PUBLIC GREEN SPACE IN THE CITY OF NEUQUÉN. AN APPROACH TO URBAN CHANGE

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Abstract

The aim of this study is to analyze the characteristics of public green spaces (PGSs) in the city of Neuquén (Neuquén, Patagonia Norte, Argentina), applying established scientific indicators from the literature. Public green spaces play a significant role in shaping the environmental and social conditions of the urban structure and the quality of life of the population. The typologies, specificities, and potential uses of the PGSs have been analyzed, advancing into new expansion areas, and the role they take on in shaping a public policy-based urban model. The study has revealed a fragmented structure and configuration that does not always enable the population to coexist with such spaces. This trend has become modified over the last decade, whereby the PGSs have gained particular emphasis in the new image of the city.

Keywords

Public Space; Urban Indicators; Environmental Quality; Urban Policies; Quality of Life.

O ESPAÇO VERDE PÚBLICO NA CIDADE DE NEUQUÉN. UMA ABORDAGEM DA MUDANÇA URBANA

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Resumo

Este trabalho tem como objetivo estudar as características do espaço verde público (EVP) da cidade de Neuquén (Província de Neuquén, Patagônia Norte, Argentina) por meio de indicadores normalmente utilizados na literatura científica. O espaço verde público desempenha um papel relevante na configuração das condições ambientais e sociais da estrutura urbana e na qualidade de vida da população. Foram levantadas as tipologias, as particularidades e as possibilidades de utilização dos EVP, avançando nas novas áreas de expansão, assim como o papel que assumem na conformação de um modelo de cidade baseado em políticas públicas. O estudo mostra uma estrutura e uma configuração fragmentadas que nem sempre permitem a convivência da população com tais espaços. Essa tendência foi modificada na última década, fazendo com que os EVP ganhassem particular destaque na nova imagem da cidade.

Palavras-chave

Espaço Público; Indicadores Urbanos; Qualidade Ambiental; Políticas Urbanas; Qualidade de Vida.

PUBLIC GREEN SPACE IN THE CITY OF NEUQUÉN. AN APPROACH TO URBAN CHANGE[1]

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Introduction

Public space serves as a key element in structuring the urban and environmental fabric, since it shapes urban planning, fosters relationships between individuals and social groups, and is ultimately an aspect that must be considered when assessing the quality of city life. Among these public spaces, public green spaces (PGSs) hold particular significance. With their vegetation as a fundamental, characteristic element (Birche; Jensen, 2018), PGSs enable a range of recreational, sporting, and cultural activities. These activities not only promote social interaction and bonding but also cultivate a sense of community.

Public green spaces are an inherent part of urban morphology, implemented by public interventions that can cause changes and continuities in the inherited urban landscape. Consequently, they constitute part of the history of the local community, of the process of urban land occupation, socio-spatial segregation and fragmentation, the requirements for public spaces and the structural frameworks of urbanization projects.

As components of public space, PGSs enable the interaction of individuals, sociability, children's leisure, a coming-together of people, the memory of a moment lived in nature. These elements of sociability are combined with environmental benefits (climate regulation, pollution control, ecosystem) and socioeconomic benefits (physical and mental well-being, landscape aesthetics, energy savings) (Roca; López, 2021).

1. The authors would like to thank the technical sector of the Instituto Patagónico de Estudios de Humanidades y Ciencias Sociales (IPEHCS-Conicet-UNCo), especially Eliana Salazar for her collaboration in the cartographic preparation using Geographic Information Systems.

Despite the absence of a single definition and measurement method for quality of life in cities, several approaches have recognized PGSs as a crucial component of urban well-being. Objectives set by the United Nations to achieve sustainable development include "[By] 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities"[2] (ONU, 2023, n.p.).

Thus, in cities that have prioritized organization, equipment, and symbolism, PGSs contribute to an image of a balanced city, where the built environment is cushioned by natural spaces, thereby affecting the general condition of the population's well-being (WHO, 2016; Gómez; Velázquez, 2018). The equity or inequity in the distribution, urban equipment, accessibility, type of sociability fostered within them, or integration with residential, commercial and service areas, all constitute a set of public and private attitudes that ultimately define the relationship of the city with its green spaces.

Considering that the PGSs are critical in shaping the environmental and social conditions of the urban structure and, a priori, co-determine the quality of life of the population, this study aims to analyze the characteristics of public green spaces in the city of Neuquén, applying established scientific indicators from the literature.

Likewise, the indicators are not only able to identify the typologies, specificities, and possible uses of the PGSs, but also shed light on their territorial configuration, potential for expansion and the role they play in shaping a city model driven by public policies. This study has employed these analytical indicators on a neighborhood scale, examining how the configuration of the PGS has influenced the different sectors of the city. This analysis helps to determine their association with urban development, citizen rights, public policies, and territorial consolidation and fragmentation.

The article is organized into three sections, in addition to this Introduction and the Conclusions: Characterization of the study area; Materials and methods; and Presentation and discussion of results. The first section presents a general characterization of the city of Neuquén (in the Province of Neuquén, Northern Patagonia, Argentina) and its centrality in articulating various functions of regional intermediation. The second section describes the materials and methods used, adopting the concept of green space as part of the analytical category of public

2. N.B. For direct citations, the English version was used of: UNITED NATIONS, Department of Economic and Social Affairs - Sustainable Development. Available at: https://sdgs.un.org/2030agenda. Viewed on: 16 May 2024.

space, and the indicators used for this analysis. In the third section, the key results obtained are presented, together with a critical assessment. In the Conclusion, the results are interpreted, relating them to the expansion of the city and the environmental conditions of new urban land occupations, within the context of the restrictions and the potentialities of the configuration of green spaces in the neighborhoods.

1. Characterization of the study area

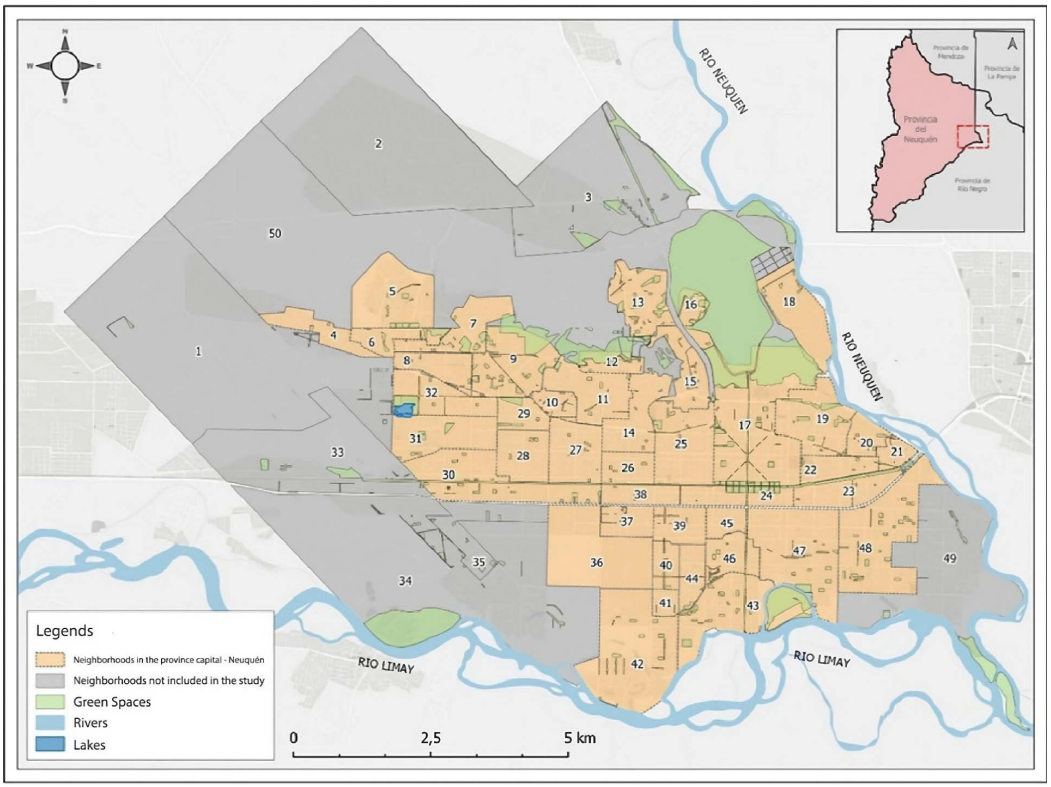
The city of Neuquén constitutes the largest urban, functional agglomeration in Northern Patagonia, given its regional centrality in articulating activities involving the extraction of unconventional hydrocarbon, energy, finance, commerce, and services. Currently, the city has 49 official neighborhoods (Figure 1), within which, it is possible to identify sectors, or sub-neighborhoods, that are products of planned (open and closed), and informal, urbanizations. The spatial configurations of the neighborhoods have resulted from the complex social production processes that created these spaces, which took into account the physical-environmental restrictions, but also the ongoing transformation of former rural areas into a variety of urban uses.[3]

Having been designated capital of the territory in 1904, the city of Neuquén was built around the current neighborhoods in the Central-East and Central-South Areas[4], and in areas close to this nucleus, Bairro Nuevo (1910) and Villa Florencia (1920) emerged. Between the 1930s and 1950s, a new urban strip extended out to the east and south: the neighborhoods of Belgrano, Villa Farrel, Mariano Moreno, Villa María and La Sirena. From the middle of the twentieth century, there was a notable expansion of the urban layout, with a marked trend toward the west, where there was a greater stretch of unoccupied land, with the emergence of the Cumelén, Bouquet Roldán and Progreso neighborhoods. During the 1970s, the neighborhoods 14 de Octubre, Unión de Mayo, Villa Ceferino, Provincias Unidas emerged in the west; Don Bosco and Limay in the southwest and in the north, Alta Barda and the Islas Malvinas. Over the following decade, the urban fabric penetrated into the edges of the plateau in the northwest, with the formation of the San Lorenzo, Gran Neuquén Norte, Gregorio Álvarez and Canal V neighborhoods; and to the east,

3. The following neighborhoods have not been included in this study: Valentina Norte Rural (1), Colonia Nueva Esperanza (2), Ciudad Industrial Obispo Don Jaime de Nevares (3), Valentina Norte Urbana (33), Valentina Sur Rural (34), Valentina Sur Urban (35), Confluencia Rural (49) and the rest of the urban perimeter (50). These neighborhoods represent spaces with urban sprawl, little or recently developed urbanization, and the PGSs have not yet been configured as such.

4. In all cases, the current names of the neighborhoods have been considered.

with the formation of Santa Genoveva and Rincón de Emilio. As of 2000, areas in the northwest were occupied by the urbanization processes of Cuenca XV, Hipeba and Esfuerzo. Private subdivisions have also advanced into rural areas close to the Limay River towards Valentina Sur Rural.



Neighborhoods

1 Valentina Norte Rural	7 Gran Neuquén Norte	16 14 de Octubre y COPOL	25 Area Centro Oeste	34 Valentina Sur Rural	43 Río Grande
2 Colonia Nueva Esperanza	8 Gran Neuquén Sur	17 Area Centro Este	26 Cumelen	35 Valentina Sur Urbano	44 Limay
3 Ciudad Industrial Obispo Don Jaime de Nevares	9 Melipal	18 Rincón de Emilio	27 El Progreso	36 Militar	45 Barrio Nuevo
4 Esfuerzo	10 Gregorio Alvarez	19 Santa Genoveva	28 Huillliches	37 La Sirena	46 Villa Maria
5 Cuenca XV	11 Villa Ceferino	20 Provincias Unidas	29 Union de Mayo	38 Bouquet Roldan	47 Manuel Belgrano
6 Hi.Be.Pa	12 Bardas Soleadas	21 Sapere	30 Canal V	39 Villa Florencia	48 Confluencia Urbano
	13 Terrazas del Neuquén	22 Villa Farrel	31 San Lorenzo Sur	40 Don Bosco III	49 Confluencia Rural
	14 Islas Malvinas	23 Mariano Moreno	32 San Lorenzo Norte	41 Don Bosco II	50 Resto del ejido urbano
	15 Alta Barda	24 Area Centro Sur	33 Valentina Norte Urbana	42 Altos del Limay	

Figure 1. Neighborhoods in the city of Neuquén and the main elements of the urban structure (2021)

Source: Own elaboration based on the Urban Territorial Information System of Neuquén (Situn, 2018), State Secretariat for Planning and Action for Development (Copade, 2019), and personal surveys (2021).

The city's expansion process, which involved the search for urban plots of land, the valorization of land, re-zoning, and the occupation of significant portions of public areas, determined formal and informal land occupation processes. This dynamic produced both continuities and ruptures in the city's configuration. Unequal access to land for families and businesses exacerbated socio-spatial segregation, which fragmented neighborhoods into sub-units, even down to the block level (Perren; Lamfre; Pérez, 2022).

This continuous transformation has given rise to very different possibilities for its inhabitants to access to land, services, community facilities and green spaces. Thus, frequent demands are made related to urban policies of social inclusion and the right to housing, caught within a discussion on environmental, economic and social sustainability, associated with the state's economic growth trajectory.

Characterized by an arid to semi-arid climate, as suggested by Morello (1995), the city of Neuquén is located between the valleys of the Limay and Neuquén rivers and the plateau (López; Gentili, 2022), and is part of the biogeographic region of Monte de Llanuras y Meseta, with arid soil, where plains and stepped plateaus prevail. Water scarcity and high levels of evapotranspiration have produced sparse, low vegetation cover, a high percentage of bare soil and the action of erosive agents (Capua; Jurio, 2011), which has given rise to very few natural green areas in urban spaces, except for riverbanks.

Environmental factors have a significant influence over assessing the different original situations of the PGSs, distinguishing those that are predominantly natural from those that have been created by public initiatives. Thus, public green spaces often involve substantial modifications and maintenance of the natural conditions, irrigation systems, grass and tree planting, and pathways. The expansion of the urban area toward the plateau has exacerbated this situation, both due to its natural conditions and to the geographical dispersion of community services and facilities that need to be served daily by the municipality.

2. Materials and methods

The concept of PGSs falls within the analytical category of public space, and is characterized by the existence of a vegetation cover (natural or planted) in a delimited space of the public domain. Each and every citizen has the right to access and use them, free from any institutional restrictions of any nature, whether social, economic, residential, or otherwise. In addition, PGSs usually have pathways, playgrounds and other equipment. Therefore, it is a concept that identifies the primacy of vegetation cover, both in its natural typology and through intervention, but not its exclusivity. In terms of the latter, it must be considered that definitions may contain different nuances and are specific to the context in which they are produced (WHO, 2016), although their definition allows, as in this case, to take a common criterion to integrate into the analysis the different typologies contained therein.

Quality of life is discussed in the terms proposed by Leva (2005, p. 14): "Quality of life as the primary purpose of public policies [...] associated with meeting a set of related needs related to the existence and well-being of citizens. The availability and accessibility to resources [in this case, green spaces] are crucial for meeting various aspects of the needs of individuals, social groups, and communities".

Public territorial planning policies, aimed at facilitating the subsequent process of prioritizing spaces for intervention in their multiple scales, appropriations and uses, comply with the demands or claims of citizens, understood as elements that highlight the requirements of different sectors for public management and the State's capacity to respond to them.

One of the most applied indicators to assess the presence of PGS in a city is the quantitative relationship between the total area of public green spaces and the total population (m2/inhabitant) (Taylor et al., 2011; Kabisch; Haase, 2013). However, as it tends to establish global or aggregated relationships, this indicator fails to provide information on how way these spaces have been distributed throughout the city, nor on their typology. Additionally, it is also considered that it provides no information concerning the environmental services offered by different typologies (Yao et al., 2014), nor on the accessibility of such spaces for different population groups, since it presupposes an equal distribution for all inhabitants (Reyes-Paecke; Figueroa, 2010; Weiland et al., 2011; La Rosa, 2014; Rodriguéz Antuñano, 2019).

In order to overcome these limitations, this article assesses the aspects of distribution, coverage, accessibility and quality (De La Barrera; Reyes-Paecke; Banzhaf, 2015), since the PGSs in a city constitute elements of the urban form, taking into account the distinctive characteristics of the settlement, uses and intensity of flows (Pasaogullari; Doratli, 2004). These variables allow for a proper consideration of the potential for social interaction and alternative uses for different age groups, as well as the cultural and environmental services that the PGSs provide. In this study, the indicators have been developed on the neighborhood scale, and for the purposes of the study, the typologies of square, plaza, boulevard, walkway and park have been included.

As a source of information, data provided by the Cadastre Directorate of the Municipality of Neuquén, through the Territorial Information System (Situn, 2018), was used, considering the spaces that had materialized until April 2021, using the vector file of Neuquén's subdivision as its basis (blocks, lots, neighborhoods, green spaces). With the support of the system or archive, the blocks, main highway axes and green spaces were digitized and updated through visual interpretation of satellite images provided by Google Earth (2021/2022) using the free GIS software – Qgis 3.8. The maps were created with the Conformal Transverse Cylindrical Projection System. POSCAR98 reference frame – Ellipsoid Belt 2: WGS1984 – Datum WGS1984.

2.1 Definition of the applied indicators

2.1.1 Distribution

This indicates the percentage share of PGSs located in each neighborhood in relation to the city's total public green area. It enables the spatial distribution of the city's PGS to be mapped on a neighborhood scale. In theory, an analysis of the current distribution reveals the successive development stages of urbanization, in terms of land occupation and public policies, and the formation of urban axes in which green spaces occupy a prominent position. In order to identify the services they provide at the neighborhood level, the analysis has focused on the location of the different types of PGS, depending on their size, functionality, and particular characteristics. By associating the map with the indicator, it was possible to infer situations of inequality, which led to the grouping of large sectors of the city.

2.1.2. Coverage

This measures the total area of PGS located within the neighborhood limits, expressed as a percentage. The indicator made it possible to verify the presence of the green component within the selected scale, while at the same time, in a comparative analysis, identifying the disparities that exist between the different neighborhoods of the city.

2.1.3. Accessibility

This measures the area of influence of the PGS, inferring proximity experienced by those who walk to it from their homes. Without ignoring the limitations of the spatiotemporal dimension (Talavera García, 2012), the minimum standards proposed by Rodríguez (1990) were adhered to, since they are intended for local and regional population settlements (Argentina/Latin America). For the square typology, a buffer zone[5] of 500 meters was designed, and for the plaza, a buffer zone of 300 meters, since the plaza has smaller dimensions and conditioning than the square, and serves the more immediate residential spaces.

2.1.4 Quality

Quality is defined based on the size, shape and functionality of the elements that make up the green space. Therefore, the quality of urban green spaces and their adequate maintenance are relevant factors for the daily use of the population, especially in certain age segments, such as older people (Aspinall et al., 2010) and

5. A buffer zone is a geoprocess that determines zones or areas of influence of a point, line or polygon. For this study, a fixed distance from the center of each polygon was defined.

the young. It is important to know whether the PGS is sufficiently satisfying and interesting so as to encourage people to go there, stay there, enjoy it, and return home. Although the treatment of the quality indicator deserves a specific study that combines qualitative and quantitative techniques (opinion and perception surveys), the study has focused on a PGS with dimensions considered for the urban scale, given that it is these that generate the greatest diversity in terms of both uses and environmental and landscape impacts.

3. Presentation and discussion of results

3.1 Distribution

The city boasts several types of PGSs, differentiated according to size and configuration. One group includes squares, plazas, boulevards, and roundabouts, distributed in different neighborhoods, serving as spaces for recreation, everyday social interaction, and circulation management. In another, there are parks and walkways, with greater possibilities to develop activities, located mainly along the banks of the Limay and Neuquén rivers and in the transition areas to the plateau in the northeast. Within the boundaries of the neighborhoods, the total area of the PGSs is 352.6 ha, thereby occupying 7.6% of the total surface of the neighborhoods included in this study (Table 1).

	Typologies of PGS								
	Boulevard/ Round-abouts	Park	Linear park	Walk-ways	Linear walkways	Square	Plaza	Lake	Total
Hectares	46.1	154.3	5.8	41.9	26.0	67.7	4.6	6.2	352.6
%	13.1	43.8	1.6	11.9	7.4	19.2	1.3	1.8	100.0

Table 1. The city of Neuquén – types of PGS contained within the neighborhoods
Source: Own elaboration based on Situn (2018) and personal surveys (2021).

The total of the related typologies of park (154.3 ha), linear park (5.8 ha), walkways (41.9 ha) and linear walkways (26.0) is around 228 ha, in which the park typology, individually, the largest area, represents 43.8% of the total area under study. The second most important typology is the square, due to its size and uses on the neighborhood scale, representing 19.2% of the city's PGSs. The boulevard typology, although in some cases still with no vegetation cover, with 46.1 ha, constitutes 13.1%. There is a lower incidence of the plaza, which represents 1.3% of the total (Table 1).

As may be observed in Figure 2, in the city center (located in the northern zone of the main North-South roadway circulation axis) there is a larger area of PGSs in relation to the other neighborhoods, based on the original layout of the city

and the various interventions that have preserved and accentuated this profile, including parks and walkways. On the banks of the Limay River (south of the main axis), the Rio Grande neighborhood is located, which takes second place in terms of green spaces, due to the parks and walkways contained there. It may be inferred that, in the distribution of the areas of PGSs in the different neighborhoods, the presence of parks and walkways plays a significant role due to their size.

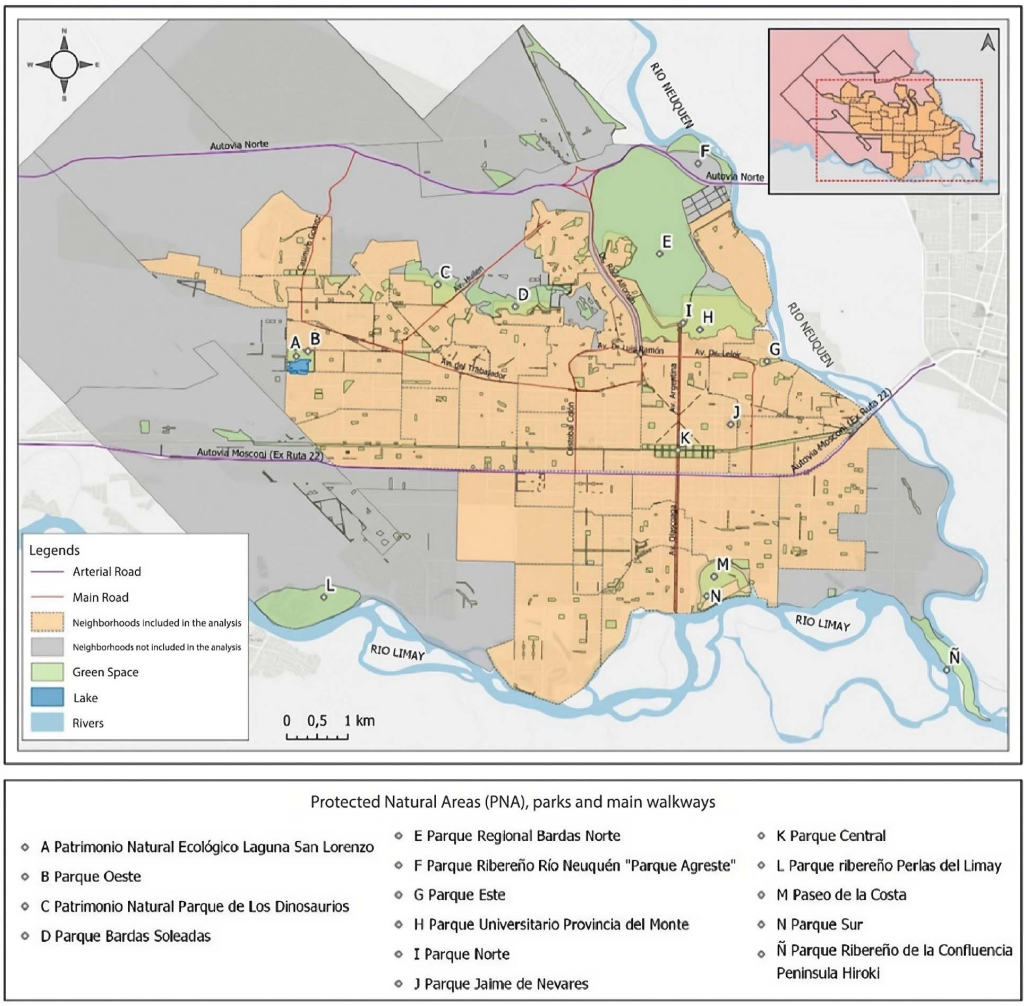


Figure 2. Location and distribution of public green spaces in the city of Neuquén – detail of the main parks and protected natural areas (PNAs) (2021)

Source: Own elaboration based on Situn (2018), Copade (2019) and personal survey (2021).

As the distance from the city center increases, the presence and size of PGSs in the neighborhoods decreases, particularly on the west side of the city – an area that has experienced the most significant urban expansion over recent decades. Thus, with a lack of planning in terms of public space, green spaces have been

relegated to residual spaces between houses and streets, with either natural and/or man-made physical barriers, in some cases very significant, adopting irregular and noncontiguous shapes.

3.1.1 Squares, plazas and boulevards

There is a particularly high concentration of squares in the central, northeast and southeast regions of the city, where the financial and service centers are located, as well as well-established residential neighborhoods or those with a higher socioeconomic level. The squares in these sectors are generally well equipped. They feature children's play areas, appropriate urban furniture, well-established vegetation, and other facilities/services, such as, sprinkler irrigation, sports stations, Wi-Fi, spaces for pets, etc.

The neighborhoods containing a total concentration of more than 4 hectares of squares are: Area Centro Este, Confluencia Urbano, Melipal, Canal V, Rio Grande, Santa Genoveva and Manuel Belgrano. The smaller neighborhoods – with less than 0.5 ha – are Gregorio Álvarez, Gran Neuquén Sur, Villa Florencia, Villa Ceferino and Mariano Moreno. The La Sirena, Militar and Area Centro Sur neighborhoods do not have this type of green space.

The plazas provide environmental benefits with a green element, although different positions exist regarding the minimum size that must be verified for this purpose. At the same time, this space fulfills both symbolic and identity functions, generally directly linked to the neighborhood of which they make part. From a technical viewpoint, they usually occupy voids in the urban fabric in relation to road axes of a certain hierarchy and are used as places of passage or crossing over to other spaces. The neighborhoods with the largest surface area in this typology are La Sirena, Confluencia Urbano and Don Bosco III. Among those with dimensions smaller than 0.2 ha are Sapere, El Progreso, Area Centro Este, Terrazas del Neuquén, Limay and Villa Farrel.

With regard to the presence of boulevards, two sub-typologies are most frequently observed in the city of Neuquén: (i) the street with a boulevard, a space generated by a difference in levels between the part of the road intended for the circulation of vehicles and the sidewalks, islands and flower beds; and (ii) the avenue with a boulevard, where the transition area between lanes is reduced to allow a passageway for pedestrians. In the first sub-typology, a certain aesthetic, environmental quality may be appreciated, since it normally includes vegetation coverage and urban furniture, thus reducing the influence of private vehicles and improving the pedestrian experience. In the second case, the benefit is related to pedestrian safety when crossing the street (Copade, 2019).

The most characteristic and representative boulevard in Neuquén crosses the city from north to south, running along the main axis of the Argentina and Olascoaga Avenues, from Plaza de las Banderas (to the north) to the vicinity of Paseo de la Costa (on the Limay River, to the south) (Figure 2). Within it, in addition to public parking lots and tree-lined, landscaped squares, which act as a separation between the two directions of circulation, there are commemorative monuments, health centers, children's playgrounds, permanent markets, fast food parks and food trucks, among others. Furthermore, there is also a tendency to give priority to pedestrian and cyclist traffic, with widened sidewalks, incorporating pathways, thus, reducing space for cars.

3.1.2 Parks and linear walkways

Parks play a vital role in rekindling the public's relationship with the nature. They function as vibrant spaces that accommodate a greater flow of people, offering a wide range of activities and also enabling a huge variety of uses throughout the day. This fosters a unique atmosphere where various social groups and age segments come together, creating a dynamic and inclusive community hub.

As a whole, parks represent the largest area within the urban PGS, containing a total area of 203 ha within the neighborhoods. The neighborhoods with this typology are predominantly the: Centro Este Area (117.92 ha), Centro Sur Area (13.32 ha), Rincón de Emilio (8.94 ha), Santa Genoveva and Villa Farrel (4, 40 ha) (Figure 2). In the peripheral areas of the city, and not integrated into a neighborhood, there is a series of parks linked to wider extensions, which make up systems of urban natural areas. This aspect is addressed in the section referring to the quality indicator.

Linear parks are public spaces intentionally designed to provide the population with access to green areas along the river and/or in other sectors of the city, whether for recreational purposes, for sporting purposes, or as a way to connect with work, since it enables moving around either by bicycle or on foot. In parks and walkways, the presence of greenery depends on soil characteristics and the arid conditions of the environment. In those where artificial irrigation is not possible, its function is closer to the concept of a dry square.

The coexistence of the river and the city has been made possible as a result of flood regulation, through the hydroelectric use of water resources. The largest and most representative linear park is the Paseo de la Costa on the Limay River (Rio Grande neighborhood). This multipurpose project stemmed from the intention of simultaneously addressing the problems of degradation of the natural or man-made environments, controlling the sector's frequent floods, stabilizing the riverbanks

and, thus, promoting new areas of economic expansion, leisure and urbanization (Boggi; López, 2019), thereby taking advantage of the scenic attractions and local identity. Similarly, and although not included in the period covered by this study, works to connect and construct linear walkways along the banks of the Neuquén River were carried out in 2022. This has enabled this sector of the city to become more integrated, since it backed on to the river and access was limited through a private neighborhood, thereby connecting different types of mobility (pedestrian, cyclist) and generating a corridor of green spaces between the parks and walkways.

3.2 Coverage

As may be observed in Figure 3, four of the neighborhoods surveyed present the best vegetation coverage parameters: (i) Centro Este Area (127.52 ha/34.4% coverage), (ii) Centro Sur Area (15.75 ha/20.6%), (iii) Rio Grande (50.11 ha/22.7%) and (iv) Mariano Moreno (16.02 ha/17.9%). Thus, the city center remains a vibrant hub for commerce and services, positioned close to areas of symbolic and scenic significance. This creates a continuity of the typologies of park, square and boulevard, fostering a strong public image, serving as a platform for social exchange, recreation, and community encounters, celebrating the city's diversity. The distribution of green space varies across the remaining neighborhoods, with a vegetation coverage that ranges from 5% to 10% of their surface. However, in the remaining 28 neighborhoods, green coverage falls below 5%.

Figure 3 shows that, toward the west of the city, the indicators reflect a lower participation of PGSs in the Neuquén neighborhoods, the result of a land occupation process with little planned infrastructure and green spaces. The city's expansion to the west occurred within the context of significant demographic growth. Formal subdivisions and informal settlements, aimed at meeting land occupation for access to housing for lower-income social sectors, foresaw no major plans for green space. Those that emerged proved to be sprawls due to the irregular distribution of the PGSs and the population. As exemplary cases, the level of coverage in the Unión de Mayo neighborhood is due to the presence of green spaces still under development, and in the San Lorenzo Norte neighborhood a lake formed during the 1970s from a stone quarry excavation thereby creating an underground water exposure, resulting in the current body of water.

In large sectors of the city, the PGS structure is fragmented, with limited connections between the different types of green areas. Through the map associated with this indicator it is possible to identify situations of inequality and that fewer possibilities of obtaining access to different green spaces is linked to a lower quality of life for part of the population.

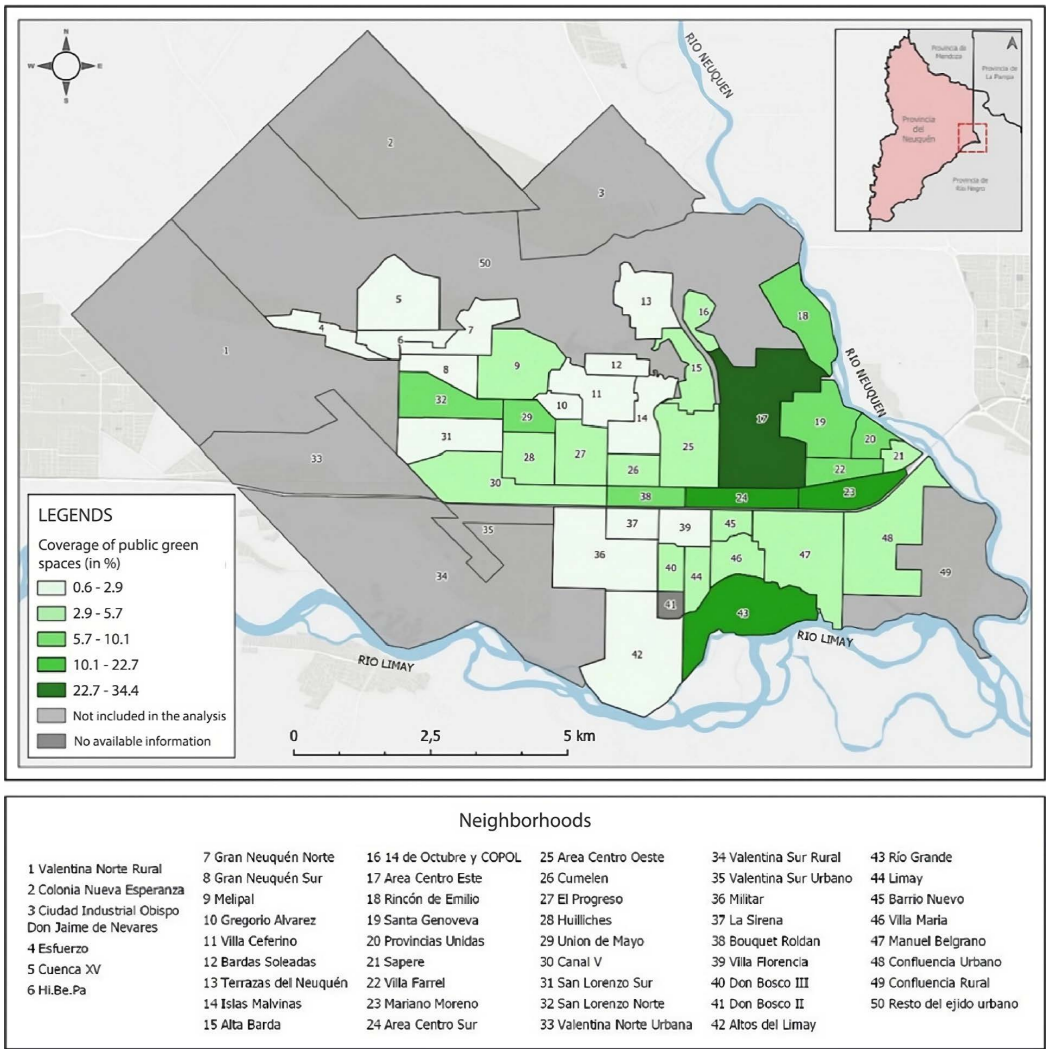


Figure 3. Coverage of public green spaces in neighborhoods in the city of Neuquén (2021)
Source: Own elaboration based on Situn (2018), Copade (2019) and personal survey (2021).

3.3 Accessibility

This indicator assesses the potential for residents to actively participate in activities offered within their immediate surroundings. By factoring in proximity, it assesses the extent to which these amenities encourage use by the neighboring population.

Spatial accessibility is considered to be measured in distance and time, indicating the conditions for pedestrians to move from their place of residence to the nearest plaza or square, in a travel interval that varies between five and ten minutes, respectively. This indicator made it possible to identify the scope of the PGS in relation to the proximity space.

By analyzing Figure 4, it is possible to deduce that the neighborhoods surveyed contain green spaces that would enable people to approach them on foot,

walk through them and participate in activities within a short distance from their place of residence. Despite the above, there are areas of partial access, with no PGS nearby, according to parameters established for the study. For example, there are deficiencies in the Cuenca XV and Gran Neuquén Norte neighborhoods (northern sectors), and an adjacent space between Melipal and Villa Ceferino, Area Centro Sur, Mariano Moreno, Manuel Belgrano, Area Centro Oeste. Likewise, there is a strip that covers the Huiliches and Canal V neighborhoods.

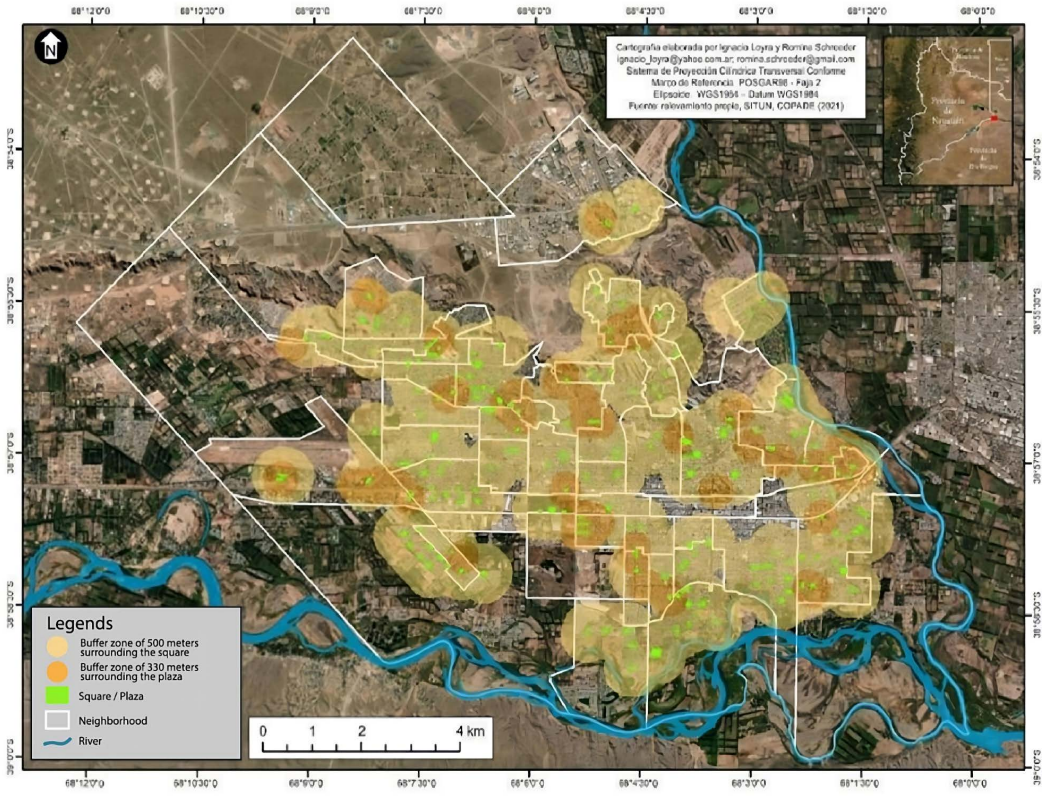


Figure 4. Accessibility measured in distance and time, taking the typologies of square and plaza as parameters (2021)

Source: Own elaboration based on Situn (2018), Copade (2019) and personal survey (2021).

In general, it may be observed that the squares and plazas are not located in central areas in relation to the neighborhood as a whole. Often, these spaces seem to respond to a spontaneous appropriation of remaining spaces from the urban fabric, transformed into PGSs by the municipal administration. They present various dimensions, with a continuity of greater extensions in the central area of the city. Therefore, according to Reyes and Figueroa (2010), the discussion should focus on establishing a minimum size of green spaces, related to the expected benefits or the objective attributed to them. However, there are neighborhoods in which the scales of squares and plazas are more limited by geomorphological and/

or anthropogenic conditions that separate sectors, even at the block level. Some subzones of neighborhoods that are outside the area of influence of a green space coincide with sectors of a lower socioeconomic status.

3.4 Quality

The presence, proximity and appropriate maintenance of urban green spaces are factors that significantly determine their daily use by the population. They also promote less sedentary, healthier lifestyles, which favor a better quality of life. This statement was based on the analysis of Valdéz and Fernández (2018), for whom PGSs with a surface area greater than 10 ha favor better environmental conditions and produce a positive ecological impact. These benefits are further enhanced when there are natural components, such as riverbeds, lakes, forests, and mountains. Sugiyama et al. (2010) suggested that the size of the green space also influences the levels of use and the types of activities that people undertake.

The hypothesizes of these authors have been confirmed in this study. The city's periphery, with river courses and areas of native vegetation, have the largest spaces and the best landscape conditions, which is why it is the most frequented place, since it permits a variety of uses for different age groups and over a wide period of time. There has also been a tendency to generate both green corridors connecting the different types of PGSs, mainly the protected natural areas, parks and squares, and infrastructure for alternative mobility, which – through the incorporation of various pathways, circulation routes and cycle paths – is intended to create better conditions for cyclists and pedestrians and, thus, limit the circulation of vehicles.

Over the last decade, parks and walkways have taken on a significant role in structuring PGSs in Neuquén. Due to their size, the areas that witnessed the emergence of this typology through public intervention, are the natural spaces along the riverbanks or on plateau areas. In the city center, 4.5 ha of the extramural sector of the former penitentiary have been converted into an open park creating the possibility for a variety of uses.

The city of Neuquén, through ordinance No. 11.874/10 (Neuquén, 2010), institutionalized the Municipal System of Protected Areas (Simap), which protects representative regional environments, in which many urban parks are contained, some of which are not included in the neighborhood boundaries. In addition to a recreational, scientific-educational, and cultural purpose, these environments seek to mitigate the restrictions that the natural physical system presents to human settlement. Currently, there are eight protected urban areas (Figure 2), seven under municipal management (Parque Regional Bardas Norte, Patrimonio Natural Ecológico Laguna San Lorenzo, Parque Bardas Soleadas, Patrimonio Natural Parque de los Dinosaurios, Parque Ribereño Rio Neuquén "Parque Agreste",

Parque Ribereño de la Confluencia “Península Hiroki”, Parque Ribereño Perlas del Limay), and one administered by the Universidad Nacional del Comahue (Parque Universitario Provincial del Monte).

The associated vegetation cover of natural areas and parks located both in the topographically elevated plateau zone to the north and at the bottom of the valleys close to the rivers, to the southeast, contributes to soil conservation and reduces the risk of particle removal, in addition to regulating floods caused by torrential rains and overflowing rivers. The natural shrub steppe of the peri-urban plateau determines a scarce vegetation cover, exposed to the action of strong, constant winds (Capua; Jurio, 2011). On the riverbanks, greater relative humidity generates a significant vegetation coverage.

Taking on these parameters, the high-quality PGSs, which correspond to the type of park linked to larger units, such as the PNAs, are located in the northeast and southeast sectors of the city. Their importance and impact on the peri-urban area are due to their proximity with neighborhoods located east of the main north-south axis. However, the quality of these spaces is also a factor to attract the population from more distant neighborhoods, which has been favored by the opening of arterial roadways that has facilitated mobility toward them.

Conclusions

Analyzing the distribution, coverage, accessibility, and quality has enabled a morphological and functional approach to the characteristics of the PGSs, while also being able to characterize the territorial configuration of green spaces, new expansion areas and their role in shaping the city model that has been built by adopting public policies and economic and community initiatives. The complexity of the urban landscape determines the need to adopt different indicators in order to describe it, since each one bases the analysis on some specific attribute of green areas. Thus, a comprehensive view can only be obtained by analyzing all its results. Indirectly, this study has also helped to generate databases in order to manage information and, thus, complement current, local territorial information systems, thereby providing another level of detail and treatment for the data obtained.

In the city of Neuquén, to be classified as “green”, it is not necessary for the entire surface of a space to be covered by vegetation; nor is it necessary for this coverage to be indigenous. Climatic characteristics are relevant in the design and maintenance of PGSs (Reyes; Figueroa, 2010). We are facing a space that is far from homogeneous, which demands the adoption of accurate design and functionality criteria in accordance with the distinctive physical and social characteristics of each sector (geomorphology, identity, population densities, age segments).

In historical terms, the expansion of the city and the environmental conditions of new urban land occupations have not sufficiently addressed the supply of PGSs. The accelerated population growth, the prioritization of housing objectives and urban equipment has signified that investment in public green spaces has been postponed, thereby giving rise to a fragmented structure and configurations that do not always permit the population to live with PGSs. The participation of the State has been delayed and limited, facing situations in which there was of lack of urban planning that restricted the possibility of intervening and creating squares and plazas of different sizes and equipment with varying conditions when comparing neighborhoods.

Although it is possible to identify a trajectory of State intervention in the city center, in which PGSs have constituted a relevant aspect, in the subsequent growth there has been no planned distribution in terms of PGS expansion. What may now be witnessed is an unbalanced urban expansion, with serious restrictions on the configuration of green spaces in neighborhoods. A relevant part of the inequalities that the city has generated, which includes the problems of harmonizing relationships between the complex natural physical system, the inhabitants and the different activities and uses of the land, is reflected in the spatial distribution of the PGSs.

In accordance with the above, it may be stated that unequal distribution leads to a deficiency in coverage that does not allow all the inhabitants to have total, direct access to the PGSs. Deficient areas or areas with low coverage should be considered, as is the case of the west and northwest sectors of the city, coinciding with popular neighborhoods with a lower socioeconomic level. It is precisely here that greater availability of these spaces is required, given the huge habitat restrictions.

The important investments aimed at constructing and recovering green spaces that have occurred over recent years, in the context of designing a new image of the city, coexist with the persistent marked differences in endowment in broad sectors of the urban space. The insertion of PGSs in this transformation is observed in the execution of new large-scale green space projects, which transform the relationship with geoform identities (rivers and plateaus). This involves changes to the urban code and enables the projection of space policies linked to real estate investment in previously productive lands or close to the rivers that surround them. This takes in the scope of new public spaces for leisure and environmental preservation, with architectural interventions of different dimensions, which range from the smallest scale (squares, sidewalks) to the largest (convention center, riverside walkways).

The differences in the built environment and in the natural physical conditions that the city of Neuquén presents in some sectors, in certain cases are elements that

facilitate and, in others, hinder access to the PGSs, therefore conditioning their ability to be attractive to different population groups. Considering accessibility to public space allows us to begin examining issues of spatial equity in the terms raised by Talen and Anselin (1998), assessing the aspects that prevent or allow different social groups to participate in information flows and access to urban goods and services.

Although physical proximity is an important element to promote the use of these spaces, people decide to take advantage of the PGSs based on their particular perception, supported by natural conditioning or anthropogenic effects generated in urban areas, among other aspects. Likewise, there may be observable factors in the city, and some not entirely visible, that constitute barriers to accessing the possibilities of using public space by different sectors of the population, both due to the precariousness of infrastructure and processes of self-exclusion arising from socio-spatial fragmentation. Such factors also interfere with the possibilities of mobilizing people with fewer resources for the new public spaces that are being formed or regenerated in different sectors of the city.

Constructing a qualitative and quantitative methodology for the study and assessment of PGSs must take into account both their physical and urban characteristics and their social uses and meanings. To achieve this, it will be necessary to involve citizens in the processes of space management, so that it is possible to learn about the various problems, opinions, and perceptions of social actors in the neighborhood. In future studies, it is essential to relate the distribution of socioeconomic groups with green areas, including the number of inhabitants, residence, and family income level, with the aim of promoting a higher level of well-being within the population.

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