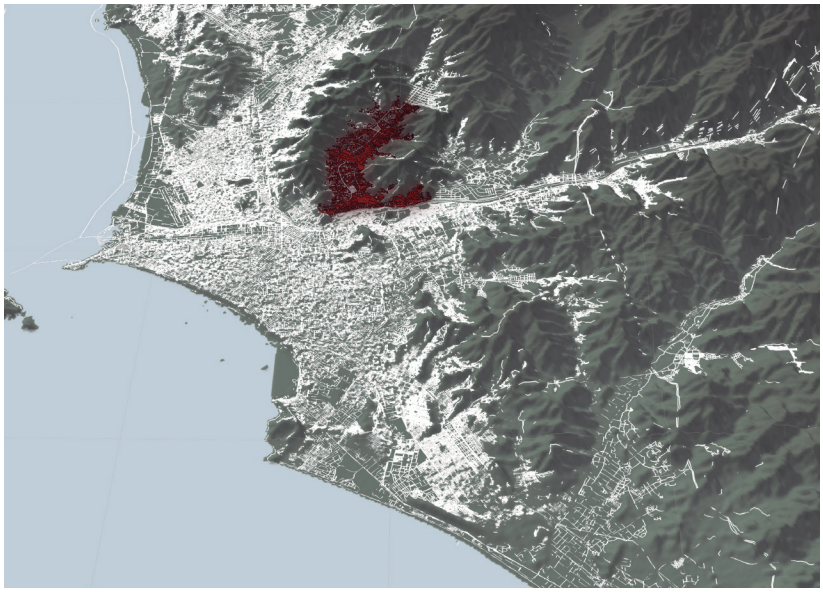


Figure 21 *San Juan Lurignacho District in Lima*

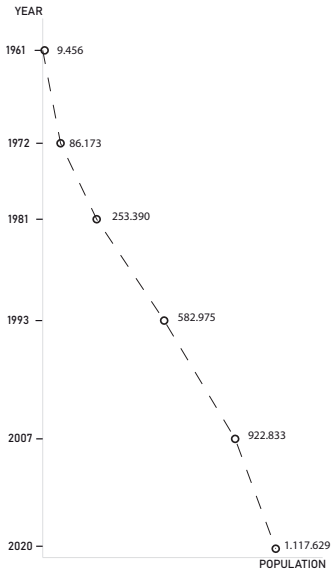


Figure 20 *Population San Juan Lurignacho Population (1961-2020)*

Source INEI, Peru

8-Metropolitan Lima is divided in 43 districts

Figure 23 *CEHAP - Canto Grande in San Juan Lurigancho 1983,(https://arquitectura.medellin.unal.edu.co/escuelas/habitat/galeria/displayimage.php?album=search&cat=0&pid=1346#top_display_media) Accessed 05 Aug 2020*

Figure 22 *Calderon, Julio, Map of "Haciendas" in San Juan Lurigancho 1940. "Mapa de Haciendas en San Juan Lurigancho 1940", 1984, In Expansion urbana y mercado inmobiliario en Lima Metropolitana(1960-1983), Lima, 1984, pag-85*

Brief history of informal development in SJL.

The district was officially founded in 1967 by the government of President Fernando Belaunde Terry. Before that point, this area of SJL was primarily dedicated to agricultural lands. At the time, the state government implemented two new reforms that would shape the urban formation of the district: the Agrarian Reform of 1969, and the Law 13517 of 1961, which allowed for the legalization of informal settlements in Peru.

In 1969, the government of Peru started a land reform program under the president Juan Velazco Alvarado. This reform aimed to redistribute wealth and land by expropriating private rural parcels from individual owners, which would be acquired by the state and then given to farmers and peasants. This reform had an impact in the initial urbanization of SJL. As Calderon has described, most of the land in SJL i was primarily rural by 1940 and it was subdivided into nine "Haciendas" that involved the property rights for 1.834 hectares of land (Calderón 1984). The land reform of 1969 exerted pressure on the owners of haciendas in order to get them to sell their properties as housing plots, before the government would decide to actually expropriate their land. The majority of these land plots were sold in a non-urban state and lacking basic public utility services (water, electricity, sewage). In other words, they were only a basic subdivision of land (Poloni 1987). As Poloni states, this process can be considered as informal, because the plots of land on sale had no such services and the only difference between them and the "Barriadas" was the legal security of their ownership. As Poloni and Driant explained, this process was also the beginning of a speculative period, where the value of land started to be controlled by select landowning families who decided when to sell and set the price of the land (Driant 2015)

The state also intervened in the initial informal urban growth of the district by relocating the informal settlements established in high risk areas to other parts of Lima, specifically in the flat valley of SJL. As we are going to explain, the formation of these relocated or "planned" settlements actually increased the formation of new informal settlements close to them. One example of this would be the settlements of Huascar in SJL(1976). Such settlements were primarily founded as a reaction to living in Villa El Salvador, an informal settlement located 29 km away from the city centers, while SJL was 8 km away. The state government relocated this population to the newly planned informal settlement of Huascar in SJL, which was a better housing alternative than the northern or southern barriadas. (DRIANT 2015). As Driant has explained, the relocation of the settlements of Huascar by the state marked the beginning of mass urbanization in SJL.

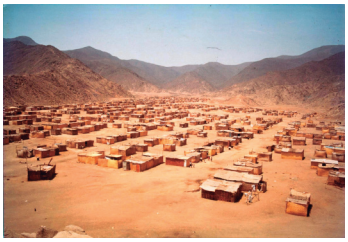


Figure 24 *Meentzen, Kathe. "Asentamiento Humano Jose Carlos Mariategui." Centro de documentacion e Investigacio. 6 Feb 2018, Lima 1985. "lum.cultura.pe/cdi/foto/asentamiento-humano-josé-carlos-mariátegui-recién-fundando-en-san-juan-de-lurigancho. Accessed 13 July 2020*

The 1993 census illustrated how SJL was the center of a massive migration in Lima, which was caused by internal migrants who were either displaced by violence or sought to obtain a better quality of life in the capital as well as access low-cost options for settling within the city. These migrants started to settle throughout the district's empty plots, though by that time these were only available in the northern neighborhoods. As the graphic portrays (Figure 25), there is evidence that between 2002 and 2007 San Juan Lurigancho became the district of Lima with the highest concentration of immigrants. The continuous flow of migrants into the district was one of the causes of the rapid and massive urban development of informal settlements, and so the initial socioeconomic conditions of such migrants are quite vulnerable as they tend to suffer lack of opportunities in terms of employment and education, which has made it difficult for these sectors to insert themselves into the city's life and as a result they tend to rely on informal circuits for the sake of satisfying their housing and job-related needs.

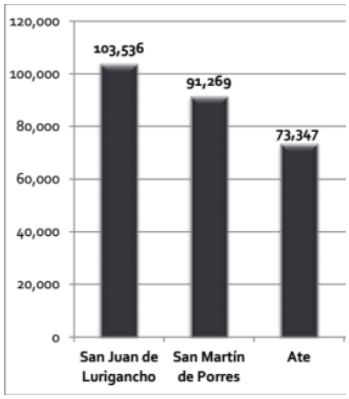


Figure 25 *Instituto metropolitano de planeacion. "Districts with the highest concentration of migrants between 2002 and 2007",Plan regional Lima 2012-2025, (Lima ,2012) pg73*

The shortage of formal housing for the low income population sector remains a problem within the district. As the official urban plan for Lima has made clear (LIMA 2035), there is a remarkable deficit when comparing the demand and the supply of formal housing inside this district. The plan acknowledges there is a shortage of 60.000 housing units in the SJL district.

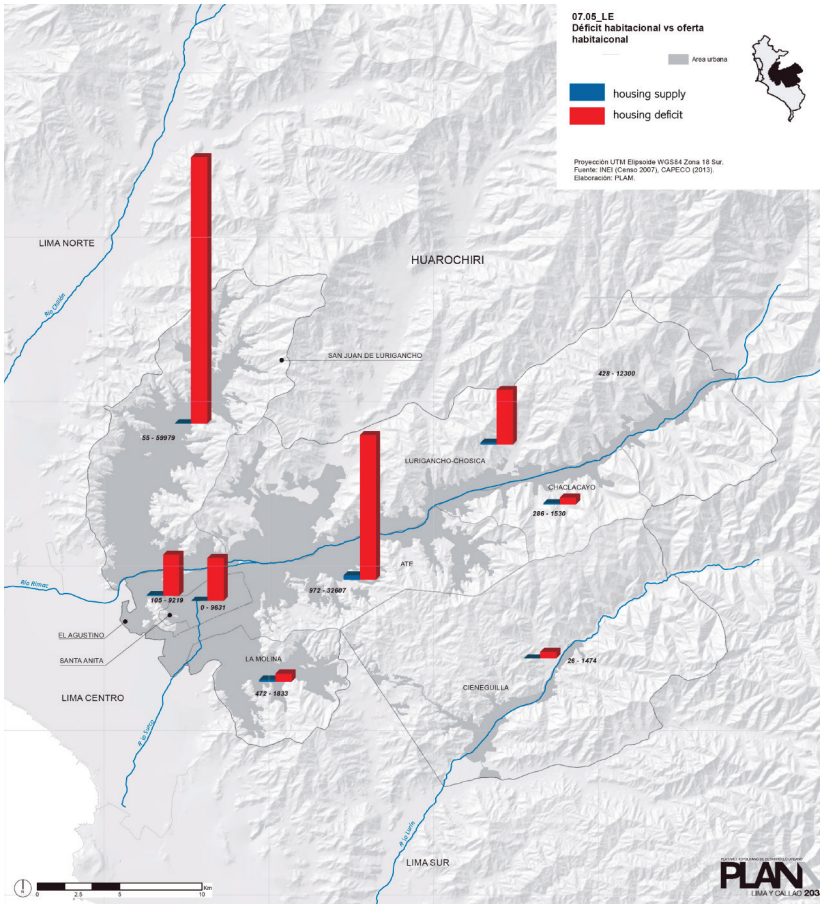


Figure 26 *Lima East housing deficit vs formal housing supply. Master Plan for Lima 2035. Tomo IV-Plano de analisis y diagnositico,Vivienda deficit habitacional Lima este, Lima,Peru (2014)*

The district of SJL also faces higher risks due to the seismic movements that threaten the eastern area of Lima. The mountainous portion of the district is affected by these high-risk conditions, particularly due to the danger of land slides or seismic movements, while the valley of the district only has to deal with relative low risks,

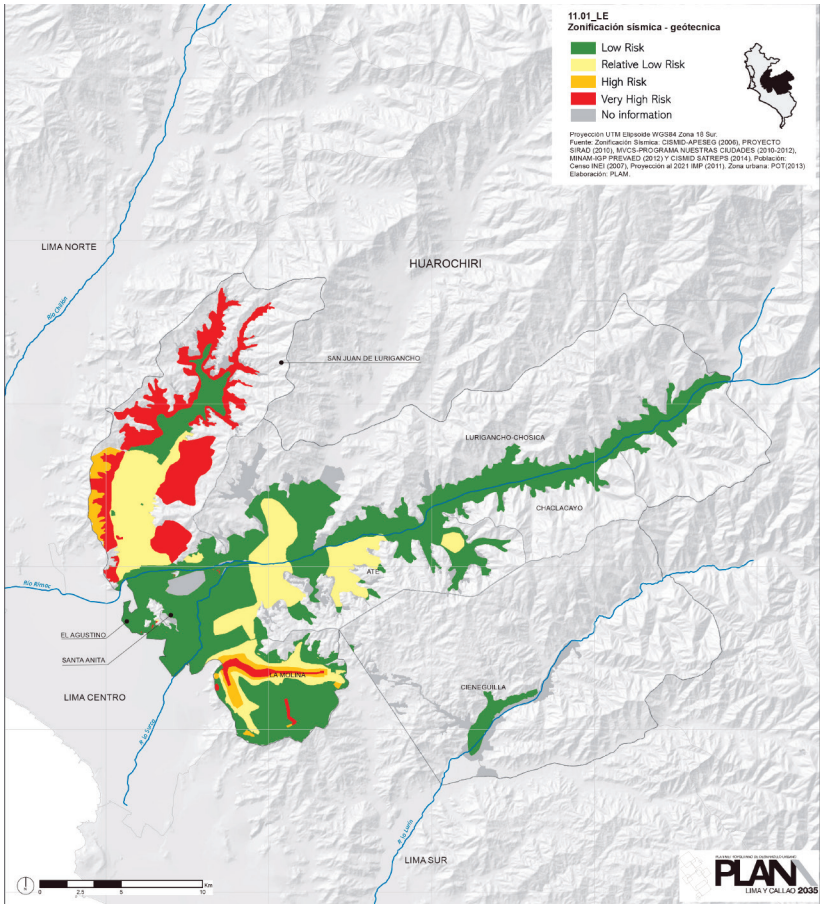


Figure 27 *Lima East Seismic Zoning. Master Plan for Lima 2035.Tomo IV-Plano de analisis y diagnositico,Gestion Riesgo 11.01, Lima,Peru (2014)*

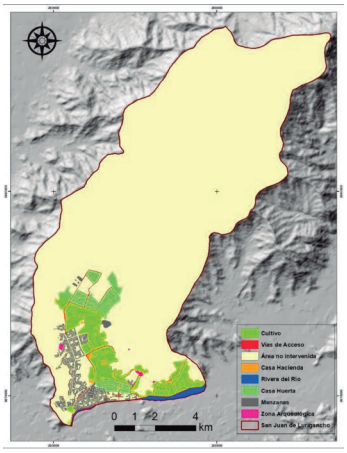


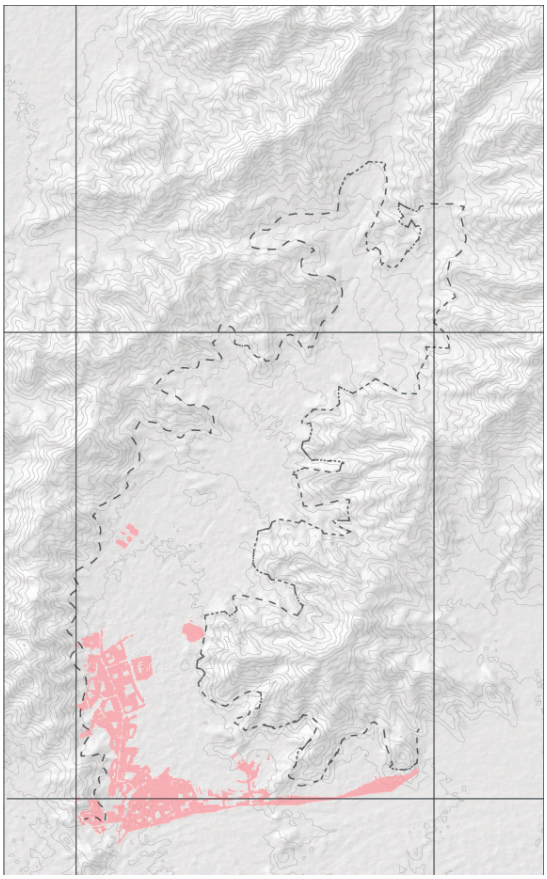
Figure 28 *Anggelo Tena, Raster image photo-interpretation SJL year 1974 (format TIFF), resolution 1x1 m. 2018, In Acción antrópica y los cambios en el paisaje del distrito de San Juan de Lurigancho entre los años 1948 – 2016 (Lima: 2018), Pg 138 .*

Historic Urban development in SJL.

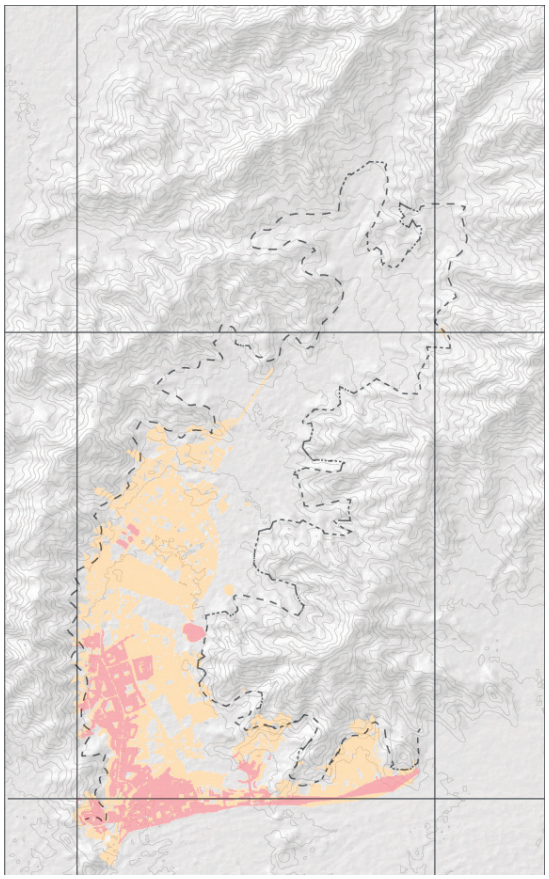
For the sake of researching and studying the historical development of informal settlements in San Juan Lurigancho, it was necessary acquire historical map information and aerial photographs of the district. Unfortunately, as a product of the Covid-19 pandemic, the opportunity to directly access these services in Lima has been restricted. Preparing this study required the use of historical map data for SJL which has been developed by Anggelo Tena as part of his thesis titled "Anthropic action and changes in the landscape of the San Juan de Lurigancho district between the years 1948 - 2016 ". Tena provided a map recreation of SJL throughout its history based on satellite images in order to analyze urban production across the landscape and the effects of human behavior within Lima. For the purpose of this analysis, I have extracted the outlines of the urban construction border of these maps in order to define the historical urbanization of the district and also to create a comparative time frame that evidences the trends and patterns seen during the district's urbanization process.

Tenna carried out his study based on historical satellite data for the years 1948, 1961, 1974, 1984, 1990, 2000, and 2016. Between 1948 and 1968, the district of SJL was classified as rural and underwent only minimum urban interventions as well as informal developments. Hence, for this analysis I have relied on the maps corresponding to the period between 1974 and 2016. While these years may not be strictly sequential, they are still useful in order to provide accurate evidence regarding the patterns of informal settlements within the district, especially the ones located on the steeper side of the western mountain of SJL, considering that area has been the central focus of this research.

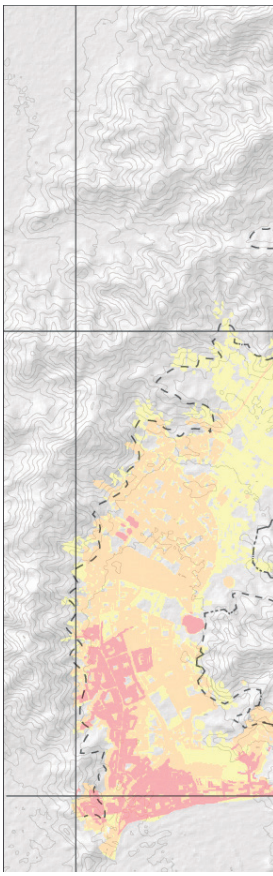
In addition to the above, the historical analysis aims to define a time frame corresponding to the informal development, occupation and growth of the valley of SJL and to clarify when the informal process started to move towards the mountains of the district.

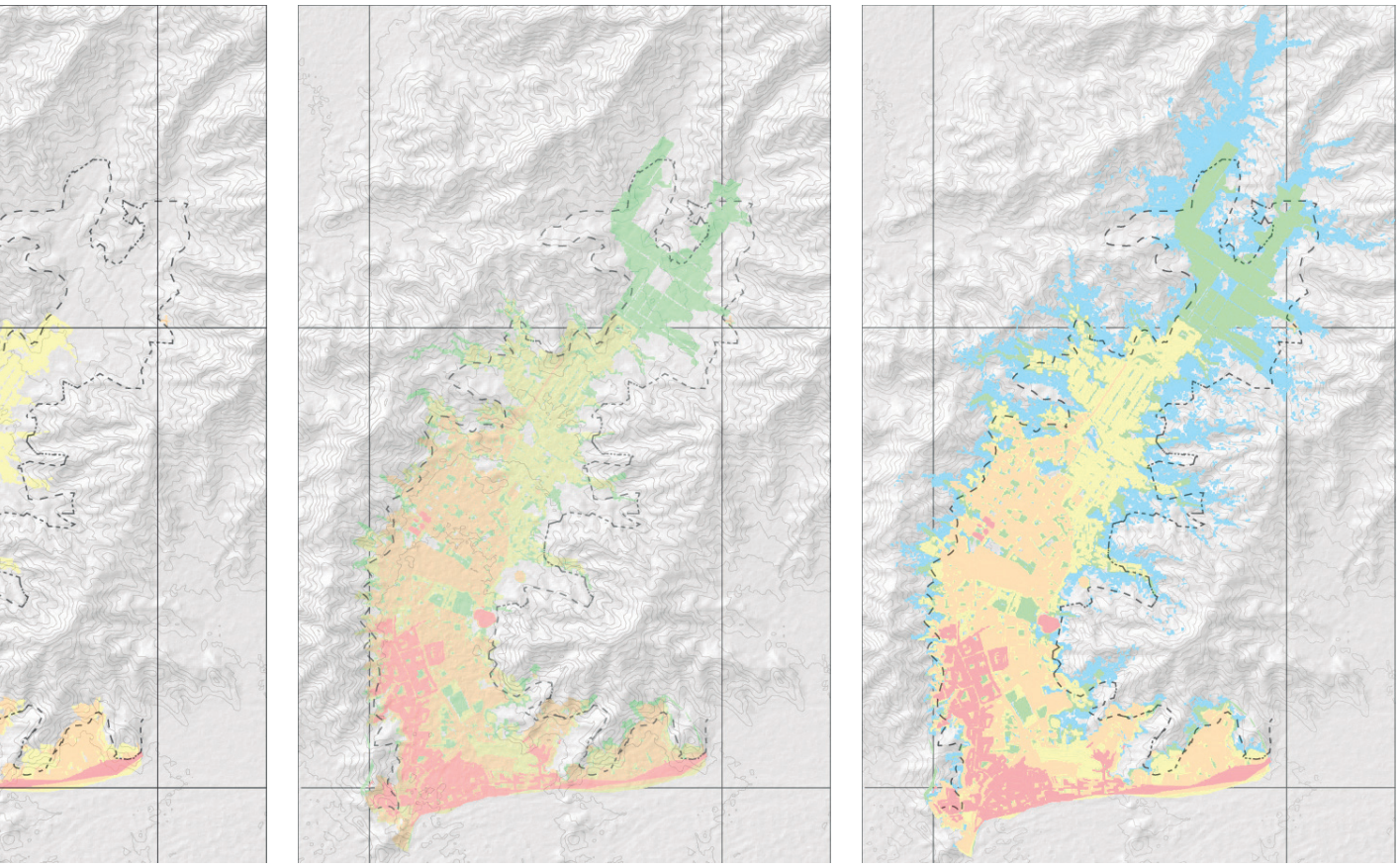


San Juan Lurigancho
1974



San Juan Lurigancho
1974 - 1984





San Juan Lurigancho
1974 - 1984 - 1990

San Juan Lurigancho
1974 - 1984 - 1990 - 2000

San Juan Lurigancho
1974 - 1984 - 1990 - 2000 - 2016

Border between the valley and the mountain in SJL

Figure 29 *Recreation of historic urban development in San Juan Lurigancho between 1974 and 2016. Source: GIS information (TENA, 2018). Own elaboration*

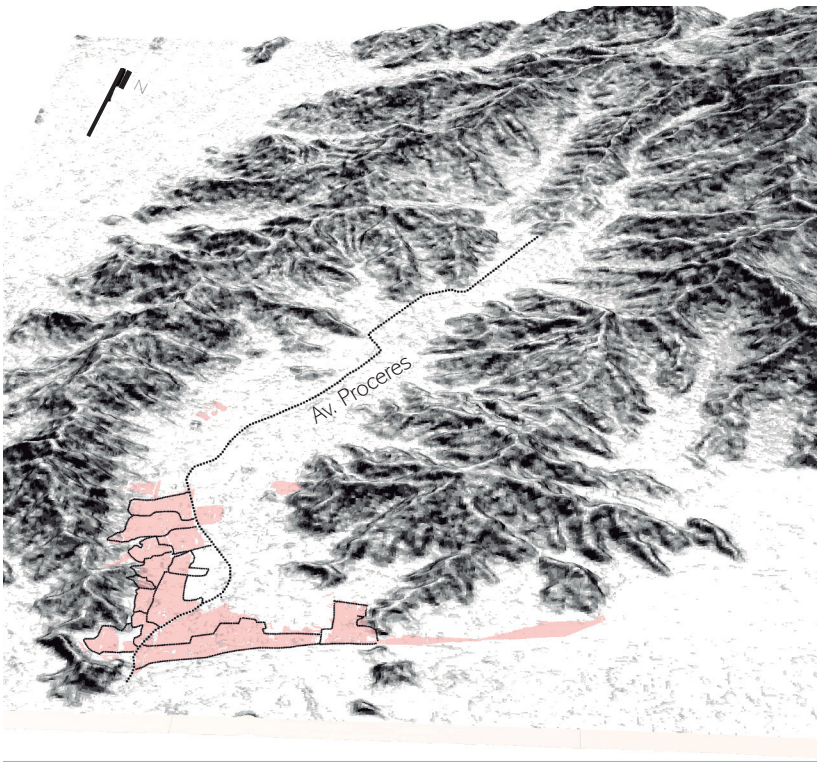


Figure 30 *Urban Land occupation 1974 San Juan Lurigancho*

Urban Land Occupation of SJL in 1974

The re-creation of a 1974 satellite image by Tena portrays the two main areas of development in the district as of 1974: First, the Southern border, which was the part of the district that was nearest to the economic and political center of the city. Second, the urban developments located between the avenue "Proceres" and the western mountain that surrounds the district of SJL.

By 1974, the Southern area's development corresponded to one of SJL's ancient "Haciendas" known as Zarate; Zarate was a 1961 housing

urbanization that offered guaranteed housing plots with public services such as water, electricity, sewer systems and paved roads (Tenna 2018).

In terms of its urban distribution plan, the urban typology of this area was considered to be predominantly formal. The Avenue "Proceres" became the focal point of development witin the district. The settlements located in this area were: Chacarilla de Otero , San Fernando, Santa Rosa, Caja de Agua, San Hilarion, 15 de Enero.

After overlaying and comparing the subsequent maps for 1984, 1990, 2000, and 2016 with the border of the western urban development for 1974, it is possible to assume that these initial settlements were located closer to the mountain border, thus rapidly occupying the available flat land area for this portion of the valley. This interpretation is valid, because by 2018 the most recent informal developments in these areas have not extended into the steeper areas of the mountain and thus the process itself has been clearly defined by topographical conditions. Also, as the density maps shows for 2017, the density value (hab/km2) of this area has become one of the highest in the district, which could also support the argument that this area experienced a quicker densification and consolidation process due to its proximity to the city center.

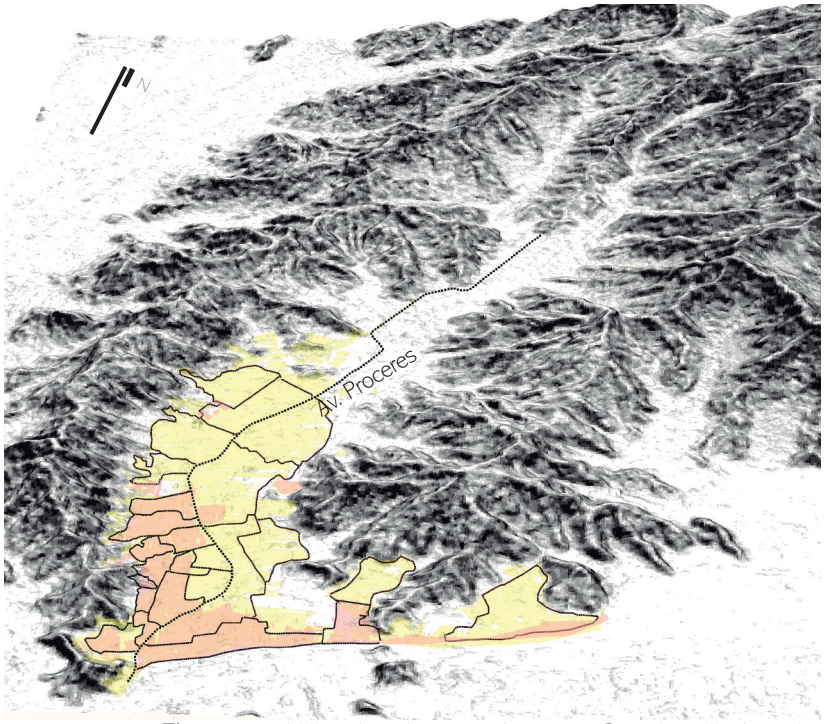


Figure 31 *Urban Land occupation 1984 San Juan Lurigancho*

Urban Land Occupation of SJL in 1984

Between 1974 and 1984 the urban development of SJL extended to 3 main sectors. First, the southern area of the District, where the urbanization and consolidation process continued with the settlements of Campoy and Mangomarca. The second area was located east of an already consolidated urban development dated to 1974 (between the Avenue Proceres and the border of the eastern mountains of SJL). The main development outcome of this area was the settlement of Huayrona. The third area consists of a new urbanization process, found towards the north of the district and driven by the extension of the Avenue Proceres. Therefore, during this decade the urban process was developed and contained between the natural borders of the district's mountains. The settlements bordering the western mountain during the same decade were: Huascar, Ganimedes, Canto Grande and Los Pinos . Finally, the settlements that are located closer to the border of the eastern mountain are Canto Rey and Medalla Milagrosa.

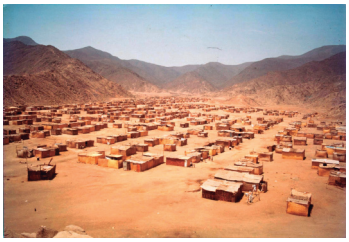


Figure 32 *Meentzen, Kathe. "Human Settlement Jose Carlos Mariategui." Centro de documentacion e Investigacion. 6 Feb 2018, Lima 1985. "lum.cultura.pe/cdi/foto/asentamiento-humano-josé-carlos-mariátegui-recién-fundando-en-san-juan-de-lurigancho. Accessed 13 July 2020*

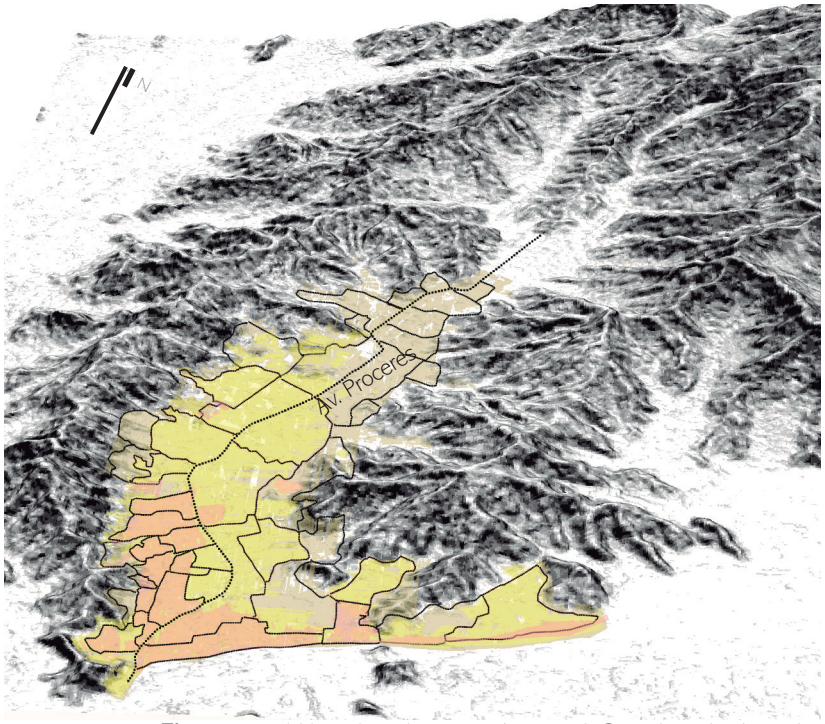


Figure 33 *Urban Land occupation 1990 San Juan Lurigancho*

Urban Land Occupation of SJL in 1990

Between 1984 and 1990, the district experienced an intense urbanization process, especially with respect to informal settlements. As Driant has mentioned, "Of the 77 Barriadas formed in Lima between 1984 and 1986 almost half were created in the district of San Juan Lurigancho and San Martin Porres"[9]. By then, the southern area of the district finally became completely urbanized.

During this time frame, the west side consisted of the settlements of Jose Carlos Mariategui. To the east, we can see settlements of Jaime Zubieta, Tupac Amaru, and Mariscal Caceres. The areas developed between 1984 and 1990 achieved higher population values in the district (Figure 36). It is in fact possible to assume that the informal development took place in larger portions of land, which were at first poorly build (Figure 32), but with the consolidation and self-construction process, the inhabitants of these areas managed to develop permanent solid housing structures that allowed for higher densification over time. (Figure 52).

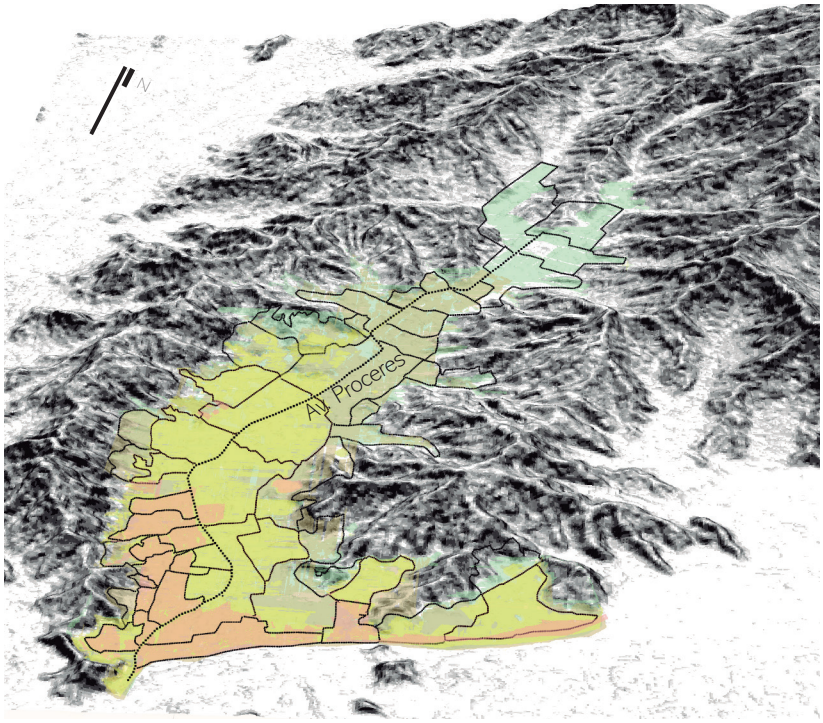


Figure 34 *Urban Land occupation 2000 San Juan Lurigancho*

Urban Land Occupation of SJL in 2000

For this period, development was based on two trends. First, the urbanization of the last portion of flat land within the district towards the north. Said area presents some of the most precarious settlements of the district and they also have the lowest income value per block in the district (Figure 36). These new settlements are known as Cesar Vallejo and Enrique Montenegro. Second, the consolidation process for this urban development occurred between 1974 and 2000. That is when the available area of the valley was rapidly urbanized and consolidated.

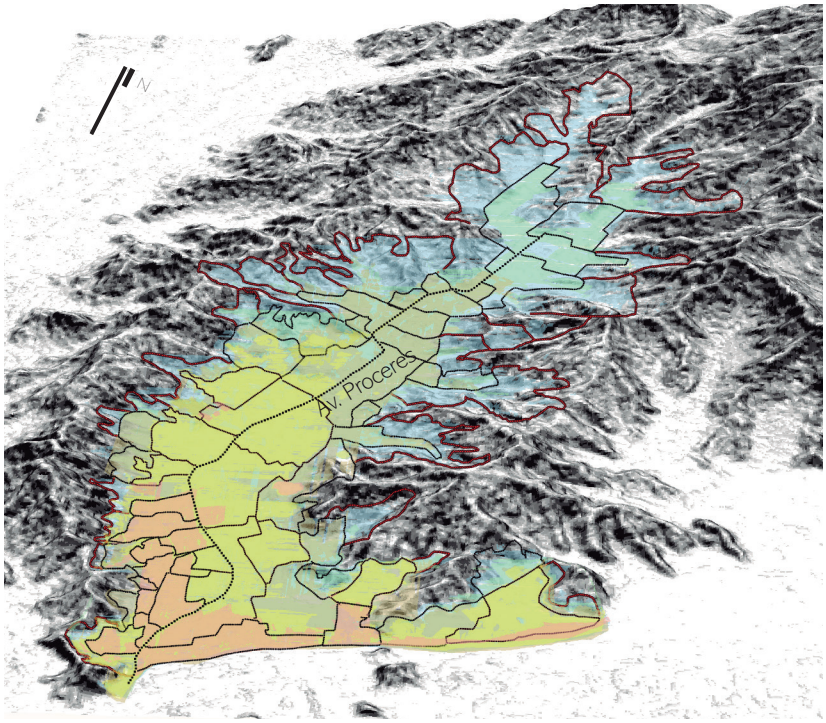


Figure 35 *Urban Land occupation 2015 San Juan Lurigancho*

Urban Land Occupation of SJL in 2015

During this period, the recent northern settlements of the district started to expand towards the steeper area of the western mountains. Until the year 2000, the urban development was contained within the flat areas of the district, but after 2000 there has been a prominent invasion of the mountainous areas of the district. As the maps shows, development lost its longitudinal character along the Avenue Proceres and then began follow a transversal path, located in the higher and steeper mountains of SJL.

Conclusion of Historic Analysis

The district of San Juan Lurigancho underwent a rapid and massive urban development. The urban densification process experienced throughout the district targetted the valley or the flat lands closest to transportation routes and commercial or industrial areas. Between 1974 and 2000, approximately some 33.8 km2 of land were formally and informally developed in the district. The previously referenced maps indicate that:

From 1974 to 1984, 13.5 km2 (aprox) of land were developed in SJL

From 1984 to 1990, 10.72 km2 (aprox) of land were developed in SJL

From 1994 to 2000, 9.6 km2 (aprox) of land were developed in SJL

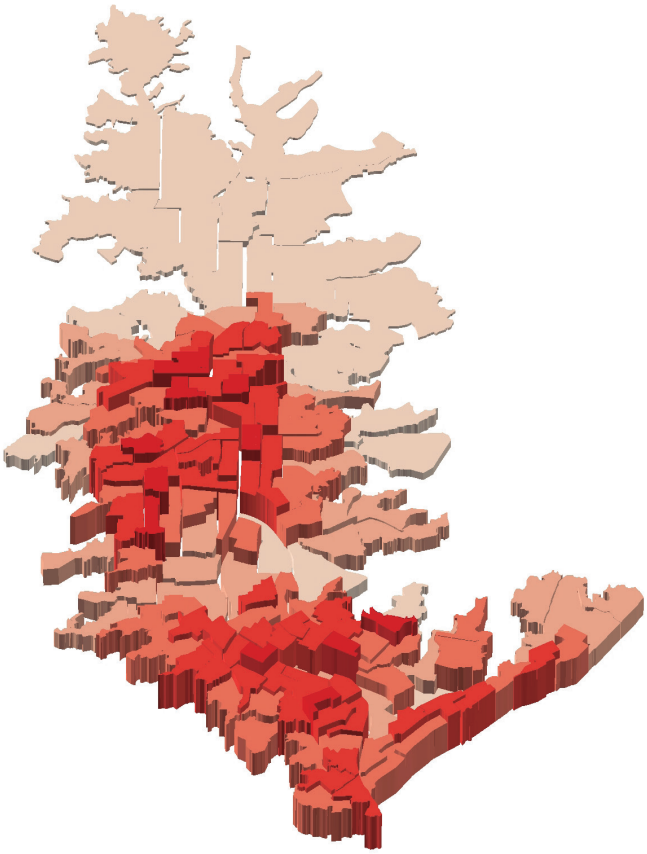
As a result, the initial informal development seen between 1974 and 2000 was organized into flat areas, which allowed for organized settlements. However, the informal settlements formed during this time have undergone various processes of legalization and consolidation by the state, , and until now they had been consolidated as stable urban structures with access to public utlity services and a low level of vulnerability. Yet further analysis has provided evidence that these areas had the highest population and most housing units per neighborhood in the district. In contrast, the district's urban development since 2000 has been predominately located throughout the mountainous areas, which has led to increased risks and vulnerability for the settlements developed during this time frame. The settlements founded within this particular time and space still face the most risks in terms of economic and environmental vulnerability. In addition, an area of approximately 20.52 km2 was urbanized between 2000 and 2016.

As we have previously explained, this phenomenon can be said to follow either the formal pattern of relocation by the state, or the formal pattern of purchase where farm land has been subdivided without service provision. This may be one of the reasons for the urban shapes seen throughout the flat lands, which are both orthogonal and organized. As the urban spread started to reach into the mountains, a new urban pattern has emerged that follows the logic of the mountain itself.

Legend - Population in SJL by neighbourhood.

4.450-6.000 6.000-7.500 7.500-9.000 9.000-10.683

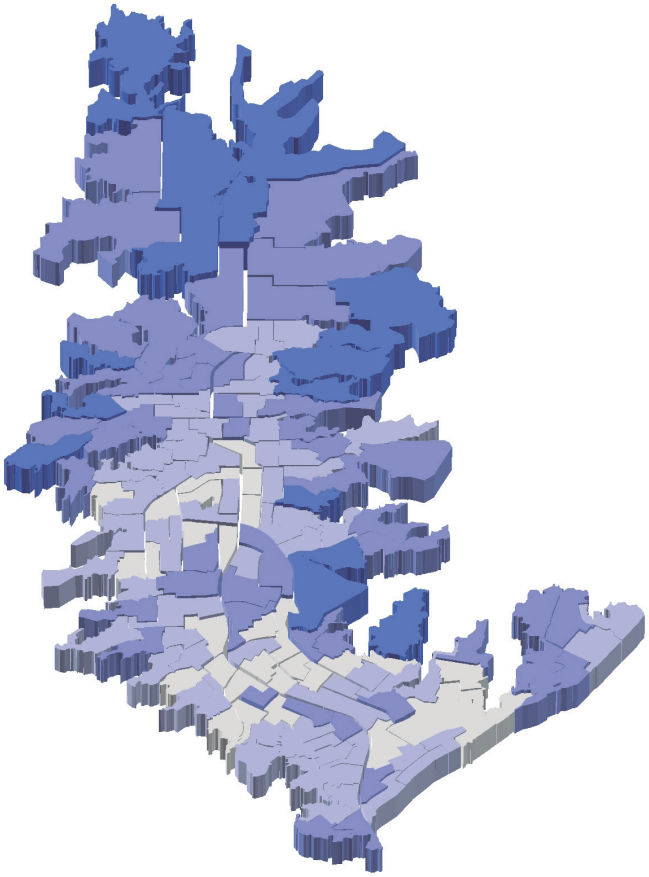
Figure 36 *Population in SJL by Neighbourhood*
Source information INEI 2017- Own elaboration



Legend - Housing units in SJL by neighbourhood.

1.536-1.660 1.660-1.740 1.740-1.880 1.880-2.200

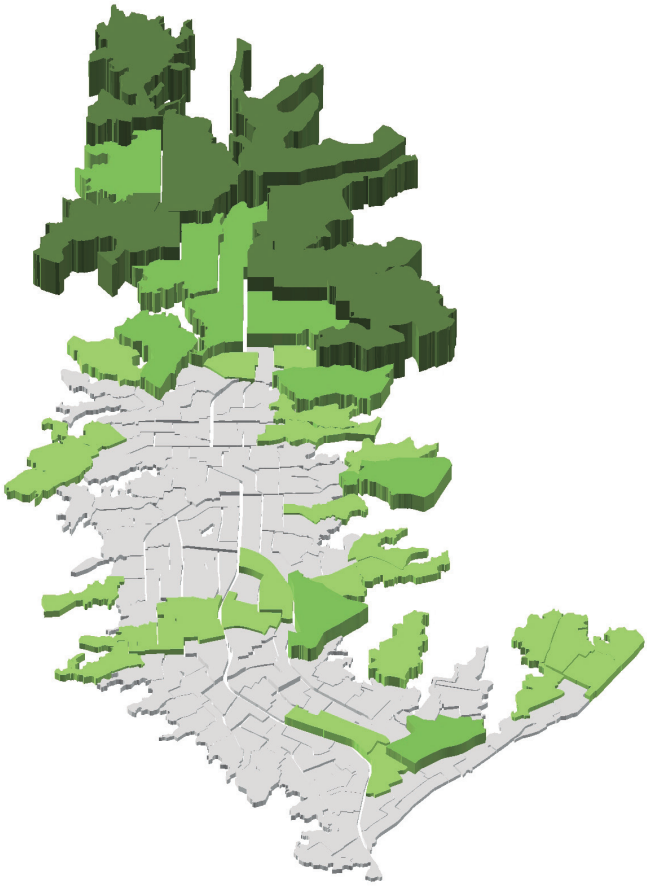
Figure 37 *Housing units in SJL by Neighbourhood*
Source information INEI- Own elaboration



Legend - Habitant density (hab x km$^{2)}$ in SJL by neighbourhood.

1.464-9.000 9.000-16.500 16.500-24.000 24.000-31.500 31.500-38.980

Figure 38 *Habitant density in SJL by neighbourhood. Source information INEI-Own elaboration*



Legend - Area in (km$^{2)}$ SJL by neighbourhood.

0.15-0.41 0.41-0.87 0.87-1.71 1.71-3.11

Figure 39 *Area in SJL by neighbourhood Source information INEI-Own elaboration*

Accesibility map in San Juan Lurigancho

The accessibility map has become a tool for the analysis of informal settlements with respect to their accessibility and the displacement capacity of the inhabitants regarding the acquisition of services or employment opportunities in other parts of town. Said accessibility map allows us to calculate the time and distance that a given habitant of an informal settlement has to walk in order to reach the main transportation avenues. This travel path has multiple variables that differentiate the conditions of the path between the informal household and the transport system itself. For example, a higher slope percentage along the travel path route will slow the travel speed and will limit the mobility and accessibility of such areas. Instead, a flat and paved road with wide sidewalks will increase the walking speed what will benefit the accessibility of the settlement. For the purpose of calculating this, it was necessary to develop a network of informal streets with the help of satellite images in order to accurately trace the informal travel paths found throughout the hillside of the district. Each of these routes was assigned a travel speed and time value based on the slope percentage, distance, and surface conditions of the street. This map shows that the area of Juan Pablo II, the upper part of Bayovar, and the upper area of Huascar are the ones facing the greatest difficulties in terms of their access to the main routes (it can take up to 45 minutes of walking just to reach a street with public transportation). As a result, this area of the settlement has become an excluded part of town, which has made it difficult for the community to the access employment, health and education. That said, this accessibility problem has been wisely resolved in the informal settlements of Medellin thanks to the "Metro Cable", a system of cable cars connecting the settlement with the main avenues and transportation system in the city, which has greatly improved the travel distance and the quality of life for the inhabitants of informal settlements in Medellin. In other words, a similar cable car system could help to address these conditions in the informal settlements of SJL for the purpose of simultaneously improving the travel time and the quality of life.

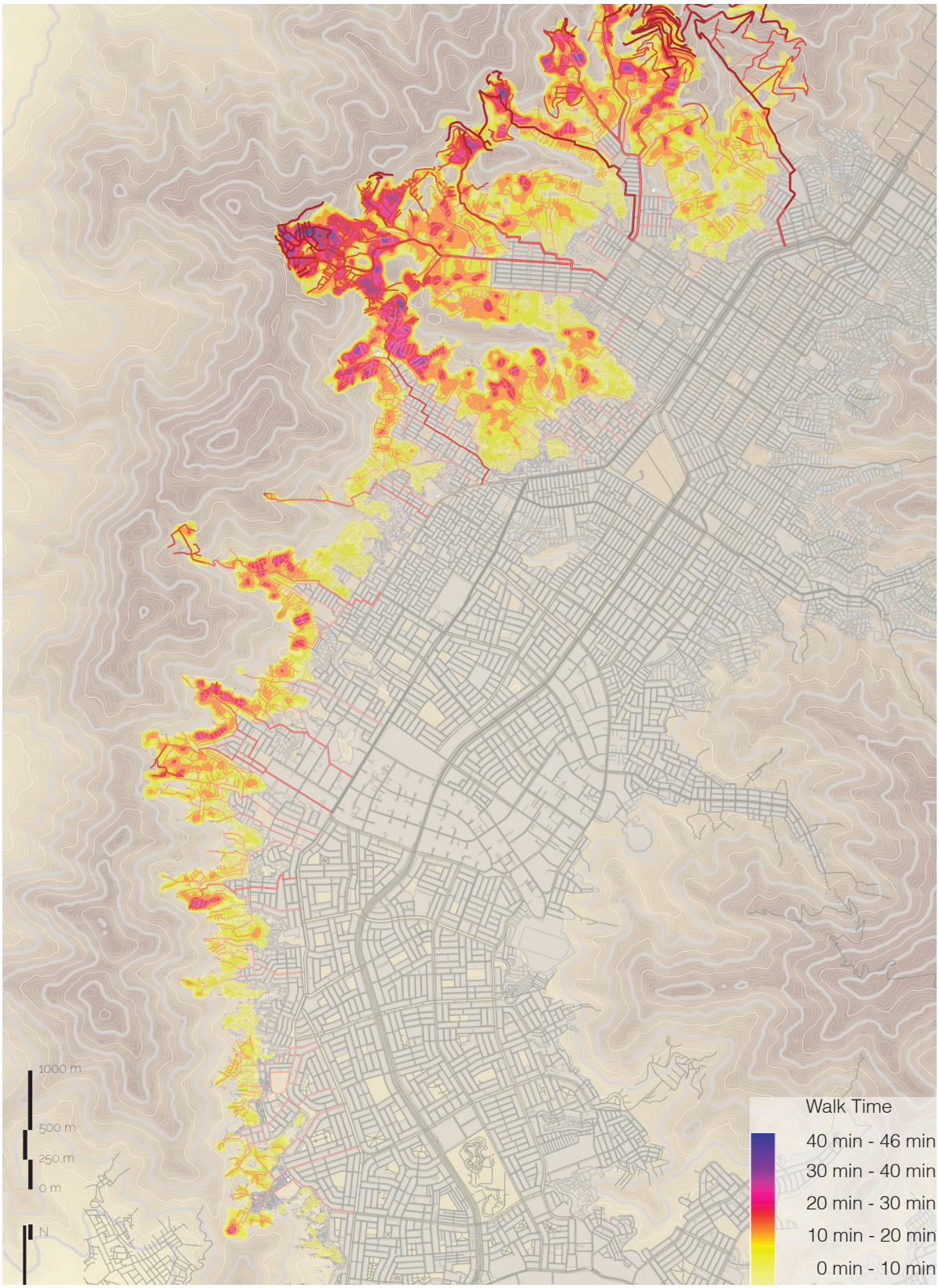


Figure 40 *Accesbility Map in SJL -Own elaboration*

Income map in San Juan Lurigancho

The map showcases that the best located areas within the district of SJL are those closest to the central Avenue Proceres. This area has the highest income per capita values of the district. As the urbanization started to move towards the mountains, the income per capita value starts to decrease, especially within the settlements located on the steepest areas of the mountain, while the areas located throughout the flat portions of the valley can still maintain a "medium" income per capita value. The settlements formed after 2000 throughout the northern area of the district also have a low income per capita value.

However, it is relevant to mention that the informal settlements located in the district's western mountain are not homogenous in their income per capita values. The south-west neighborhoods present medium-high income values while the north-west neighborhoods are predominantly populated by low-income value households. The maps reflects how informal settlements with better locations, access routes, and closer transportation systems can manage to maintain a medium income per capita value, because the inhabitants of these settlements can move and access employment opportunities and services in other parts of town, despite living inside the informal settlements.

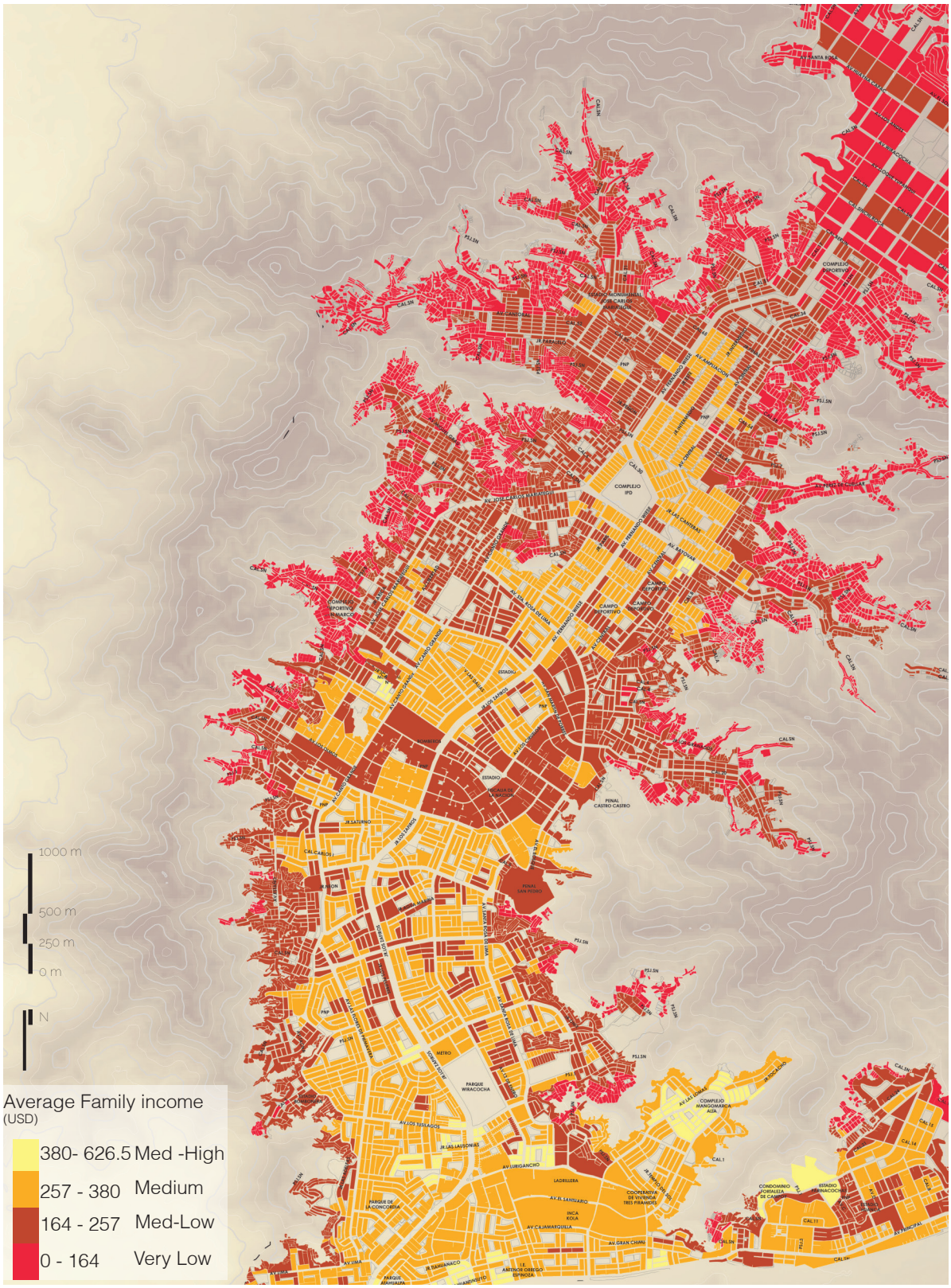


Figure 41 *Income per Block in SJL. Source Information : INEI. Income Per Block SJL, 2020, in Planos Estratificados de Lima Metropolitana Nivel Manzana,2020 (Lima, 2020), 48*

Density in San Juan Lurigancho

The density per block map was useful for analysing the progression of informal settlements on the west edge of SJL, particularly referring to the level of consolidation of each neighbourhood. Based on the INEI census information for 2016, it was possible to isolate and calculate the inhabitants for each block of the district and thus estimate the density for each block. The study area was defined between the Avenue Proceres and the western edge of the SJL district. The zone with the highest density values per block is the southern area of the district (Area 1 and 2 (Figure 45) This area achieved a rapid consolidation process over time and has not expanded deep into the hillside area; this process has led to a higher densification value per block even in the informal hillside settlement. The Huascar settlement (Area 4) is the second area with a high density per block value within the area of study. The Huascar neighborhood has consolidated over time and has become a center capable of promoting nearby informal settlements. Another pattern has become evident too, concerning the settlements located on the steepest mountainous area of the district, which have the lowest density figures per block, while the settlements throughout the flat areas and around them have the highest density values per block in the district. Therefore, the map underlines that there is still room for densification within the district, especially along the informal settlements on the hillside.

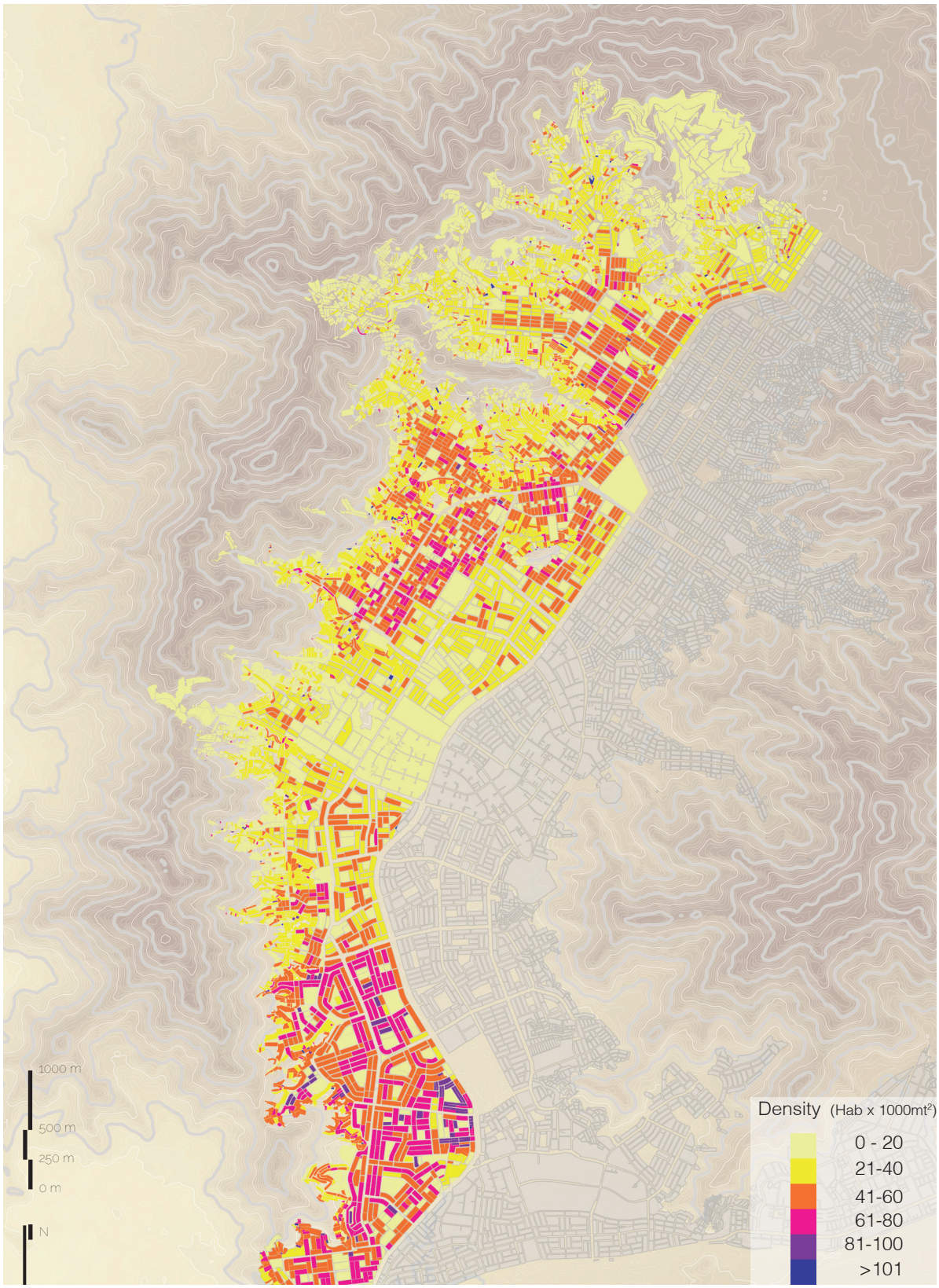


Figure 42 *Population Density per block in SJL- Source information: INEI- Own elaboration*

Area of Study

For the purposes of carrying out a specific analysis of the informal settlements in the district and in order to determine the relationship between the general conditions of the district and the specific traits of each neighborhood, it was necessary to develop 6 small areas of study to consolidate and compare the information,

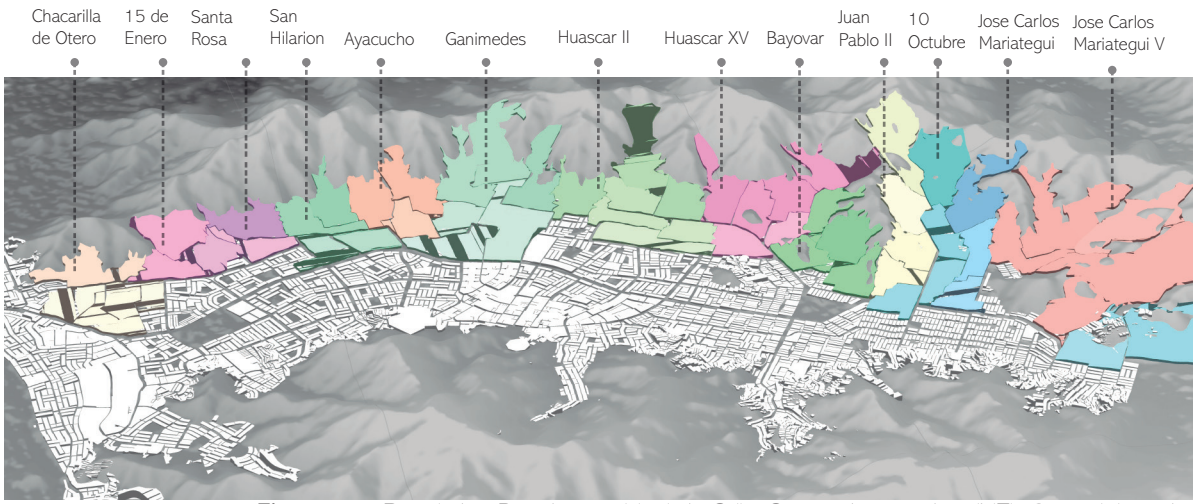


Figure 43 *Population Density per block in SJL- Source information: INEI- Own elaboration*

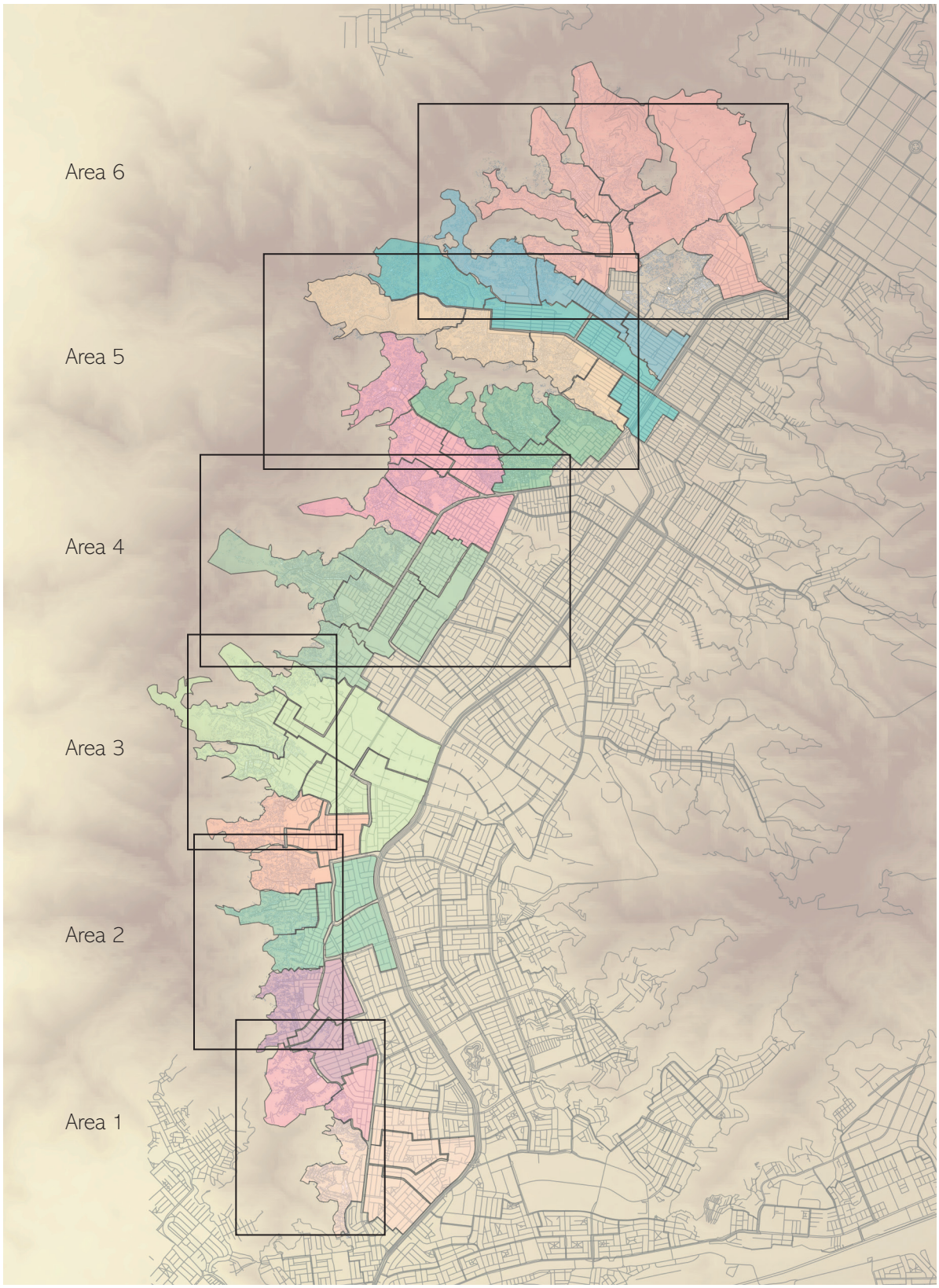


Figure 44 *Population Density per block in SJL- Source information: INEI- Own elaboration*

AREA 1

In this first area of study of SJL are located the settlements of Chacarilla de Otero and 15 de Enero. This area as the historic map analysis evidences was one of the first areas that was urbanized in the decade of 1960, this area is one of the best located areas in the district in relation to public transport and proximity to the city economic and foundation center. Despite this fact, this area has one of the lowest density values in the west border of the district. Also, this area has particular conditions because unlike the other areas in this area there are available land with a slope percentage less than 30% closer to the street network that has not been squatter yet. The travel walk distance from this area to main avenues is less than 10 min. The informal urban sprawl has not been extensive in to the steeper area of the mountain.

The regular or orthogonal urban block is located in the flat areas of the district where there is a slope value between 0 and 15%. As the topography starts to rise a different informal urban block is conformed where the buildings and the streets form a new urban informal structure. The principal routes of the settlement located in the mountain are located parallel to the contours lines and normally are vehicular streets; While the secondary streets, paths, or stairs are located perpendicular to the contours lines of the terrain, this system difficult the access of cars due to the steep slope of the streets but benefits the construction of the housing unit reducing the need of excavating and build retaining walls. Instead is cheaper build elevated foundations of rough materials (rocks, concrete, earth). These secondary streets started either from previous formal streets or from the principal streets that are located parallel to the contour's lines.

Figure 45 *Area 1 (SJL) - Base Map - Own elaboration*

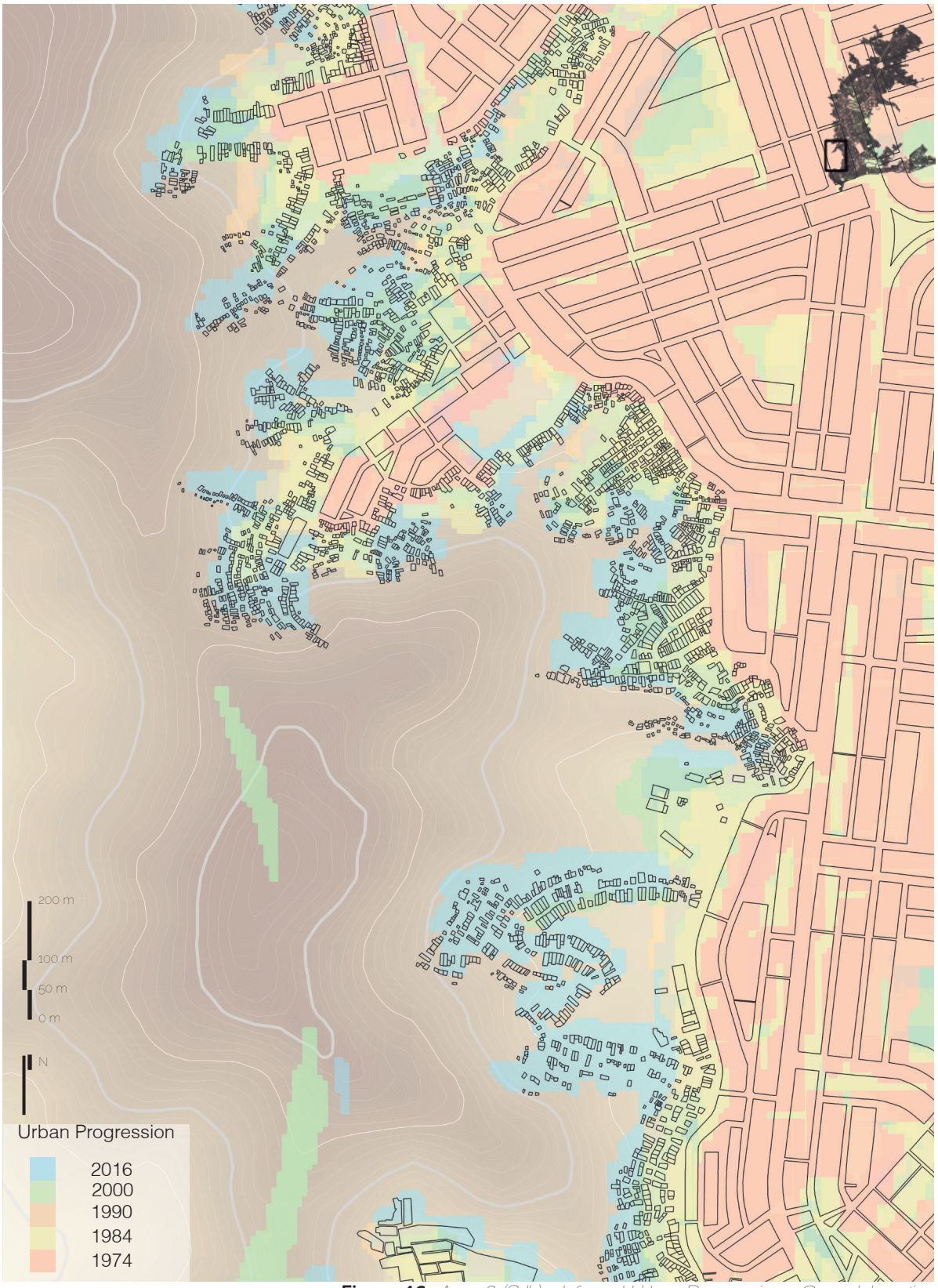


Figure 46 *Area 2 (SJL) - Informal Urban Progression - Own elaboration*

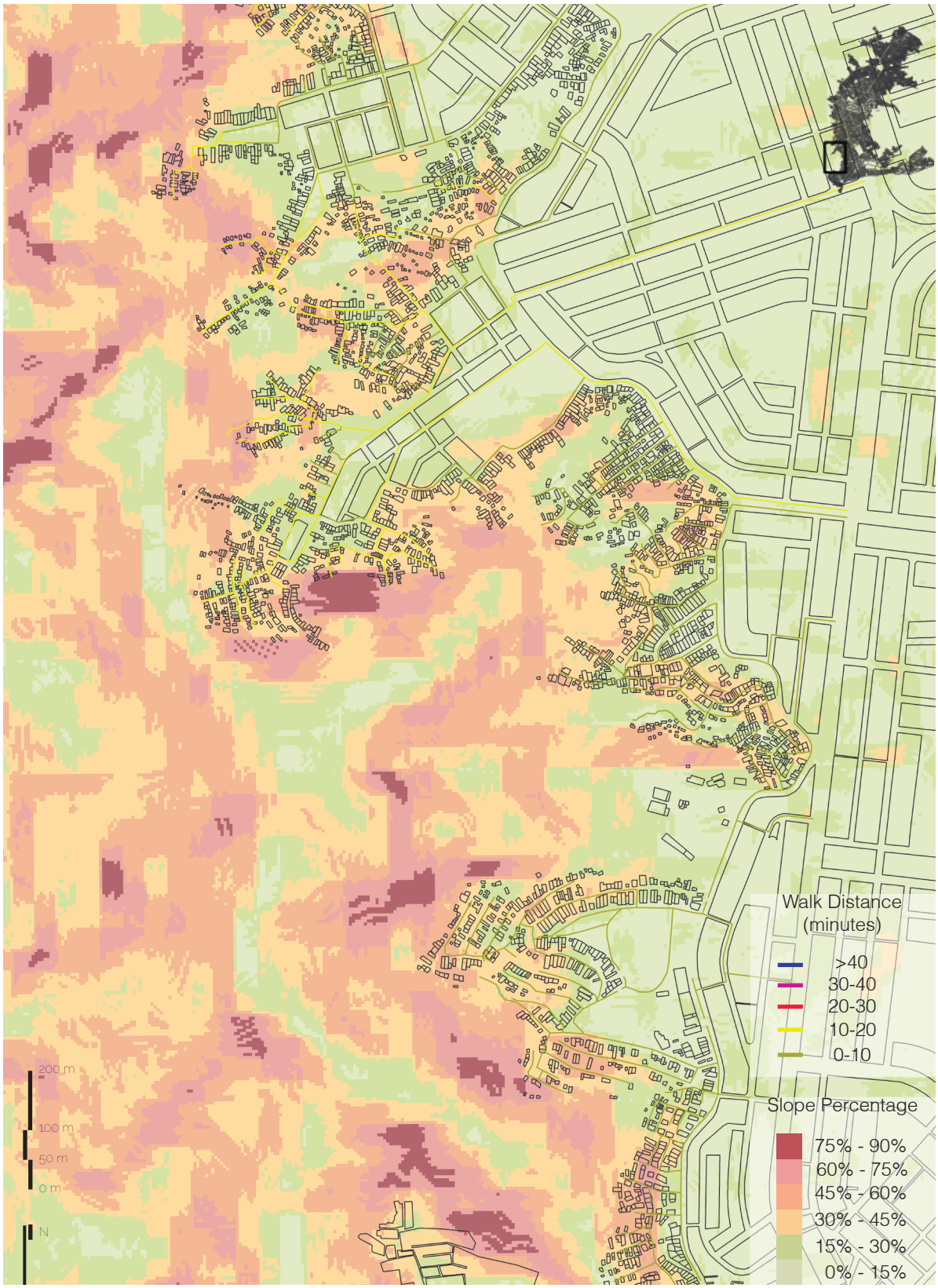
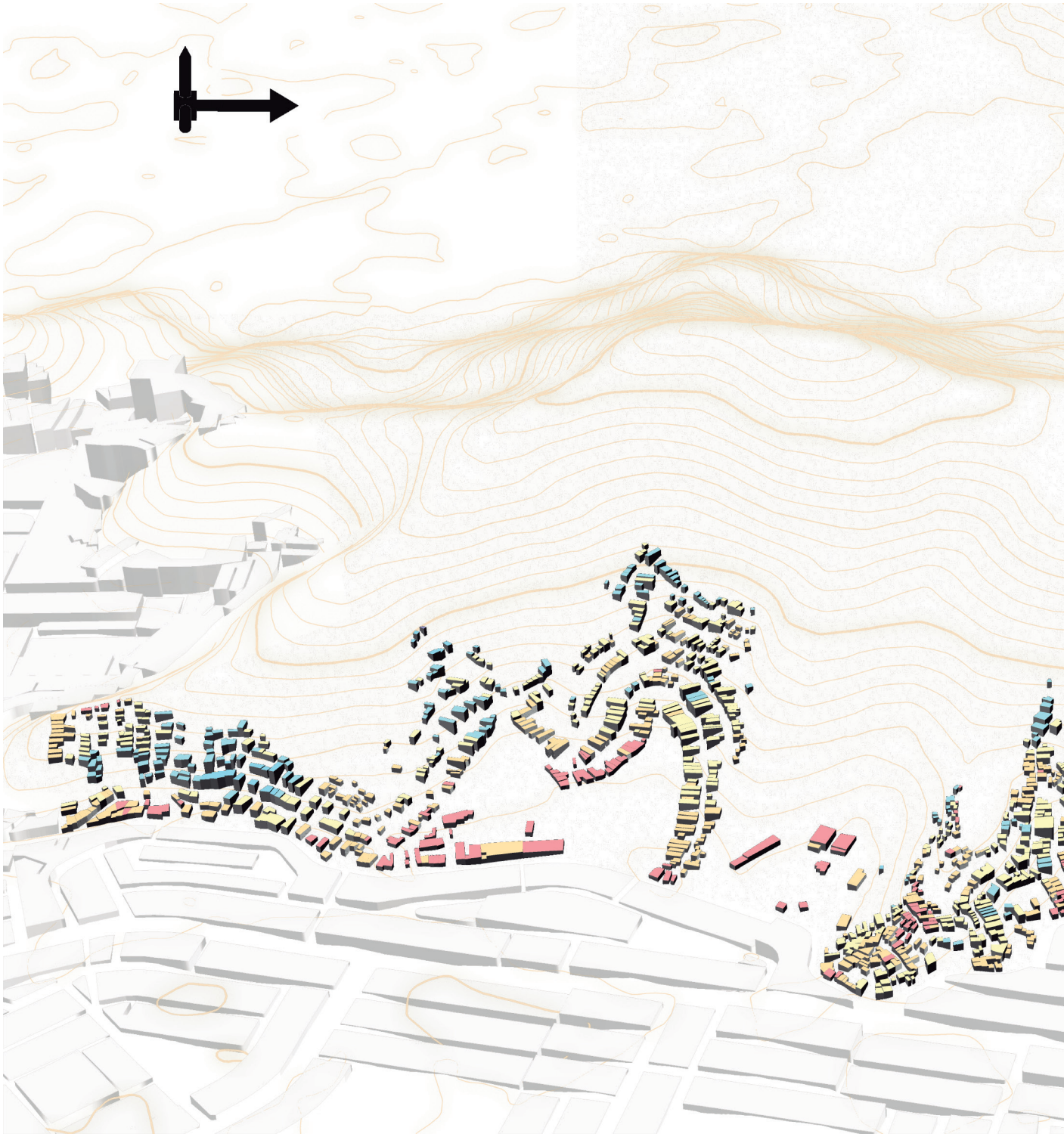


Figure 47 *Area 1 (SJL) - Slope terrain map and Walk diistance map to bus stops - Own elaboration*



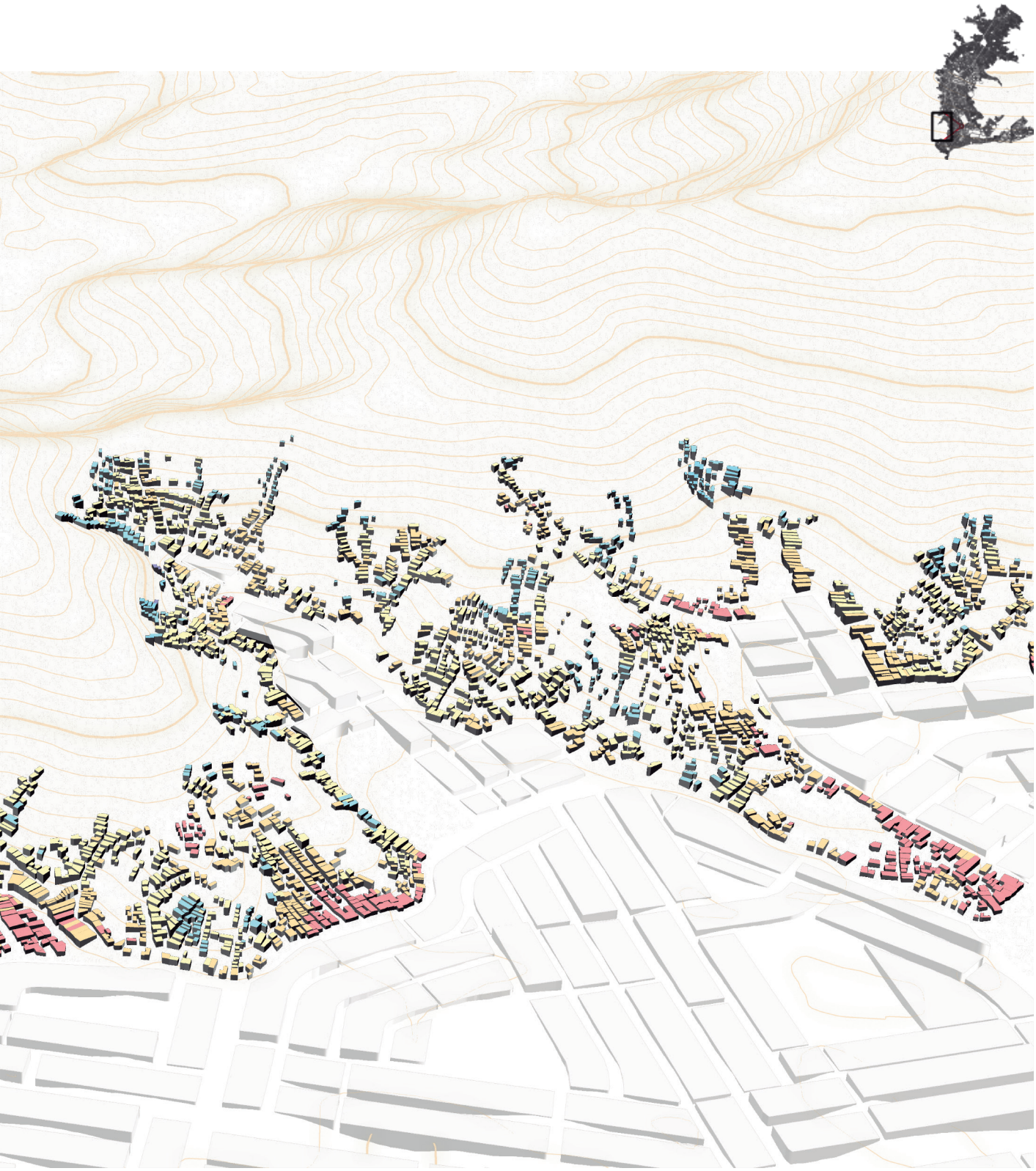


Figure 48 *Area 1 (SJL) - Perspective - Own elaboration*

AREA 2

Inside this area, the settlements of Santa Rosa y San Hilarion are located. Similar to the case of Area 1, the formal urbanization on the flat land has been developed since 1974, and said zone is one of the oldest and thus most consolidated sectors of the district. The urbanization edges that were established back in 1974 limit with the border of the western mountains. Upon carrying out an analysis of the plan for the year 1984, the beginning of the urban expansion into the mountains can be identified, but it only became extensive after the year 2000.

The slope map illustrates that there are still more available spaces toward the south, with slopes of less than 45% that can be informally urbanized, while on the northern side the available space for informal development is quite reduced. It takes less than 20 minutes of walking in order to reach the main transportation routes.

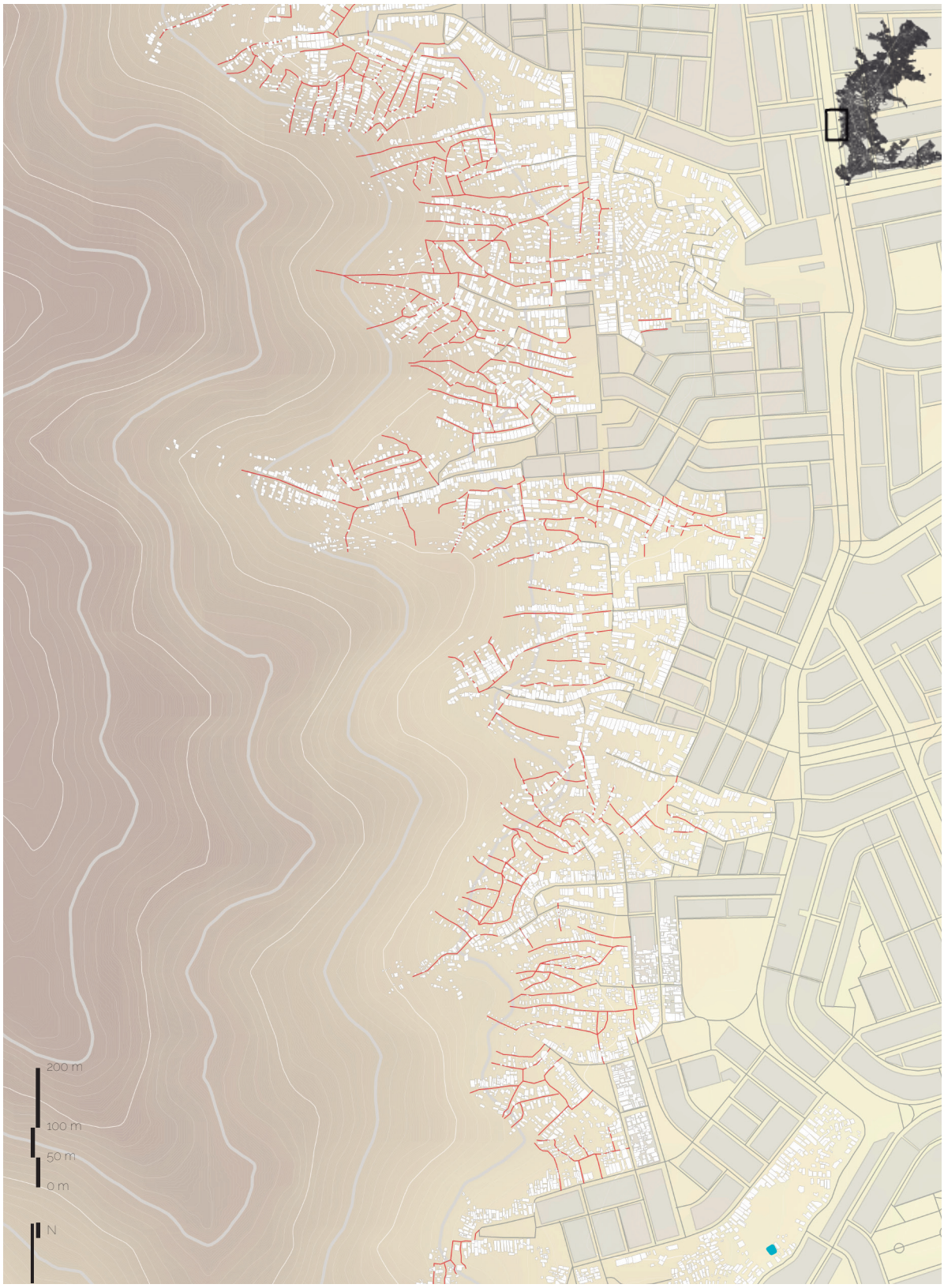


Figure 49 *Area 2 (SJL) - Base Map - Own elaboration*

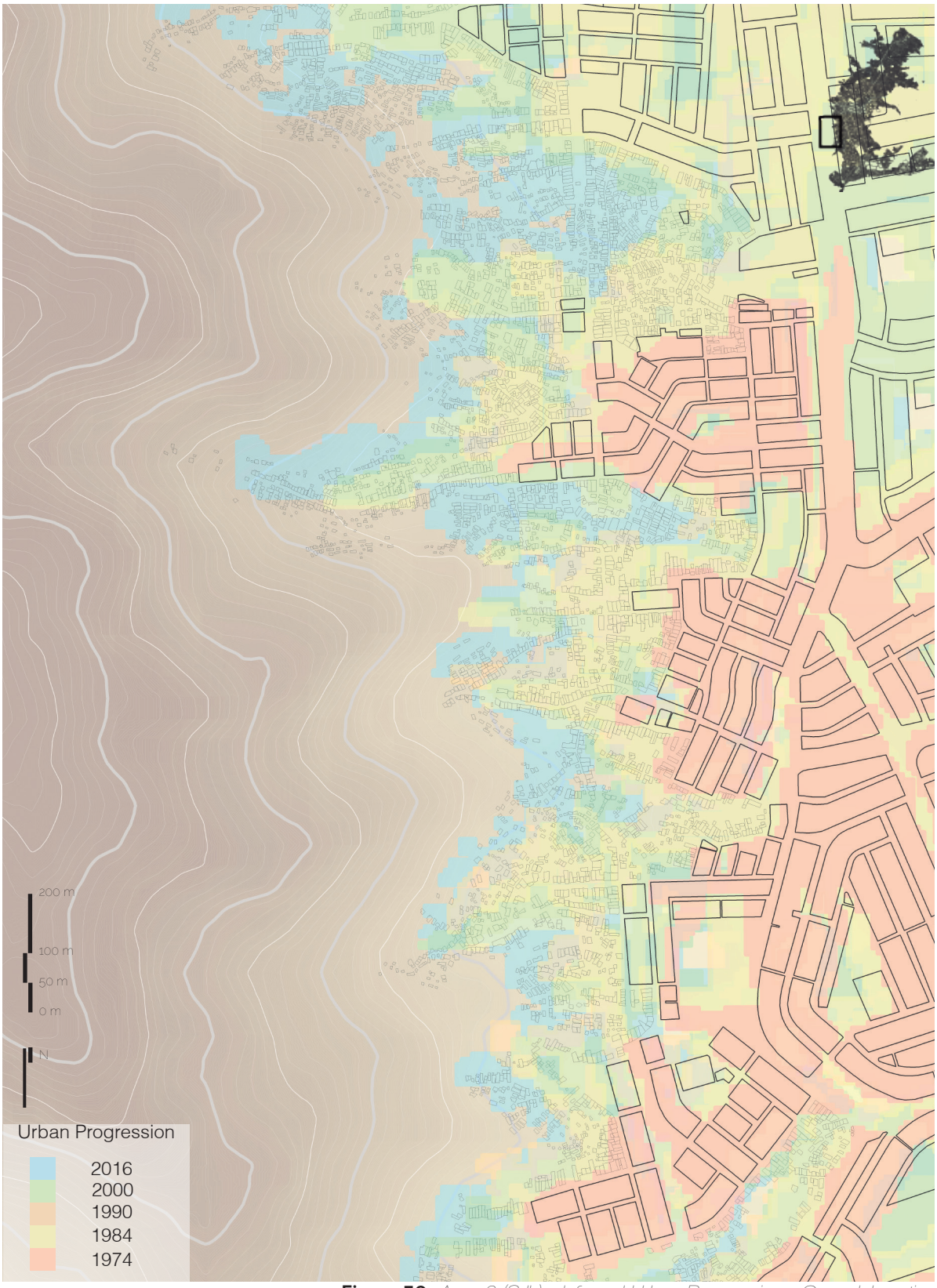


Figure 50 *Area 2 (SJL) - Informal Urban Progression - Own elaboration*

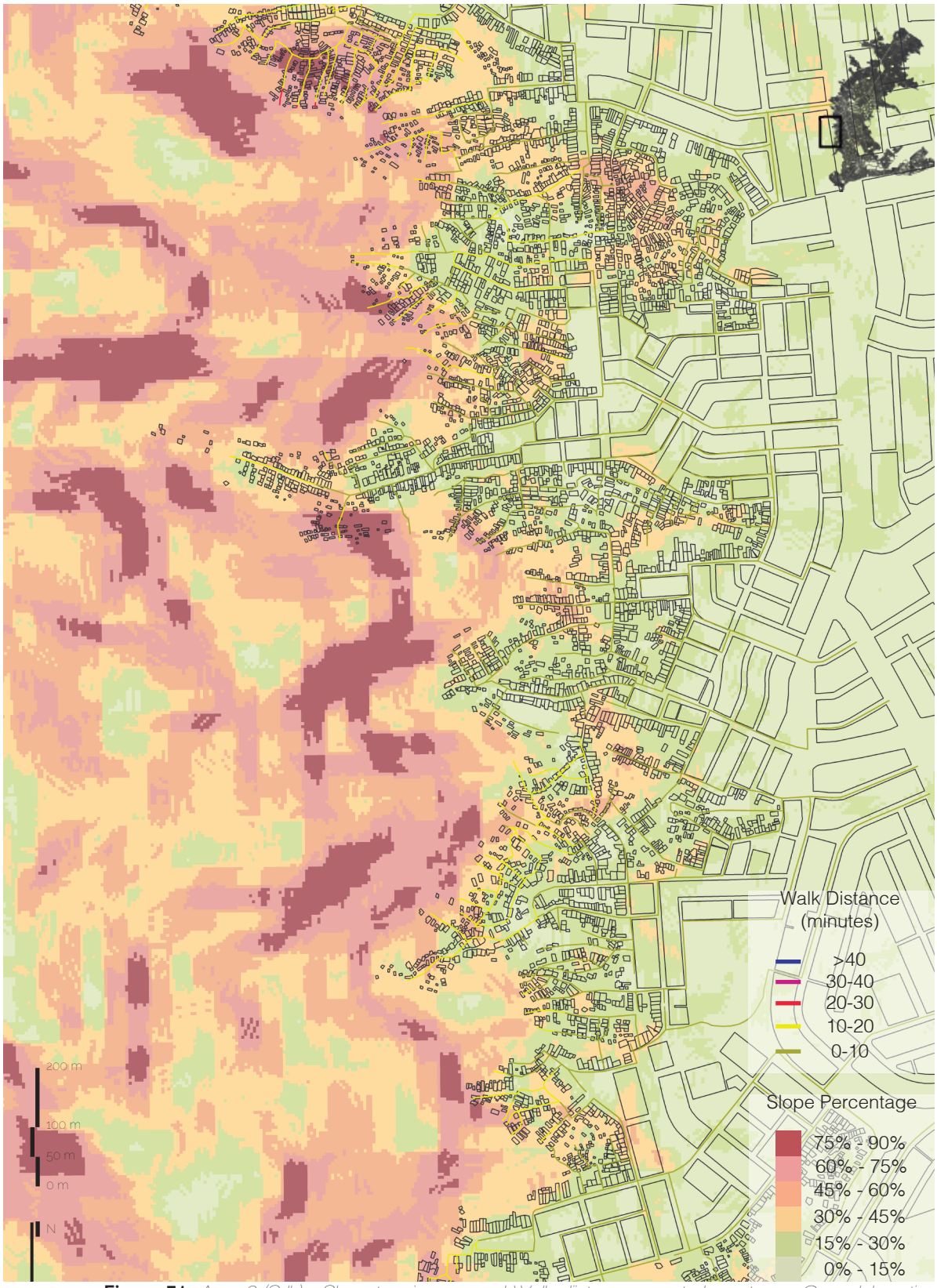


Figure 51 *Area 2 (SJL) - Slope terrain map and Walk diistance map to bus stops - Own elaboration*

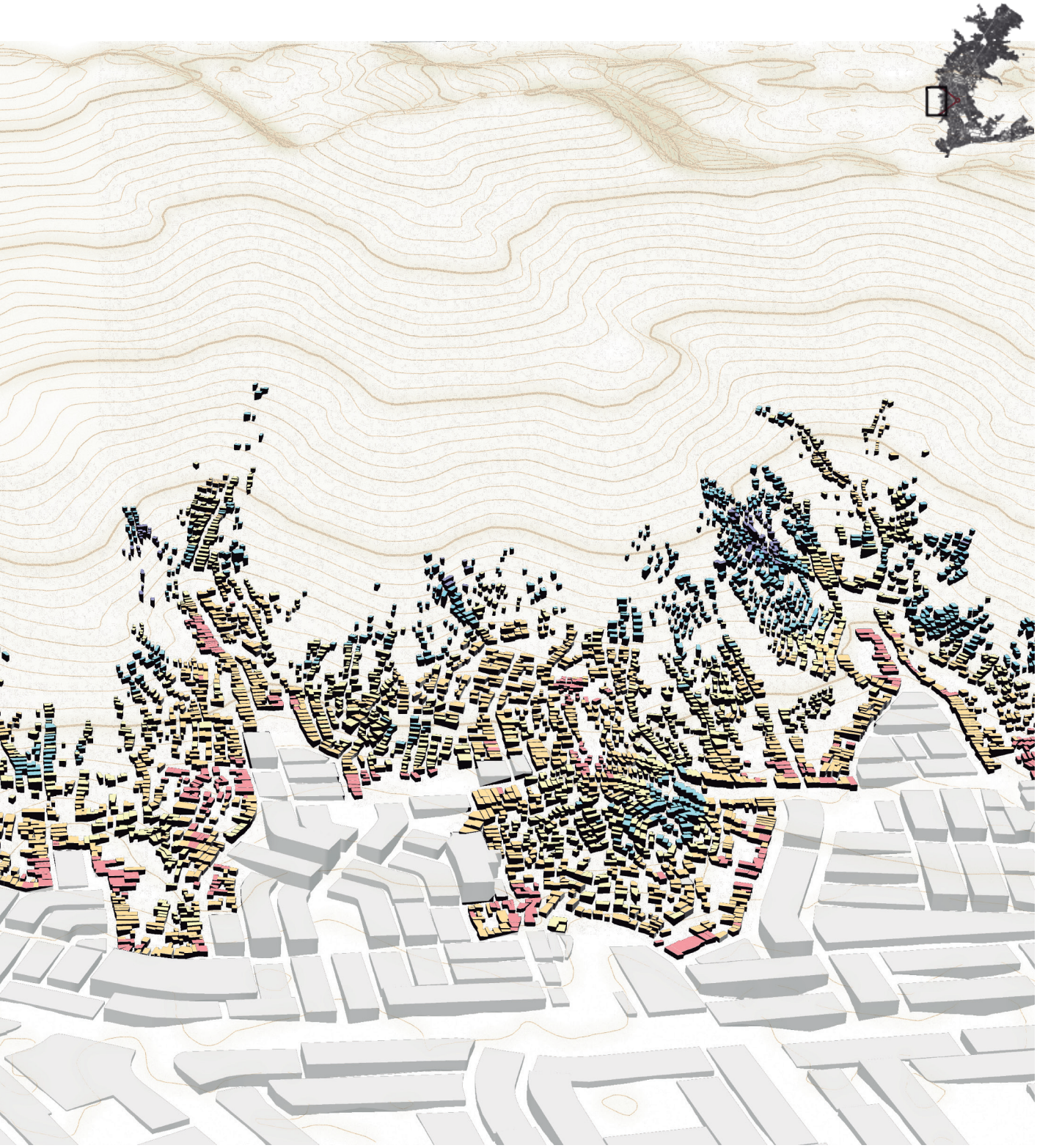


Figure 52 *Area 2 (SJL) - Perspective - Own elaboration*

AREA 3

The settlements of Ayacucho and Ganimedes are found within this area. The beginning of urbanization only became visible on the 1984 maps, so said area can be considered as part of the second stage of urbanization in the district. The 1984 map initially portrays that the urbanization process did not expand to cover all the available flat land at the time, and it was only by 1990 that the available flat land had become completely urbanized. Likewise, as seen in the previous area of study, the informal expansion of development within the mountain took place after the year 2000. This area presents one of the lowest percentages of density per block in the district, even in terms of formal development. The main transport routes can be accessed with less than 20 minutes of walking. In this part of the zone, the available land for further new informal developments is limited.

Figure 53 *Area 3 (SJL) - Base Map - Own elaboration*

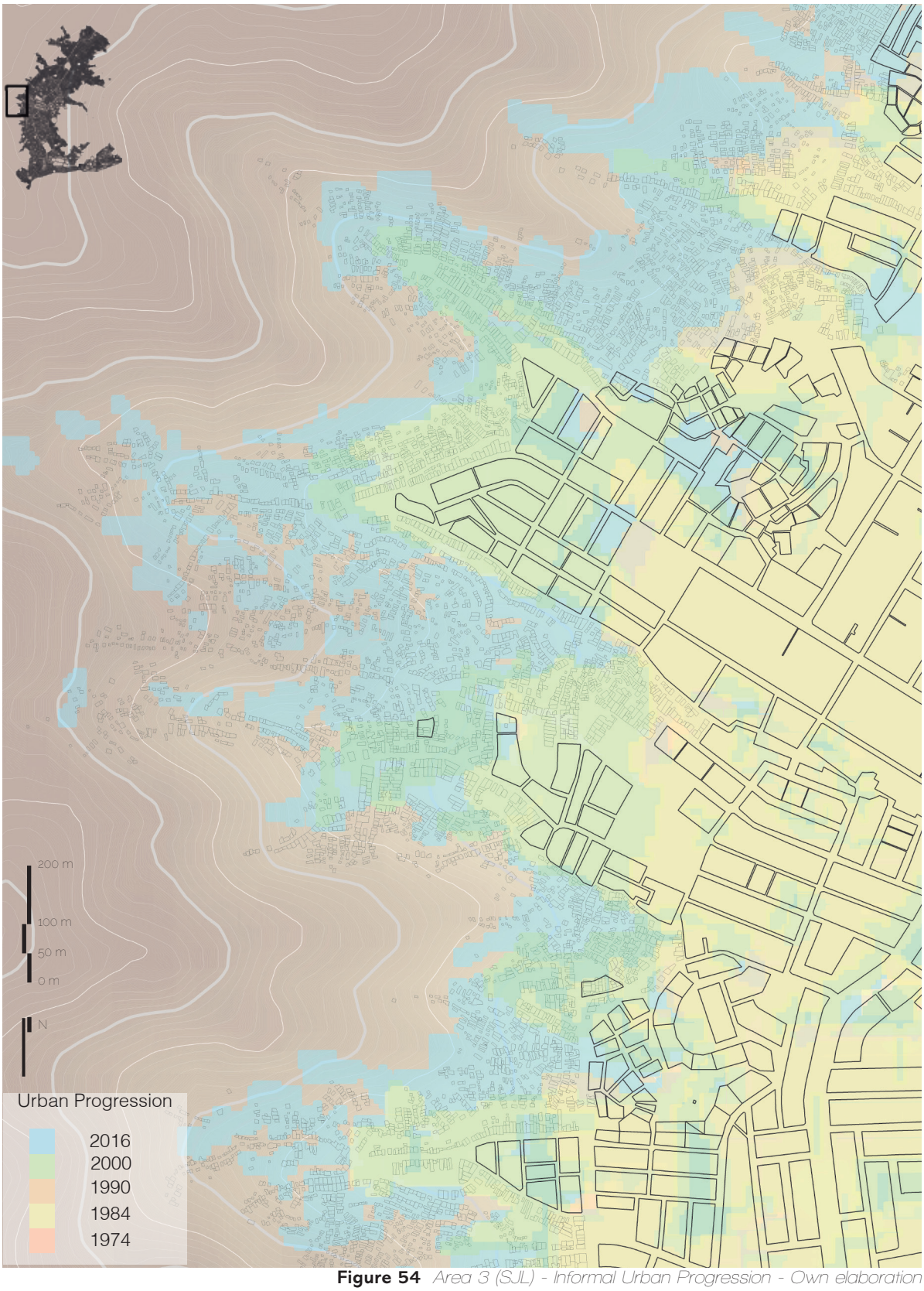


Figure 54 *Area 3 (SJL) - Informal Urban Progression - Own elaboration*

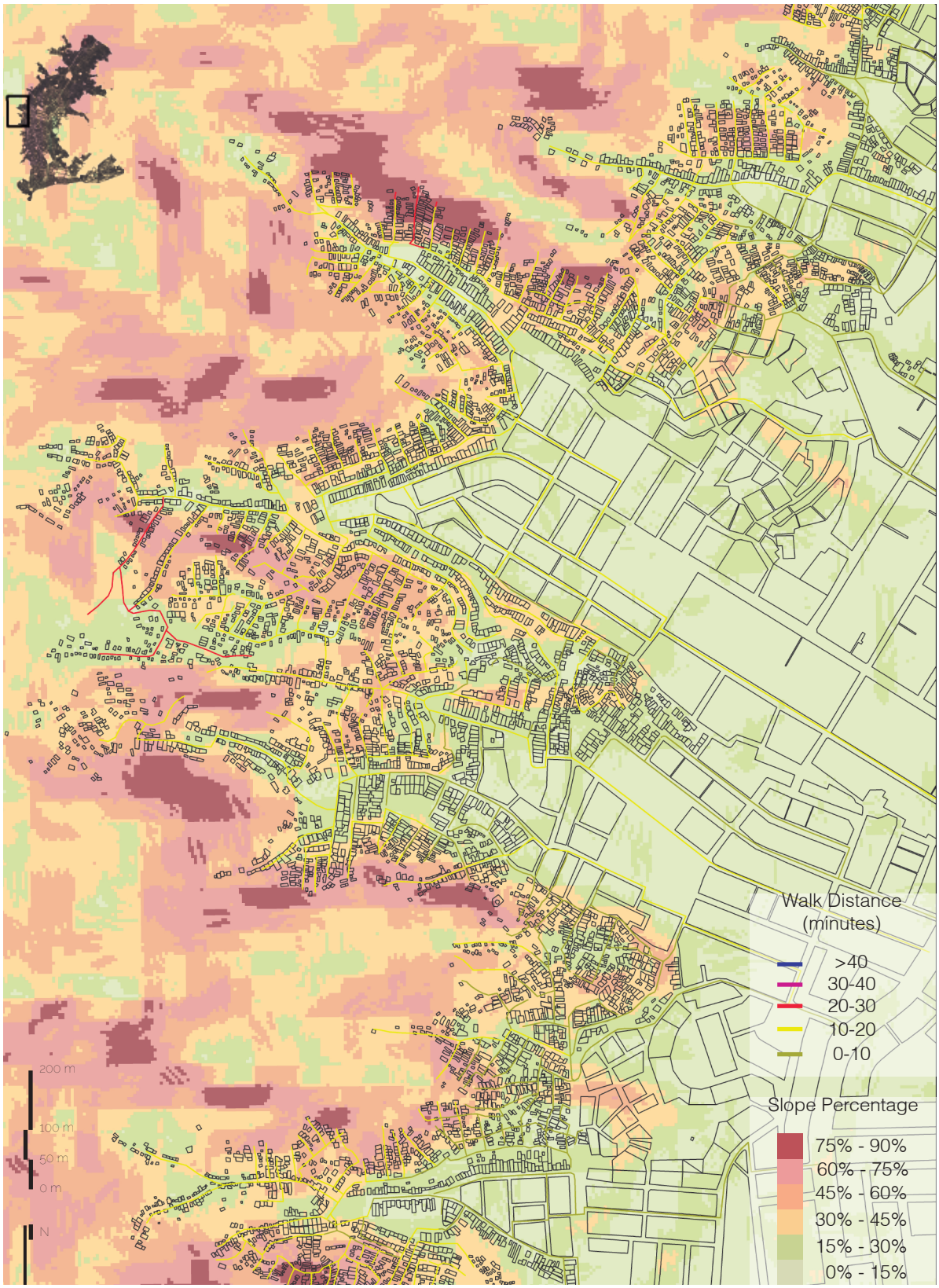
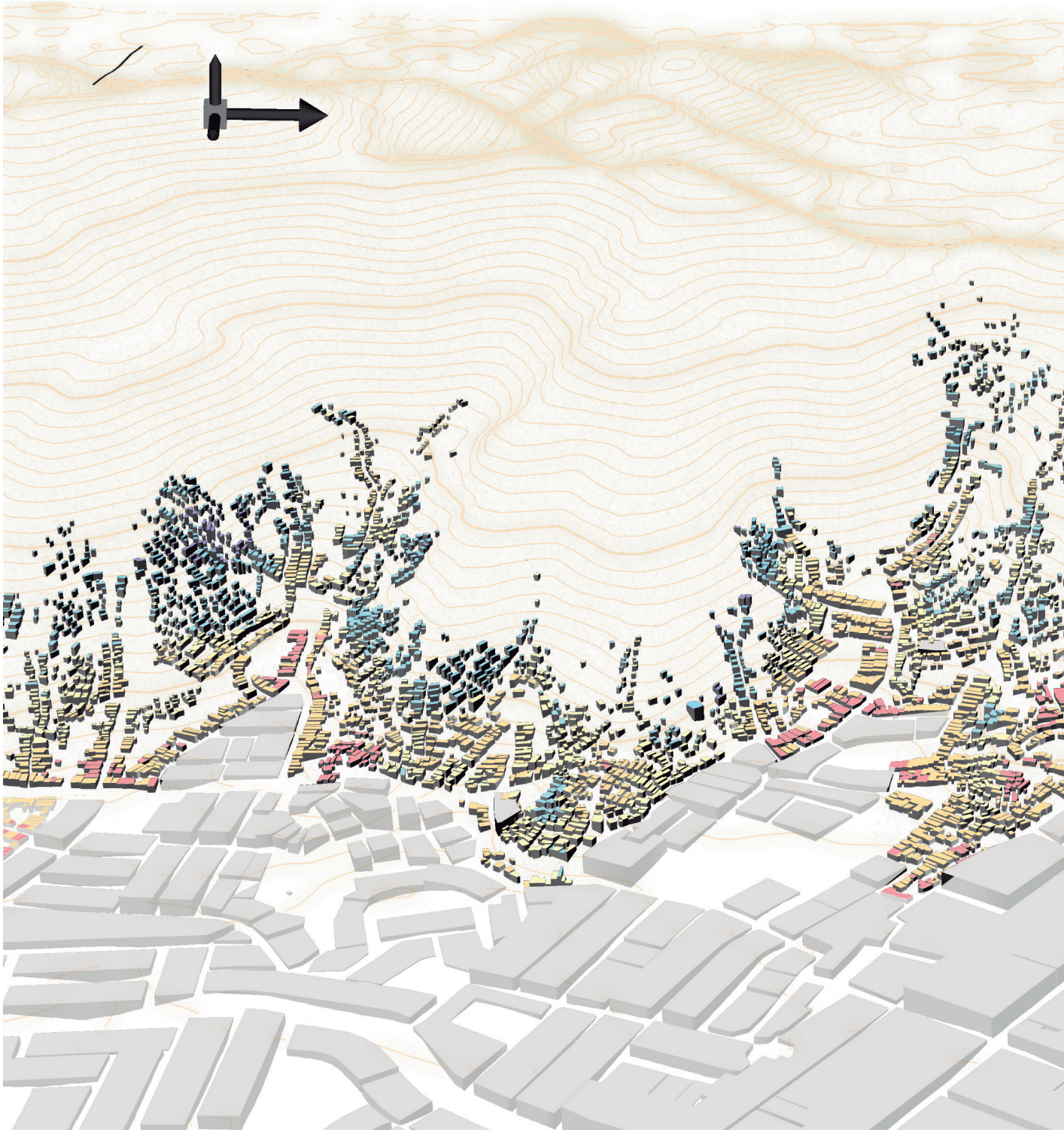


Figure 55 *Area 3 (SJL) - Slope terrain map and Walk diistance map to bus stops - Own elaboration*



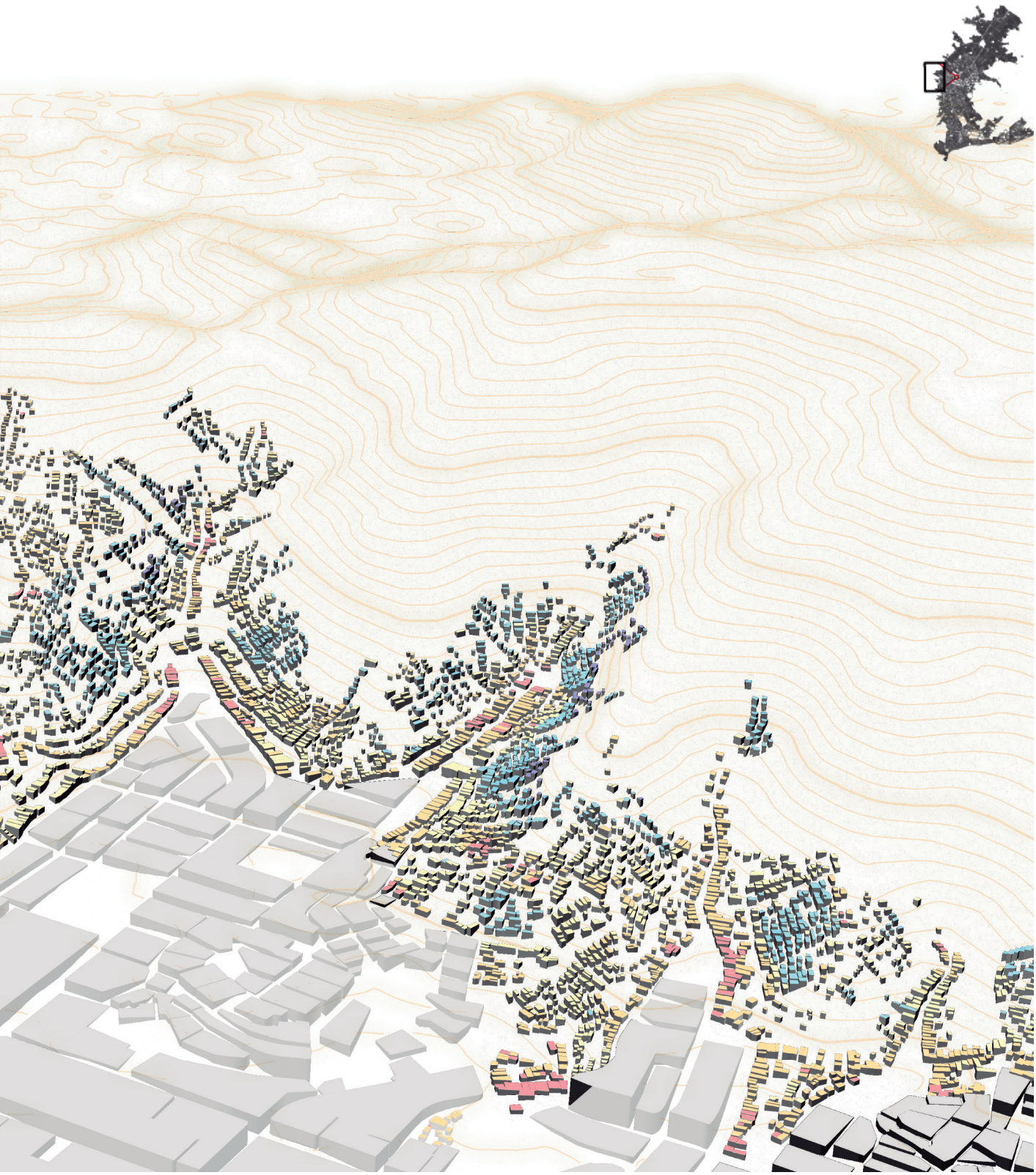


Figure 56 *Area 3 (SJL) - Perspective - Own elaboration*

AREA 4

The settlements of Huascar III and Huascar XV are located here. The Huascar settlement was one of the first informal settlements of the SJL district. The 1984 map already showed a consolidated state of the neighborhood, one where all the available flat land was occupied during this year. Historical maps, at least until the year 2000, showed a process of consolidation within the same edges of the preceding 1984 development. This may explain the high level of density per block that was achieved in this neighborhood (Figure 43). The Slope Map shows that there is only a small amount of available land for new informal development with slopes of less than 45%. By rapidly completing the flat urban construction area, the informal hillside development has also obtained a higher density. This area also has good accessibility in relation to transport routes and the walking time to reach transportation routes is, likewise, less than 20 min. A small group of settlements is being generated at the top of the mountain, which aims to connect the other side of the western mountains with a different district.

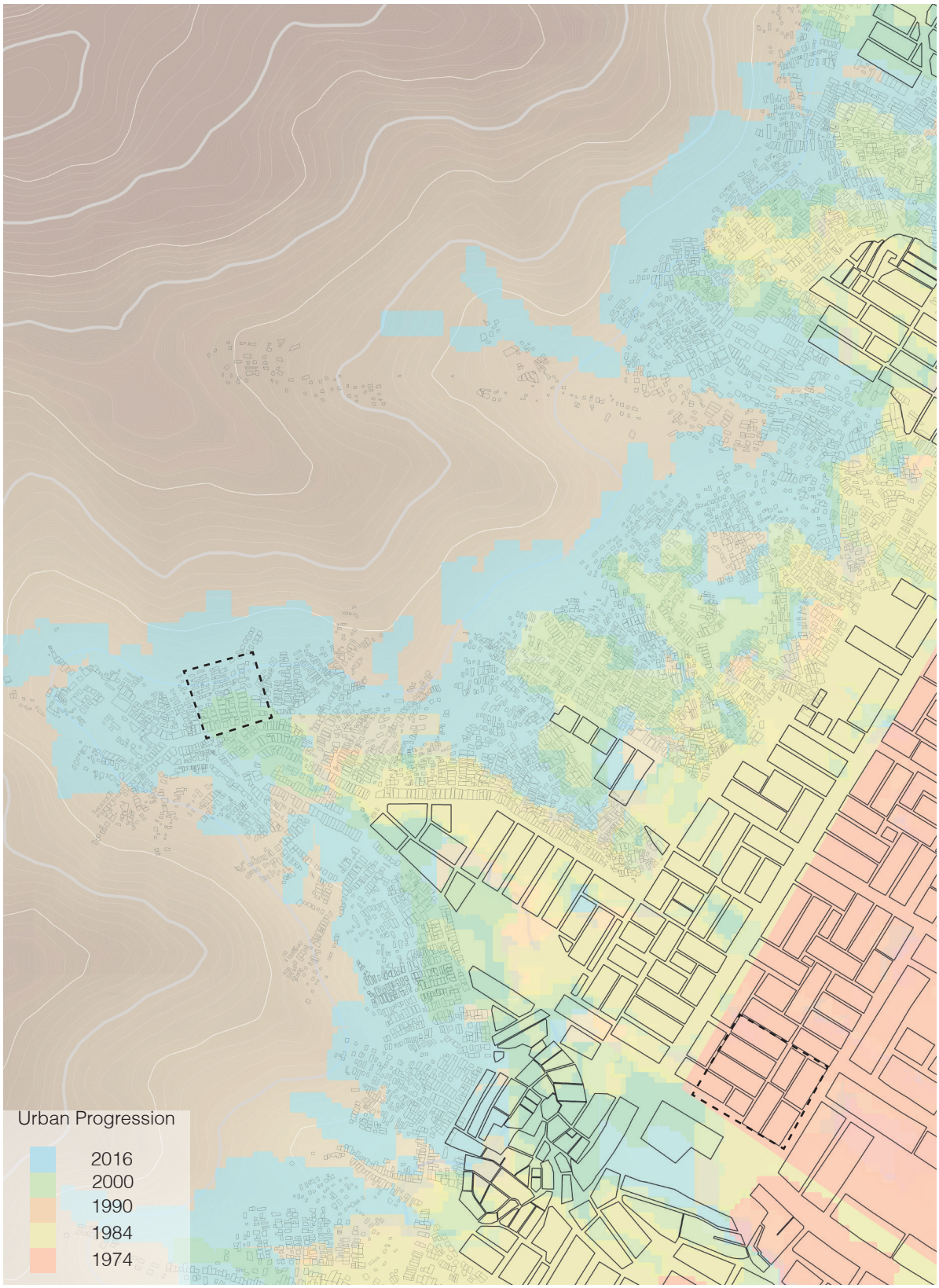


Figure 57 *Area 3 (SJL) - Informal Urban Progression - Own elaboration*

Axo 1
200 m
100 m
50 m
0 m
N

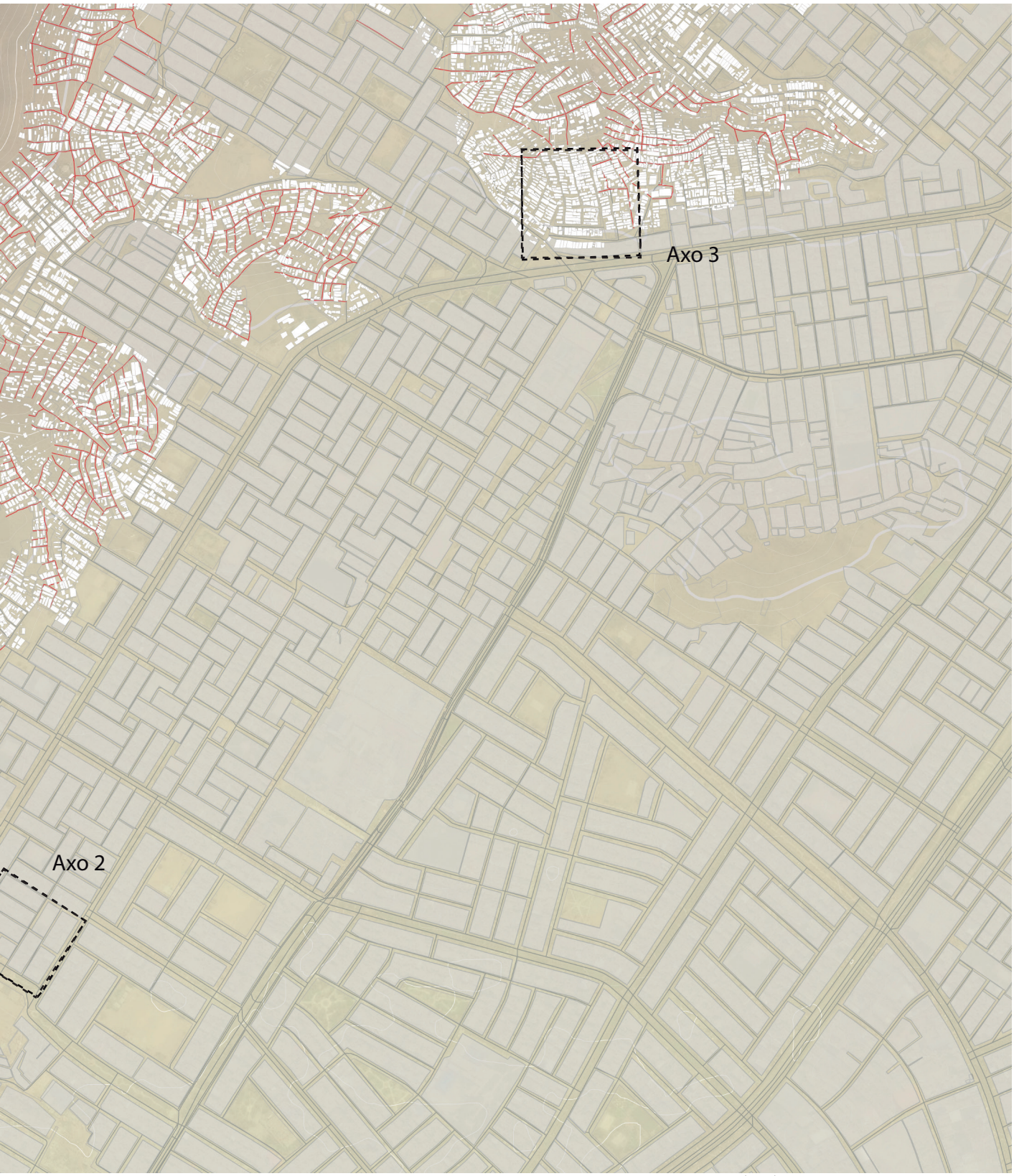
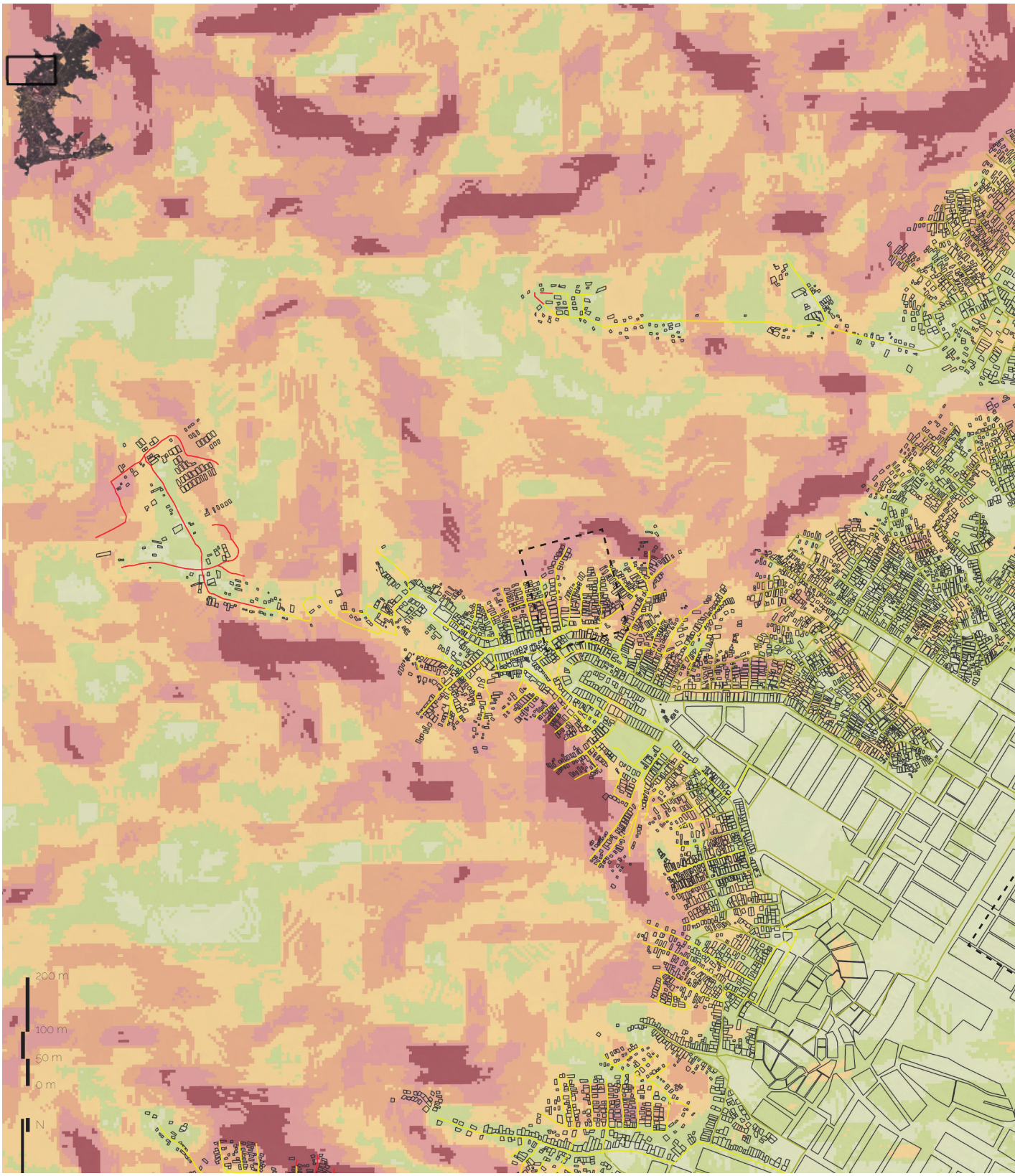


Figure 58 *Area 4 (SJL) - Base Map - Own elaboration*


200 m
100 m
50 m
0 m
N

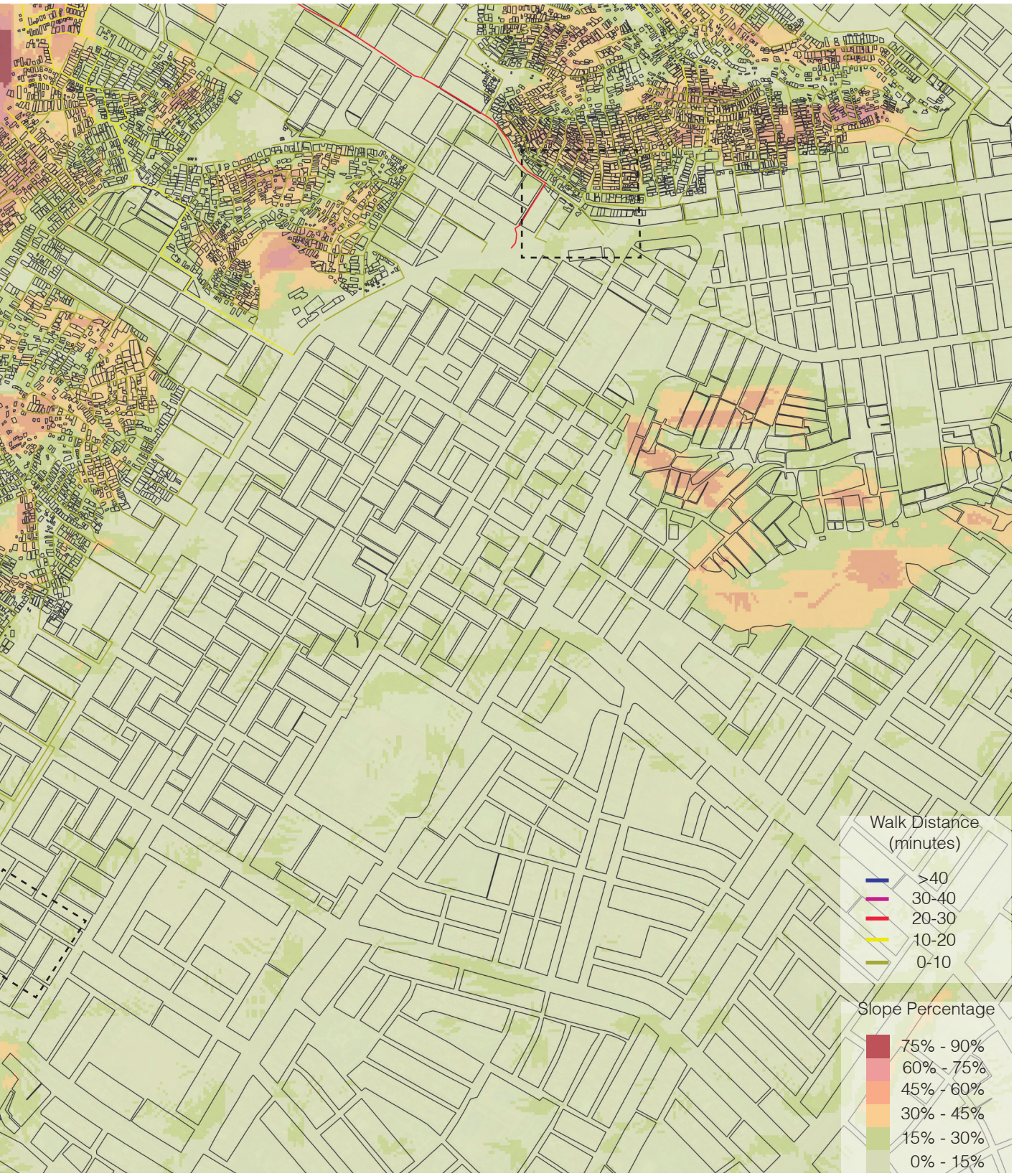


Figure 59 *Area 4 (SJL) - Slope terrain map and Walk diistance map to bus stops - Own elaboration*

Low Density - Steep Topography

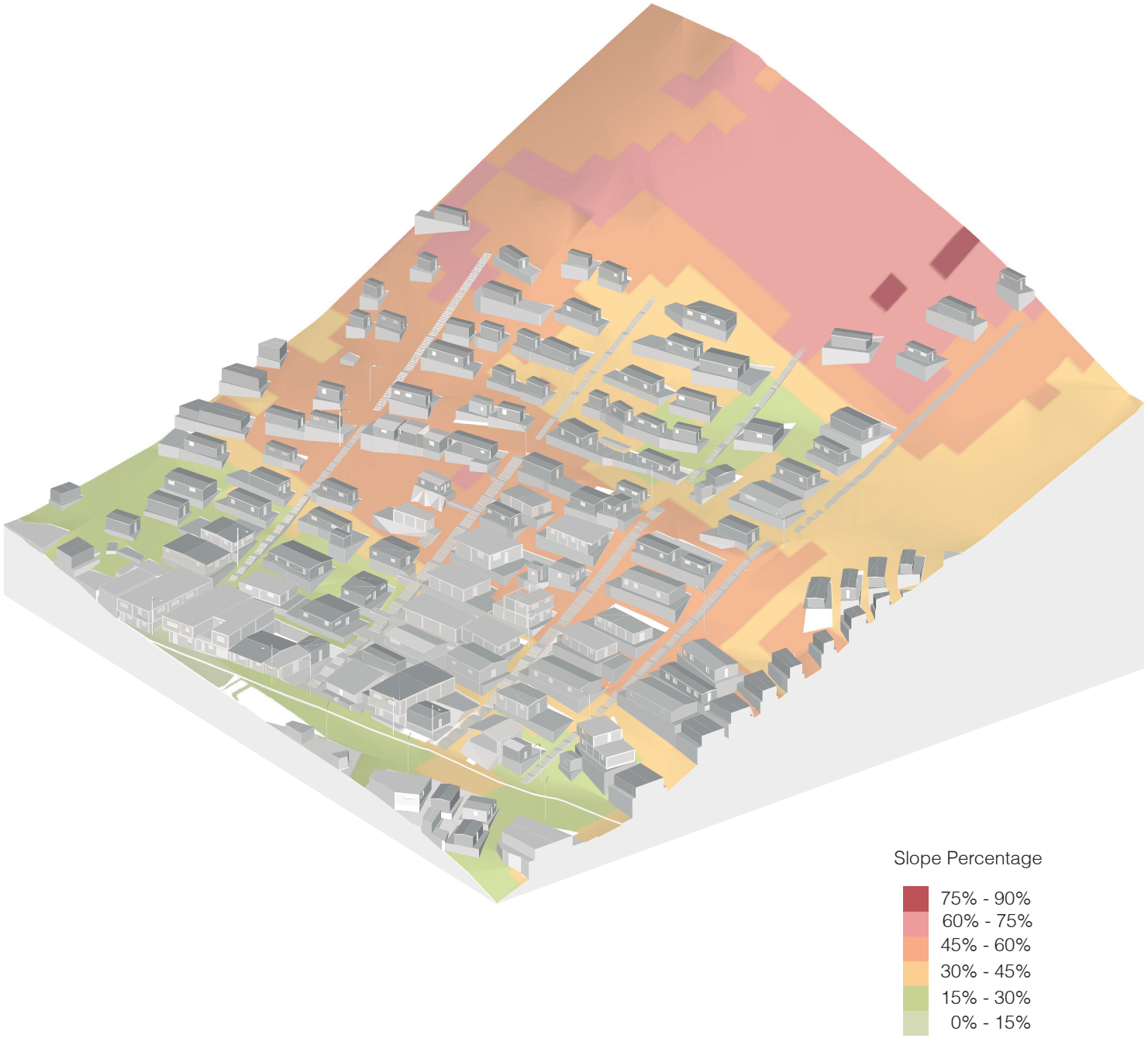


Figure 60 *Axo 1 - SJL - Huascar- Informal Typology Steep Terrain-Low Density*

San Juan Lurigancho

High Density - Flat Terrain

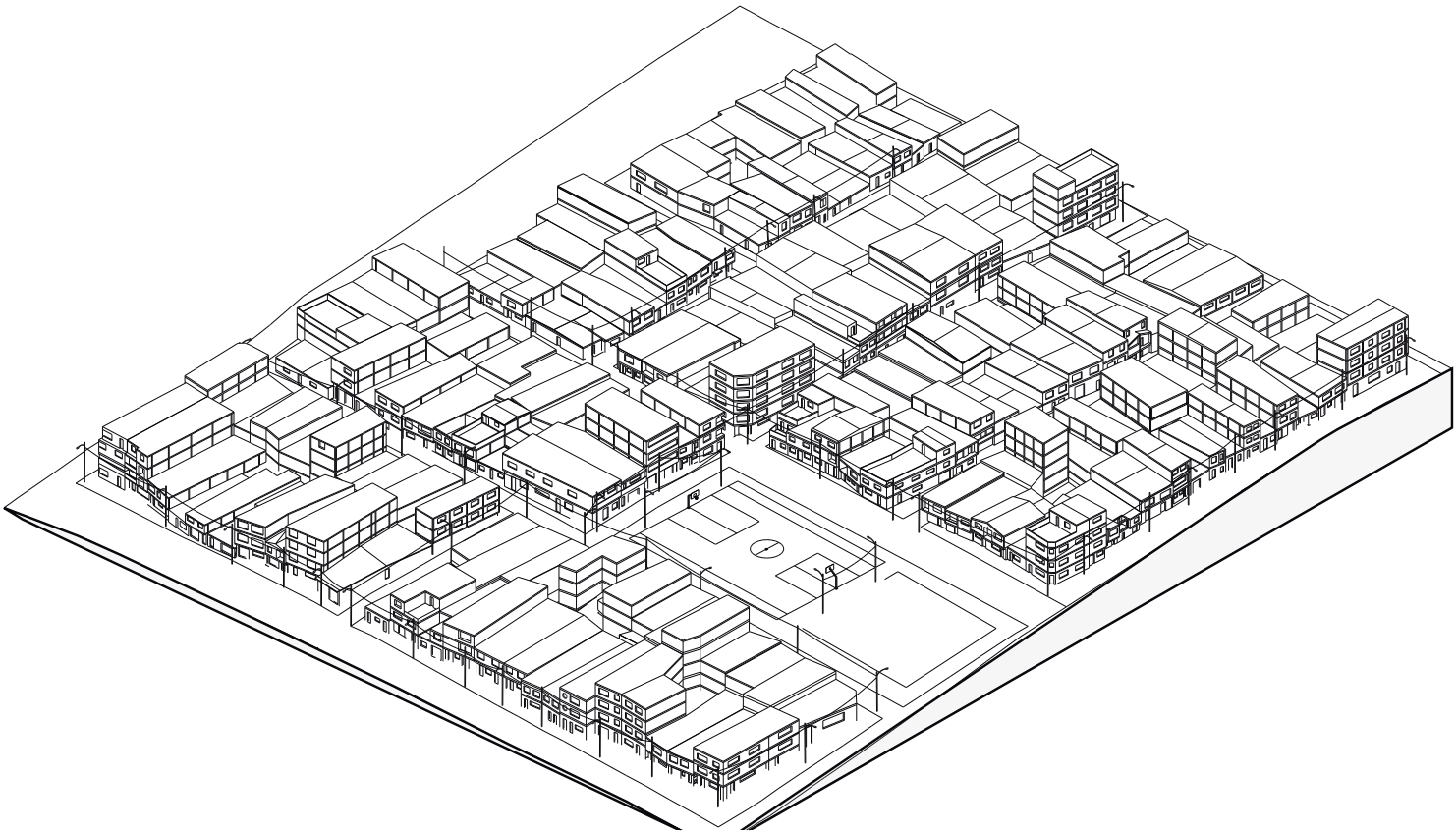


Figure 61 *Axo 2 - SJL - Huascar- Informal Typology Flat Terrain-High Density*

High Density - Steep Topography

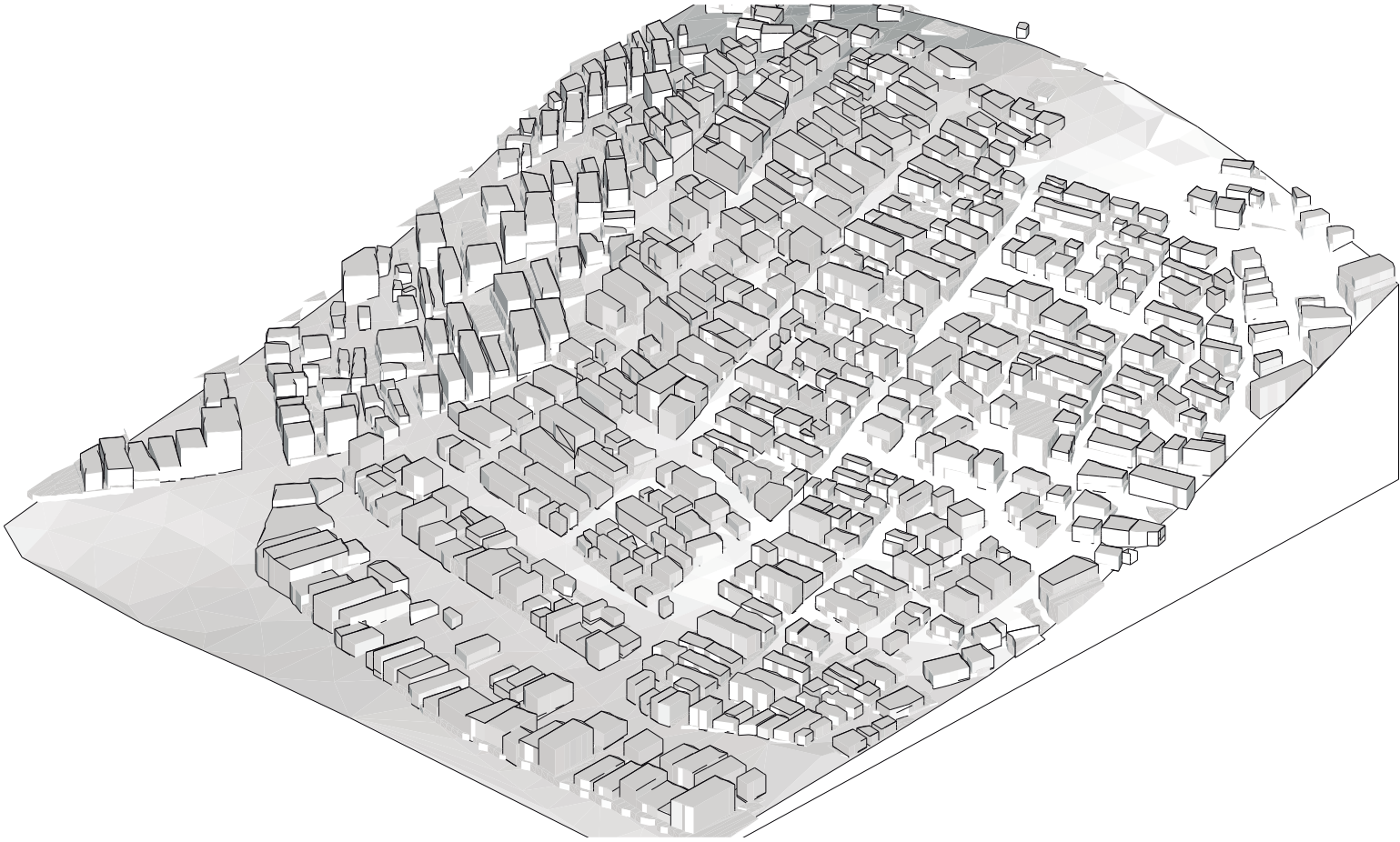
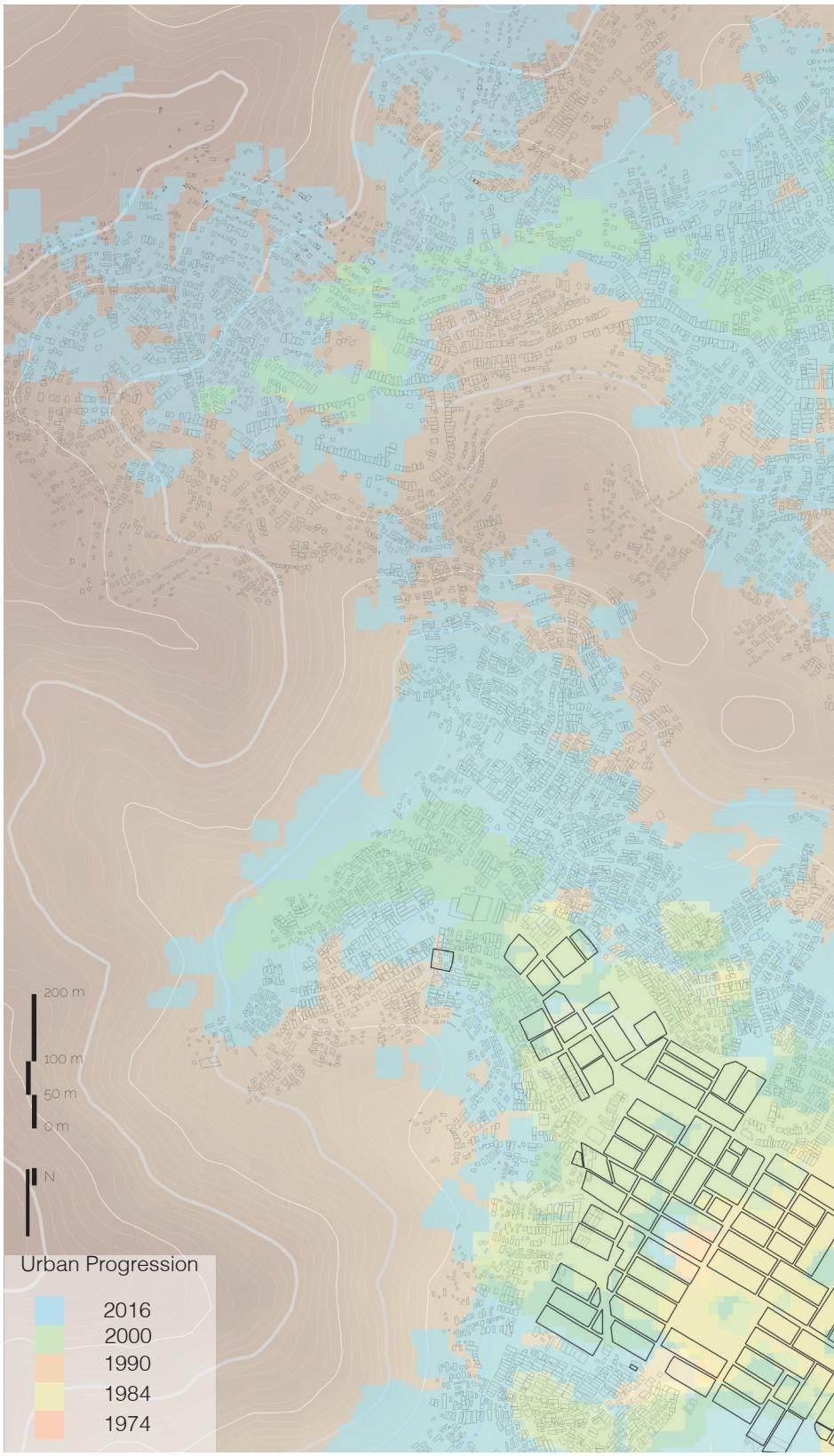


Figure 62 *Axo 3 - SJL - Huascar- Informal Typology Steep Terrain- High Density*

AREA 5

In this area, we can identify the settlements of Bayovar, Juan Pablo II and 10 Octubre. According to the historical maps analyzed, this area began to develop from the year 1990 and this is the third stage of its development. Based on the historical information, it is possible to deduce that a large part of the development occurred within the district in the decade following 1990. This was the result of a massive movement of immigrants who settled on the edge of the western hillside of the district. The 1990 map shows that they had initially settled in flat areas, but after 2000 there was an expansion towards the mountains. The area faces accessibility issue regarding its access to public transport. Some informal assemblies require more than 40 min of walking before reaching the bus lines. This outcome is a consequence of the slope on which the settlements were located and it is also affected by the quality of the existing transport routes.



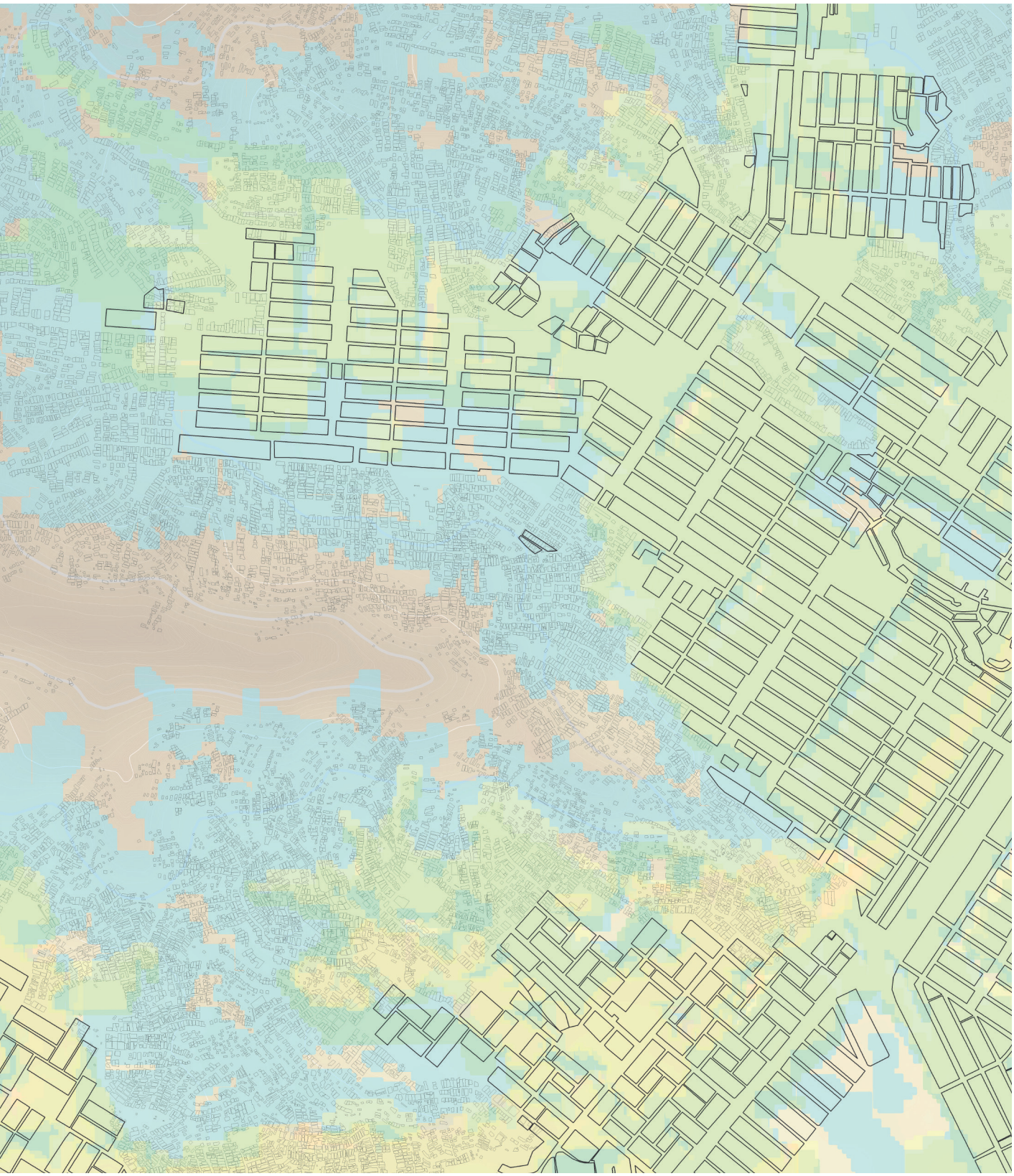
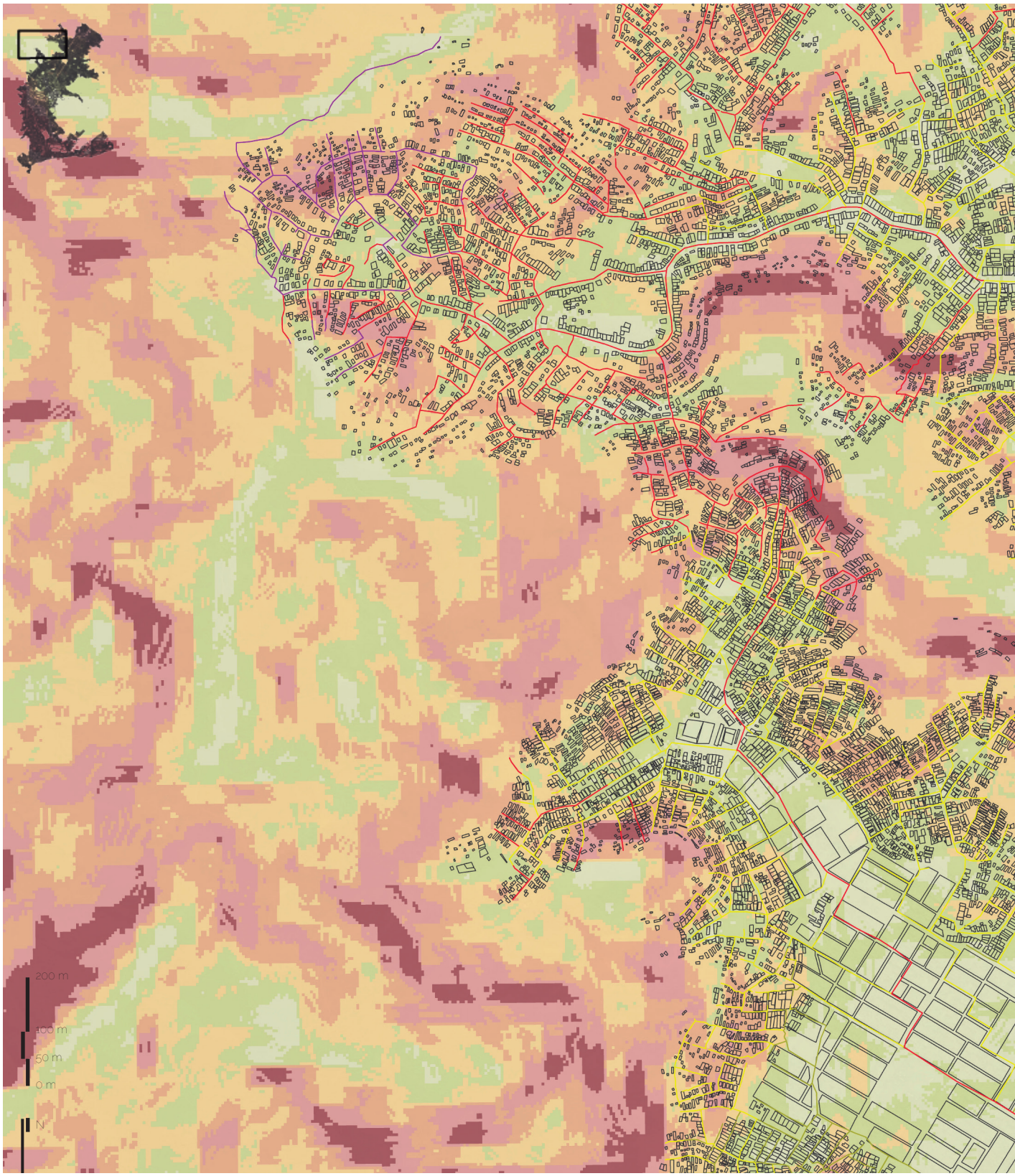


Figure 63 *Area 5 (SJL) - Informal Urban Progression - Own elaboration*

200 m
100 m
50 m
0 m
N

Figure 64 *Area 5 (SJL) - Base Map - Own elaboration*


200 m
100 m
50 m
0 m
N

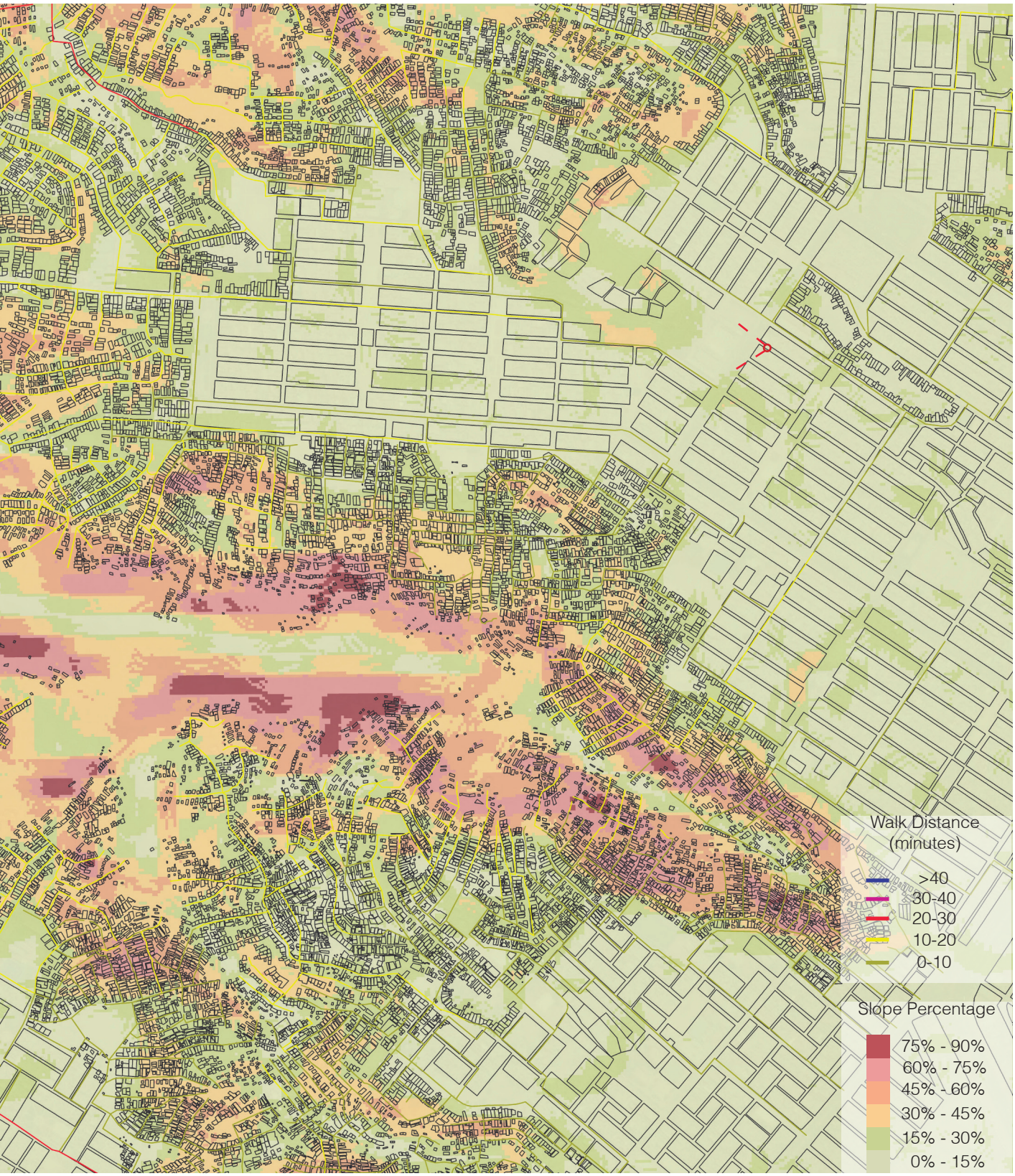
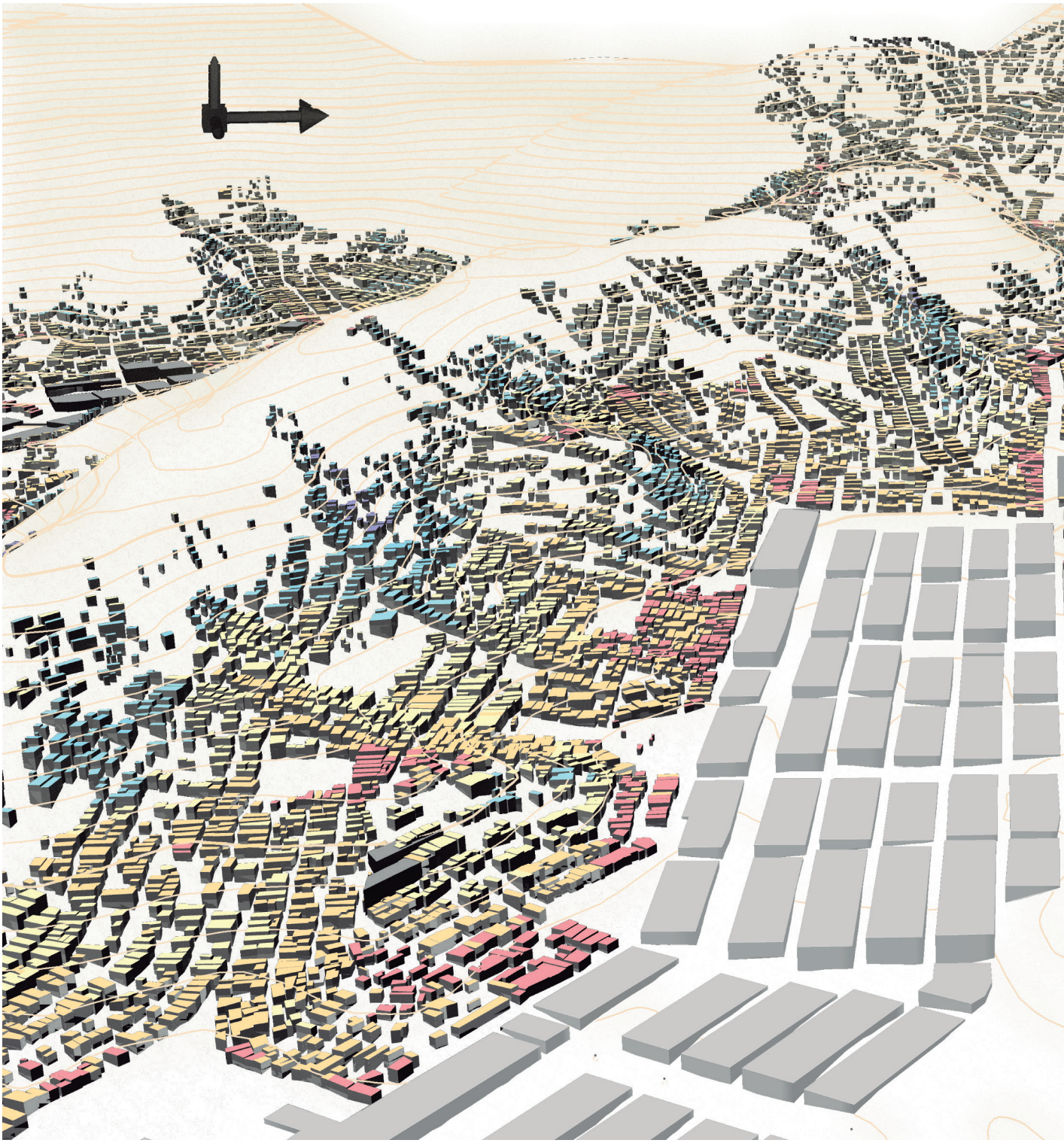


Figure 65 *Area 5 (SJL) - Slope terrain map and Walk diistance map to bus stops - Own elaboration*



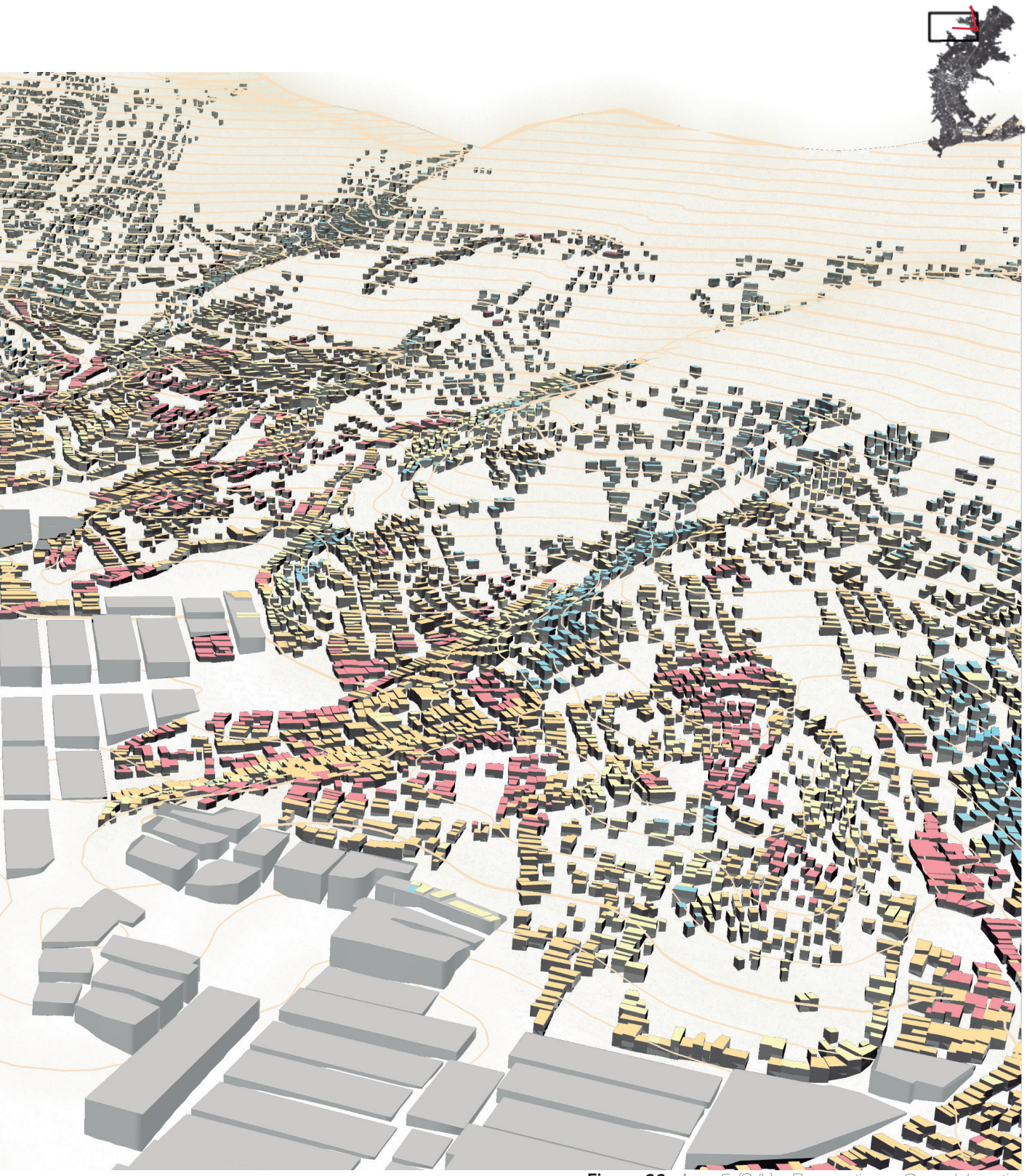
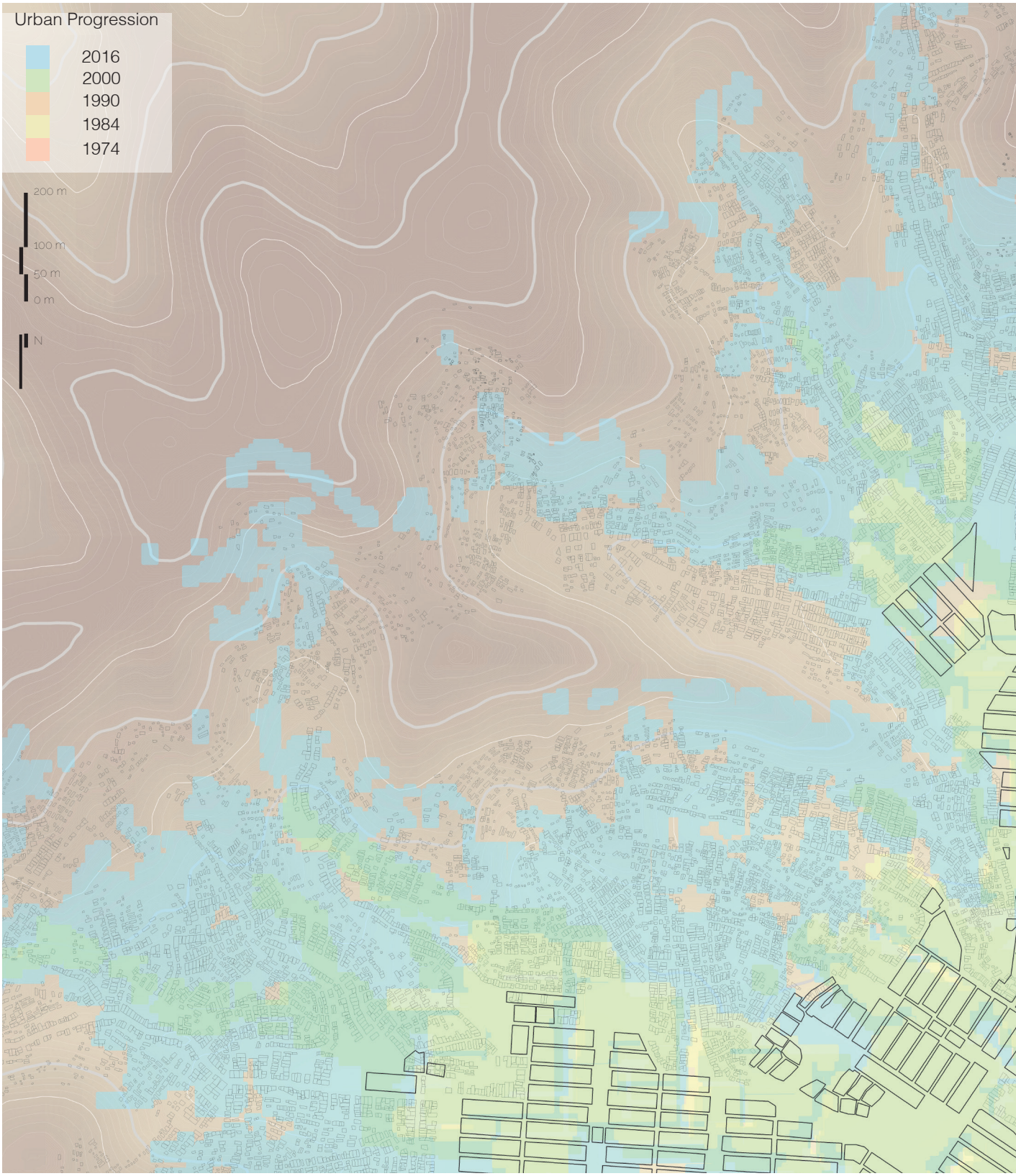


Figure 66 *Area 5 (SJL) - Perspective - Own elaboration*


Urban Progression
2016
2000
1990
1984
1974
200 m
100 m
50 m
0 m
N

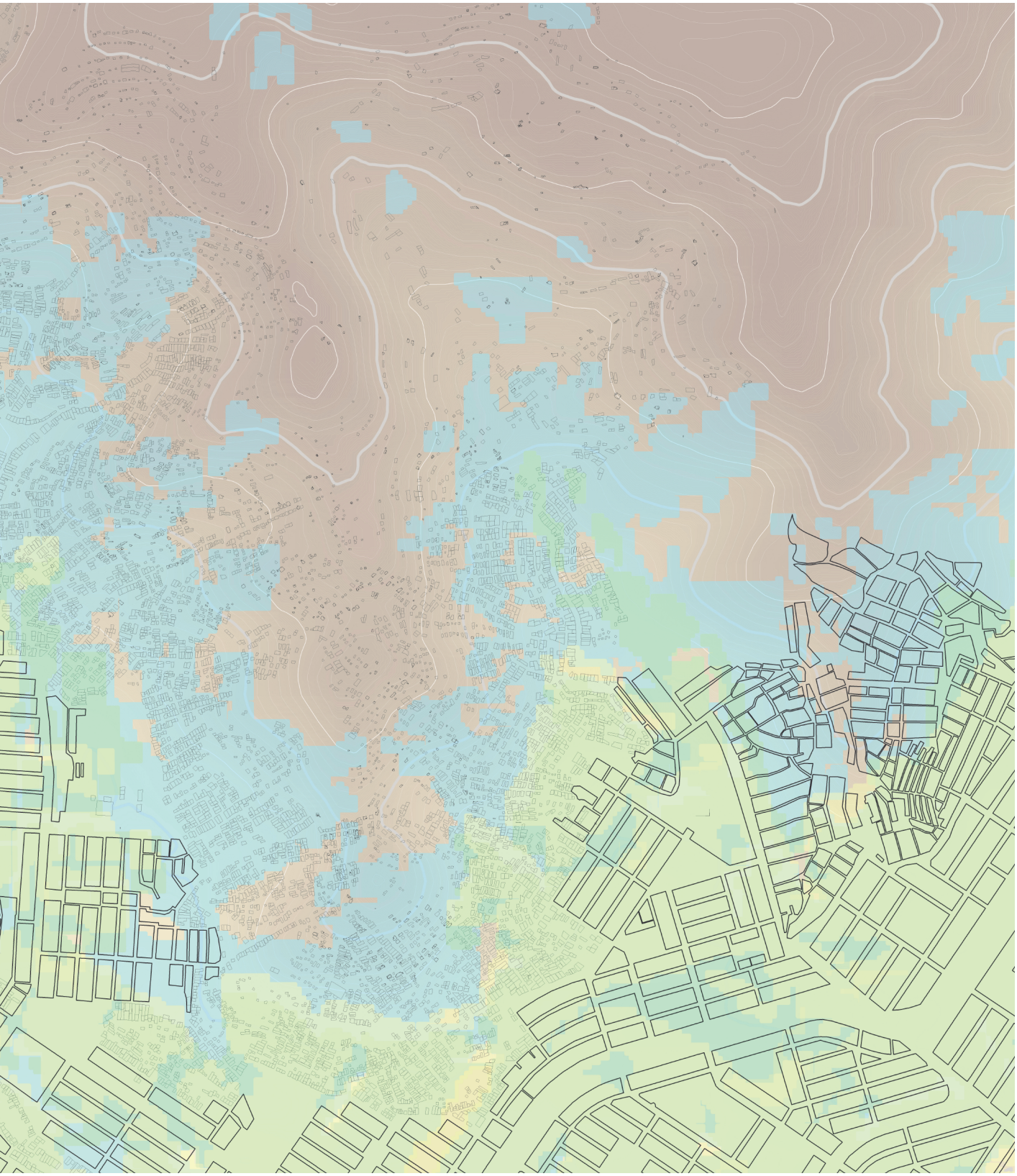


Figure 67 *Area 6 (SJL) - Informal Urban Progression - Own elaboration*

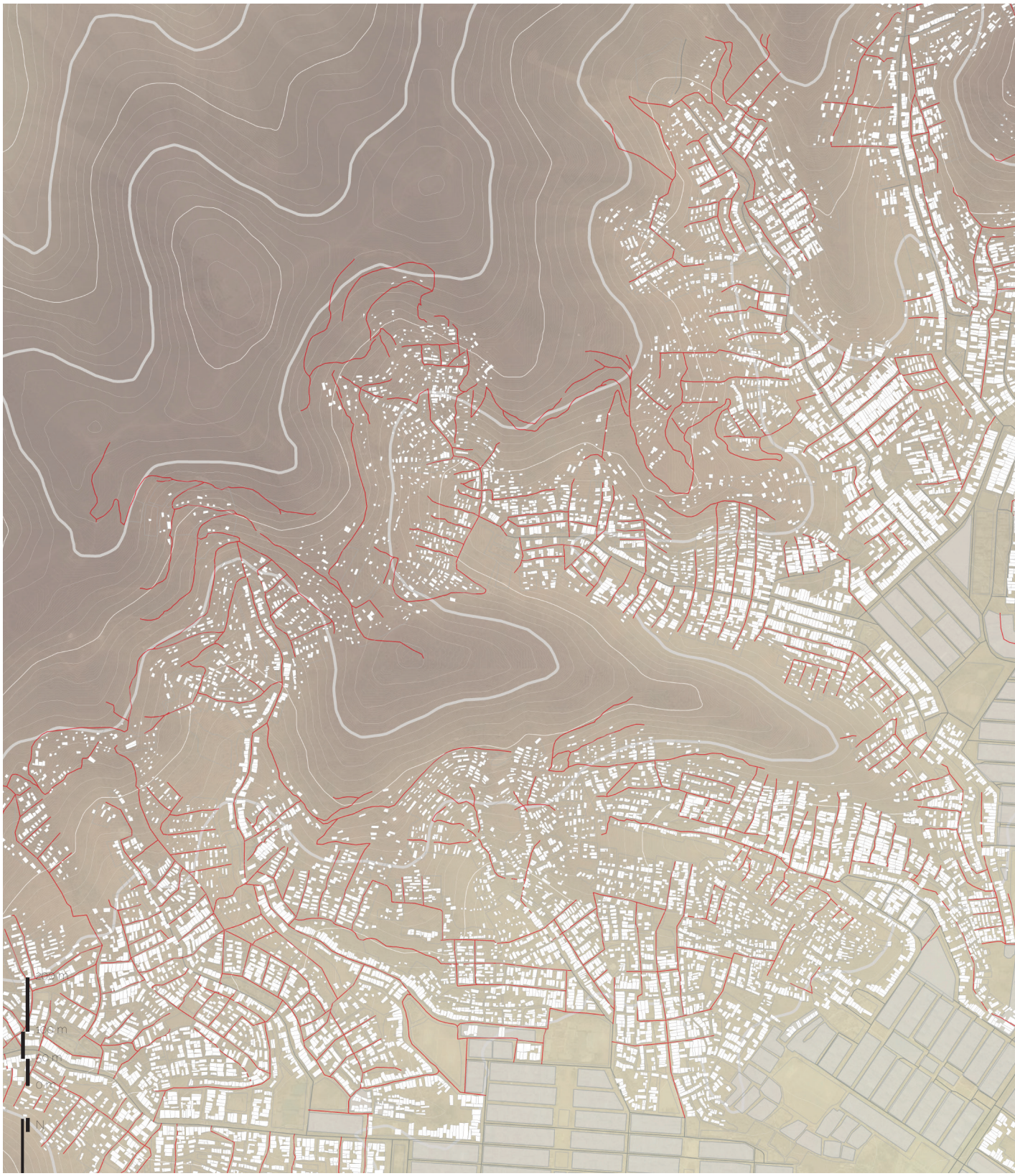
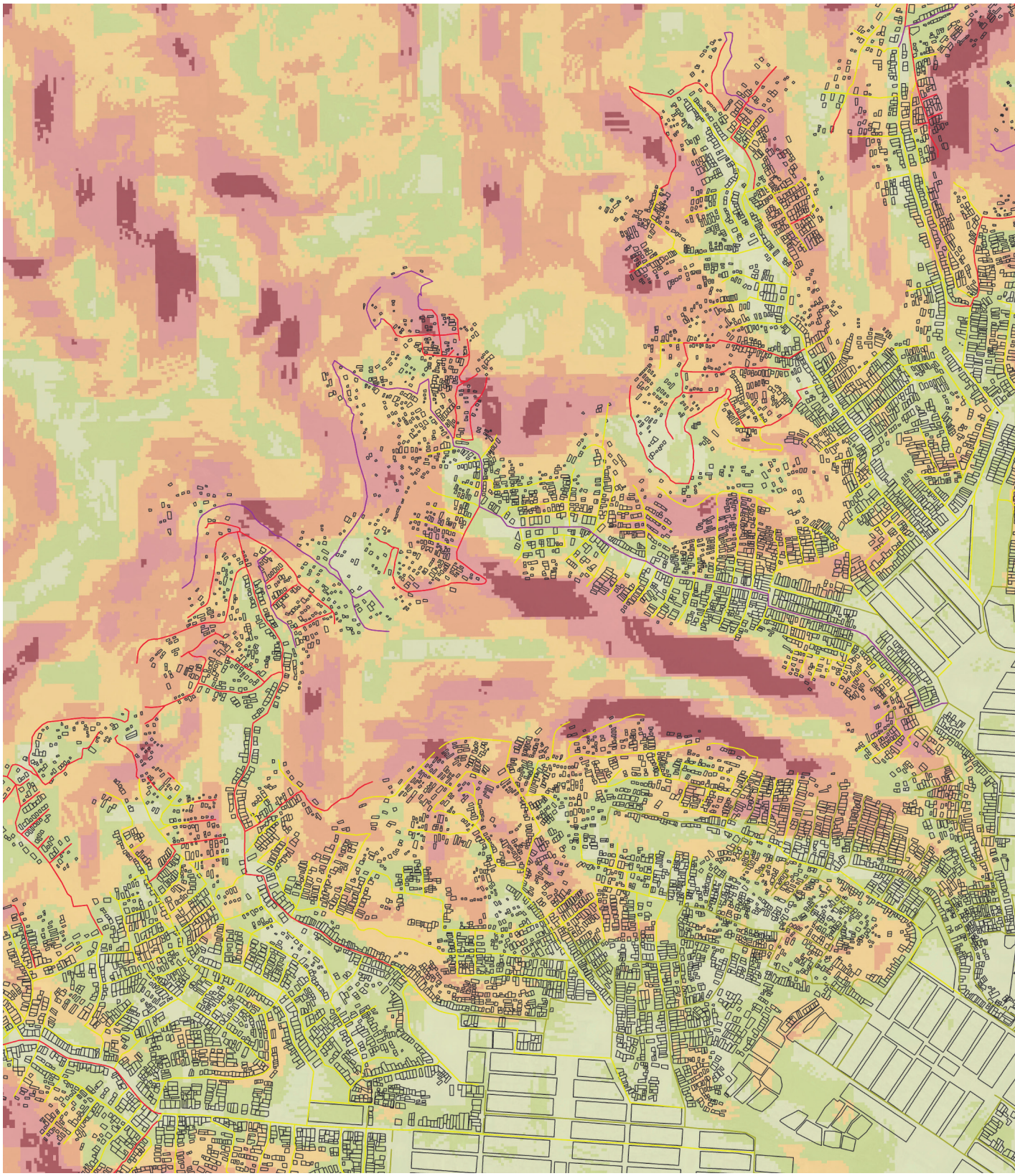

250 m
100 m
50 m
0 m
N

Figure 68 *Area 6 (SJL) - Base Map - Own elaboration*



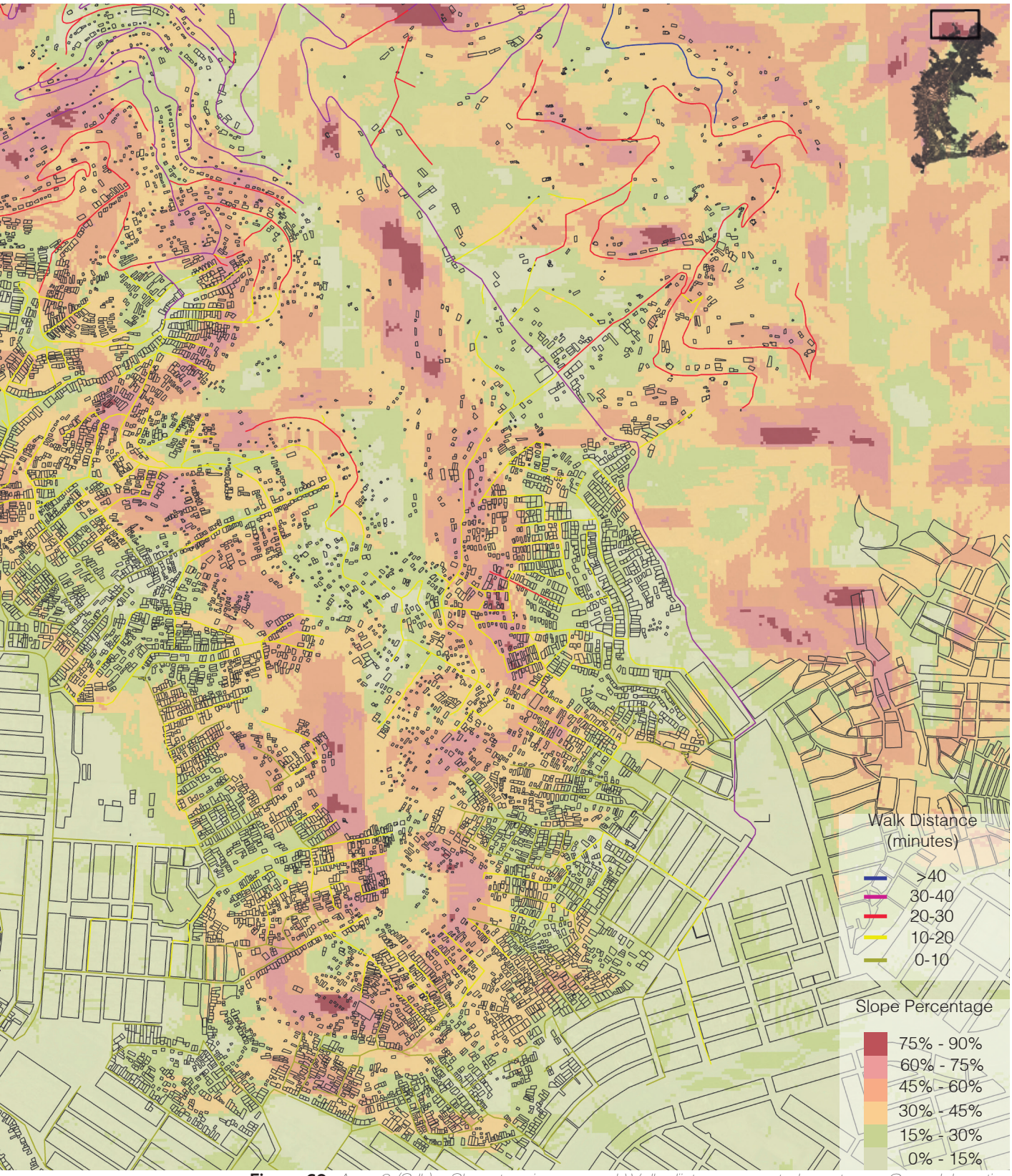


Figure 69 *Area 6 (SJL) - Slope terrain map and Walk diistance map to bus stops - Own elaboration*

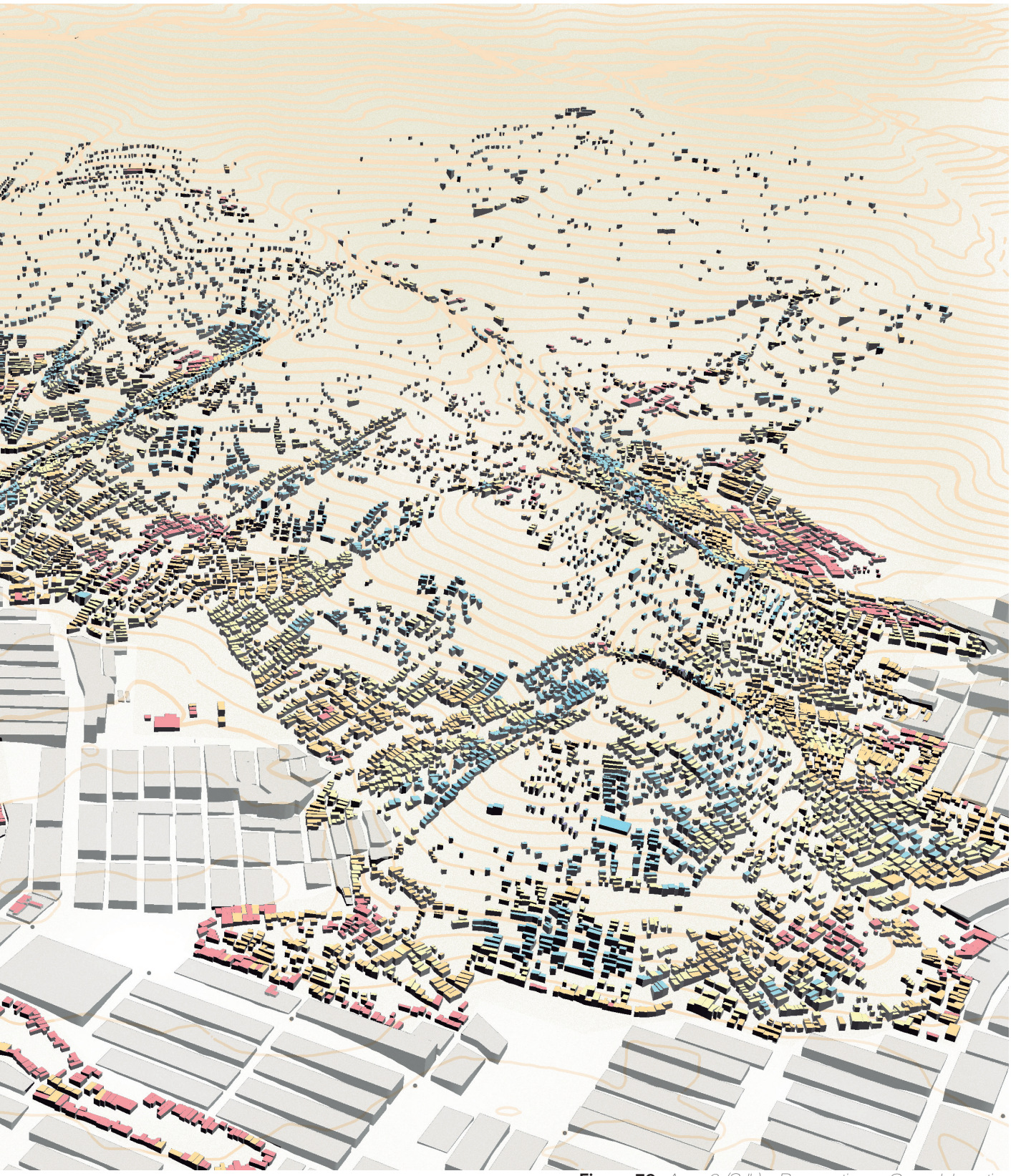


Figure 70 *Area 6 (SJL) - Perspective - Own elaboration*

An Scenario for future informal settlements in SJL

The agent-based model is used to show the next area of possible informal development based on the patterns collected through the analysis. The location of these possible attraction points is based on the spatial and territorial analysis identifying points and areas that have natural conditions for informal development. This analysis is conducted ignoring further government intervention and restrictions to invade this territory. To develop this analysis, the agents have been defined in the existing informal and formal street network and keeping this in mind, new areas of informal development have been sought. The undeveloped areas that have a slope higher than 50% have been defined as repulsion points and the areas with a slope minor than 30% close to the existing streets networks have been considered an attraction point. The accumulation of agents in certain points generate a center or a place that will indicate a possible area for future informal development.

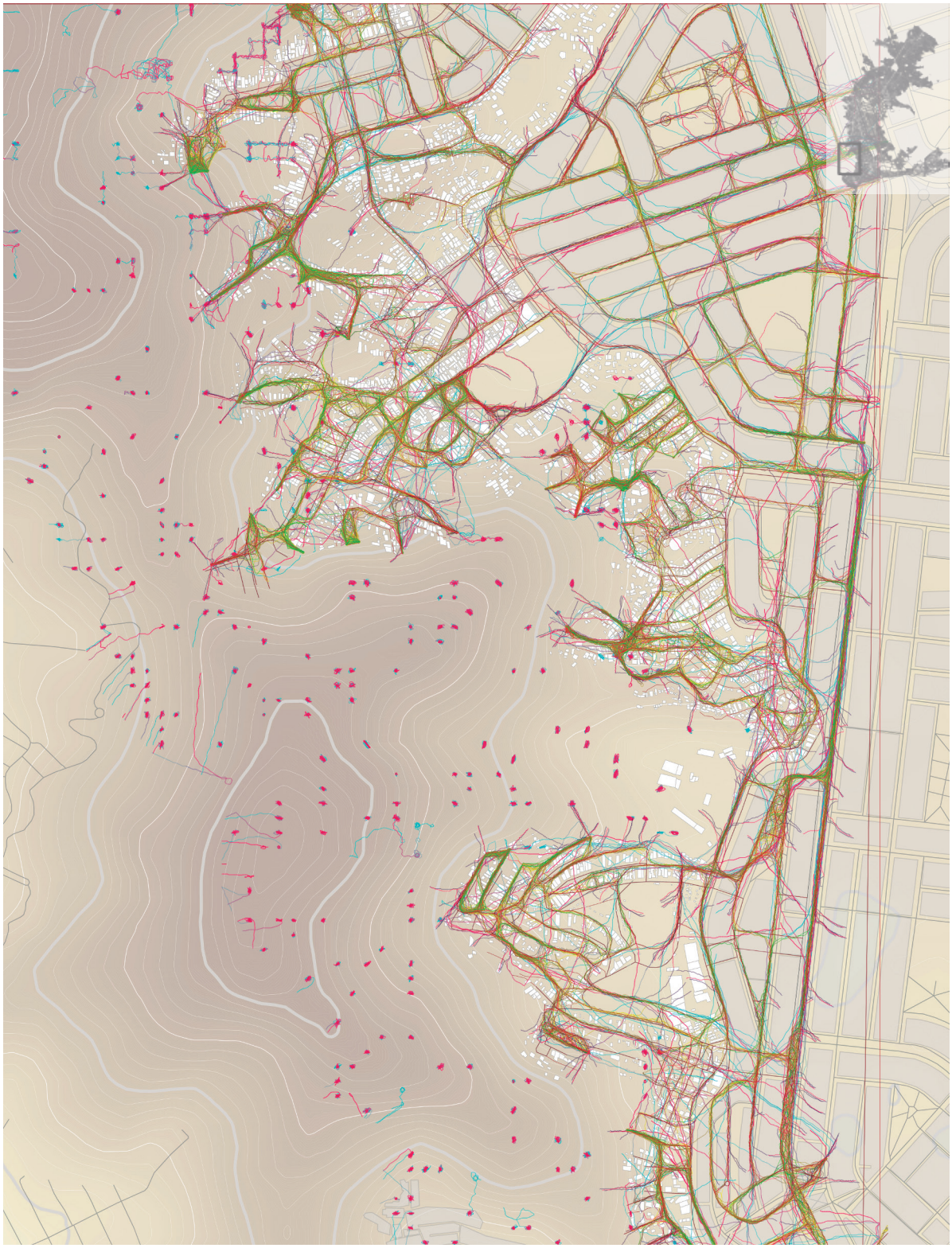


Figure 71 *Area 1 - West Border SJL- Agent Base Model analysis - Own elaboration*

Figure 72 *Area 2 - West Border SJL- Agent Base Model analysis - Own elaboration*

Figure 73 *Area 3 - West Border SJL- Agent Base Model analysis - Own elaboration*

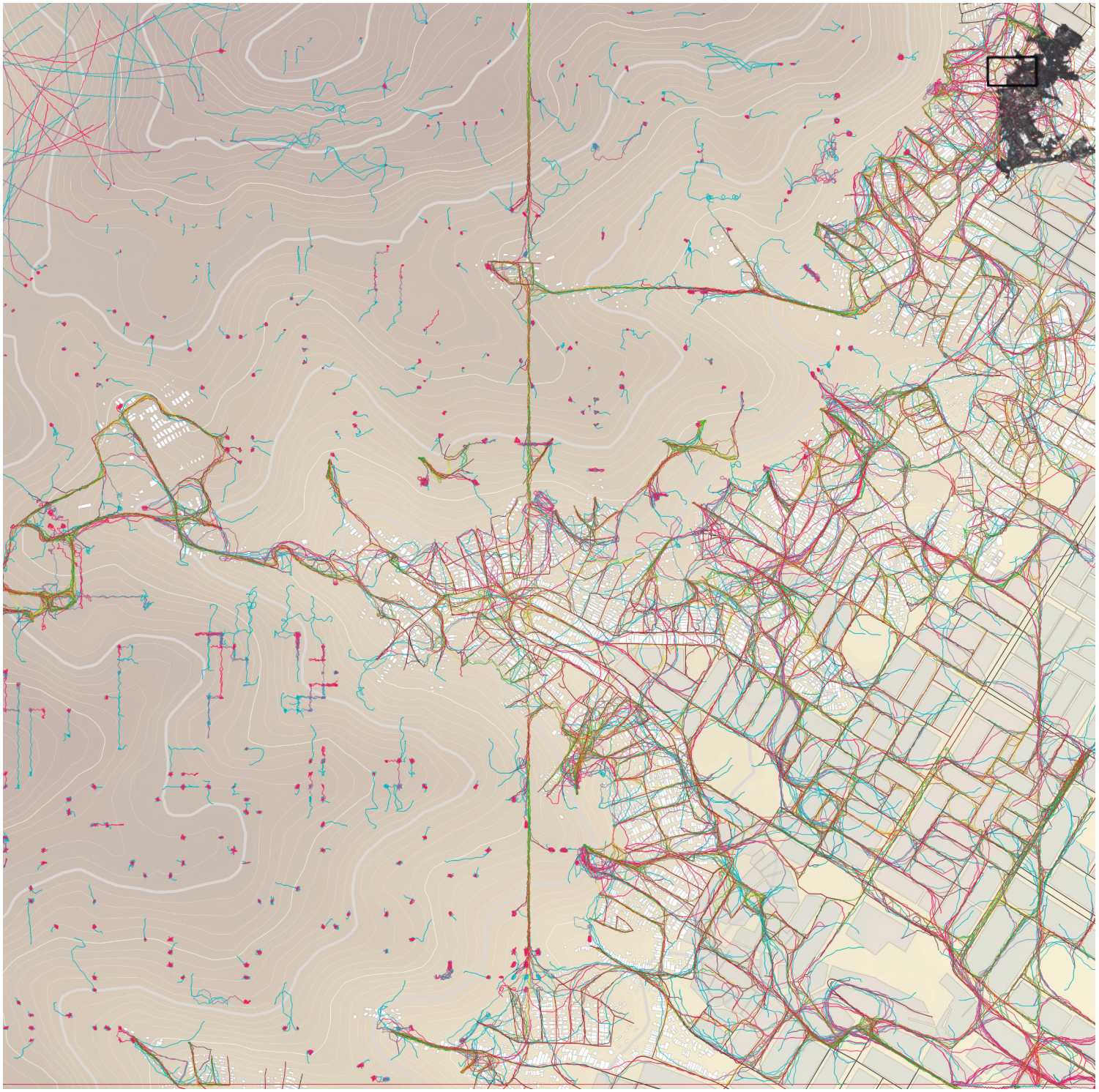


Figure 74 *Area 4 - West Border SJL- Agent Base Model analysis - Own elaboration*

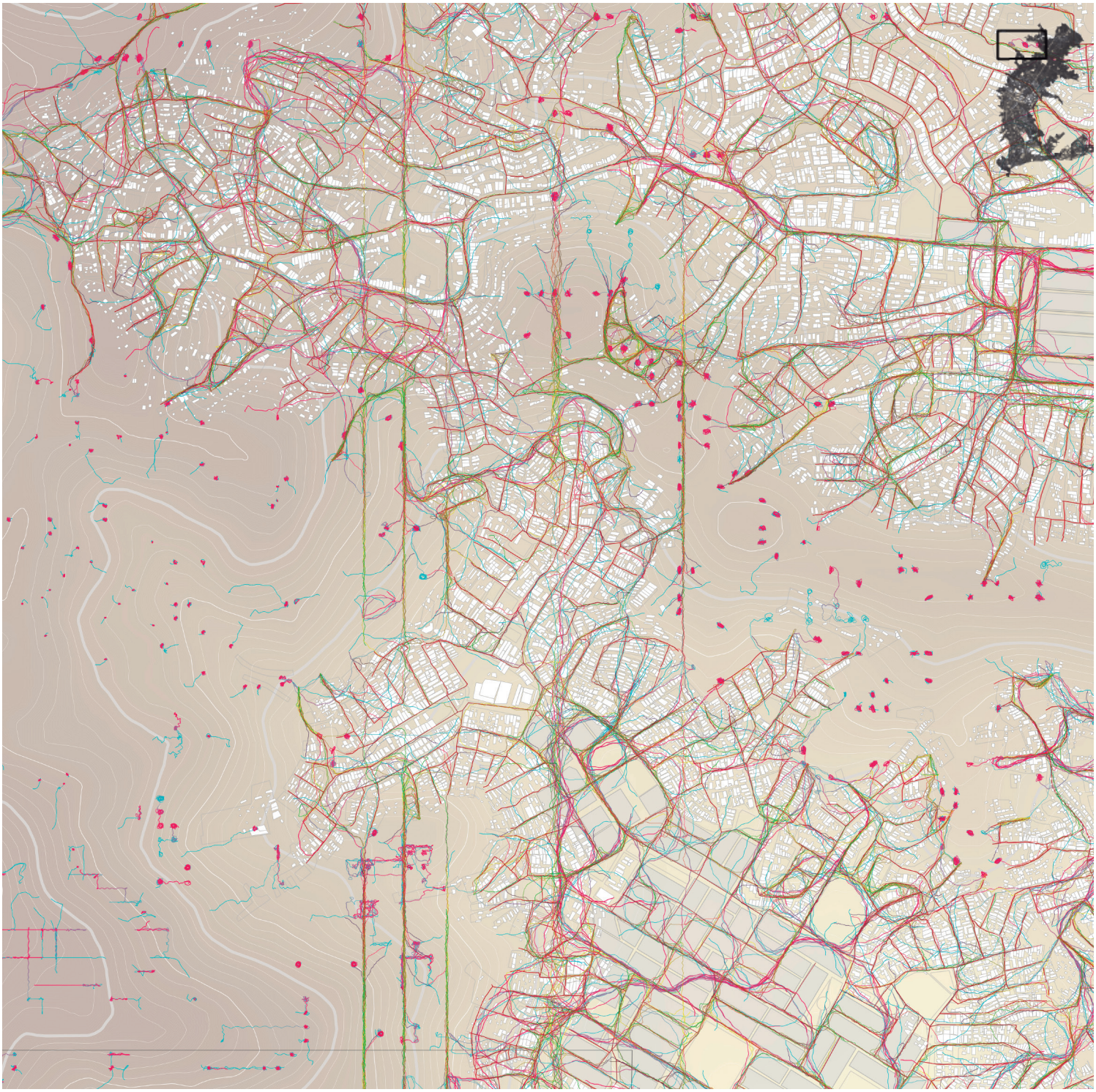


Figure 75 *Area 5 - West Border SJL- Agent Base Model analysis - Own elaboration*

Figure 76 *Area 6 - West Border SJL- Agent Base Model analysis - Own elaboration*

Conclusion Chapter 1

Concerning the urban structure of the informal settlements of SJL, the regular or orthogonal urban blocks are primarily located in the flat areas of the district where there is a slope value ranging from 0 to 15%. As the topography starts to rise, a different and informal urban block emerges, where buildings and streets form a new urban informal structure. The principal routes of the settlement throughout the mountain are located in parallel to its perimeter lines and they are normally coinciding with vehicular streets. Nevertheless, secondary streets, paths, or stairs are found in a position that is perpendicular to the contour lines of the terrain, and therefore this system makes it difficult for cars to access the area due to the steep slope of the streets. At the same time, this state of affairs benefits the construction of housing units by reducing the need for excavating and building retaining walls. Instead, it is cheaper to build elevated foundations using rough materials (rocks, concrete or soil) and due to Lima's lack of rain these temporary and precarious foundations generally do not fail nor slide. These secondary streets were based on either previous formal streets or are derived from the principal streets located in a parallel position to the surrounding perimeter lines.

One of the first conclusions, which also provides a possible hypothesis regarding the future of Lima's informal settlements, is that the settlements located in flat areas may possibly reach high levels of densification while the settlements established on the hillside areas will have similar densification values despite their risky topographic conditions. According to the informal structures already built and relying on the analysis of the basic agent model, it can be assumed that there is potential for a consolidation process within the hillside's informal areas

If transportation services improve and thus they provide better acces-

sibility to the informal settlements located throughout the mountains of SJL, there may well be an increase in the informal constructions in these areas.

The rapid and massive urban growth seen inside the district can be explained due to the growing migration to Lima and because of the privileged location of this district in terms of its proximity to the economic and political center of the city. Concerning the post-Covid urban scenario, the key question will be whether it is possible for the traditional rural-urban migration patterns to change into urban-rural movements, because in that case these settlements will likely experience an entirely different and novel urban condition.

Even though the topography has become an important barrier to informal development within the district, in other parts of Lima such as Cerro San Cosme, there has been urbanization in spaces with slopes greater than 60. Depending on the pressure for urban land, the urban conditions of Cerro San Cosme may become greater or equal to those which have stopped the informal urbanization in the district with respect to the urbanization of San Juan Lurigancho. This space is located inside the center of the informal economic activities of Lima (La Victoria), which is why it has suffered a rapid process of urbanization.

It is possible to consider that, as it has already happened elsewhere, at some point the settlements on the two sides of the mountains will be connected and this would increase the possibilities of displacement between different points in the city and therefore this could increase the amount of informal development in these areas.

The agent model seeks to find immediate areas for informal development, following the established patterns that have been studied.

To the extent that there is a strong institutional presence preventing

and controlling the extension of informal settlement on the hillside, it is both possible and likely that the existing informal settlements will become consolidated and thereby prevents further construction on high risk areas. Nonetheless, the densification of these spaces will inevitably increase the values per m2 for these spaces, at least until the low-income inhabitants are relegated to the more vulnerable parts of the city.

At that moment, it will become clear that as long as the housing supply continues to rely on solutions based on the current market's terms, the urban popular sector will not solve its existing housing problems, since the supply itself is progressively contributing to marginalization.

Chapter 2: Medellin

The informal settlements of Medellin

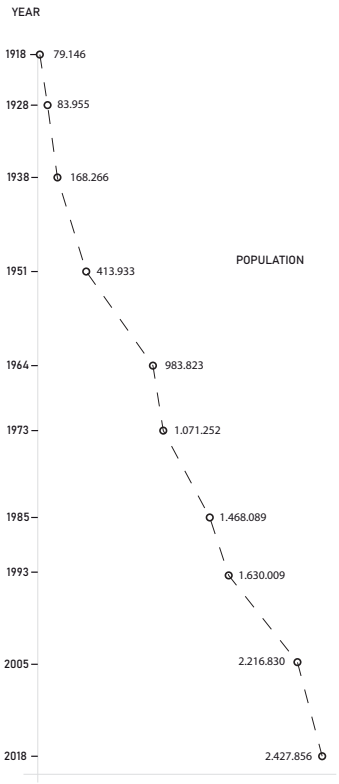


Figure 77 *Population Medellin (1918-2018)- Source information: DANE- Own elaboration*

Colombia is the second most populated country in South America, with 48.5 million inhabitants, approximately 77% of them live in urban areas[1]. One-third of total Colombia's population lives in three cities: Bogota, with 7.2 million inhabitants, Medellin with 2.4 million inhabitants and Cali with 2.2 million. Despite not being the capital city of Colombia, Medellin has been publicly recognized by its urban interventions and new ideas about informal urban development. The city of Medellin experienced constant population growth in the second half of the 20th century, mostly due to internal migrants that suffered forced displacement as a result of the internal Colombia's violent conflict.

The city of Medellin presents similar topography, demographics and urban conditions to the district of San Juan Lurigancho in Lima. As well as the district of SJL, the city of Medellin is located in a valley surrounded by mountains where commerce, market and employment centers are located in the flat land of the valley and the informal settlements are located in the steep topography. These similar conditions help to develop a more accurate comparative analysis between two cities that have a similar framework of conditions in a Latin American context. Besides, Medellin presents a more similar informal structure to the one presented in Lima, compared to Bogota, in which the informal structure has a different organization especially because the informal development in Bogota was not only mainly generated by invasion, but also by the market of illegal plots of land. In the case of Bogota, the illegal development aims to magnify the profit of the plot guarantee, in most of the cases, space for vehicular streets and have and a regulated urban structure, even though it is located in a steep topography[2]. This situation created a more orthogonal urban framework different from the one in Medellin and San Juan Lurigancho.

1"¿Dónde Estamos?". 2020. Dane.Gov.Co. https://www.dane.gov.co/index.php/estadisticas-por-tema/demografia-y-poblacion/censo-nacional-de-poblacion-y-vivenda-2018/donde-estamos.

2 Camargo Sierra, Angélica Patricia, and Adriana Hurtado Tarazona. 2013. "Urbanización Informal En Bogotá: Agentes Y Lógicas De Producción Del Espacio Urbano".

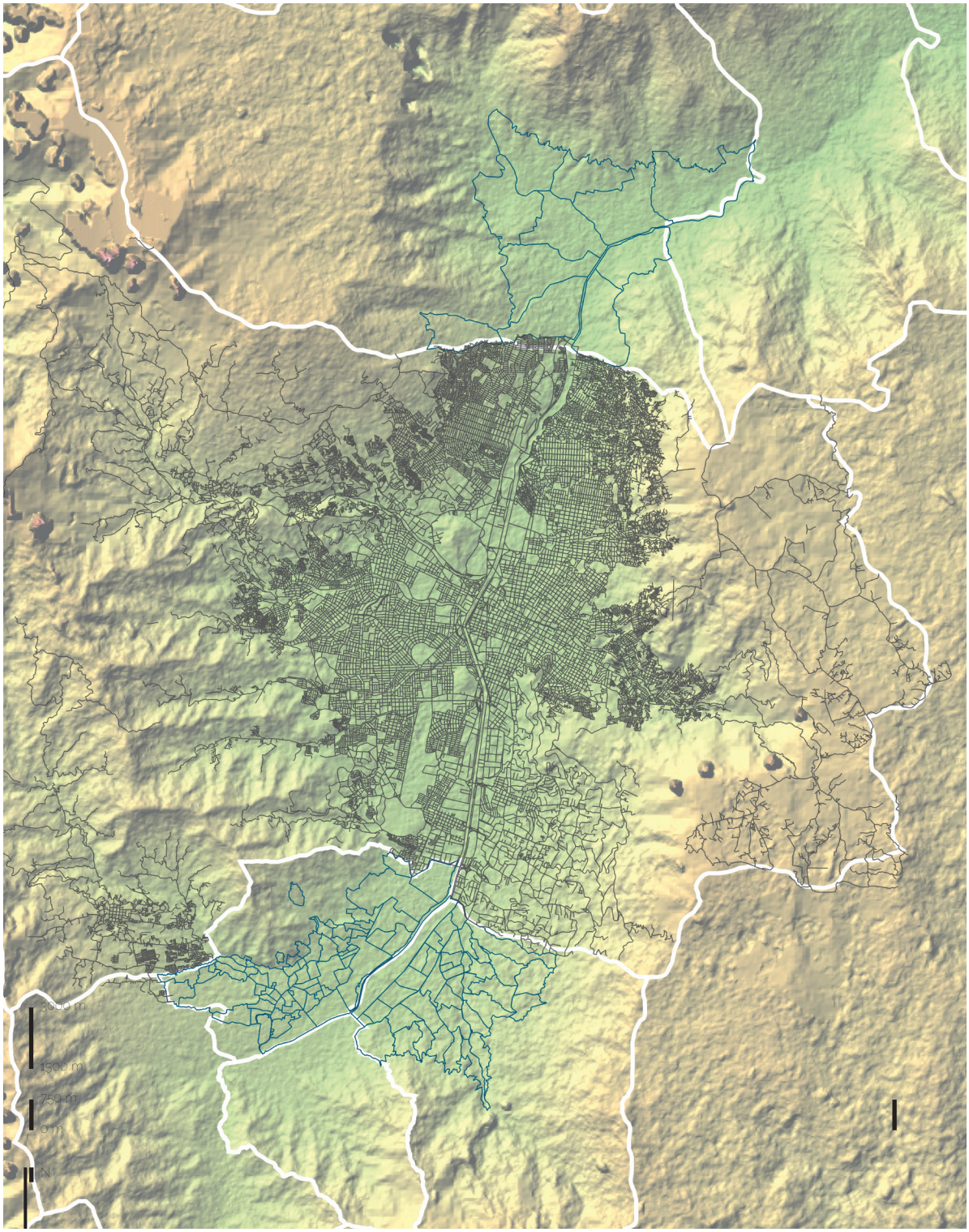


Figure 78 *Medellin Terriory and urban Border*

Figure 79 *Medellin -Urban Land occupation: 1944, 1979, 1999, 2019 Scale: 1.750.000*

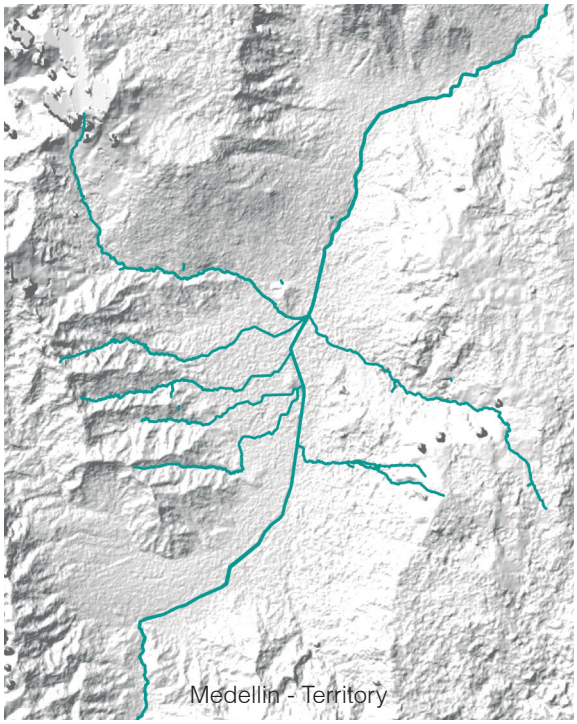


Figure 80 *Medellin -Territory. Scale1: 750.000*

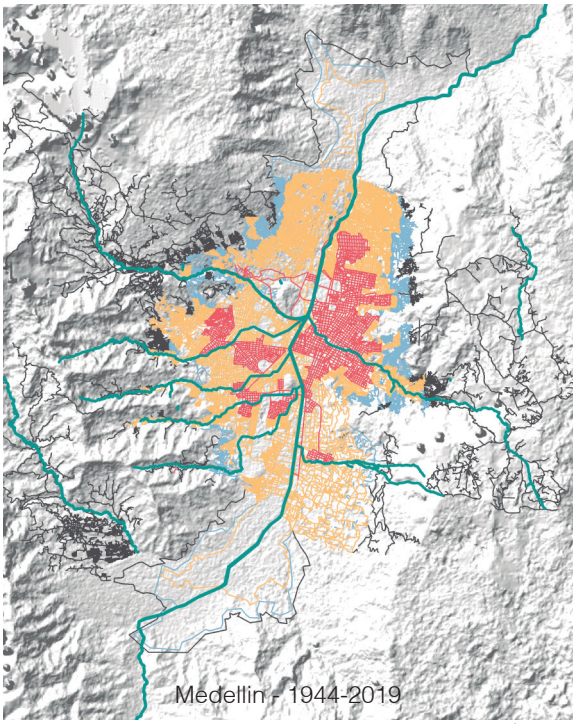


Figure 81 *Medellin-Urban Land occupation (1944-2019) Scale1: 750.000*

Brief history of Informal settlements in Medellin.

Informal settlements in Medellin may have been initiated before the decade of 1930 as housing settlements of rural migrants that were allocated in the city in precarious housing units (there is a record of foundations of informal settlements in Medellin from 1910 such as the Betania, Sucre and Ladera neighbourhoods (Gonzales,2009). (Figure 82). Despite these initial formations, the gradual growth of informal settlements in Medellin brought the economic and industrial development of the city in the decade of 1930[3].This new economic growth of the city motivated migrations of rural peasants that came to fulfill the demand of workers for the new industrial factories. The new industrial low-income workers and migrants started to be allocated in the hillside of the mountains of Medellin, mostly, because this area of the city was considered the periphery of the economic and political center of the city, therefore the most affordable land. From that time on, the city started to build a segregated urban structure where the wealthy were located in the valley and the south areas of the city while the poor were allocated in the hillside mountains of Medellin. Informal Settlements such as Castilla, Bermejal, Versalles, Enciso, Santa Rosa de Lima, Pesebre, and Soledad were built in this decade. The new urban population did not find appropriate urban and economic structures to be received in the city as Torres states "the exaggerate population growth was not absorbed by economic sectors, therefore there was an increase of informal circuits built by inhabitants that lived in the city periphery and the mountain hillside[4].

In the decade of 1950, the internal migration to Medellin increased due to forced displacement of farmers, produced by the internal violent conflict in the country. These internal migrants had to move to the principal cities of Colombia without economic support and they had no initial

3-Revista INVI 28 (78): 77-107. doi:10.4067/s0718-83582013000200003.
4-Carlos Torres, Ciudad Informal Colombiana: Barrios Construidos Por La Gente (Bogotá: Universidad Nacional de Colombia, 2017)126.

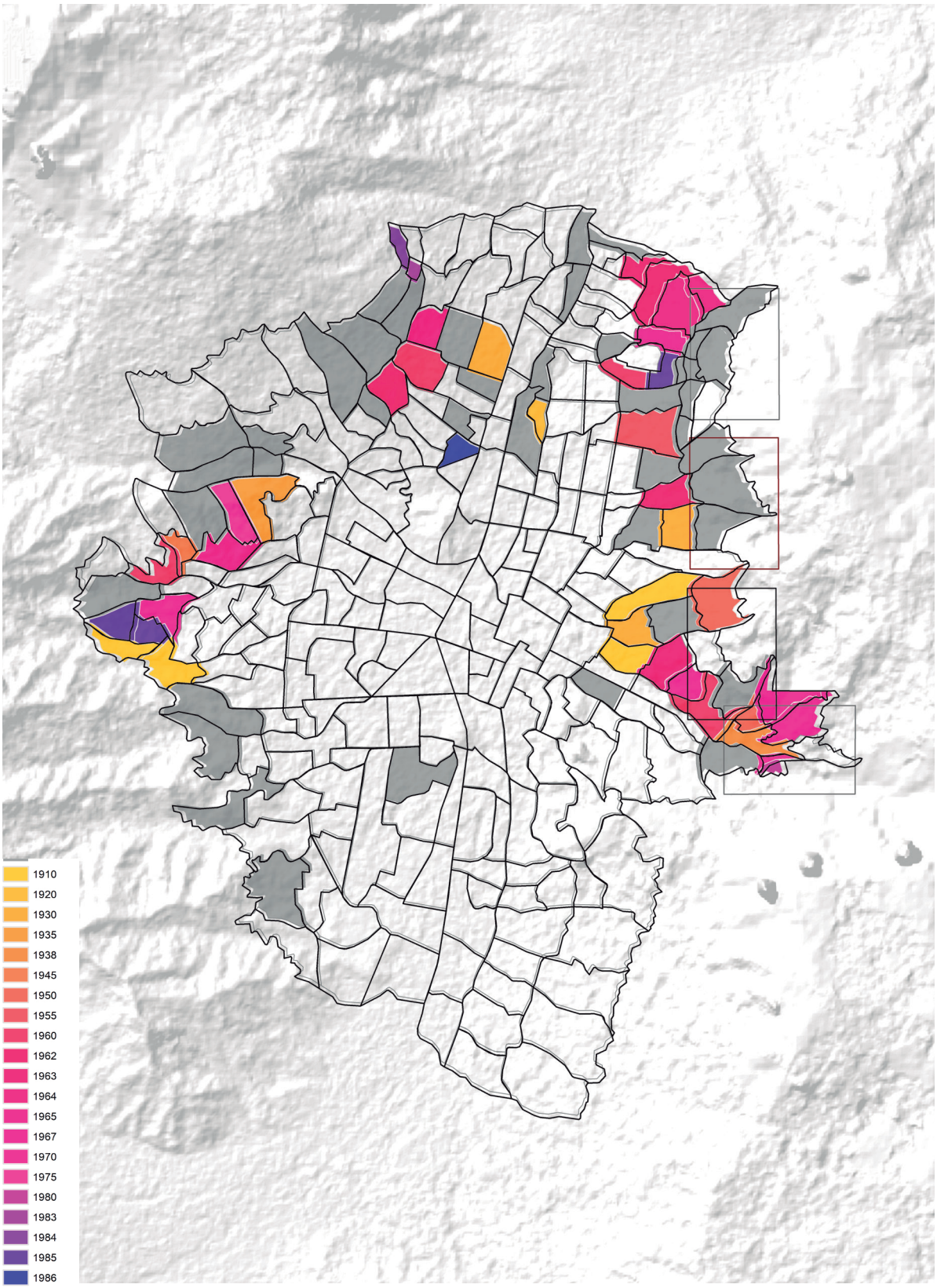


Figure 82 *Informal Neighbourhoods by foundation year , Medellin- Source information:(Gonzales, Gloria-2009)*

intention to live in the city. This situation increased the precarious economic condition of migrant farmers who did not have a job or professional education to join the qualified labor force of the city and ended up working in informal jobs that increased their economic vulnerability. Besides their economic condition, this rural population experienced a difficult process adapting to life in the city, adding a factor of deterritorialization, which some authors state can also be a cause for the formation of informal settlements. Since this new rural population did not adapt to the city, they created rural patterns and typologies that were familiar to them.

In the decade of 1960, as Gomez mentions, the informal settlements in Medellin were almost 50% of the urban population. "In the decade of 1960, the land squatter and the self-build construction was typical" [5].In 1960, the state politics was aimed to eradicate these settlements and to relocate the inhabitants into the peripheral areas of the city.

In the decade of 1970, informal settlements experienced a change concerning the public policies related to them. Before this year, the settlements had been considered a problem regarding the disorganization of poor populations and unhealthy conditions. Then, the solution was to eradicate these settlements. In 1970, the government started to develop programs to relocate these settlements and to legalize the existing ones in order to guarantee the rights of tenure, and at the same time to take measures preventing the future emergence of these settlements (Gómez 2010). This process, in addition to the increasing internal migration, intensified the urbanization process and increased the informal settlements. During this period of time, almost 50 new informal neighbourhoods were built in Medellin (Torres 2017).

Torres affirms that in the early decade of 1980, there was a shortage of buildable land in Medellin, especially for the low-income population and this condition motivate the migrants to displace to steep mountains

5-Gloria Gómez, "Desplazamiento Forzado Y Periferias Urbanas: La Lucha Por El Derecho a La Vida En Medellín" Escuela Nacional de Salud Publica, 2010). 9-11

areas of Medellin. In the mid-decade of 1990, there were approximately 84 informal settlements in Medellin where about 200.000 people lived. At the end of the decade of 1990, there were 250.000 inhabitants of informal settlements in informal neighbourhoods in Medellin (Torres 2017).

During the rural-urban migration in Colombia in the 20th century, there was another factor that significantly boosted this transition: the multidimensional Colombian internal conflict. From 1946 to 1960, an internal conflict between two principal political parties produced the displacement of 2 million Colombians (Gómez 2010). The next stage of the internal conflict was between the state of Colombia and the new communist groups or guerrillas. The conflict became more violent in 1980 with the beginning of drugs trafficking and the foundation of the right-wing armed groups "Autodefensas", the confluency of this agents created one of the worst periods of violence and forced displacement in Colombia.

In the decade of 2000, the mayor of Medellin, Sergio Fajardo, formed a government program called Social Urbanism, .
Social Urbanism is an urban transformation model that was put in practice by the local administration of Medellin between 2004 and 2015. This strategy consists of the physical transformation, social intervention as well as government insight and community participation in order to develop urban and architectonic projects for the promotion of equity within the territories throughout the peripheral areas of Medellin which have the lowest indexes in terms of social and economic development (ALCALDIA DE MEDELLIN 2008). Between 2004 and 2007, the resulting developments included building 5 Library Parks, 10 new schools, 132 school building improvements as well as the construction of sidewalks, urban parks and public plazas around Metro-cable stations, in addition to the preparation of 3 master plan projects (PUI). Social Urbanism sought to correct the mistakes of the past and make up for the

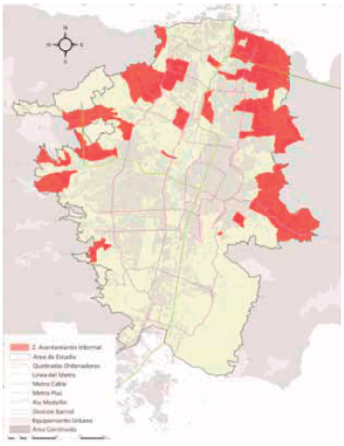


Figure 83 *Dávila, J.; Gilbert, A.; Rueda, N. y Brand, P. Informal Settlements in Medellin 2006. Estudios de caso: Bogotá-Soacha-Mosquera; Medellin y Área Metropolitana. Development Planning Unit, University College of London, 2006.*

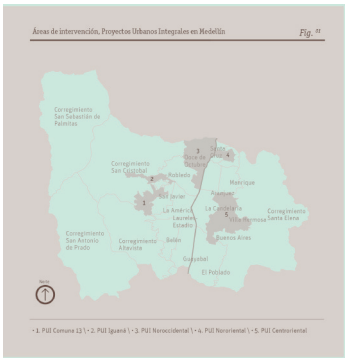


Figure 85 *PUI Medellin 2008-2015 . Alcaldia de Medellin. 2008*

deficits concerning the institutional intervention in informal settlements. As the local government of Medellin has stated: "We aim to provide complete coverage in the city with wide-ranging activity centers around education, culture, sports and recreation". Therefore, the goal was to improve informal settlements through urban interventions as a way to contributing to the living conditions of their inhabitants.

The Social Urbanism model was highly regarded on an international scale. It received the 2007 Global Knowledge Partnership award and the 2008 Habitat Dubai award, while the city of Medellin was recognized for its innovation in 2014 by the Wall Street Journal and Citigroup[6]. All of these awards were delivered under a premise of acknowledging social change in a city that had evolved from once being known as one of the most violent places in the world by the year 1988 [7] and could now be identified as a center of urban and architectonical innovations for the sake of developing a new model for sustainable modern cities. In other words, the Social Urbanism model transformed the city's image as an insecure and violent regional capital and portrayed it as a safe city for global and economic forums as well as a world-class architectural and tourist center. Contrasting with this success, various authors have counter such a point of view by analyzing the real impact of social urbanism on the city. For example, Nataly Montoya has mentioned that this international recognition based on Social Urbanism has relied on a two-sided narrative: "Such a practice is not exclusively social, as most people believe, but rather it is also seeking to both improve the city's productivity and to develop it as a destination for investors and tourists." (Montoya 2014). Montoya has underlined that the innovative modern discourse of the city and its aesthetically pleasing buildings are shown side by side with pictures of absolute poverty and misery. In general, the detractors of the social urbanism model state that the program served to develop certain superficial and high publicity projects that did not provide direct

6- Wall Street Journal And Citi Announce Medellín Wins 'City Of The Year' Global Competition. 2013. Citigroup.Com. https://www.citigroup.com/citi/news/2013/130301a.htm.

7- Borrel, John. 1988. "Colombia The Most Dangerous City". TIME.Com. http://content.time.com/time/magazine/article/0,9171,967029,00.html.

benefits or solutions to the structural problems faced by informal settlements and instead the new face of the city became a form of product marketing in order to attract international investors (Brand 2010, 99-103). Furthermore, critics has discussed that the social urbanism model cannot be understood in isolation from a neoliberal economic ideal, one where the administration has decided to carry out very specific low-cost interventions that can be publicly recognized instead of focusing on more structural and long-term interventions that could mitigate the structural problems surrounding informal settlements.

Speaking in terms of the analysis required by this current academic effort, the objective is to examine and display how the interventions developed under the Social Urbanism program, particularly the PUI*, have affected or promoted the development of informal communities. As part of the selected area of study, we can consider the master plan for the PUI Border North-East and the PUI Center-East.

PUI Border North-East.

The PUI Border North-East (Borde Urbano Noriental) is a project that was implemented under the Social Urbanism program between 2008 and 2015. The project intended to create an ecological and sustainable new urban border that could contain the sprawl of informal development around its location. Said project was able to include 3 types of areas for expansion: consolidation area, transitional area, and conservation area. The area of consolidation was where urban expansion and building densification were projected. Within this portion of the city, the goal was to construct new high-rise buildings, connect the existing urban structure to new architectonic interventions under the Social Urbanism program, and develop new parks as well as green areas around the hydric system of the city. The transitional area would act as mediator between the conservation area and the previously mentioned urban expansion. The

Figure 86 *Alcaldia de Medellin. PUI Borde Nororiental Franjas de intervencion . 2008. Urbanismo social proyectos urbanos integrales. Alcaldia de Medellin (2008)*

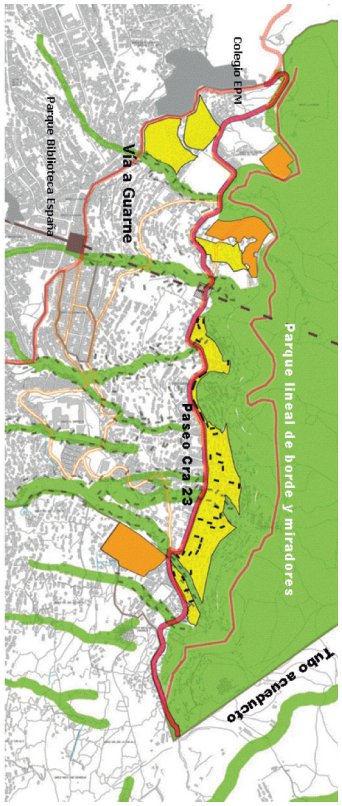


Figure 87 *Alcaldia de Medellin. PUI Borde Nororiental- Area de transicion. 2008. Urbanismo social proyectos urbanos integrales. Alcaldia de Medellin (2008)*

purpose of this area was to relocate the informal settlements at risk and turn them into high-rise buildings, in addition to developing parks and green belts that could restrict the informal sprawl. The so-called area of conservation was intended to protect the landscape and no construction would be allowed within its boundaries. The rural-urban expansion limit would be marked by a linear park, acting as both a border and as an urban landscape element. Concerning the architectonic interventions involved, there would be a series of institutional public buildings along the main avenue known as "Paseo Cra 23".

Results

Construction of the buildings around "Paseo Cra23" was completed and this avenue has become a center for informal developments. Regarding the efficacy of the strategic areas that were previously defined in the plan, the protected or conservation area has been generally kept intact, but urban sprawl is pushing the transitional boundary and there are sectors where said informal sprawl is entering into the conservation area. However, the development of high-rise buildings within these areas in order to increase density has not happened. That can also be said for the green belts and parks. Thus, this part of the plan was ultimately not put in practice. As a conclusion, many small and specific urban interventions have already been built or taken place yet the larger urban interventions have been put on hold. The PUI Border North -East had generated certain unrealistic expectations with respect to the development of high rise buildings and landscape projections in this area. Because the urban sprawl has not been extended too far into the conservation area, it can be argue that the strategies for containing informal development have been partially successful.

Figure 88 *Alcaldia de Medellin. PUI Borde Nororiental -Condicion Inicial. 2008. Urbanismo social proyectos urbanos integrales. Alcaldia de Medellin (2008)*

Figure 89 *Alcaldia de Medellin. PUI Borde Nororiental - Propuesta 2008. Urbanismo social proyectos urbanos integrales. Alcaldia de Medellin (2008)*

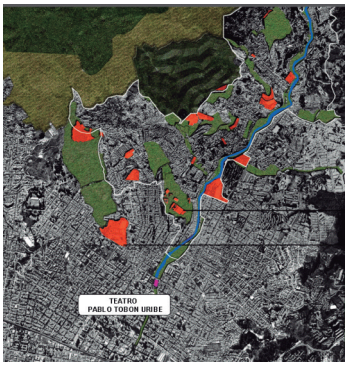


Figure 90 *Alcaldia de Medellin. PUI Borde Centro oriental- Area de Conservacion. 2008. Urbanismo social proyectos urbanos integrales. Alcaldia de Medellin (2008)*

The PUI Center East.

The PUI Center-East (Centro Oriental) was another effort under the banner of Social Urbanism that was implemented between 2008 and 2015. This plan developed a series of architectural and urban interventions over the so-called Comuna 8. The proposal included the creation of a new sports center, improvements for existing parks, sidewalks and a new system of public spaces around Quebrada Santa Helena that would improve the connections between the ecological system and the informal settlements. Regarding the consolidation of the urban border, this plan drafted the construction of a system of mid-rise housing projects that could act as a boundary for the expansion of the city and, at the same time, would provide densification to the existing border and avoid further expansion into new areas. Just as well, the plan proposed a new system of parks and protected areas that could serve as a so-called green border to limit the informal sprawl. When the efficacy of the effort to contain of informal settlements is analyzed, the results indicate that despite not developing the mid-rise buildings nor the green areas of protection, the urban border has been limited and remains within the areas defined in the PUI .

The link between the PUI and the progression of informal settlements in Medellin can be approached from two point of views. Specific interventions and the creations of public spaces had generated a positive increase in public spaces that are necessary, particularly for informal communities where these spaces are insufficient. Concerning the expansion of informal settlements in the areas of study, it is already clear that this phenomenon has been contained. However, it is not clear whether this was truly a product of the PUI or of multiple additional interventions, but the limits defined in the PUI have been maintain during a period of 15 years. It is possible to assume that, in general terms, the plan was effective because its specific urban and architectonic interventions did

Figure 91 *Alcaldia de Medellin. PUI Centro Oriental-Condicion Inicial. 2008. Urbanismo social proyectos urbanos integrales. Alcaldia de Medellin (2008)*

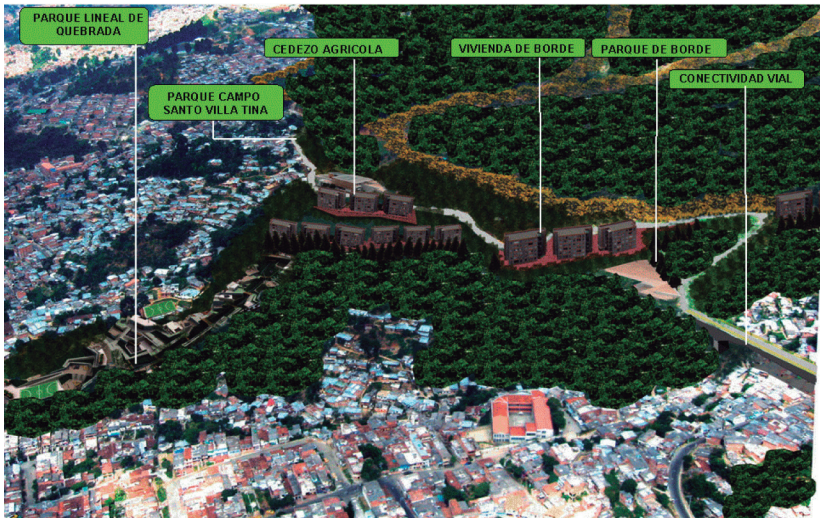


Figure 92 *Alcaldia de Medellin. PUI Borde Centro orientral- Propuesta 2008. Urbanismo social proyectos urbanos integrales. Alcaldia de Medellin (2008)*

not directly increase the expansion of informal settlements, and instead served to improve and consolidate the existing areas.

As a general conclusion, the Social Urbanism initiative has been showcased and portrayed with an image of inclusion but the scale of poverty within these settlements can hardly be resolved with such kinds of interventions. As Alejandro Echeverry has remarked, "the lack of state intervention in these spaces for more than 60 years is not going to be solved in 10 years" (Echeverri and Orsini 2011). This project represents an initial step for the sake of addressing the issues found within these communities, but finding a solution to the structural challenges faced by these neighborhoods would require a new structural viewpoint that can alter the terms of the state's approach to the problem.

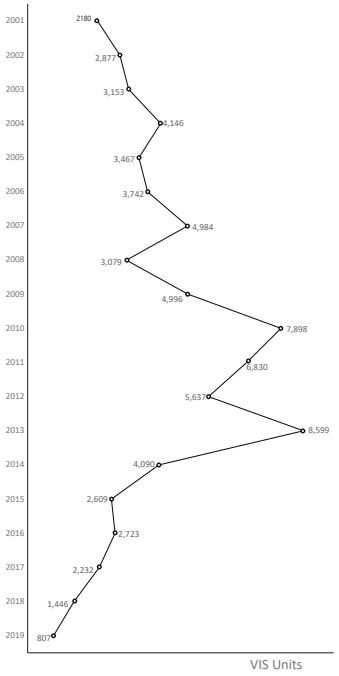


Figure 93 *Production of Social Housing units Medellin 2001-2019. Source Information: DANE*

Economy and informal settlements in Medellin

As previously seen in Lima, the disparity between the formal supply of low-income housing and the demand for them has constantly increased the production of informal settlements. Did the process in Medellin have similarities with the process in Lima? Is it possible to reach similar conclusions and to consolidate the idea of a Latin American informal situation?. To verify this statement, it is necessary to review the formal housing supply for the low-income population in Medellin in the second half of the 20th century, the shortage in low-income housing, and the growth of informal settlements in Medellin.

Formal offer housing in Medellin for low-income population.

The principal kind of formal housing for the low-income population in Colombia is the one denominated VIS[9].This type of housing is structured under the Colombian political constitution of 1991, this represents a change in the previous system of public housing in the country. Before this reform, the state had multiple public entities that provided and developed social housing. With these new reforms, the state reduced its intervention on public housing considerably and assumed a subsidiary role for the private market of housing projects. The development of VIS projects in Medellin has not been enough to fulfill the requirement of the low-income housing market. According to " Medellin como vamos", from 2014 to 2018, there was a difference between the demand and the supply of VIS units of approximately 30.000 units per year. As the report explains "the construction companies are not interested in building VIS because it does not make a big profit due to the relationship between the unit's sale value, the increasing value of urban land, and the growth of construction and the labor prices."[10]. The lack of affordable and appropriate land to build within the city is now creating a new urban

9-Social Housing (Vivienda de Interes social) is the housing unit that the maximum value is 150 minimun montly wage

10-Alcaldia de Medellin, Medellin Cómo Vamos, Informe De Calidad De Vida De Medellin 2018 (Medellin, Colombia: ,[2018]).

dynamic where the low-income housing projects are now being developed outside the city in the adjacent and small towns where the land is cheaper and there is no pressure for urban density. But this presents problems on account of the daily travel distance to work and job areas, public space and urban facilities. This ends up increasing life cost when living outside the city since it generates a more vulnerable economic situation.

Shortage of housing in Medellin from 1970 to 2010.

To calculate this housing deficit, the government implemented two measures: a quantitative and a qualitative analysis in 1993 . The quantitative housing deficit defines the difference between the number of housing units in relation to the number of families and habitants in the city. The qualitative analysis refers to the deficit of minimum conditions to habit in existing houses, which can be improved over time, such as utilities (electricity, water), finishing materials and overcrowded spaces. According to Torres, there has been a shortage of housing in Medellin since 1920.

According to the 1973 Census [11] the number of housing units in Medellin was 167.930 in the urban area of the city while the number of habitants that year was 1.053.964. In the 1985 Census, there were 284.424 housing units in the urban area of Medellin and 12.1% of those units had a qualitative deficit. The 1985 Census does not mention a quantitative deficit. The 1993 Census presents a more complete scenario of the housing situation in Medellin, with 370.633 housing units in the urban area of the city; 77.200 of these units presented a qualitative deficit (13.89%) and there was a quantitative deficit of 51.508 units (11%). According to a report made by CEHAB in 1998, 64% of the quantitative housing deficit in Medellin in the year 2004 corresponds to low-income population[12]. In 2017 there were 844.277 housing units in Medellin, a quantitative housing deficit of 32.733 units(4%) and a qua-

11-DANE, XIV Censo Nacional De Poblacion Y III De Vivienda 1973 (Bogota, Colombia: , 1973).
12- (CEHAP, 1998 pg-17)

litative deficit of 52.761 that corresponds to the 6%[13]. Another analyisis made in the national census of 2018 reflect that in 2018, there were 815.493 housing units in Medellin with a 2.02% quantitative deficit of 16.472 housing units and a qualitative deficit of 12.98% corresponding to 105.850 housing units (DANE 2018). The 88% of the quantitative deficit is focused on the low-income population.

13-Alcaldia de Medellin, Medellin Cómo Vamos, Informe De Calidad De Vida De Medellin 2018 (Medellin, Colombia: ,[2018]).

Historic Maps of Informal Settlements in Medellin

For the purpose of developing an analysis of the historic progression of informal settlements, it was necessary to acquire historic maps and historic aerial photographs. The selected area of study was the North-East border of Medellin (Area 1 and Area 2). There are good quality aerial historic photographs from 1983 that could be used to develop an accurate comparative analysis from that year. These photographs were isolated and dispersed, so it was necessary to collect, overlay and scale them properly in order to generate a broad area of information. The information from 2005 and 2019 was found in Google Earth and ArcGIS satellite maps, respectively. Also, it was necessary to collect this data and to scale it properly so that it matched the information under the same features.

Informal Settlement Comuna 1 (1984)

There are three patterns of urban development in the area of study. Firstly, there is the orthogonal block that is located in the low slope areas of the settlement. This block has good accessibility because it is built around vehicular streets. In 1983, the perimeter of this block was not completely built, besides there were empty plots in the perimeter and repetitive internal patios in the center that guaranteed a small green area in the units. The rural background of the first settlers influenced the layout, so the settlements tried to guarantee a green open space to cultivate or to harvest (VIVIESCAS,1985. Pg 102). Secondly, there is an organic urban block. The natural elements of the territory like rivers or slope patterns of the mountain defined the shape and perimeter of the organic blocks. This block appears on high percentage slope areas where it is not possible to build an orthogonal block. The Informal units of this block are normally located in the perimeter of the block. But due

to the organic feature of the block, a new type of unit was built and it did not have direct access to the street, instead, the only way of access was internal pedestrian paths. Thirdly, there is the sprawl development. The sprawling development consists of isolated informal units that started to build urban assemblies thanks to the proximity between them, but there was not a clear pattern of organization or urban border. These units are normally located in high slope areas.

Informal Settlement Comuna 1 (2005)

There was an increase in land occupation area by new settlements between 1983 and 2005 of almost 1.027 km2. The principal characteristic of this stage is a process of consolidation of the already precarious informal urban structures. The orthogonal block and the organic block are now completely urbanized in his border and in some cases, even the internal patios are covered and built over. The informal routes that in 1983 were wide rural paths have now become narrow paths that are essential in order to access the internal units of the block. However, this represents precarious conditions of lighting and accessibility. The precarious rural streets of 1983 are now formal vehicular streets that have encouraged informal settlements to be built nearby.

Informal Settlement Comuna 1 (2019)

Between 2005 and 2019, there was only an increase of 0.16 km2 of informal build land in the area of study. Despite this, the Census of population reflected that in the area, there was an increase in population (DANE 2018)[14]; Therefore, it is possible to assume that the settlements in this area had a process of vertical densification instead of extensive horizontal expansion of the settlement. The few new informal units that have appeared during this period of time are located in the existing pedestrian routes that connect different urban areas of the settlements

14-Population in 2005, 122 067 habitants(DANE)
Population in 2018 131.968 habitants (Municipality Medellin)

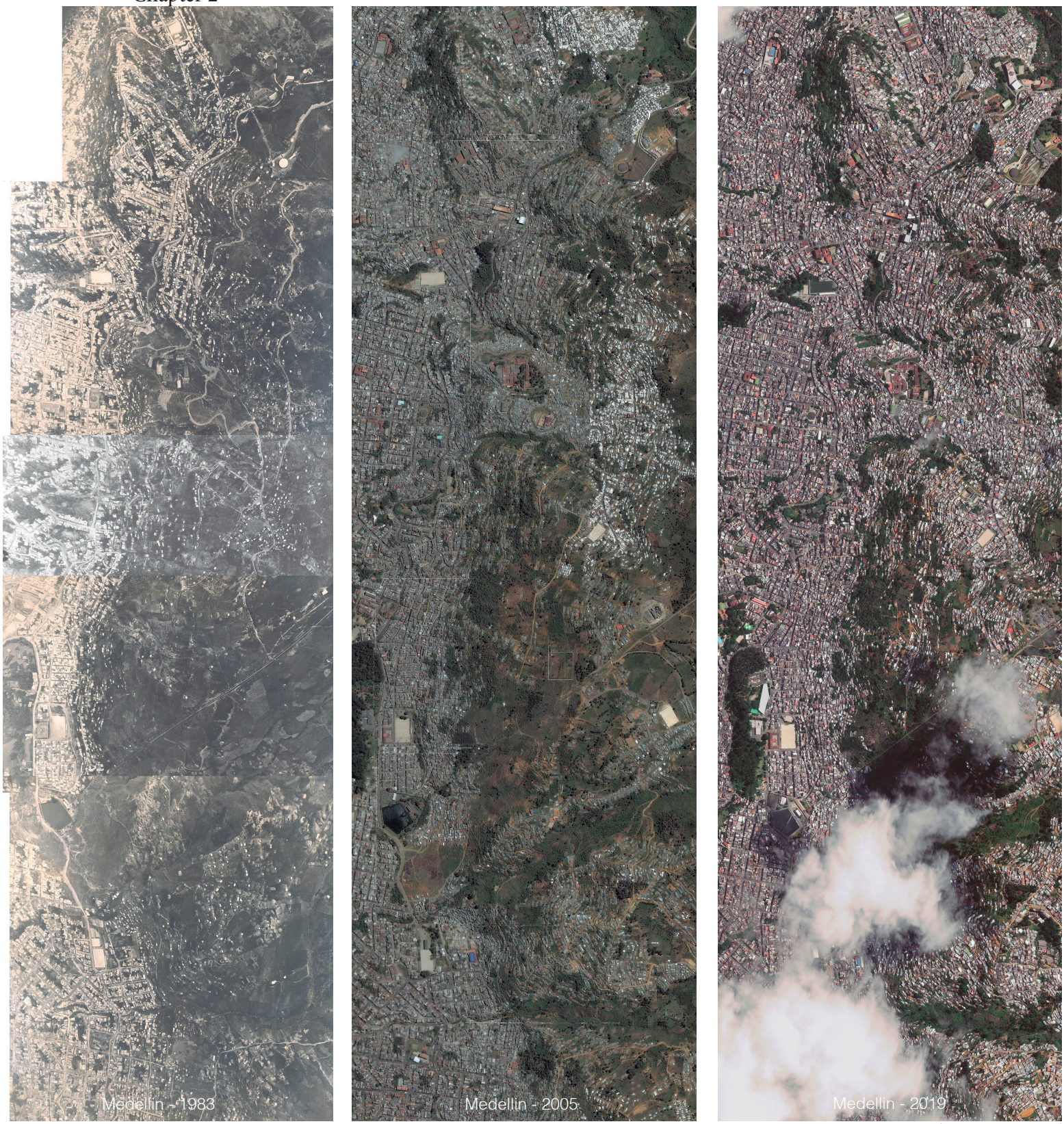


Figure 94 *Sattelite historic image of the North-east area of Medellin - Comuna 1-(1983,2005,2019)*

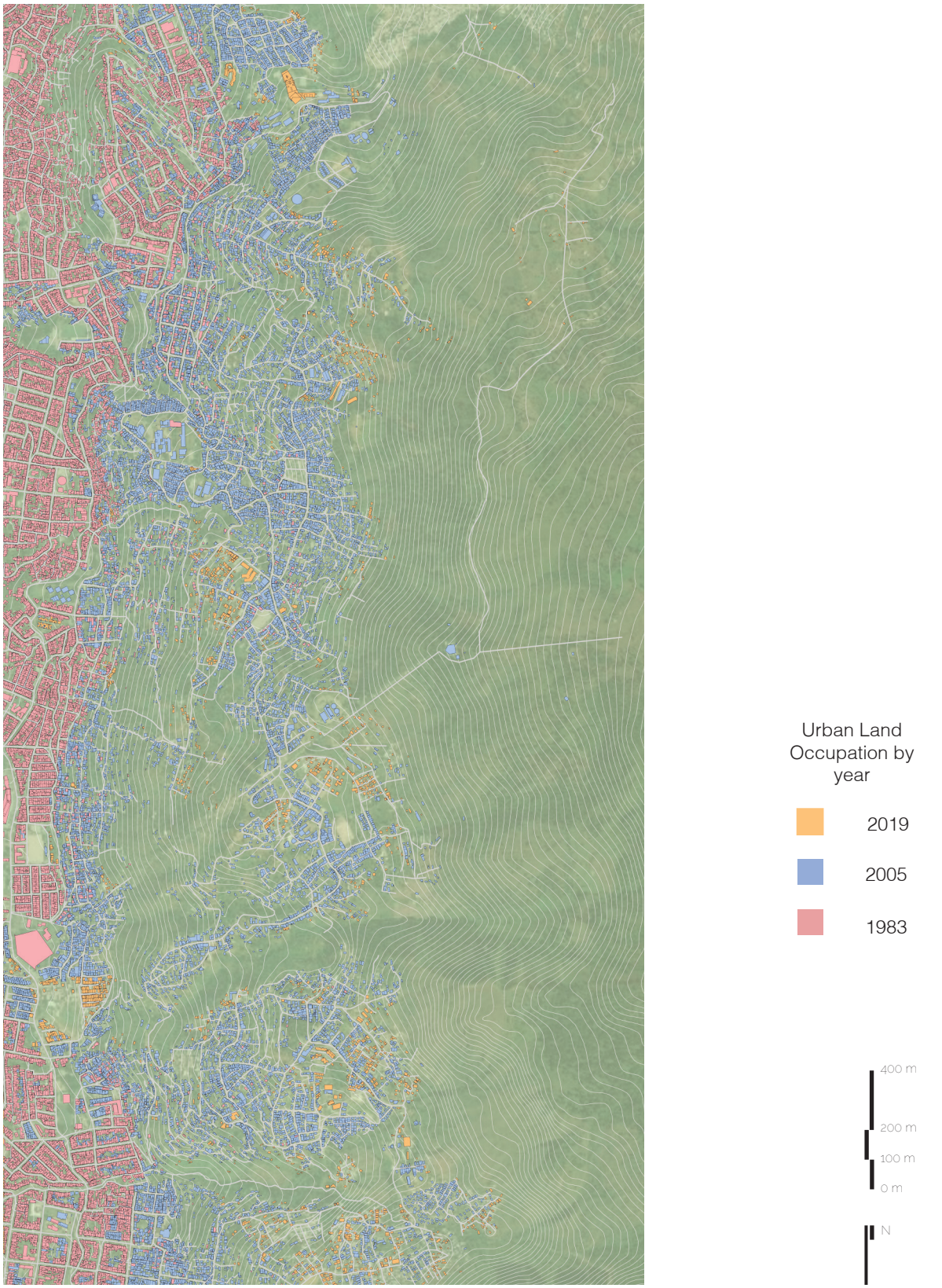


Figure 95 *Progression of Urban Informal settlements a the North-east border of Medellin*

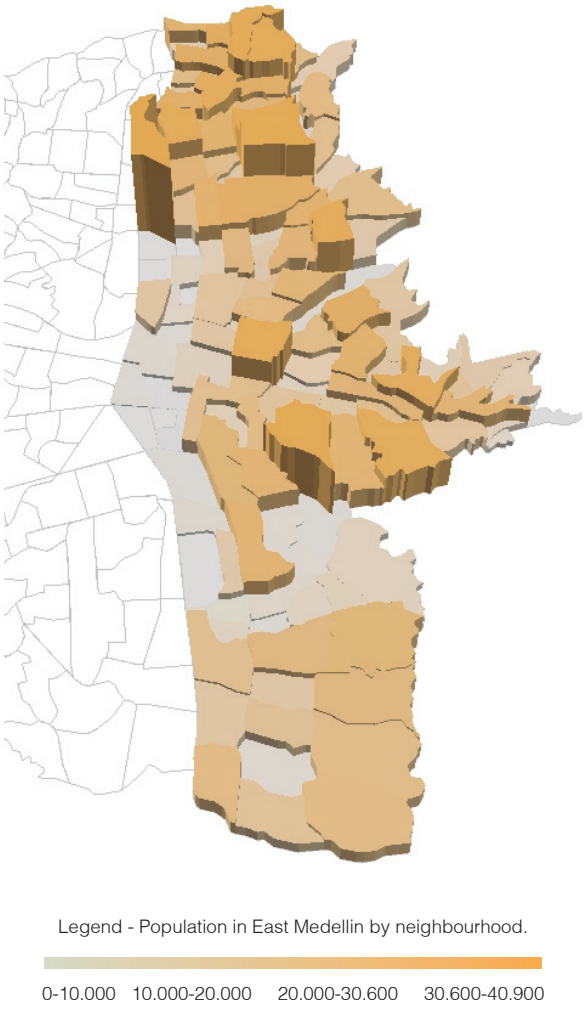


Figure 96 *Population in East Medellin by neighbourhoodSource information DANE 2016 -Own elaboration*

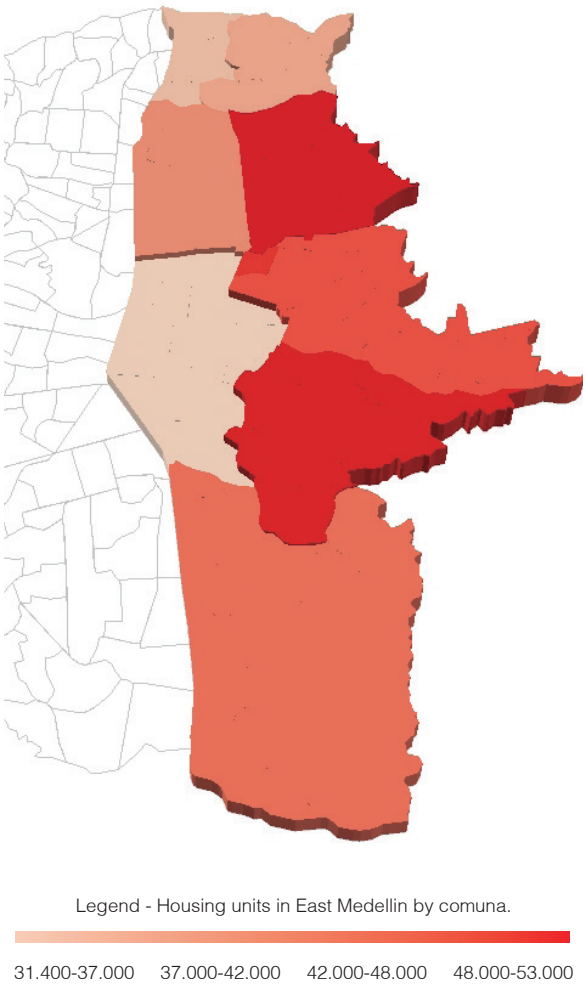
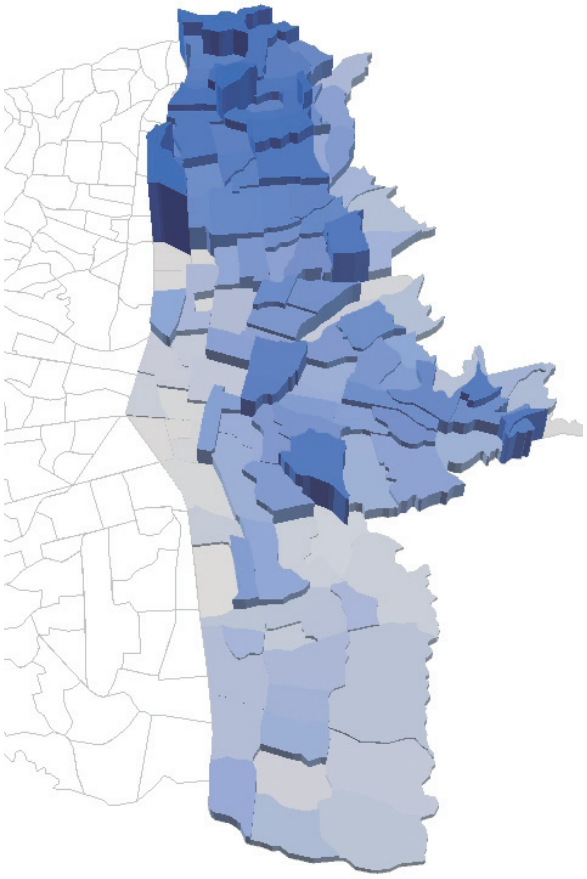


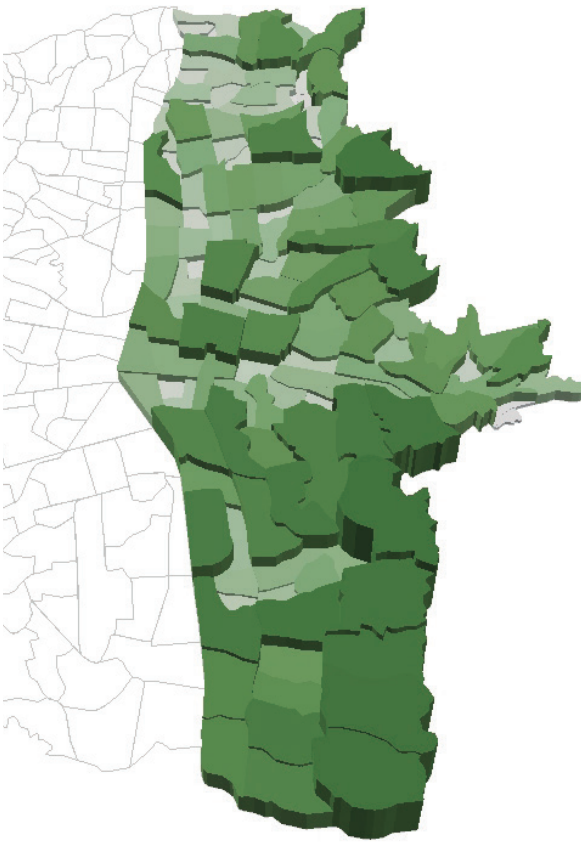
Figure 97 *Housing units in East Medellin Source information DANE 2016- Own elaboration*



Legend - Habitant density in East Medellin by neighbourhood.

0-20.000 20.000-41.000 41.000-61.000 61.000-82.000

Figure 98 *Habitant density in East Medellin (hab/km²) Source information DANE 2016-Own elaboration*



Legend - Area in East Medellin by neighbourhood.

0.05-0.29 0.29-0.50 0.50-0.86 0.86-1.43

Figure 99 *Area by Km² of neighbourhood in Medellin Own elaboration*

Area of Study

For the purposes of carrying out a specific analysis of the informal settlements in the city of Medellin and in order to determine the relationship between the general conditions of the City and the specific traits of each neighborhood, it was necessary to develop 4 small areas of study to consolidate and compare the information,

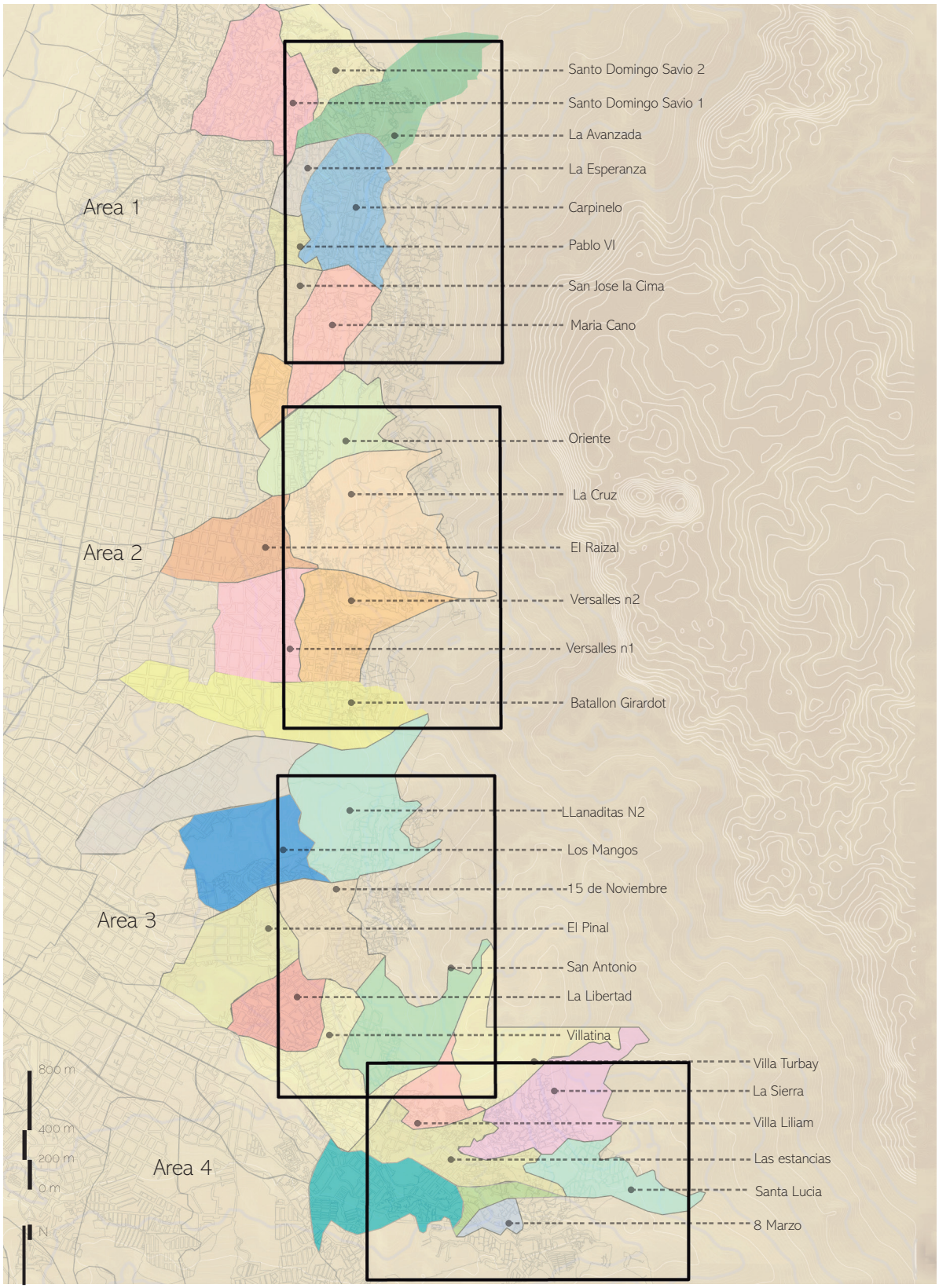


Figure 100 *Area of study Medellin East Border - Own elaboration Scale -1.40.000*

Accesibility map in Medellin

The accessibility map was the tool used to analyze the conditions in informal settlements to access the public transportation system. The analyzed area was the East border of the city of Medellin. To develop the analysis, the GIS information about bus stops given by the government of Medellin and the streets network provided by the city government were gathered. The purpose of the analysis was to define the walk time inhabitants of informal settlements have to take in order to get to the transportation system. Since the less time they take, a better quality of life and a better opportunity to access services and multiple benefits in the city are guaranteed. When walk traveling time increases, it represents difficulties that affect daily life in the settlements. The analysis showed that in general, in the eastern border of Medellin, inhabitants need less than a 20 minutes walk to access the transportation system. The areas where inhabitants need a more than 20 minutes walk to get to the bus stops present either absence of bus stops nearby or a poor topographic condition and quality of the travel path that increases the distance. There are 3 neighbourhoods with a more than 40 minutes walk: Santo Domingo Savio N2, La sierra, and Llanaditas.

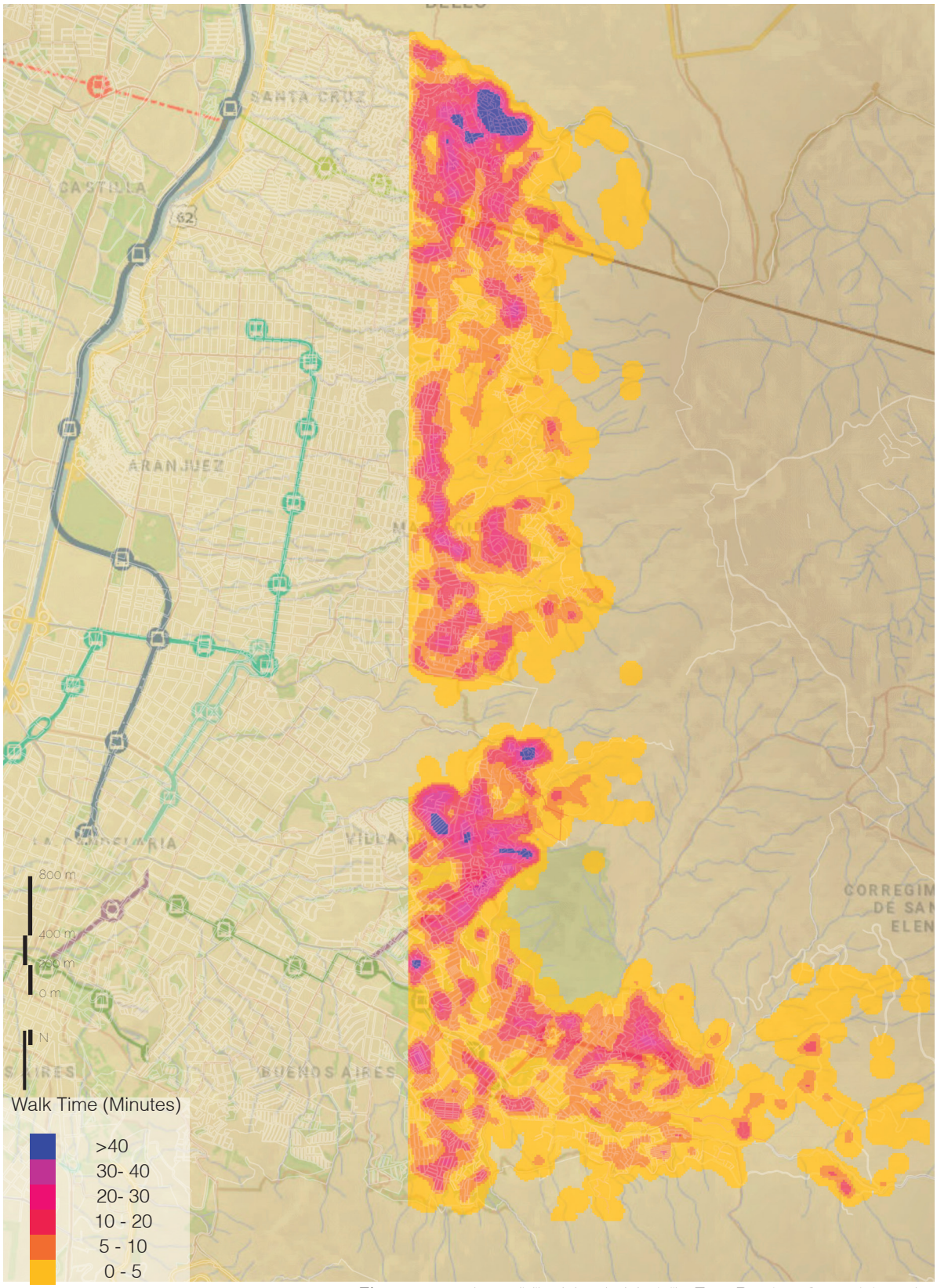


Figure 101 *Accesibility Map in Medellin East Border -Own elaboration*

Income per Family by Neighbourhood Medellin

The income per family became a tool to analyze the relationship between the income per family and the location of the neighbourhood in the city. The information was gathered by researching data collected from SISBEN in order to define the income per family in each neighbourhood in Medellin in 2014 [14]. The collected data from the map reflects that the neighbourhoods located on the edge of the urban development are the ones with the lowest income value per family. Instead, the neighbourhoods that are located close to the city center and the best commercial locations are the ones where the medium income families are located with the exception of Santa Lucia Estancias neighbourhood, which is located close to the avenue that leads to the airport attracting a different group of inhabitants.

14-(Personas encuestadas y clasificadas en el Sisben por ingresos segun comuna o corregimiento, 2014)

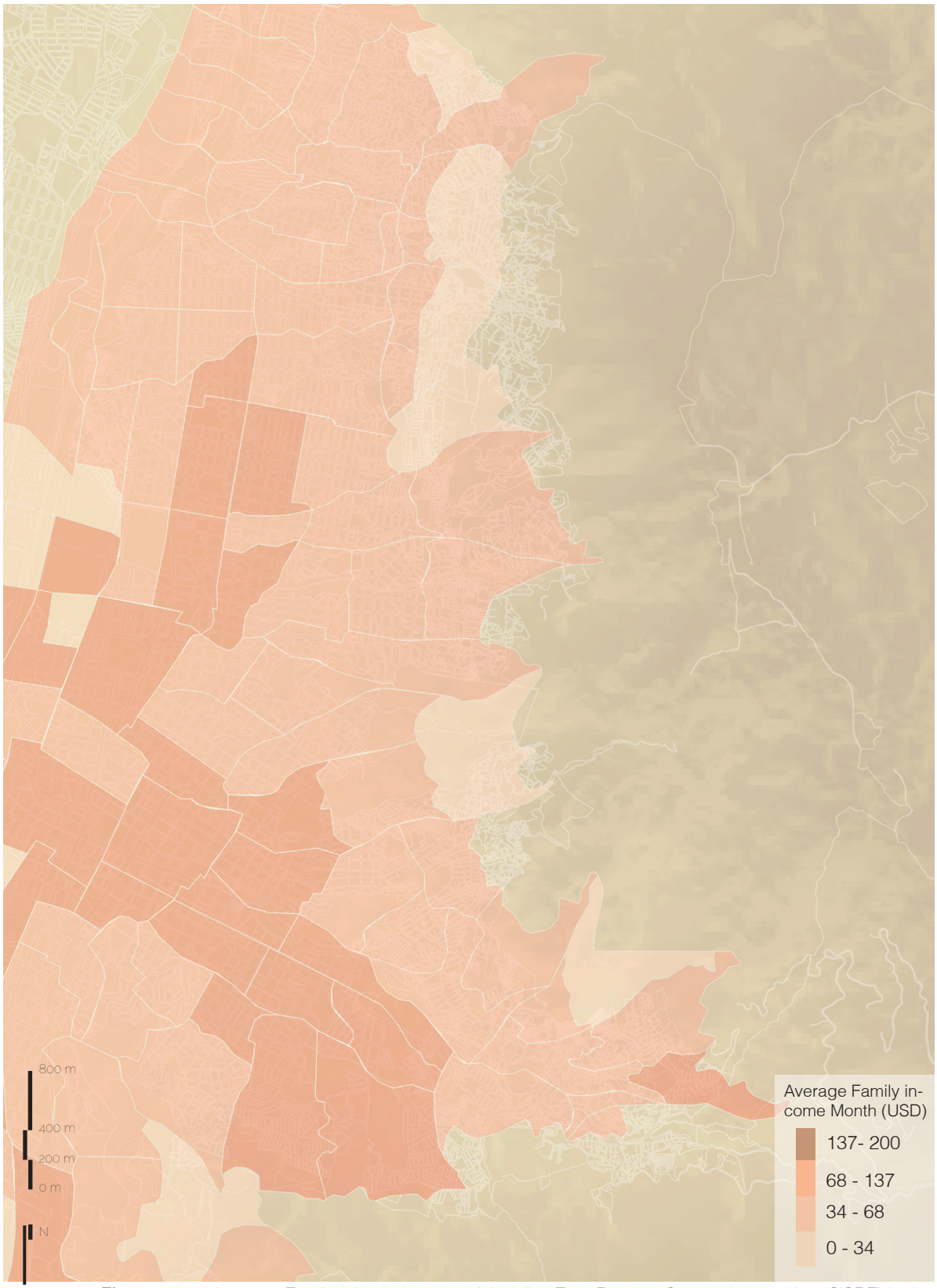


Figure 102 *Average Family Montly income , Medellin- East Border- Source information: SISBEN 2014*

Area 1

IInformal Urban Typology.

In areas with low slope terrain conditions, the informal urban block form is orthogonal and often rectangular or square. As you go up the mountain, the informal block outline starts to adapt to the natural conditions of the terrain or the hydric structure following an organic-based shape. In this area, the orthogonal and organic informal blocks have a high level of horizontal density, the urban sprawl has been extensive and there is reduced available land for future informal development. The reason for this condition is that this area has been one of the first informal urbanizations in the city, thus it has become a center of informal development. The high level of horizontal density is evident because even in high-risk areas that have a slope degree greater than 50%, there are informal settlement units at great risk.

Topography.

The topographic condition in this area presents progressively low and high slope areas as you go up the mountain. This condition has generated an urban system of highly densified areas in flat areas and areas with low density in high slopes terrain conditions. In this area, informal sprawl has been contained either by the high slope topographic barrier or by the hydric structure that has generated natural edges in the informal growth. The rivers that are in the external perimeter of the settlement have contained the development, while the rivers that are immersed in the settlement have shaped the organic informal urban form or have been integrated into the existing informal shape.

Accesibility

In terms of accessibility, this area presents good conditions due to the L and K line of Metro-Cable that connect this informal community with the Metro system of the city. In terms of walk accessibility to bus stops, this area presents relatively low walk time values to bus stops (between 10 and 20 minutes). With the exception of Santo Domingo N2 neighbourhood, which presents one of the highest walk time values in the area of study, with more than 30 minutes to get to bus stops. Despite having an excellent urban transportation system in the neighbourhood, the topographic condition and urban streets patterns make it difficult to have direct walk access to bus stops in that neighbourhood.

Architectonic and Urban Features

This area experienced multiple interventions under the social urbanism program. In terms of urban interventions, there are the L and K Line of the Metro Cable system, the public squares built around these interventions, the Bridge of Peace, and the Urban Park of UVA. In terms of architectural interventions, there are the Spain Library Park, Antonio Derka School, the House of Justice in Santo Domingo, the Kindergarten in Carpinelo, the sports unit of Granizal and the Reino de Belgica School. There is a correlation between the density and consolidation of the settlement with the amount of state intervention in terms of schools, libraries and public squares.

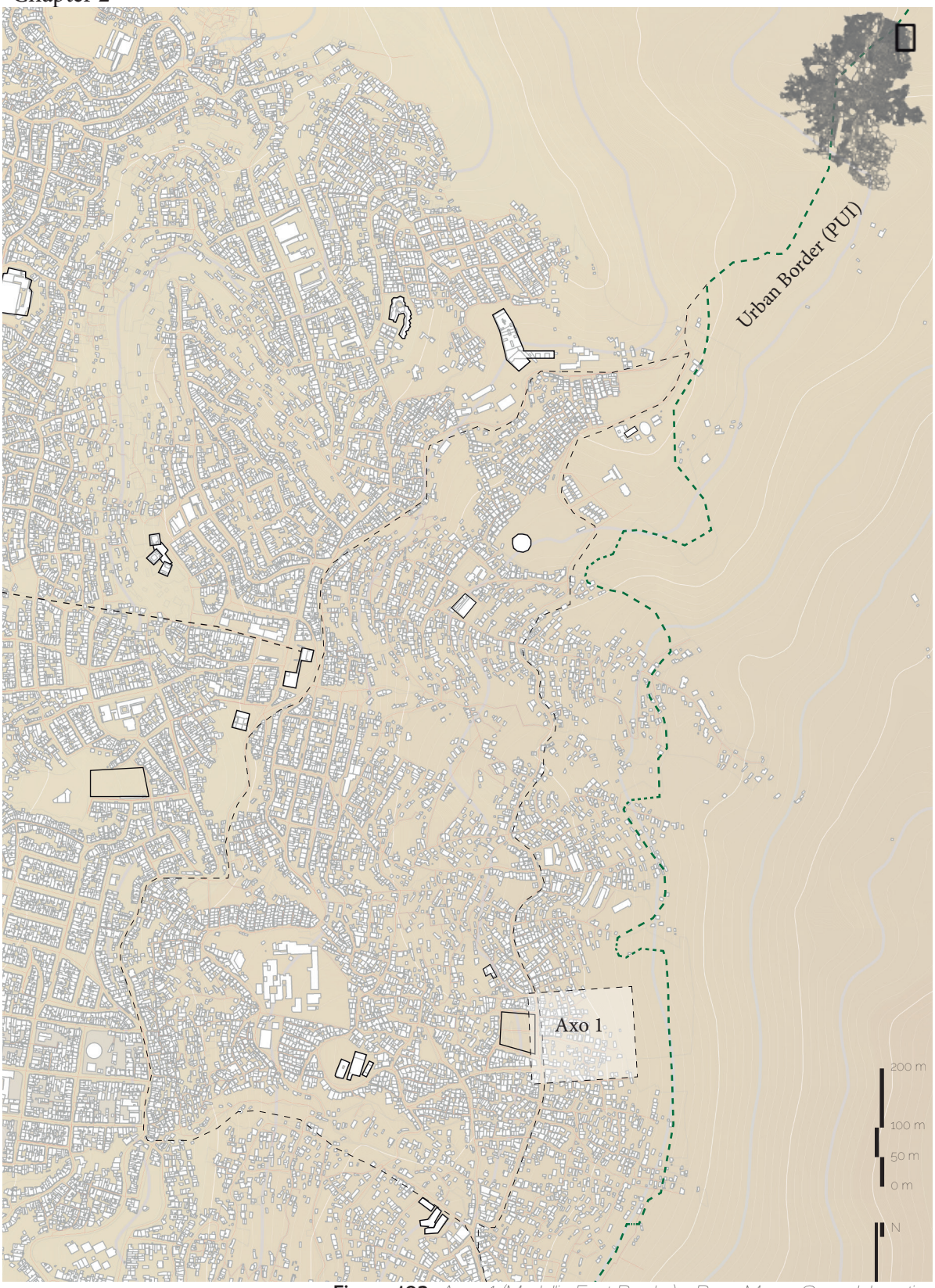


Figure 103 *Area 1 (Medellin East Border) - Base Map - Own elaboration*

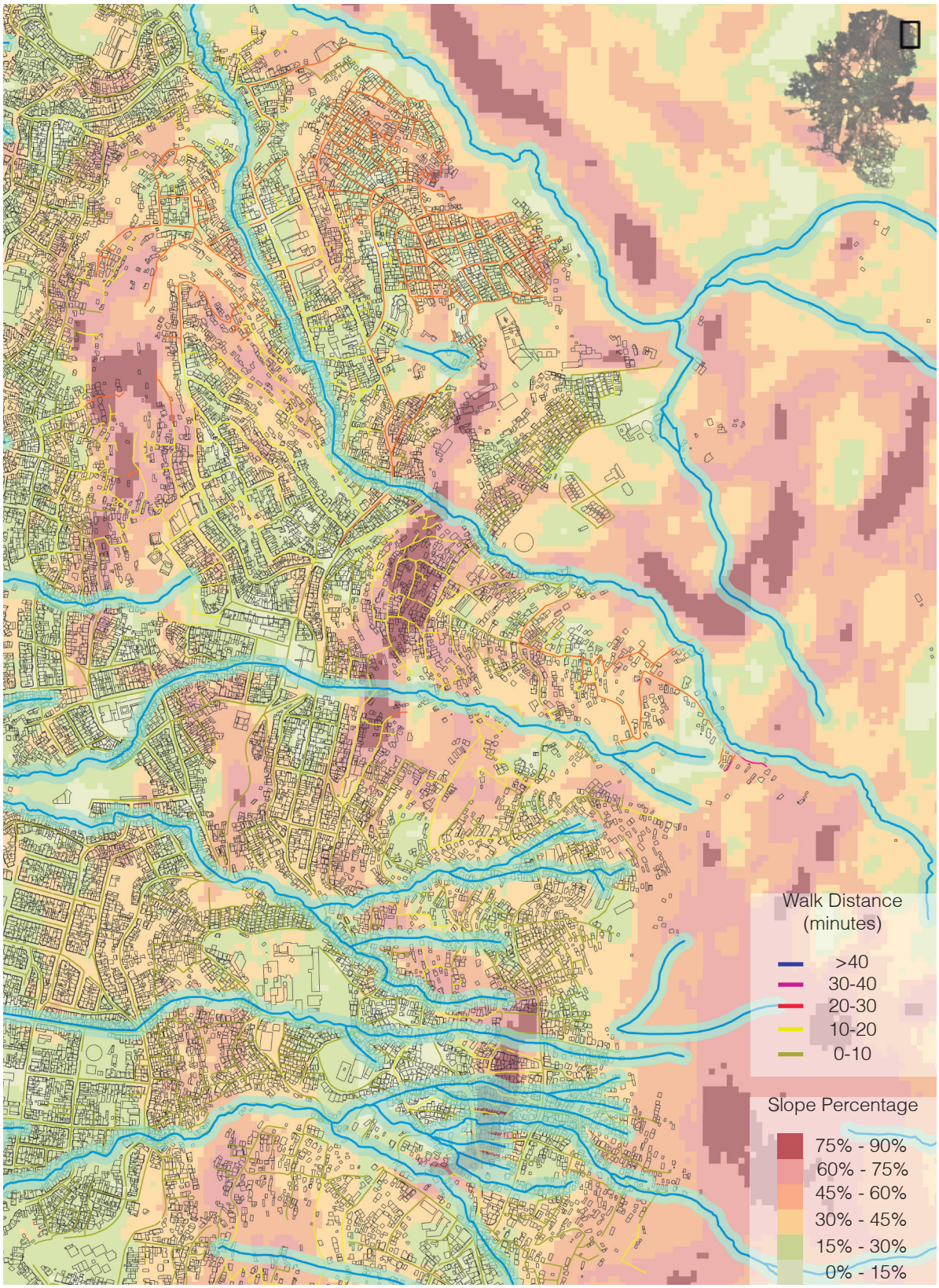
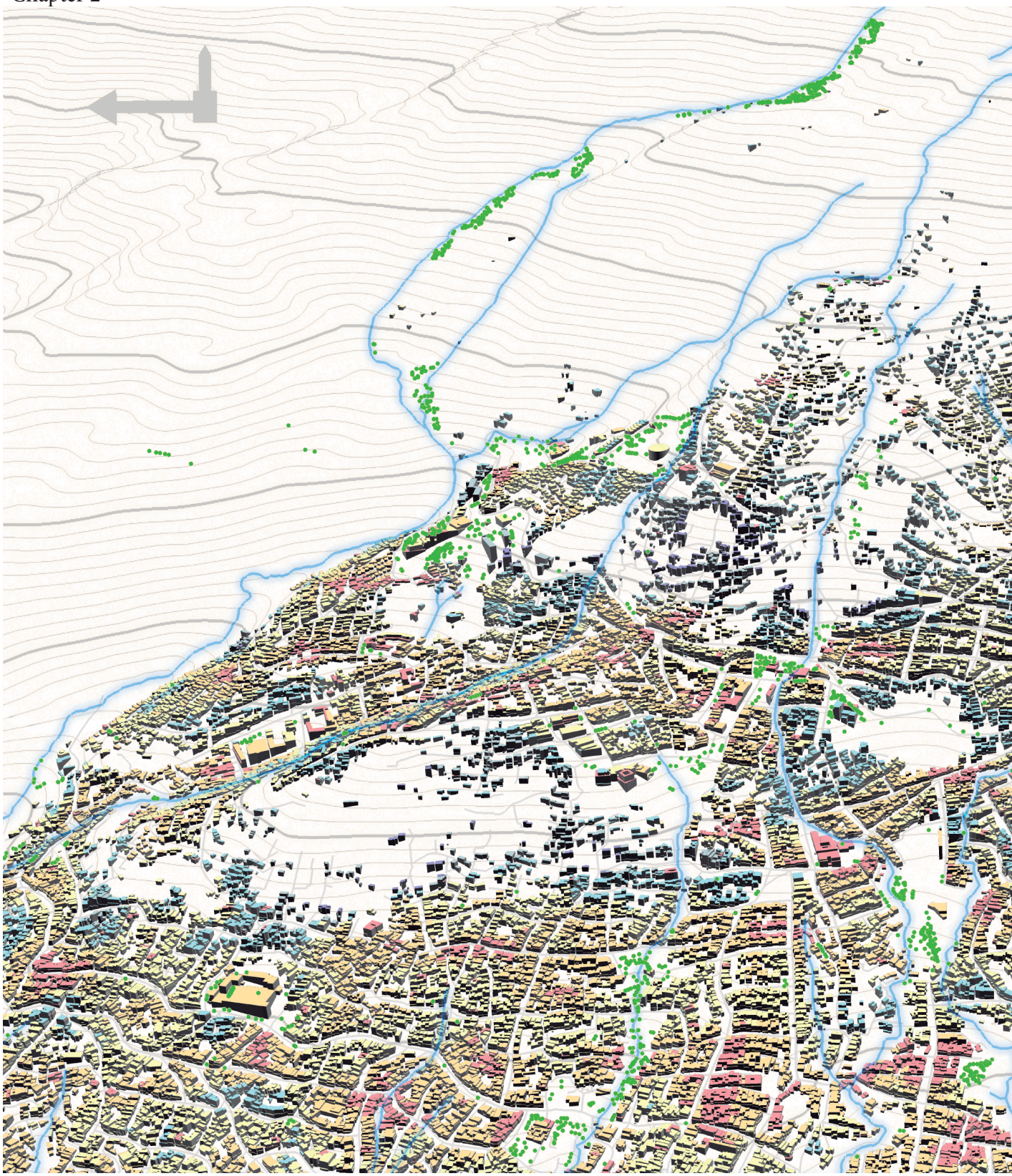


Figure 104 *Area 1 (Medellin East Border)-Slope terrain map and Walk diistance map to bus stops - Own elaboration*



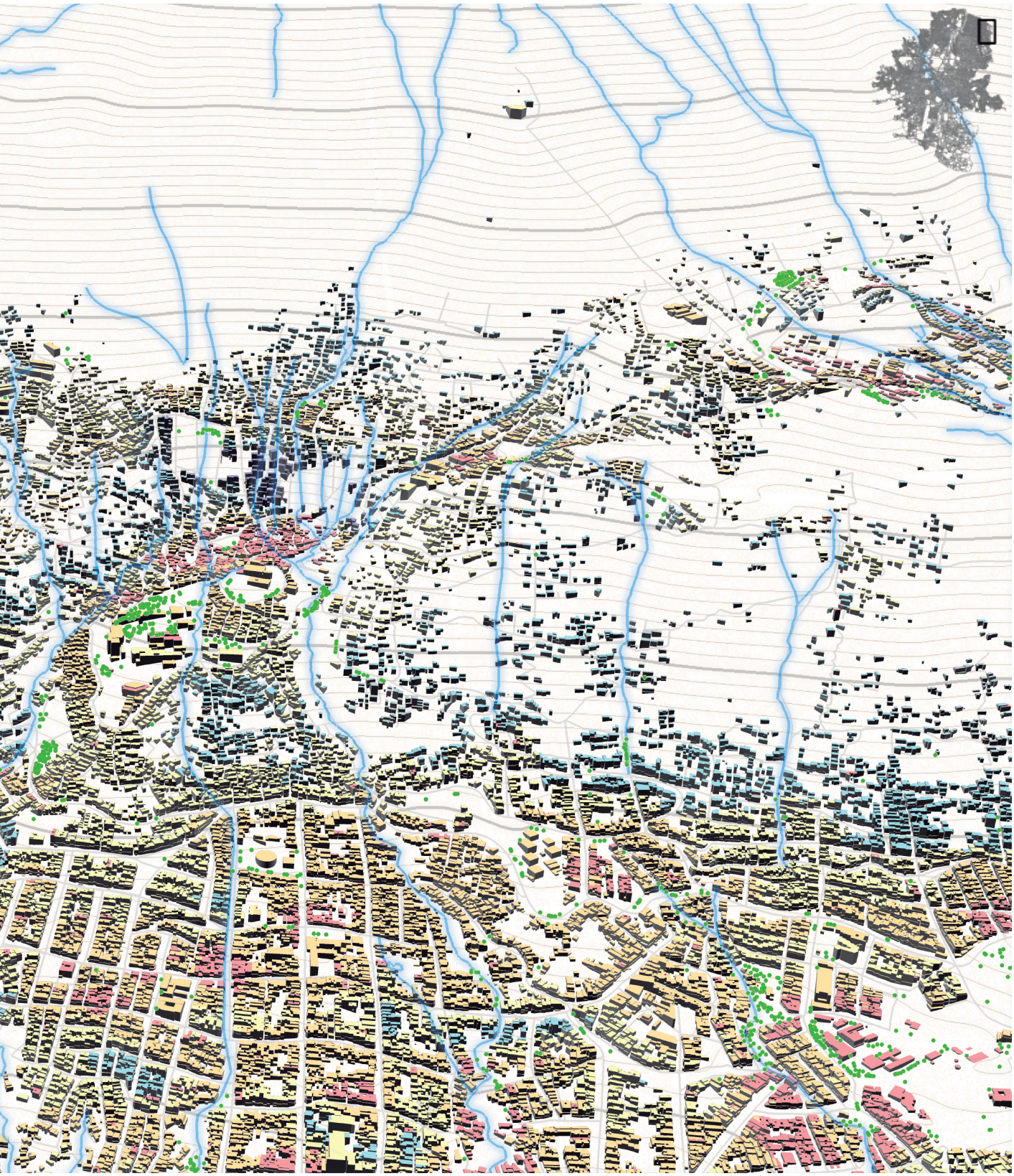


Figure 105 *Area 1 (Medellin East Border) - Perspective - Own elaboration*

Low Density - Steep Topography

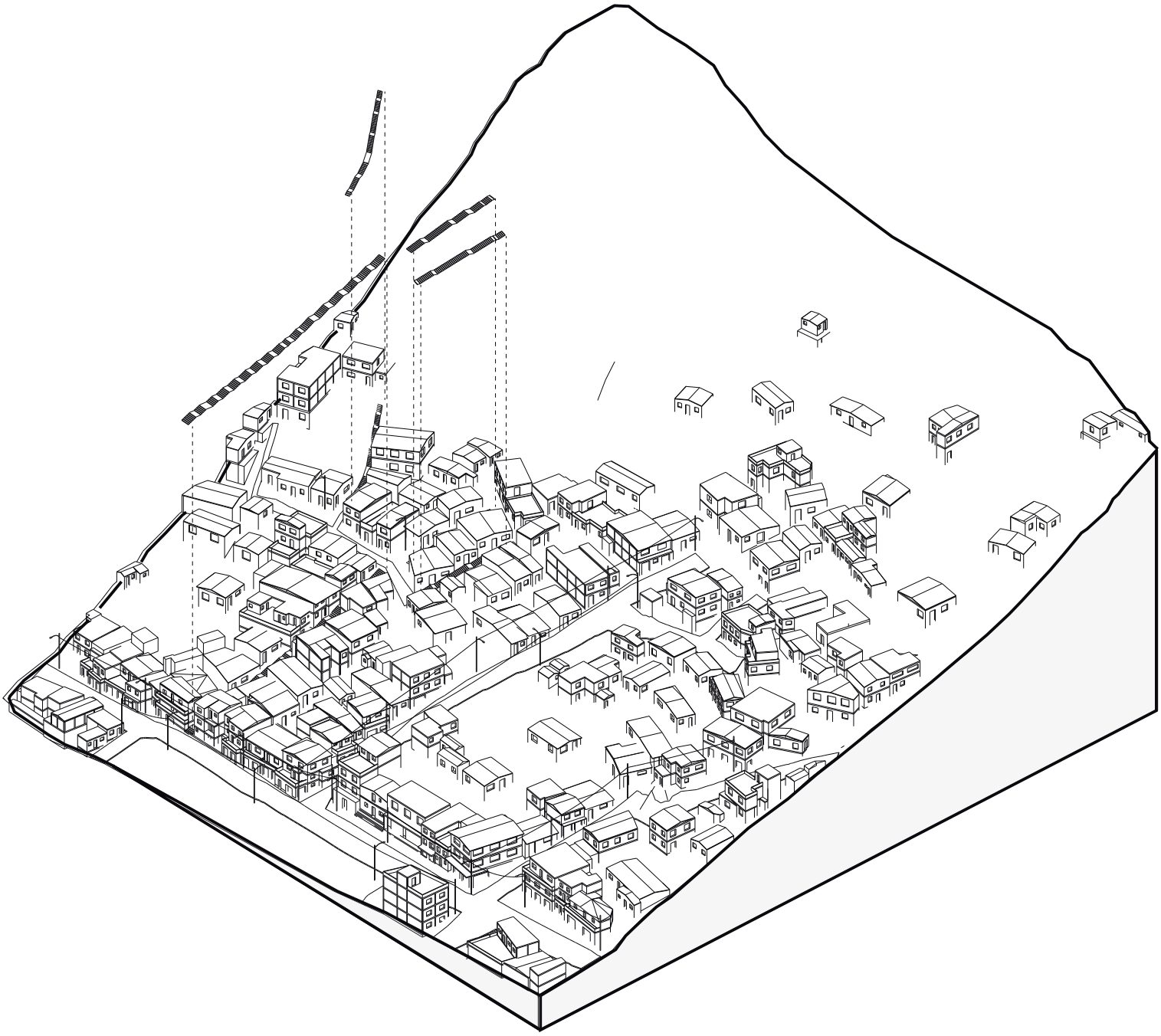


Figure 106 *Axo 1 - Carpinelo -Medellin East Border- Own elaboration*

Area 2

Informal Urban Typology.

This area has typological urban conditions similar to the ones in Area 1. In the low slope areas, the regular orthogonal blocks are located and there are organic pattern typologies in the high slope areas. The principal differences between Area 1 and Area 2 are the level of consolidation and the density in the areas. There is an urban sprawl of isolated informal units that did not have a built block or consolidated urban structure. Even so, there are places with low slope areas, in which the informal development has not been extensive and there is available land.

Topography.

The topographic condition in this area is a steep slope with high slope and low slope areas. The first high slope areas have been an initial barrier for informal development. Due to this condition, a high-density area of the settlement has been consolidated until this point. The slanted terrain condition presents a valley between high slope areas and the informal settlement has settled in this area. Besides, the hydric structure has defined the outlines of the informal settlement and even in some cases, the informal settlements have been built along the river lines. The low density of this area has helped to maintain the river flooding areas free of informal development.

Accessibility

This area has no direct access to the Metro system of the city by Metro-Cable lines, the connection with the center of the city is through the bus system. The average walk traveling time to bus stops is between 10 and 20 minutes. The areas of the settlements that have a more than 25

minutes walk travel distance are the ones that, owing to the topographic condition, have difficulties to access vehicular streets and do not have available bus stops nearby.

Architectonic and Urban Features

The public, urban and architectural interventions in this area were reduced in relation to Area 1. In terms of urban interventions, there are the UVA Dreams Park and the "Raizal" Park. Moreover, in terms of architectural interventions, there are Lara Bonilla School, "Luz de Oriente" School, and Montecarlo Guillermos Gaviria School.

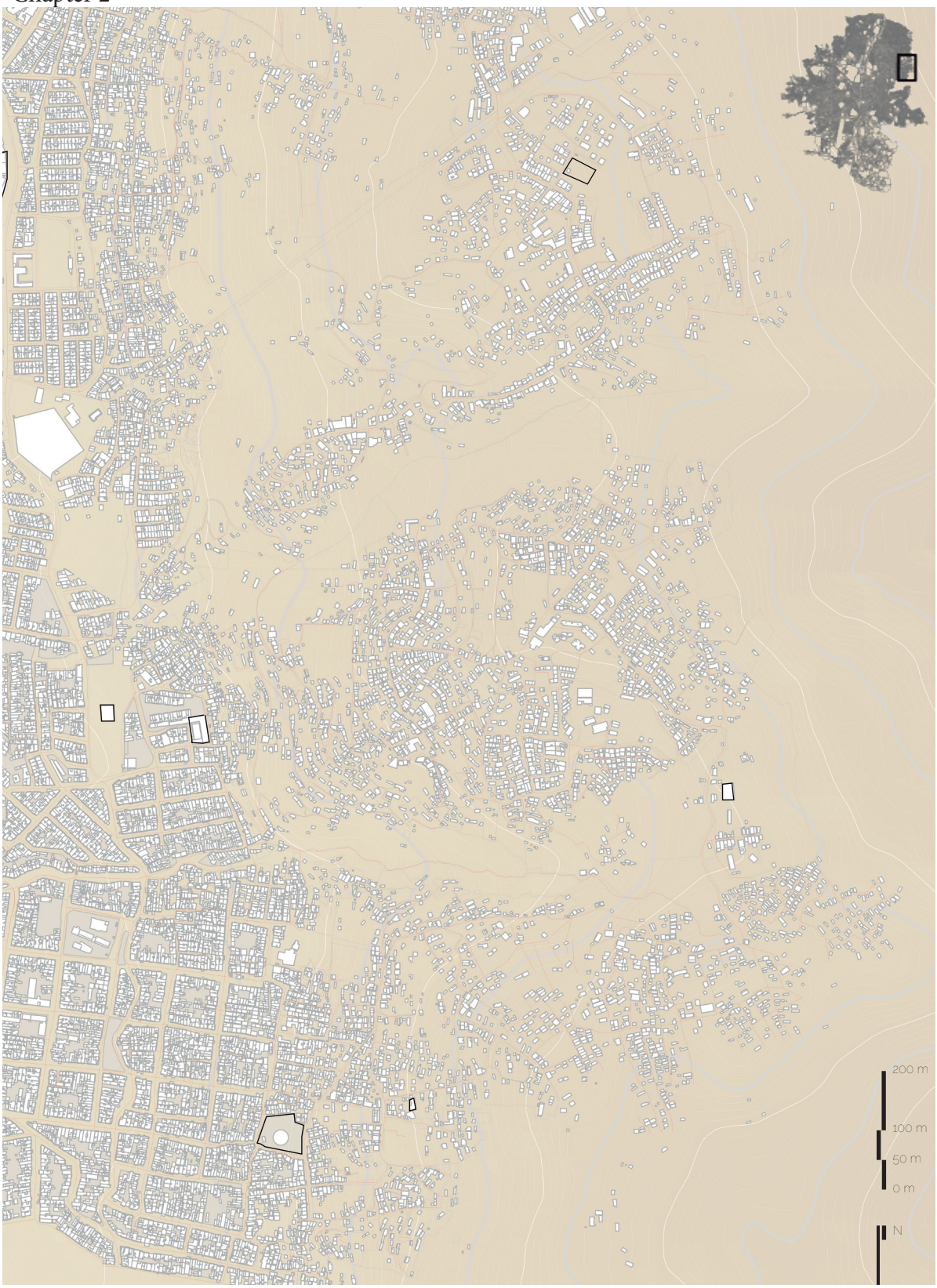


Figure 107 *Area 2 (Medellin East Border) - Base Map - Own elaboration*

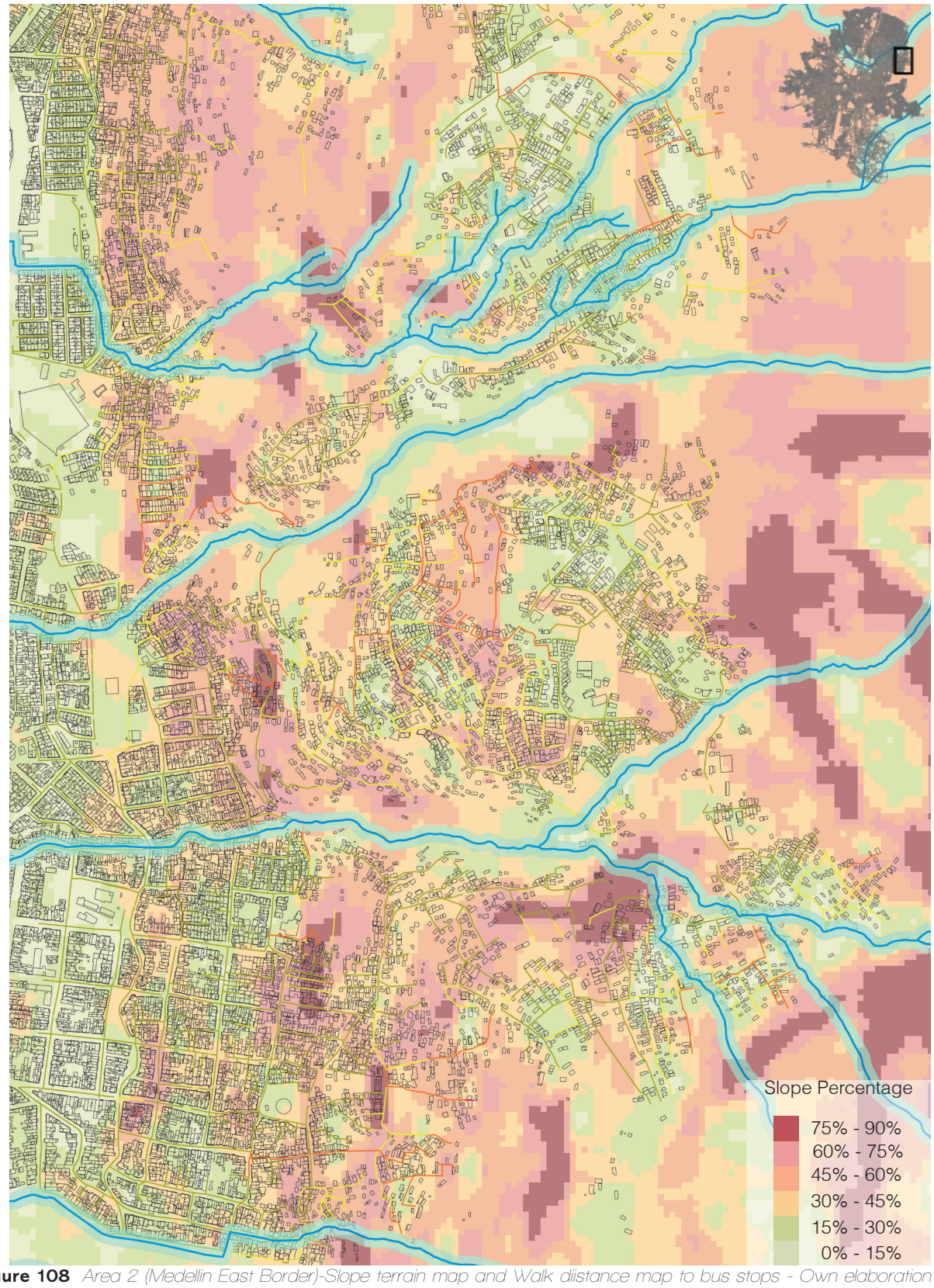
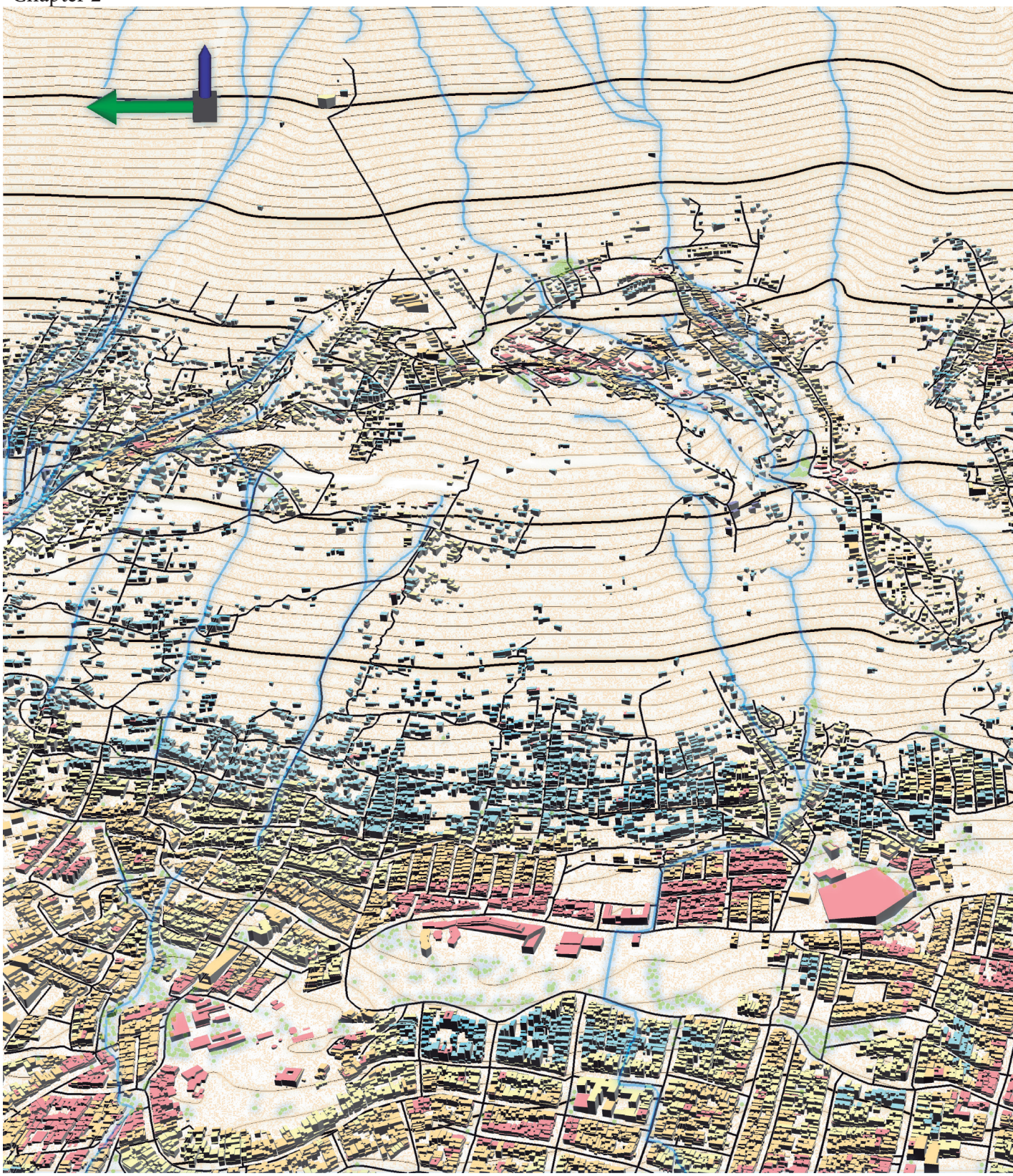


Figure 108 *Area 2 (Medellin East Border)-Slope terrain map and Walk diistance map to bus stops - Own elaboration*



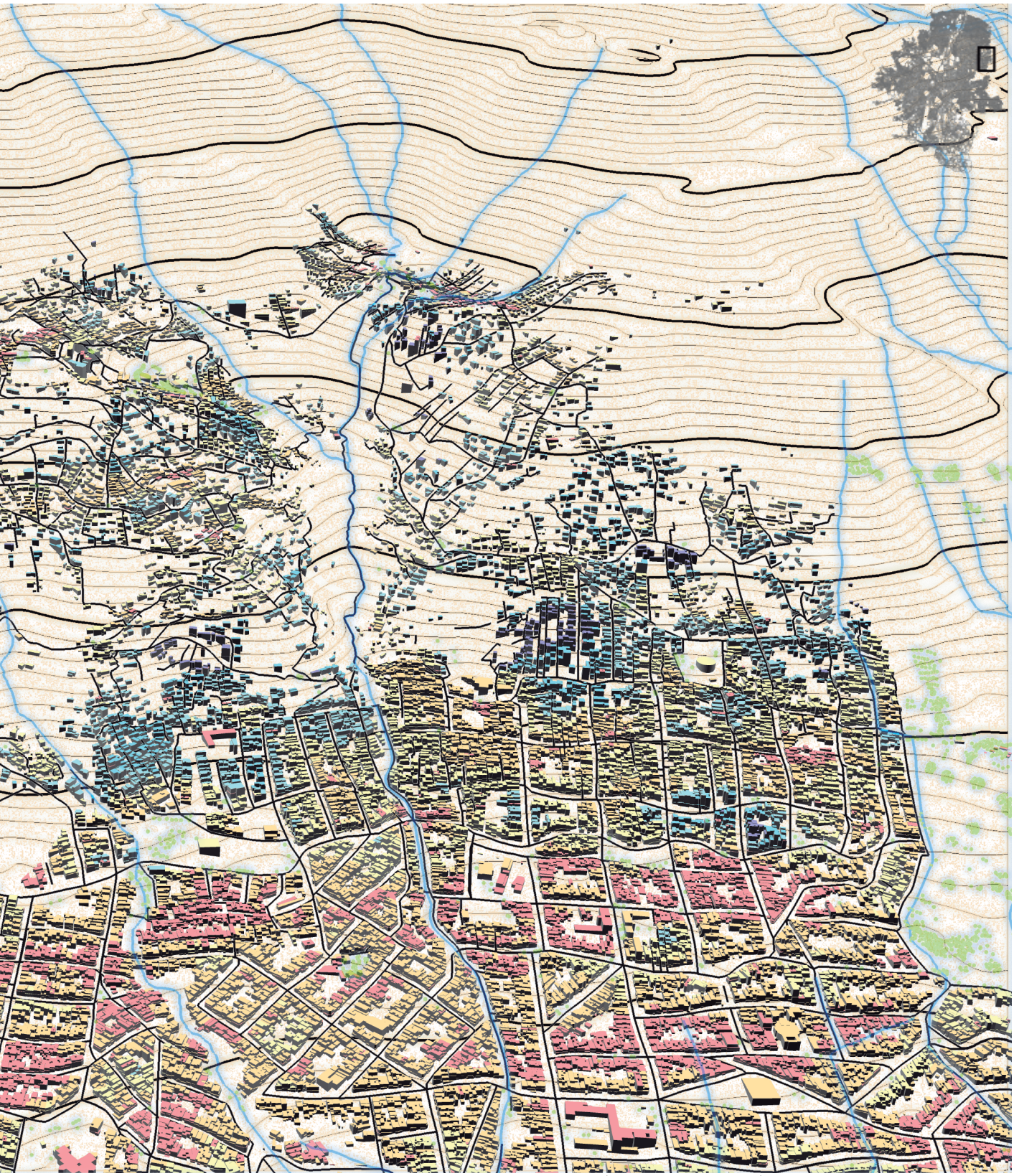


Figure 109 *Area 2 (Medellin East Border) - Perspective - Own elaboration*

Area 3

Informal Urban Typology.

Unlike the previous areas of study, in this area, there are no clear topographical boundaries that initially contained informal development. Instead, the orthogonal urban pattern has been regular throughout the settlement. The settlements in this area have low-density values and are organized around a border by the hydric structure.

Topography.

There is a topographic condition, which is different from the previous areas, where there is flatter land and there are no intermittent conditions of low and high slope areas. Vertically, there are 2 high slope areas that have contained the vertical sprawl of the informal settlements. The horizontal growth of the settlements has been contained by the hydraulic system, even the settlements located in the interior are transversally defined by the river paths.

Accessibility

In terms of accessibility to the city transportation system, this area has access to the M line of the Metro-Cable system. The walk time to bus stops is relatively short, the average time is between 10 and 20 minutes with the exception of the edges of the informal development where there are no nearby bus stops and the informal paths are rural and have high slope conditions that affect the traveling time and distance.

Architectonic and Urban Features

The urban interventions are the H line of Metro-Cable, the UVA SOL sports center, the Buildings of León de Greyf Library, Joaquin Vallejo

School, Golondrinas Park and Centro Libertad School

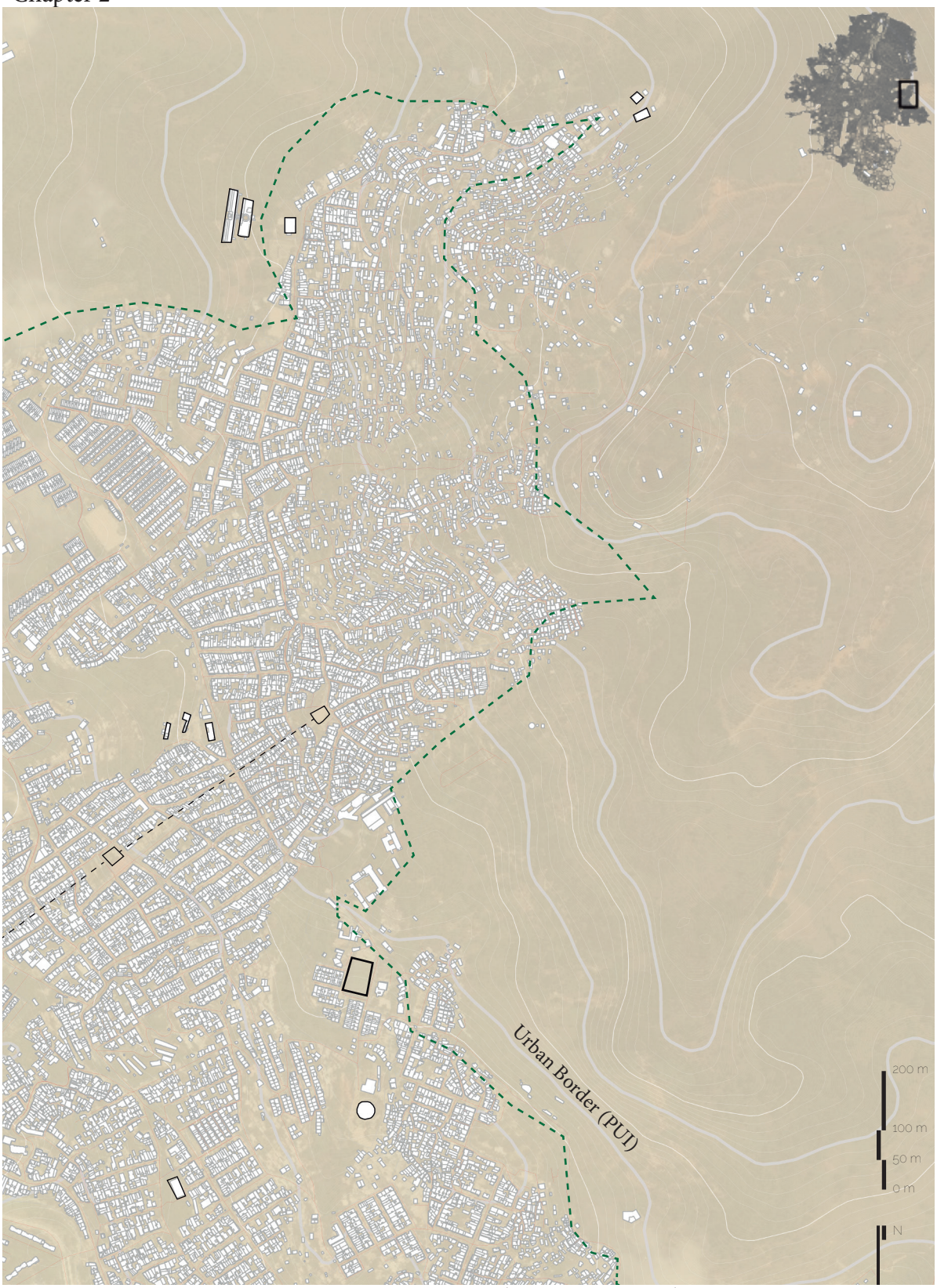


Figure 110 *Area 3 (Medellin East Border) - Base Map - Own elaboration*

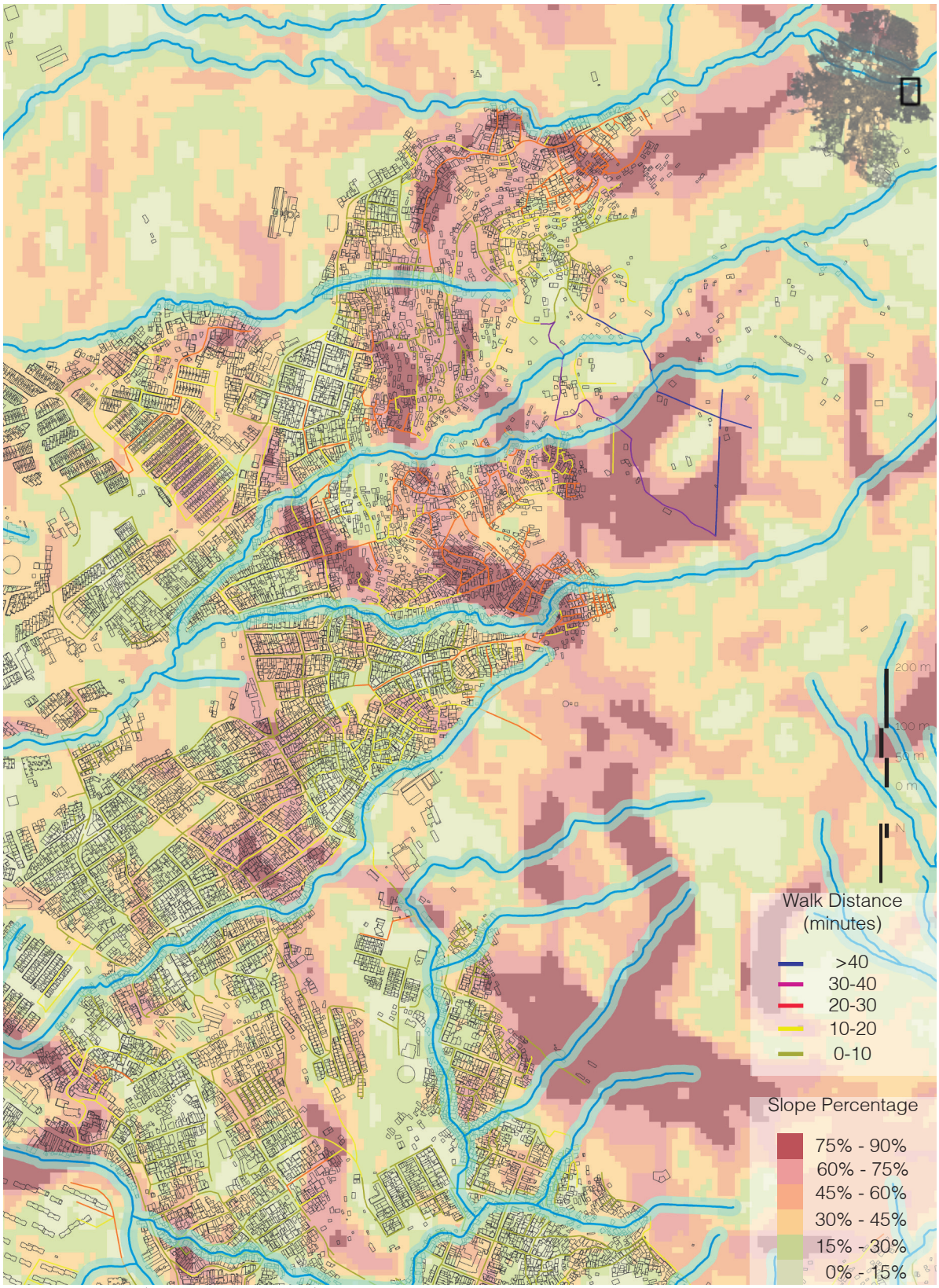


Figure 111 *Area 3 (Medellin East Border)-Slope terrain map and Walk diistance map to bus stops - Own elaboration*

Area 4

Informal Urban Typology.

In this area, there is the highest density value in the area of study and one of the highest in the eastern border of the city, The principal reason for this condition is the privileged location of this area since it is close to the airport and it is one of the neighbourhoods with the highest income of the city (El Poblado). In this area, a process of transformation from informal to formal is shown by pressure and speculation of land value. According to the income map in this area, the population with the highest income in the area of study is located in these neighbourhoods. Formal housing development has appeared in heights, which has increased the value of square meters in this area modifying the urban structure.

Despite the informal organic patterns, there is a growing development of isolated high-rise housing complexes.

Topography.

This area was initially the root of a valley in the topographical condition of the mountain. On this topographic condition, an empty space was generated, in which the informal development in this area has developed. The informal roads start from this central route. Furthermore, a central river is born in this valley, where the neighboring streams are poured. This condition has defined a center of development and a perimeter development around this area.

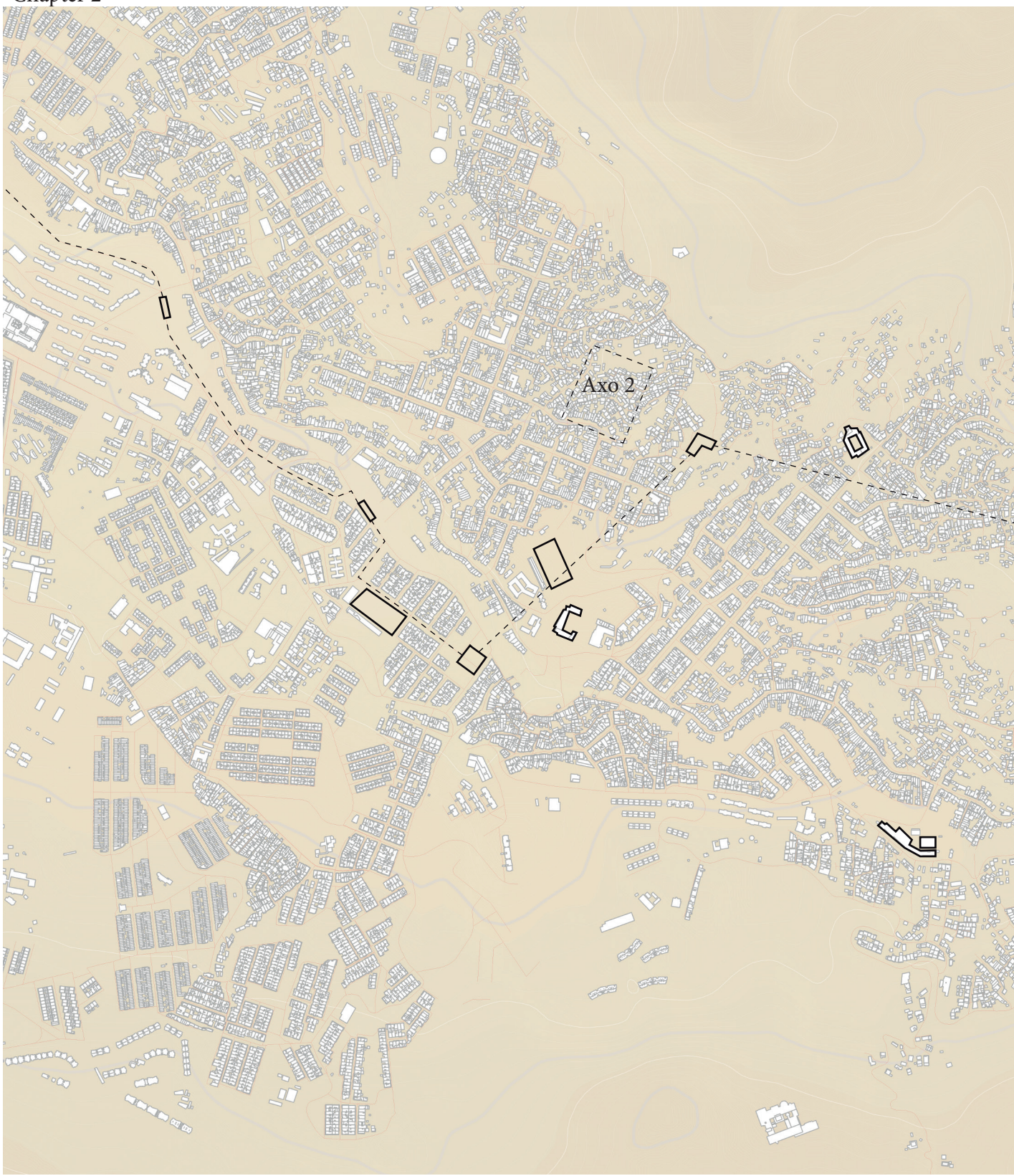
Accessibility

This area has access to the H line of the Metro Cable system. In terms of the walk time to bus stops analysis, the values are relatively low between 10 to 20 minutes with a similar exception in Area 3.

Architectonic and Urban Features

The urban interventions are the Metro Cable stops, Las Estancias Public Park and Alejandro Echevarria Park. Besides, in terms of architectural interventions, there are Gabriel Garcia Marquez School, La Sierra School, Julio Botero School.

The informal development is defined by natural elements such as the topography and the hydric structure of the mountain. In contrast with the topographic conditions of SJL where the high slope areas present a continuous limit of the urban sprawl, in Medellin, the high slope areas are intermittent and have been left out in order to continue the informal development in better-located areas.


Axo 2

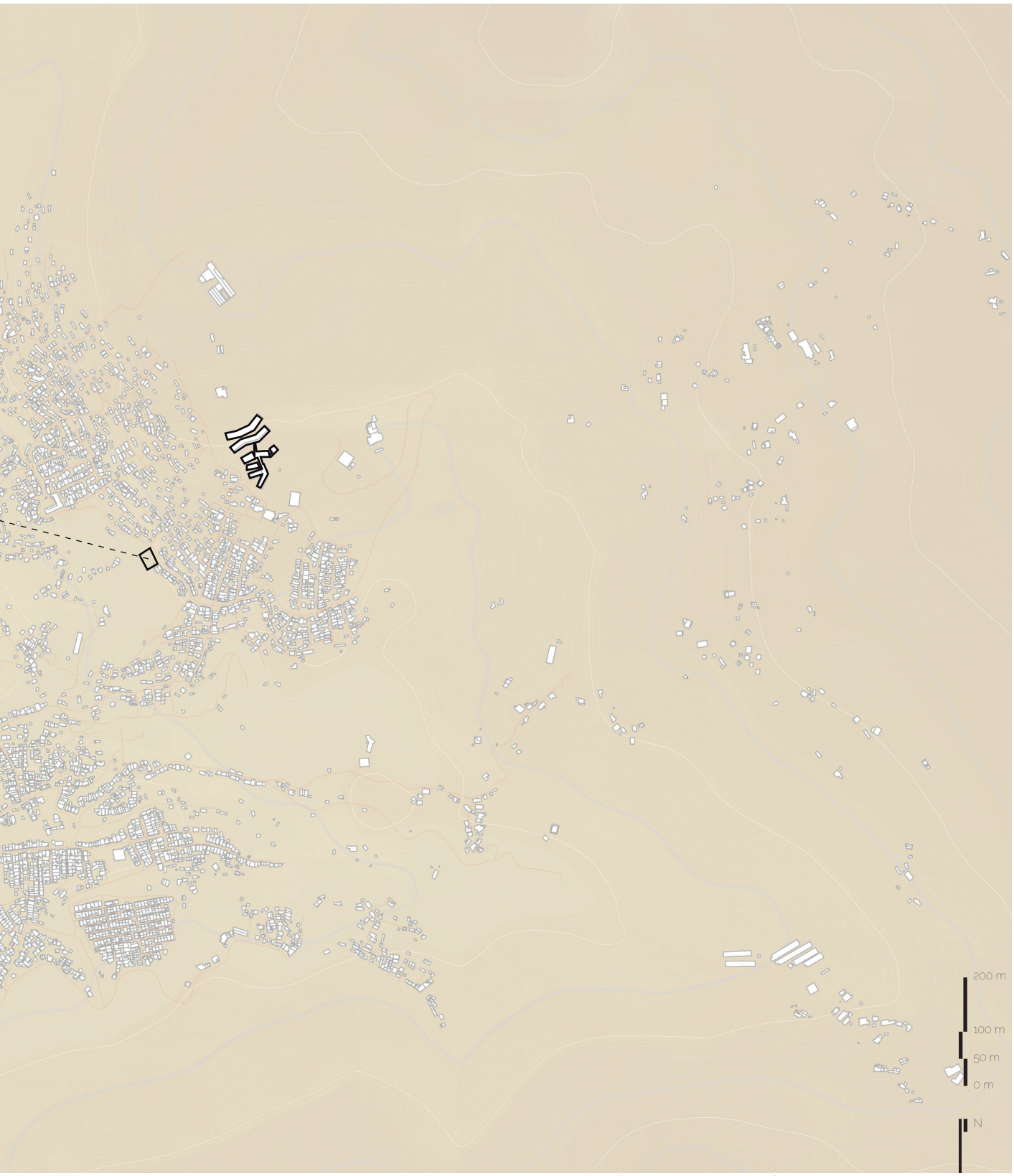
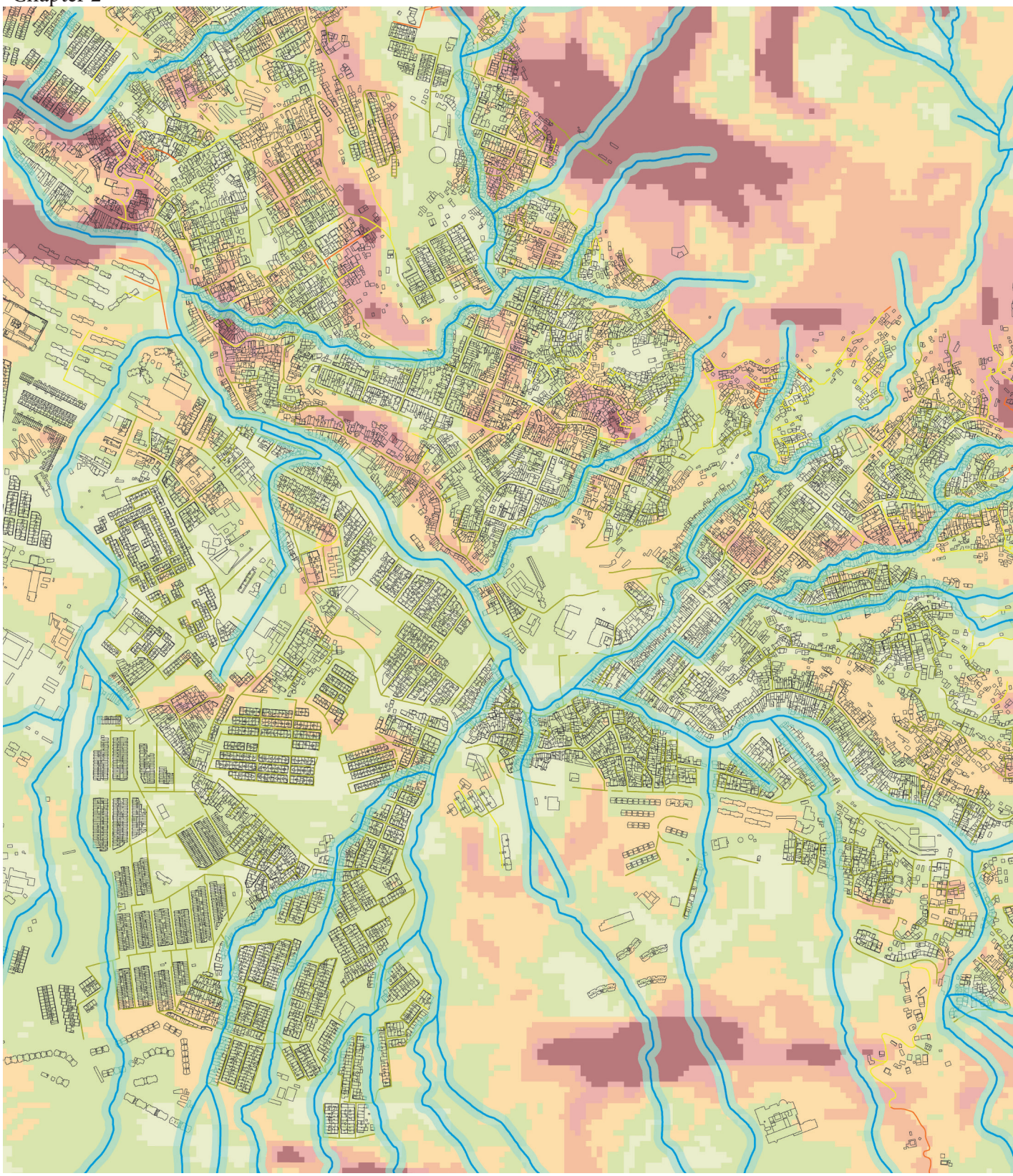


Figure 112 *Area 4 (Medellin East Border) - Base Map - Own elaboration*



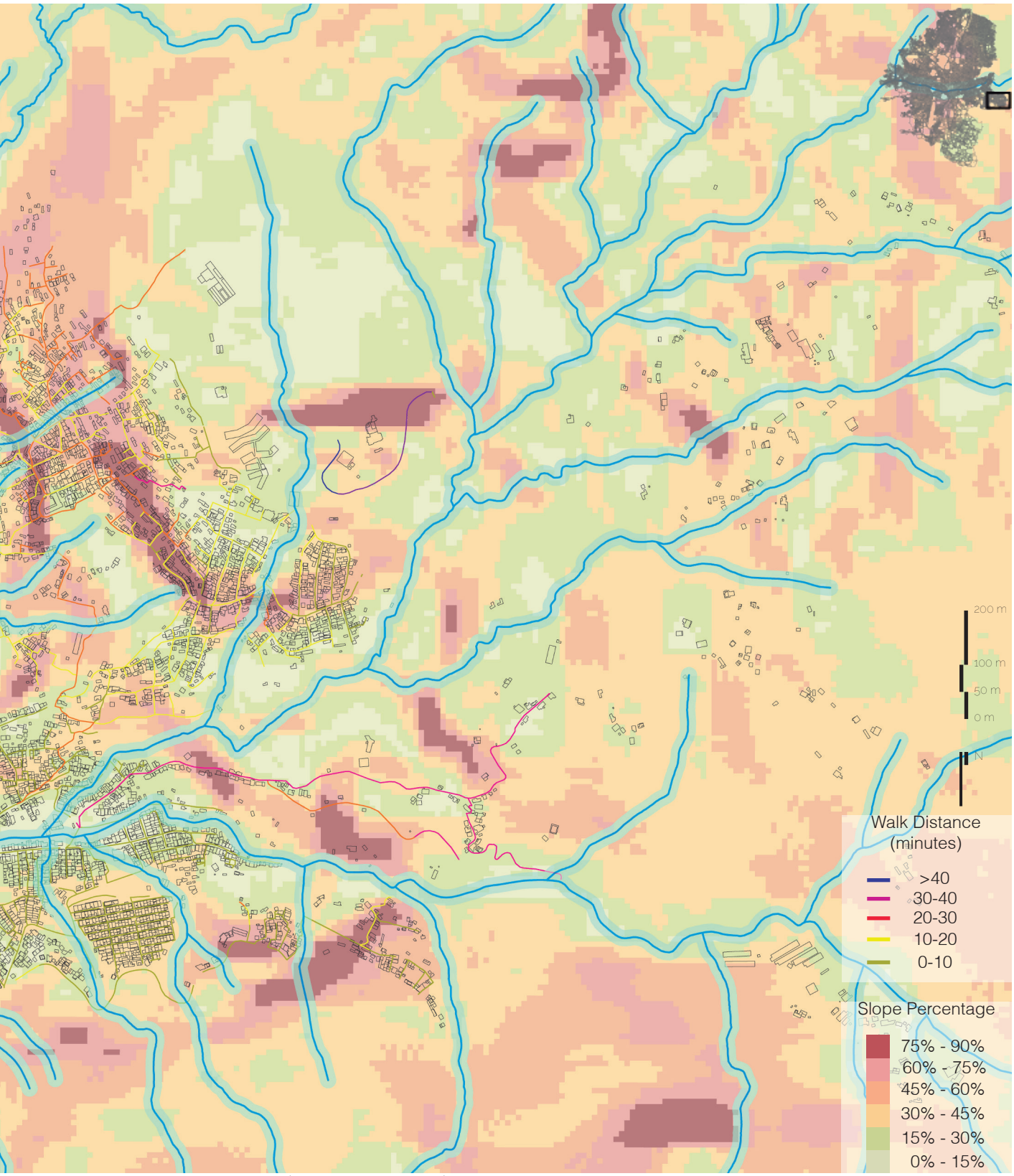


Figure 113 *Area 4 (Medellin East Border)-Slope terrain map and Walk diistance map to bus stops - Own elaboration*

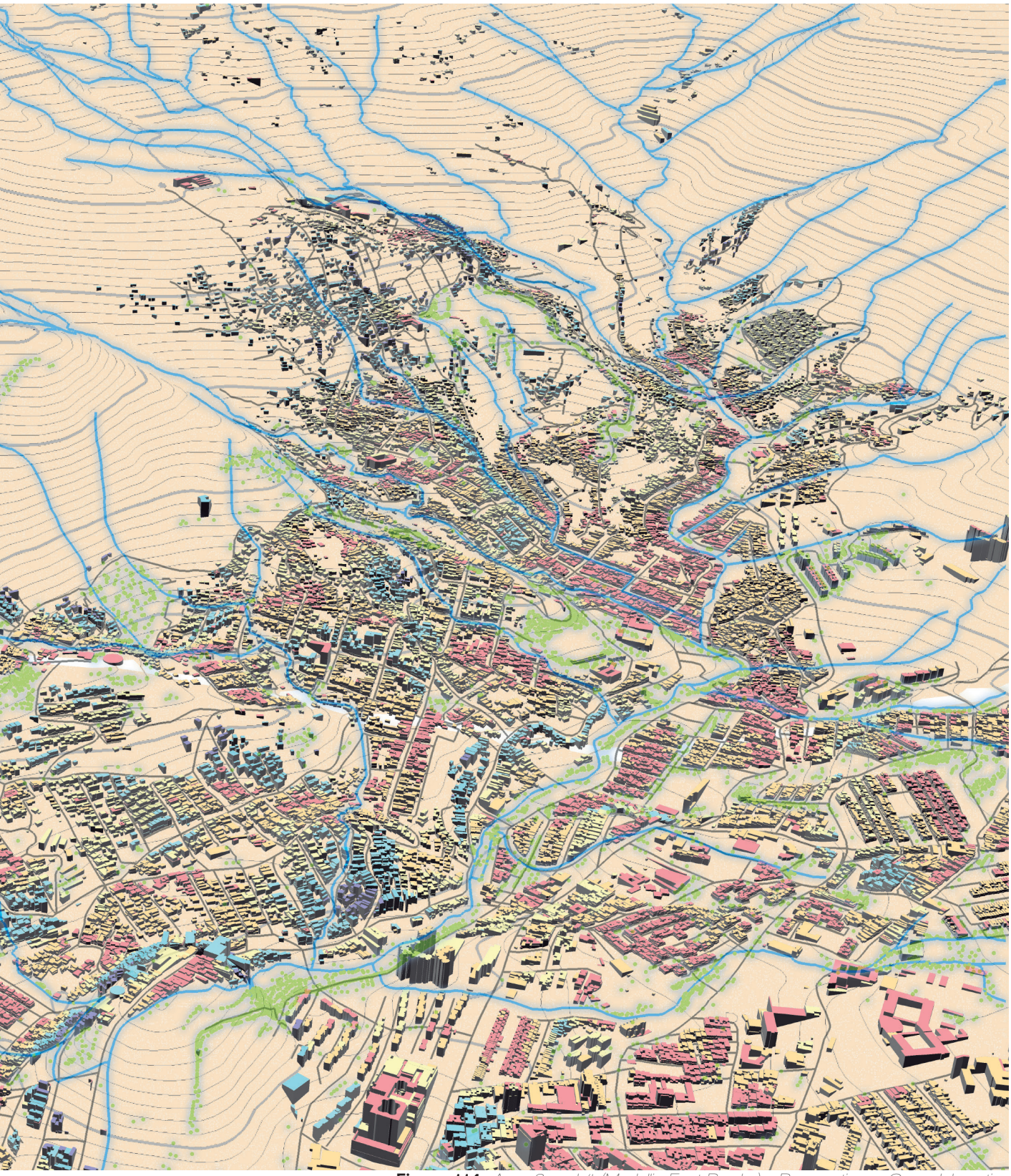


Figure 114 *Area 3 and 4 (Medellin East Border) - Perspective - Own elaboration*

High Density - Steep Topography

Figure 115 *Axo 2 - Area 4- LLanaditas -Medellin East Border- Own elaboration*

An Scenario for future informal settlements in Medellin

The agent-based model is used to show the next area of possible informal development based on the patterns collected through the analysis. The location of these possible attraction points is based on the spatial and territorial analysis identifying points and areas that have natural conditions for informal development. This analysis is conducted ignoring further government intervention and restrictions to invade this territory. To develop this analysis, the agents have been defined in the existing informal and formal street network and keeping this in mind, new areas of informal development have been sought. The undeveloped areas that have a slope higher than 50% and the river flooding protection areas have been defined as repulsion points and the areas with a slope minor than 30% close to the existing streets networks have been considered an attraction point. The accumulation of agents in certain points generate a center or a place that will indicate a possible area for future informal development.

Figure 116 *Area 1 - East Border Medellin- Agent Base Model analysis - Own elaboration*

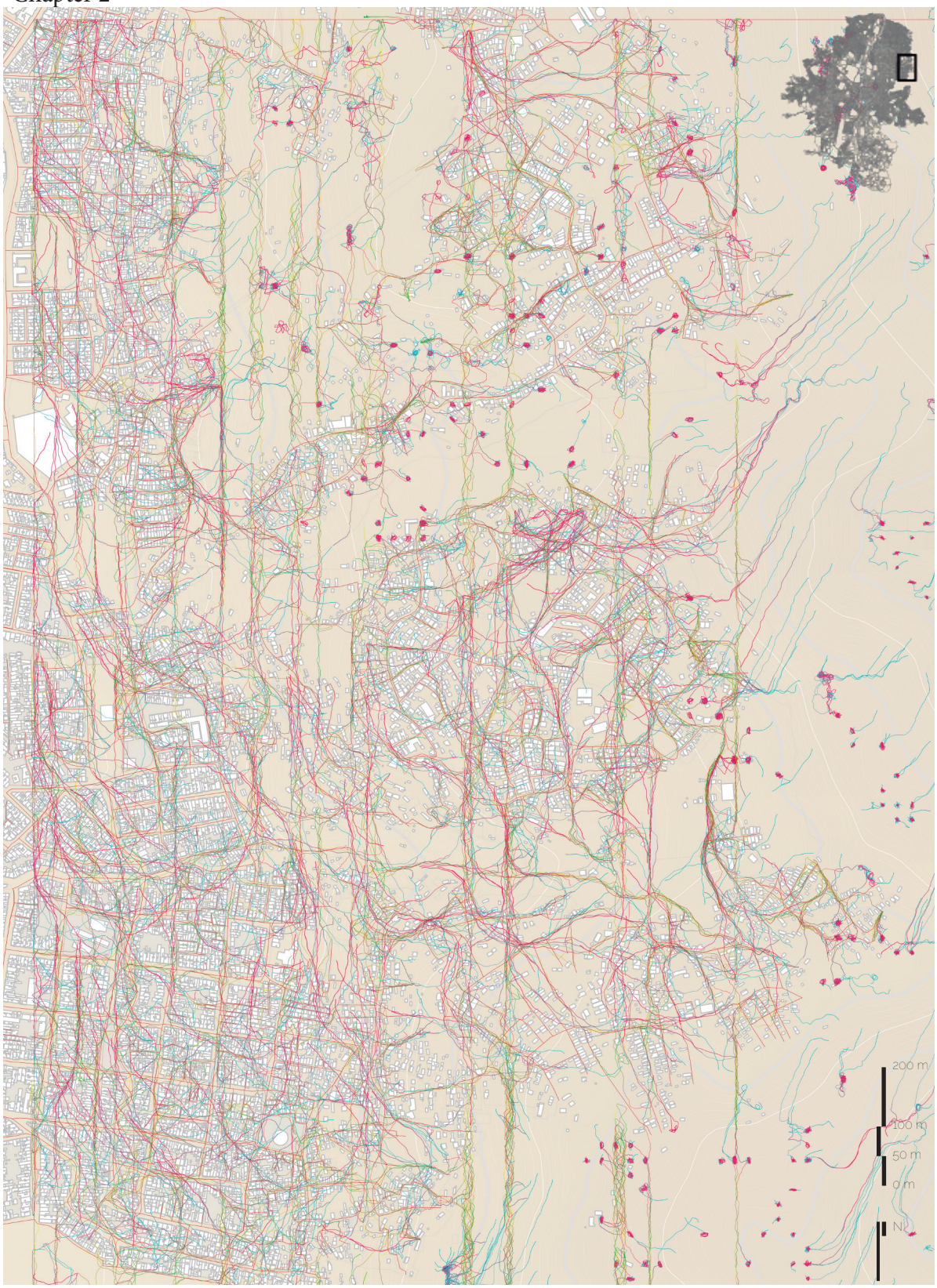


Figure 117 *Area 2 - East Border Medellin- Agent Base Model analysis - Own elaboration*

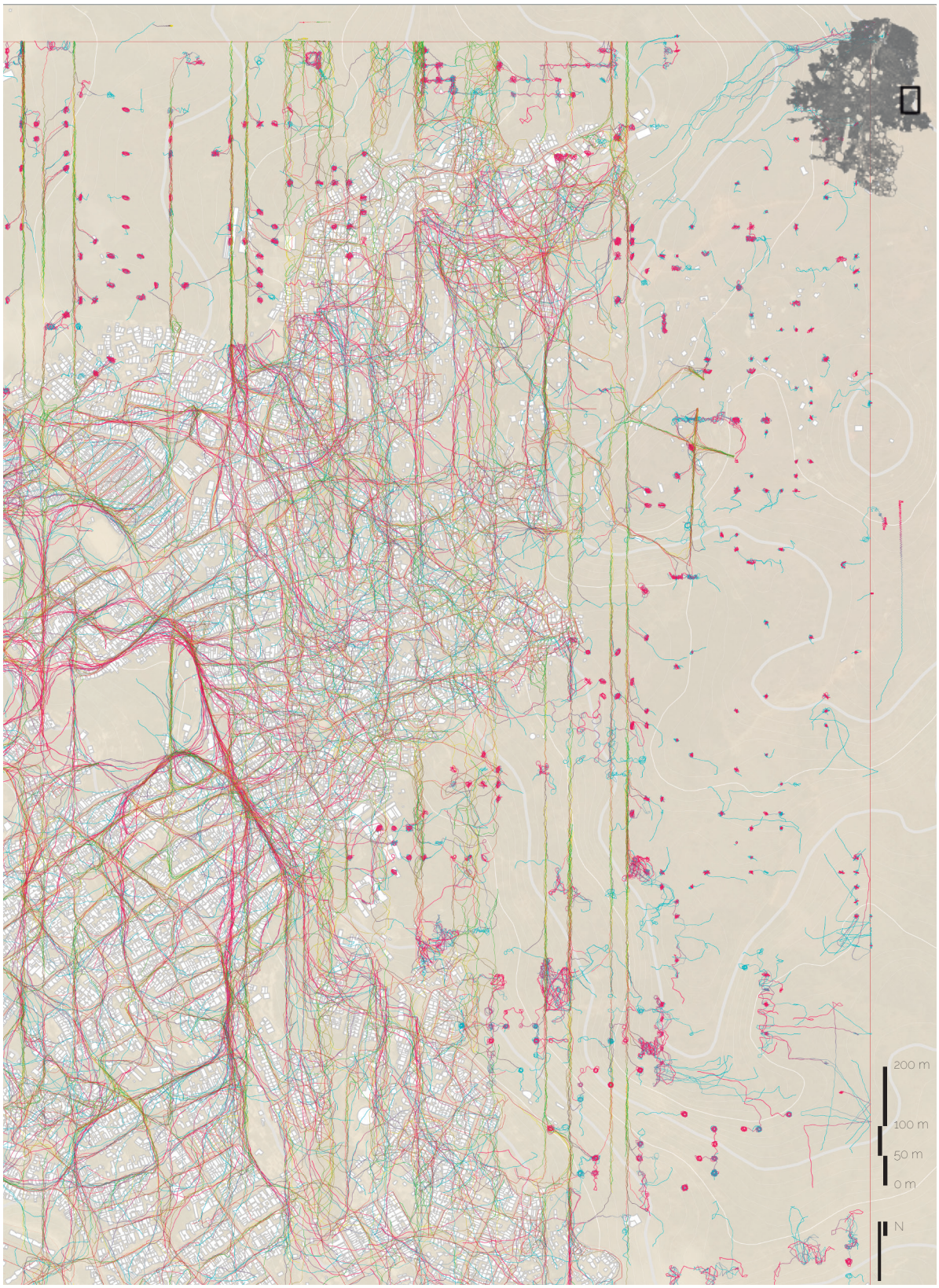


Figure 118 *Area 3 - East Border Medellin- Agent Base Model analysis - Own elaboration*

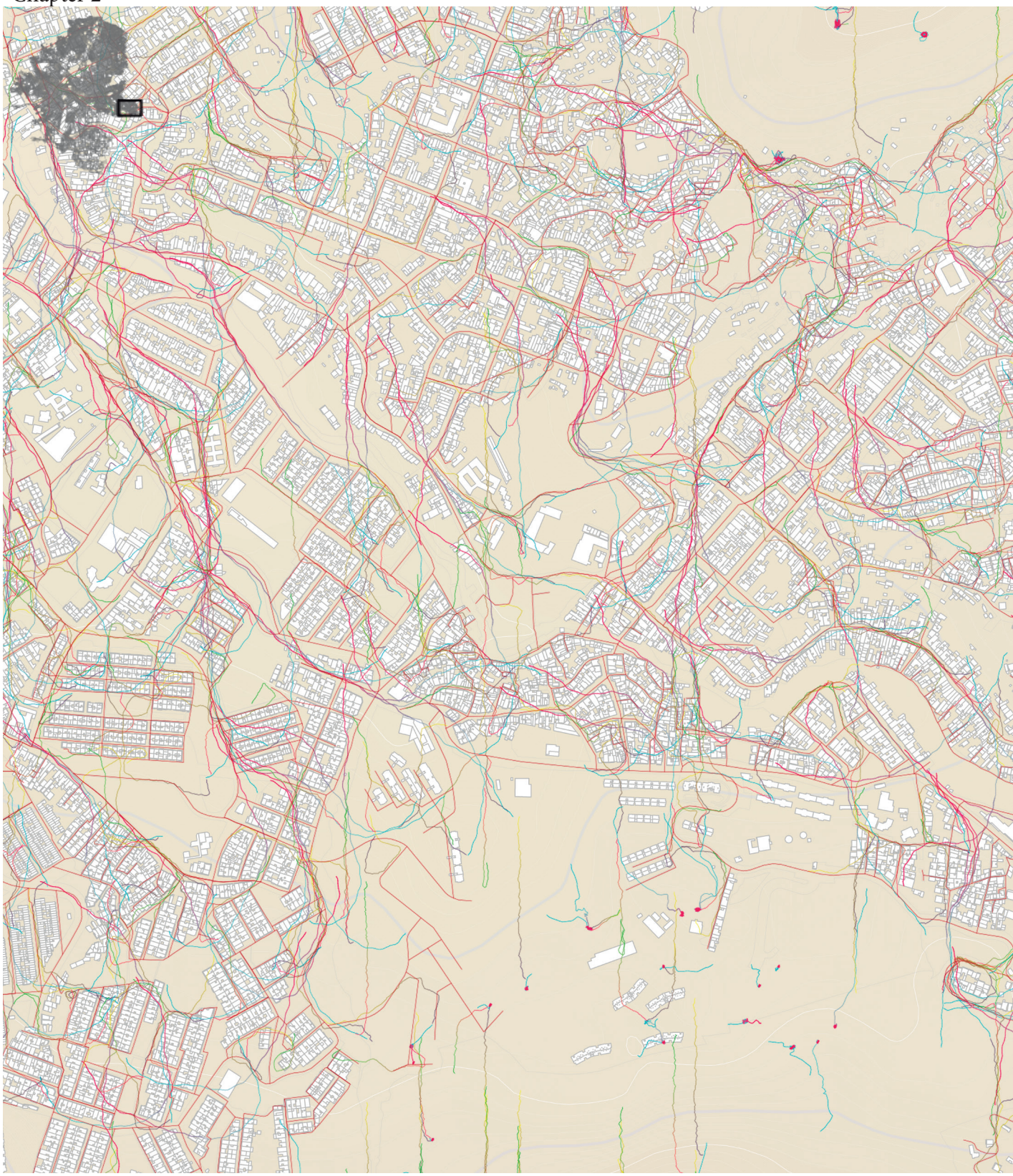


Figure 119 *Area 4 - East Border Medellin- Agent Base Model analysis - Own elaboration*

Conclusion

The objective of this analysis isn't based on blindly defending informal urbanization. Instead, its aims are based on emphasizing how both Medellin and Lima can demonstrate the fact these informal settlements are still growing despite the inner difficulties that are inherent to the process (squatters of public land, illegal construction, land title conflicts, segregation). Therefore, said process has to have some degree of validity, or at least certain benefits in economic, urban and architectural terms that have allowed it to remain as an alternative for construction within the city. Medellin and Lima are also examples of locations where the amount of housing for low-income populations has been considerably reduced over the last 50 years. The state has turned away from facing the housing problem and various administrations have preferred to assume a neoliberal position, based on providing subsidies and letting the flow of supply and demand manipulate the market.As we have already examined throughout this study, this approach has not been beneficial for low-income populations, particularly those who can barely find any other alternatives to live in the city outside of informal settlements. It is quite clear that the informal process of urbanization may not be ideal, on paper, but the urban and social structures that have taken root are ultimately a reaction to economic and social systems that were built in order to exclude them from the mainstream order.

The agent-based model presented was built using the topographical data as well as the travel distance values collected during the analysis of informal settlements in Lima and Medellin. This condition reflects a limited scenario where the model can accurately project the future of informal development within the relevant areas of study. However, the multiple additional variables that could be involved over time and any

potential political, economic or social interventions inside these settlements which were not previously considered might feasibly alter these results. Despite the limitations of the agent-based model, this tool could still become a useful mechanism for future planning strategies related to informal settlements. For instance, the model could be used to identify possible areas for future informal development and either the state itself or its planning agencies could foresee and prevent informal sprawl by developing the landscape or building architectonic projects in these areas in order to contain said sprawl and attempt to improve the living conditions of the current inhabitant of these settlements.

It is possible to affirm that Lima, Medellin and other Latin American cities have generally seen reduced demographic growth as well as expanding urbanization during the early 21st century when compared to the overwhelming growth experienced in the second half of the 20th century. The post-COVID19 scenario is amplifying this trend, particularly because the rural-urban migration is likely to revert as long as cities remain the center of the pandemic's expansion. Likewise, the current health crisis has had an impact on the already vulnerable state of informal communities, especially in the case of Lima where the death rate for the ongoing pandemic has hovered around 90%. Lack of access to basic public services, absence of basic housing equipment and overcrowded spaces in both markets and houses has increased the vulnerability of these communities. Modernism, as an architectural movement, was derived from the will to overcome the deplorable living conditions of factory workers during the industrial revolution. In that sense, a post-COVID19 future may provide the right opportunity to modify and improve the living and housing conditions of both workers and low-income communities for the purpose of achieving a better quality of life and guaranteeing their essential rights.

The main coincidence resulting from this analysis is the lack of consis-

tent political and economic actions against the problem of housing faced by the low-income population. Whether it is due to the massive scale of the emerging demand or a simple lack of political will, the fact is there's a large deficit in these cities in this respect. A precarious economic situation is motivating people to settle in increasingly risky places, particularly considering the threat of landslides or areas with large slopes.

Regarding the question of whether it is possible to speak of informal urban patterns on a Latin American scale, the initial conclusion based on these 2 cities is negative. The economic and political conditions of each country have influenced the typology, arrangement and organization of their informal developments. For example, while Lima has implemented a lax policy towards these settlements, it has led to their greater territorial extension. Conversely, in Medellin the local public policies have managed to contain the extensive growth of these settlements and, as a result, a more vertical informal kind of growth has been achieved. Likewise, the geographical and territorial conditions of each region greatly influence the organization of the settlements. Medellin showcases how the hydric structure of the city has largely contained and drawn the boundaries informal development; in SJL, the absence of natural elements beyond a mountainous topography has generated a more continuous urban pattern with fewer open spaces. Natural barriers have served as the most predominant condition for containing informal development within the areas of study. Concerning the presence of points of coincidence, there are common patterns involving how settlement try to adapt to the conditions of terrain and reduce the cost of foundations by adopting parallel contour lines. The building materials employed for consolidated settlements are often similar to constructions bearing brick walls with concrete columns at the corners.

Informal developments in Medellin have moved to other parts of the city or to nearby municipalities, and even when there has been vertical grow-

th within existing urban areas, the border defined in the master plans has been maintained. On the contrary, we find a completely opposite trend in the district of San Juan de Lurigancho. Since 2000, informal development has spread into high-risk areas and has extended to new areas. For the district of San Juan Lurigancho and Lima generally, invasions and informal settlements in steep mountain areas continue to act as the main housing alternatives, while the low-income population of Medellin continues to be located on the city's periphery.

For the purpose of developing a comparative study, it was necessary to match the information for both cities. This was a time extensive endeavor, requiring considerable research in order to find and select the same type of data from different cities under the same context. For example, the district of SJL in Lima did not provide any GIS information on the informal settlements. The rapid transformation of these informal neighbourhoods has presented a challenge in terms of mapping such data. However, the needs of carrying out a comparative analysis made it necessary to draw more than 5000 outlines for the informal units in order to understand the patterns and analyze their constructions. Such a procedure can in and of itself become a source of archeological information on informal forms of construction for future research, particularly acknowledging that, due to its dynamic and always mutative transformations, an informal city will continue to change, erase and rebuild itself.

Trends regarding the value and speculation of urban land may also continue to relegate the poor to the periphery of cities and force them to experience long commuting times. In this sense, informal settlements will become a better alternative for low-income populations who wish to live within the city itself, rather than settling in remote municipalities with even longer transportation times and fewer job opportunities. Large-scale urban planning has focused on creating more sustainable, compact cities with a lower ecological footprint and, in this scenario, there will likely be an upcoming phase of high densification throughout informal neighborhoods, including those located on hillside areas and high slopes, because of their benefits with respect to location and displacement within the city.

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