Revista GEOGRÁFICA VENEZOLANA

Volumen 66(1) 2025 enero-junio

ISSN*e* 2244-8853 ISSN*p* 1012-1617
Recibido: abril, 2024 / Aceptado: noviembre, 2024
pp. 132-158 / https://doi.org/10.53766/RGV/2025.66.1.08

Sociospatial injustice manifestations arising from urban

public spaces' evaluation

Manifestaciones de injusticias socioespaciales a partir de la evaluación de los espacios públicos urbanos

Manifestações de injustiças socioespaciais decorrentes da avaliação de espaços públicos urbanos

Juan Eduardo Jiménez-Caldera[1], Gren Durango-Severiche[2], Raul Pérez-Arévalo[3], José Luis Serrano-Montes[4], Jesús Rodrigo-Comino[5] y Andrés Caballero-Calvo[5]

[1] Universidad de Córdoba, Facultad de Ingeniería Ambiental, Departamento de Ingeniería Ambiental
[2] Universidad de Córdoba, Facultad de Ciencias Básicas, Departamento de Geografía
Montería, Departamento de Córdoba, Colombia
[3] Universidad del Atlántico, Facultad de Arquitectura
Barranquilla, Colombia
[4] Universidad de Granada, Facultad de Filosofía y Letras, Departamento de Geografía Humana
[5] Universidad de Granada, Facultad de Filosofía y Letras, Departamento de Análisis Geográfico Regional y Geografía Física, Campus Universitario de Cartuja
Granada, España
juanjimenezc@correo.unicordoba.edu.co; gdurangoseveriche@correo.unicordoba.edu.co; raulpereza@mail.uniatlantico.edu.co; joselsm@ugr.es; andrescaballero@ugr.es

Jiménez: https://orcid.org/0000-0001-7509-1902
Durango: https://orcid.org/0000-0002-7019-3026
Pérez: https://orcid.org/0000-0002-9969-8706
Serrano: https://orcid.org/0000-0003-1396-9235
Rodrigo: https://orcid.org/0000-0002-4823-0871
Caballero: https://orcid.org/0000-0002-4382-0055

Abstract

In Latin America, urban spaces such as parks, plazas, and sports venues are fundamental for urban habitability, especially in cities affected by poverty, inequality, and social exclusion. These places are key to promoting inclusive and sustainable urbanization, a goal of the Sustainable Development Goals. This research highlights the importance of properly planning and managing these spaces to combat the socio-spatial injustices that deteriorate urban quality of life. Using an evaluation model, the study focuses on Commune #9 in Montería, Colombia, a low-resource area, revealing problems of inequitable accessibility, insecurity, and inequality in services provided according to population diversity. The results underline the effectiveness of the model in addressing socio-spatial justice and demonstrate its potential to improve urban planning and quality of life in the region.
KEYWORDS: socio-territorial cohesion; spatial justice; public participation; decision-making processes; territorial planning.

Resumen

En América Latina, los espacios urbanos como parques, plazas y recintos deportivos son fundamentales para la habitabilidad urbana, especialmente en ciudades con pobreza, desigualdad y exclusión social. Estos lugares son clave para fomentar una urbanización inclusiva y sostenible, un objetivo de los Desarrollos Sostenibles. Esta investigación destaca la importancia de planificar y gestionar adecuadamente estos espacios para combatir las injusticias socioespaciales que deterioran la calidad de vida urbana. Mediante un modelo de evaluación, el estudio se enfoca en la Comuna #9 de Montería, Colombia, una zona de bajos recursos, revelando problemas de accesibilidad inequitativa, inseguridad y desigualdad en los servicios ofrecidos en función de la diversidad poblacional. Los resultados subrayan la efectividad del modelo en abordar la justicia socioespacial y demuestran su potencial para mejorar la planificación urbana y la calidad de vida en la región.
PALABRAS CLAVE cohesión socioterritorial; justicia espacial; participación pública; procesos de toma de decisiones; planificación territorial.

Resumo

Na América Latina, os espaços urbanos, como parques, praças e instalações esportivas, são fundamentais para a habitabilidade urbana, especialmente em cidades com pobreza, desigualdade e exclusão social. Esses locais são essenciais para promover a urbanização inclusiva e sustentável, uma meta dos Desenvolvimentos Sustentáveis. Esta pesquisa destaca a importância de planejar e gerenciar adequadamente esses espaços para combater as injustiças socioespaciais que prejudicam a qualidade da vida urbana. Usando um modelo de avaliação, o estudo se concentra na Comuna #9 em Montería, Colômbia, uma área de baixa renda, revelando problemas de acessibilidade desigual, insegurança e desigualdade nos serviços oferecidos com base na diversidade da população. Os resultados destacam a eficácia do modelo na abordagem da justiça socioespacial e demonstram seu potencial para melhorar o planejamento urbano e a qualidade de vida na região
PALAVRAS-CHAVE: coesão socioterritorial; justiça espacial; participação pública; processos de tomada de decisão; planejamento territorial.

1. Introduction

In Latin American countries like Colombia, public spaces such as parks, green areas, squares, and sports venues -collectively referred to as articulating areas of public space and meeting (APSM)- are vital for urban structuring. The APSM provide environmental, landscape, and social benefits and are essential components of sustainable urban systems (Cohen, 2018; Restrepo, 2017; Dziekonsky *et al*., 2015; Mehta, 2014; Romero Chávez, 2016; Paramo *et al*., 2018; Salas-Zapata *et al*., 2016). These APSMs are particularly crucial in cities grappling with poverty, inequality, marginality, and social exclusion, addressing the global push for inclusive and sustainable urbanization, a central aim of the Sustainable Development Goals (Segovia & Jordán, 2005; Terán & Zicardi, 2012; Guzmán & Cisneros, 2019).

The proper functioning of these spaces necessitates comprehensive urban planning and management, based on an in-depth analysis of multiple variables that can handle the complexities of urban systems (Cárdenas, 2017; Oliveros, 2017; Reyes & Figueroa, 2010; Wang, 2009). Research has shown that APSMs strategic placement significantly impacts environmental quality and overall urban experience, influenced by factors like noise, air quality, and greenery (Murcia, 2009; Byrne & Sipe, 2010; Dziekonsky *et al*., 2015; Romero Chávez, 2016; Hunter *et al*., 2019; Carmona, 2019; Tavares *et al*., 2020; Rodrigo-Comino *et al*., 2021).

Exhaustive and accurate diagnoses of the functionality of APSMs should reveal complex socio-spatial conflicts or injustices, favoring the formulation of balanced and fair spatial organization proposals (Jiménez *et al*., 2022). This is required by the principle of social and spatial justice of sustainable development, which aims for all citizens to enjoy, in the most homogeneous way possible, equal conditions regarding the quality of life (Sedano *et al*., 2021; Lezama & Domínguez, 2006). Recent evaluation models propose systems of multiple variables to inquire about the conditions that determine the functionality of the APSM places, helping to identify possible manifestations of socio-spatial injustice. Some of them focused on highlighting and describing variables and justifying their use (Jian *et al*., 2020; Páramo & Burbano, 2013); while others, in addition to the above-mentioned, described elements of analysis and metrics (DADEP, 2020; UN-Habitat, 2020; Villanueva *et al*. 2015; Mehta, 2014; Garnica & Jiménez, 2014; Jiménez & Durango, 2021). They also establish links or dependency relationships between those variables to reach the exhaustiveness that the comprehensive analysis of the APSM demands (Jiménez-Caldera *et al*., 2022).

Methods to analyze urban public spaces in Latin America and the rest of the world include observational studies, which involve on-site observations to understand use patterns and social interactions, and surveys that gather data on public perceptions and satisfaction (Hino *et al*., 2010; Ferrari *et al*., 2020; Arellana *et al*., 2020; Zamanifard *et al*., 2019). Participatory approaches engage communities in the analysis process through workshops and participatory mapping, facilitating a more inclusive and community-driven approach (Low *et al*., 2005). Additionally, spatial analysis techniques like Geographic Information Systems (GIS) and Remote Sensing (RS) are employed to examine the spatial distribution of public spaces and their accessibility and connectivity to other amenities (Smith, 1991; Vergara-Perucich & Arias-Loyola, 2021).

This research is grounded in the hypothesis that socio-spatial problems, conflicts, or injustices related to the functionality of APSMs can be highlighted through a sequential and articulated approach integrating multiple analytical elements. This model associates relevant variables for understanding urban reality, assessing it, and identifying solutions applicable to urban planning. The main goal of this research is to perform an exhaustive diagnosis focused on evaluating the functionality of APSMs to detect manifestations of socio-spatial injustices that negatively affect the quality of urban life. This is crucial information for formulating adequate proposals for the spatial organization of cities. Using various geospatial

modeling techniques, and through the construction of summary tables and statistical graphs, multiple elements of analysis associated with variables such as satisfaction based on the diversity of spaces, conservation state, dimensions, sufficiency, accessible distances, spatial distribution, perception of insecurity, and general satisfaction have been addressed. The case study for this research is Commune 9 of Monteria (Department of Córdoba, Colombia). This method can be used alone or in combination with other methods to comprehensively analyze and assess urban public spaces and meeting areas in Latin America, aiding urban planners, designers, and policymakers in making informed decisions for improvement.

2. Materials and methods

2.1 Study area

The Commune #9 of Montería (Department of Córdoba, Colombia), one of twelve internal divisions outlined in the Territorial Planning 2021-2023, has been selected for the case study (FIGURE 1). This densely built area houses 14,815 residents (DANE, 2022) and is isolated from the main urban fabric along the Sinú River, surrounded by urban voids and agricultural lands. The eleven neighborhoods in Commune #9 fall into the lowest socioeconomic strata 1 and 2, within the Colombian official stratification system, indicating prevalent extreme poverty (Bonilla *et al*., 2014). Commune #9 has recently implemented two geoinformatics tools, Field Geoform (FG) and Crowdsourcing Geoform (CG), for APSM planning and management, facilitating the collection of crucial data (Jiménez-Caldera *et al*., 2024).

The implementation of the two geoinformatics tools, Field Geoform (FG) and Crowdsourcing Geoform (CG), in Commune #9 was designed to address distinct but complementary objectives in APSM planning and management. The FG, aimed at urban planners and technical staff, facilitates a structured and thorough inventory and assessment of APSM, including characterization of its conservation status and typology. This data collection process gathered detailed information on the physical state and functional attributes of APSM, serving as a foundation for strategic planning.

On the other hand, the CG was developed to directly engage local residents by allowing them to contribute data on their experiences and perceptions of APSM. Through CG, citizens provided information on the conservation status of APSM, usage patterns, security concerns, and satisfaction levels, enhancing planners' understanding of public needs and preferences. This dual approach resulted in a comprehensive dataset: the FG captured objective, technical aspects of the infrastructure, while the CG provided subjective information, reflecting the community's relationship with APSM. Integrating these two perspectives aims to strengthen decision-making by grounding it in both expert evaluation and community input.

The FG data collection was conducted in December 2022 by an expert in urban public space planning, focusing on the characterization and state of conservation of the area's 12 APSM zones. Meanwhile, the CG process targeted three APSMs -Park Veinte de Julio, Park-Court Soccer Veinte de Julio, and Court Siete de Mayo Field- for a week-long study from January 22 to 29, 2023, during afternoon hours when the ambient temperature favors higher people influx (Jiménez-Caldera *et al*., 2024).

2.2. Analysis and metrics for the evaluation of the APSM

To evaluate the APSM functionality based on socio-spatial justice, analysis elements and metrics related to eight variables were incorporated, as highlighted in various evaluation models (Sedano *et al*., 2021; Jian *et al*., 2020; Páramo & Burbano, 2013; DADEP, 2020; UN-Habitat, 2020; Mehta, 2014; Garnica & Jiménez, 2014; Jiménez & Durango, 2021; Jiménez-Caldera *et al*., 2022). These are grouped into: (1) community participation-based variables and (2) geospatial modelling variables, both aimed at identifying socio-spatial injustices and facilitating assertive urban planning decisions (Segovia & Jordan, 2005; Moro, 2011; Oliveros, 2017; Wang, 2009; Jiménez-Caldera *et al*., 2022).

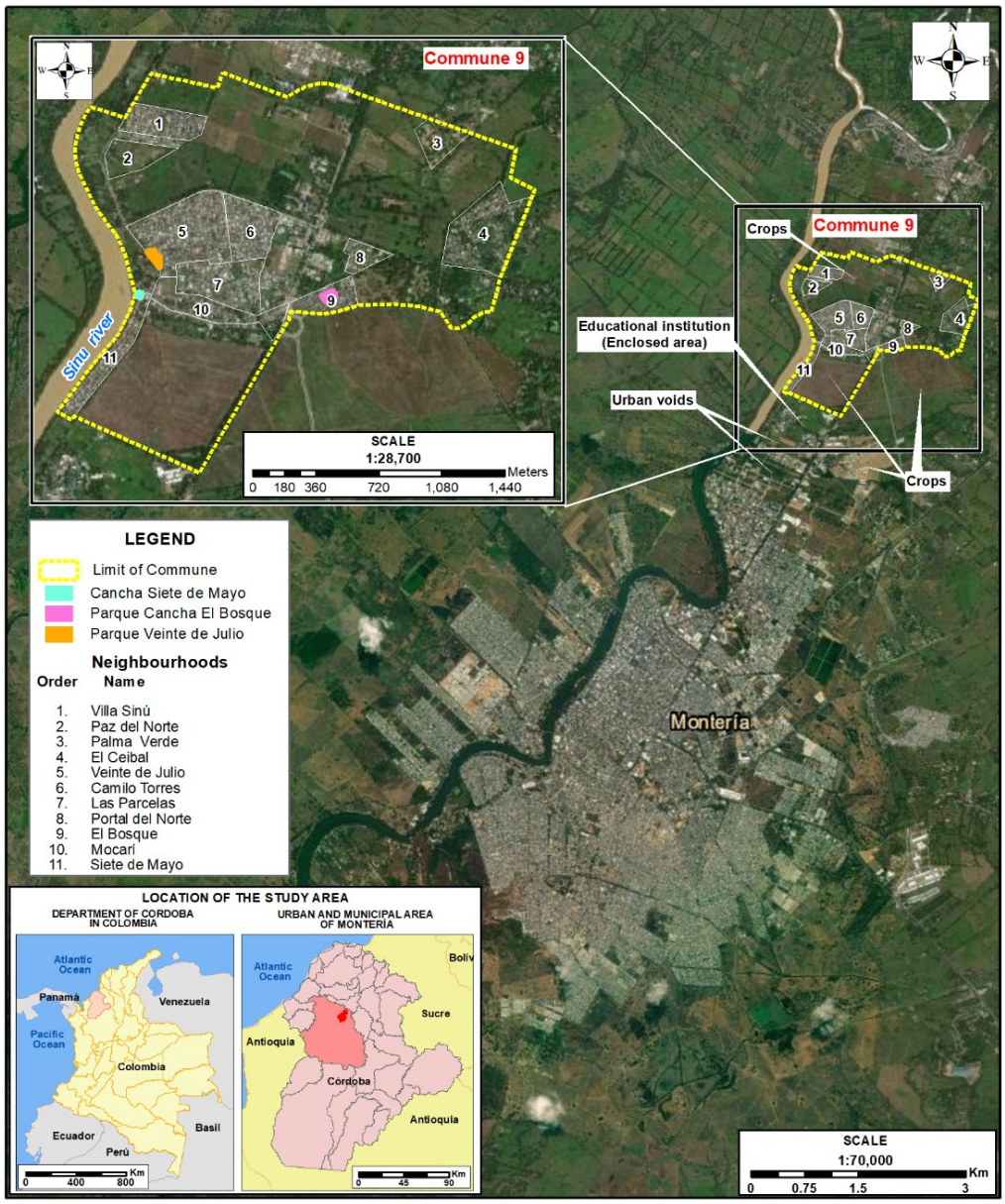

FIGURE 1. Study area based on the information of the Land Management Plan (2019-2033)

2.2.1 Community participation: perception of insecurity and satisfaction

Safety and satisfaction condition APSM usage (Heal Cities Campaign & ChangeLab Solutions, 2016; Cárdenas, 2017; Páramo & Burbano, 2013). Data analysis from the APSM user community covered aspects like bad experiences and the most unsafe hours in the APSM, leading to a general security rating by visitors. Satisfaction factors included motivations for visiting, identification of frequently visited APSMs, and overall satisfaction levels. Analysis was based on summary tables and statistical graphs that identified trends or patterns in socio-spatial injustices, enhanced by sociodemographic user data to correlate user characteristics with variable behaviors.

2.2.2 Variables analyzed through geospatial modelling

Eight elements of analysis were addressed through spatial modelling associated with six variables considered relevant to evaluate the functionality of the APSM areas from precepts of spatial justice. These must be sequentially implemented to ease the comprehensive analysis of the APSMs.

First, satisfaction based on the diversity of spaces considered the sector of the population not benefitting from APSM designs or compositions as described below in TABLE 1.

TABLE 1. Classification criteria and categories according to their internal composition and the function they provide to society. Source: Garnica & Jiménez (2014: 264), modified by Jiménez *et al.*, 2024

Category/Scenarios	Function	Description
Sport	Leisure and active recreation	Surface intended solely for the exercise of the sports activity of the community (soccer, baseball, basketball, shuffleboard, etc.)
Children	Leisure and active recreation	The surface is intended, due to its constituent elements (children's equipment), solely for the exercise of recreational activity for children
Stay	Leisure, passive recreation, meeting, and harmony	Surfaces are made up of environmental elements such as trees or grass and equipped with furniture such as benches; intended for passive activity
Bio-healthy scenarios	Leisure and active recreation	Surfaces are equipped with machines or special instruments for the improvement of the health and physical condition of people

The equation used to evaluate the diversity of spaces was:

$$\% \text{ PEsc } (i) = \frac{\#\ total\ APSM\ \ Esc\ (i)}{\#\ total\ APSM} \text{ x } 100$$

Where, %PEsc *(i)* represents the percentage of Stay, Child, Sports, or Biohealthy scenarios; # total APSM the total number of APSM in the study area (city, commune, neighbourhood, or any other planning unit or urban action); and # total APSM Esc (i) the total number of APSM per scenario (Stay, Child, Sports, or Bio-healthy).

Second, the state of conservation of the spaces (Republica de Colombia, 1998; Jiménez & Garnica, 2016, adjusted by Jiménez-Caldera *et al.*, 2022), emphasizes the impossibility using the APSMs due to the poor state of conservation; the inadequate practice of recreational activities due to the overuse of usable APSM; and the increase in access costs to use these APSM in a good state of conservation. This variable is evaluated through the Individualized Qualitative Deficit Indicator (IQD), whose estimate is expressed in percentages that are grouped and associated with qualitative categories as shown below in TABLE 2:

TABLE 2. Qualitative Deficit categories. Source: Jiménez & Garnica, 2016, based on Republica de Colombia, 1998; and subsequently adjusted by Jiménez-Caldera *et al*., 2022

Deficit Percentage Ranges	Deficit Category
0.00%	Null
0.01 - 20.00%	Very low
20.01 - 40.00%	Low
40.01 - 60.00%	Moderate
60.01 - 80.00%	High
80.01 - 99.00%	Very high
100.00%	**Total**

High, very high, and total deficits correlate with unusable APSM due to conservation issues. Third, space dimensions evaluated APSM capacity to satisfy diverse recreational needs and ecological contributions, with suitable sizes ranging from one to two hectares or adapted figures like 5000 m^2 for Latin American contexts, as per WHO recommendations (Reyes & Figueroa, 2010; Natural England, 2010; UN-Habitat, 2020). To facilitate urban analysis based on the evaluation of the dimensions of the present APSM, these spaces were also classified according to two strategic typological classifications highlighted by Jiménez *et al*. (2022), as shows in TABLES 3 and 4.

TABLE 3. Classification criteria and categories according to level or scale based on the representativeness or particularity that each APSM. Source. Garnica & Jiménez (2014: 264), modified by Jiménez *et al*., 2024

Scale or influence	Description
Municipal/regional	Large dimension and high urban and environmental values, icons of a city, which meet the needs of the local population and residents from other distant locations. They are not abundant or predominant in the urban area
Zonal	Variable dimension, equipped with common areas suitable for urban planning, with furniture and unusual internal components among existing public spaces. They are not abundant or predominant. That is why they are visited by people from distant towns or neighbourhoods
Local/ neighbourhood	Small size, intended for recreation, meeting, and community integration. They cover the needs of neighbourhoods. They present similar characteristics to most of the existing public spaces in the city. They are generally distributed throughout the urban area

TABLE 4. Classification criteria per scale or area of influence associated with the surface of the spaces. Source: Administrative Department of the Public Space Ombudsman DADEP (2020)

Scale	Description
Metropolitan	Area greater than 10 ha
Zonal	The area between 1 and 10 ha
Neighbourhoods[1]	Area smaller than 1 ha
Pocket[2]	Area smaller than 1,000 m^2

The extent of APSM is associated with the intensity and variety of available uses (Reyes & Figueroa, 2010) and is also linked to a greater capacity to provide environmental benefits (Kühn *et al*., 2004; Knapp *et al*., 2008; Sorensen *et al*., 1998). Larger spaces are typically scarce in cities, which increases their influence. Due to their ability to attract users from distant areas, these spaces require specific internal facilities. All of these aspects constitute criteria for evaluating the quality of these spaces.

Fourth, sufficiency was considered to evaluate if the surface of space constituted in APSM is sufficient to contribute to the quality of urban life. For this purpose, two approaches were considered: (a) the total area of APSM concerning the total urbanized area, taking into account that 15% of all urban surfaces should be devoted to open public spaces, whether or not they are green areas (UN-Habitat, 2020). In this context, 'urbanized area' refers to built-up surfaces typically occupied by structures and generally inhabited, as represented in the urban footprint. This definition emphasizes physical structures rather than population density alone, focusing on the extent of land converted to urban use, which aligns with observable development patterns in the city's spatial layout. And (b) the total area of APSM concerning the number of inhabitants (Republic of Colombia, Decree 1505 of 1998). For this purpose, the quantitative deficit indicator was considered, which is based on the following equation:

QuD = MIAPMS – APMSPer

QuD is the Quantitative Deficit of APSM; MIAPSM is the Minimum Index of APSM (15 m^2 per inhabitant); and APMSPer represents the Per Capita APSM, derived from the ratio of APSM to the number of inhabitants.

From this approach, the sufficiency of children's APSM was also inquired about the number of infants, using the following equation:

QuDC = MICAPMS – CAPMSPer

QuDC denotes the Quantitative Deficit of Children APSM; MICAPSM represents the Minimum Index of Children APSM (15 m^2 per infant); and CAPMSPer is the Per Capita Children APSM, calculated from the ratio of Children APSM to infant inhabitants.

Fifth, is accessible distances, which focuses on the evaluation of the proximity between the places of residence of citizens and the typologies of APSM. No established distance refers to the ideal proximity. In some studies, 300 meters is taken as a reference (Garnica & Jiménez, 2014; Annerstedt Van Den Bosch, 2016). In others, it is defined in relation to the size of the spaces, for example, 250 meters in proximity to spaces smaller than 1 ha. , and 500 meters for those larger than 1 ha (DADEP, 2020). International organizations suggest that, throughout the city, residents should live an average of 400 m from the nearest open public space (UN-Habitat, 2020).

Sixth, spatial distribution, considered to determine how equitable is the disposition of the APSM. It is considered that the distribution of the APSM is inequitable when from the places of residence, the level of accessibility (according to proximity) based on the number of types of accessible scenarios is not total. Inequity levels increase when fewer types of scenarios are accessible as indicated in TABLE 5 (Garnica & Jiménez, 2014; Jiménez & Durango, 2021).

TABLE 5. Distribution de APSM according to the level of accessibility: number of different types of accessible scenarios. Source: Own elaboration, based on Jiménez & Garnica, 2016; and subsequently adjusted by Jiménez-Caldera *et al*., 2022

Level of accessibility	Types of scenarios accessible	Distribution degree
Total 4 of 4 accessible scenarios	- Children, stay, sports and bio-healthy	(+) Equitable
High 3 of 4 accessible scenarios	- Children, stay, and sports - Children, stay, and bio-healthy - Children, sporty, and bio-healthy - Stay, sporty and, bio-healthy	
Moderate 2 of 4 accessible scenarios	- Child and stay - Children and sports - Children and bio-healthy - Stay and sports - Stay and bio-healthy - Sporty and bio-healthy	
Low 1 of 4 accessible scenarios	- Children - Stay - Sports - Bio-healthy	
Null	- No accessible scenario	(-) Inequitable

3. Results

3.1 Diagnosis of the APSM: identification of socio-spatial injustices

3.1.1. Satisfaction based on the offer: diversity of spaces.

In Commune #9, twelve APSM were identified and characterized by visual inspection based on two strategic typological classifications: (1) according to the internal composition and function provided to society, and (2) according to the scale or area of influence.

Satisfaction is linked to the diversity of spaces, categorized into four types: children's, stay, sports, and bio-health scenarios. The twelve APSMs comprise 28 scenarios: 8 stay, 4 children's, 2 bio-health, and 14 sports, with sports scenarios including 3 volleyball, 3 basketball, 1 soccer, and 7 micro-soccer (FIGURE 2). The percentage of each scenario relating to the total APSMs in the area was calculated to assess their distribution:

$$\%\ \text{PEsc (Children)} = \frac{\#\ total\ APSM\ \ Esc\ (Children)}{\#\ total\ APSM} \times 100 = \frac{4}{12} \times 100\ \% = 33{,}3\ \%$$

$$\%\ \text{PEsc (Sports)} = \frac{\#\ total\ APSM\ \ Esc\ (Sports)}{\#\ total\ APSM} \times 100 = \frac{7}{12} \times 100\ \% = 58{,}3\ \%$$

$$\%\ \text{PEsc (Stay)} = \frac{\#\ total\ APSM\ \ Esc\ (\text{Stay})}{\#\ total\ APSM} \times 100 = \frac{8}{12} \times 100\ \% = 66{,}7\ \%$$

$$\%\ \text{PEsc (Bio-healthy)} = \frac{\#\ total\ APSM\ \ Esc\ (Bio-healthy)}{\#\ total\ APSM} \times 100 = \frac{2}{12} \times 100\ \% = 16{,}7\ \%$$

The presence of four types of scenarios in the study area supports social and urban development, yet an uneven distribution of APSMs limits access for users of bio-healthy scenarios and infants. The limited availability of bio-healthy and children's scenarios may result in overcrowded spaces, hindering activity development and exacerbating socio-spatial injustice due to uneven accessibility.

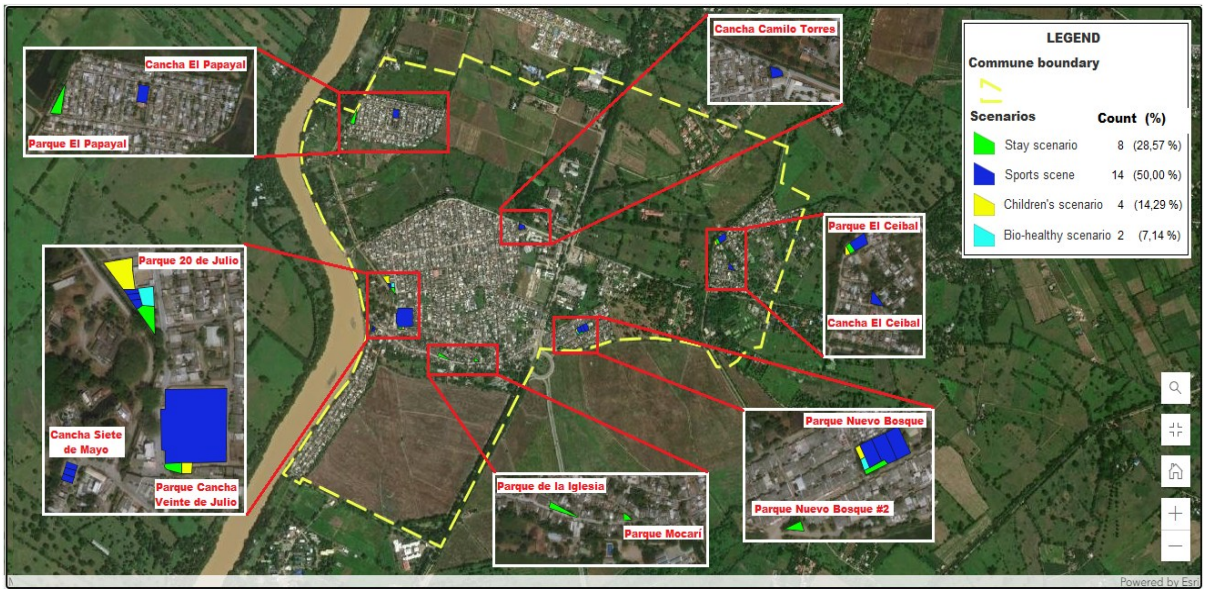

FIGURE 2. Classification of the APSM of the study area based on the internal composition or function that they provide to society. Source: Dashboard for visualizing data collected with the Field Geoform (Jiménez-Caldera *et al.*, 2024)

The diversity of the APSM according to their scale or area of influence was classified based on two strategic typological classifications: size and particularity (TABLE 6).

TABLE 6. Characterization of the APSM according to the scale or area of influence

Identification of the APSM	Scale or area of influence According to		
	Particularity of the space	Surface of the space	Area (m^2)
Court Siete de Mayo	Local	Pocket	340,84
Park Mocarí	Local	Pocket	229,32
Park de la Iglesia Mocarí	Local	Pocket	666,27
Park-Court El Bosque	Zonal	Neighbourhood	2179,05
Park El Bosque	Local	Pocket	145,72
Park-Cancha Veinte de Julio	Zonal	Neighbourhood	7598,34
Park Veinte de Julio	Zonal	Neighbourhood	2042,09
Park Paz del Norte	Local	Pocket	1068,71
Court Paz del Norte	Local	Pocket	1088,19
Park El Ceibal	Local	Neighbourhood	1539,90
Court El Ceibal	Local	Pocket	529,02
Court Camilo Torres	Local	Pocket	620,29

Neighborhood spaces serve multiple neighborhoods, whereas pocket parks meet the needs of a single neighborhood or cluster of homes. These categories correspond to zonal and local spaces, respectively, based on their scope.

Out of the 12 APSM inventoried in the study area, only the 'Parque Cancha de Fútbol Veinte de Julio' has an area greater than 5,000 sq m (TABLE 6). Indeed, this space is made up of three scenarios: children's, stay and sports. However, the large size of this space is due to a large field that meets the regulatory measures for the practice of soccer. The remaining APSMs, n=11, do not reach half of the aforementioned reference value. Coincidentally, the largest, with dimensions that exceed 2,000 sq m, turn out to be the most diverse, with the presence of the four scenarios (children's, stay, sports and bio-healthy). These are the APSM 'Parque Cancha El Bosque' and the 'Parque Veinte de Julio'. It should be noted that in the study area, all the APSM have a few soft areas covered by vegetation, in proportion to the total area that each one presents.

3.1.2 State of conservation of the APMS

The data on the state of conservation of the APMS that were collected by Field Geoform allowed the automated calculation of the individualized Qualitative Deficit indicator. The results show that 11 of the 28 scenarios have a qualitative deficit that reflects inadequate conditions for their use and enjoyment (FIGURE 3). None of the three zonal-scale APSMs has special internal equipment such as bicycle parking, public toilets, or hydration areas that require this type of space that potentially receives people from distant places.

3.1.3 Sufficiency of the APSM

3.1.3.1 Total area of APSM concerning the number of inhabitants

The population of Commune #9 is 14815 inhabitants and the sum of the total area of the APSM complex (∑APSM) is 18047,7 m^2. Considering the officially established 15 m^2 $inhab^{-1}$ as the minimum reference index to evaluate the sufficiency of public spaces (MIAPSM), the indicators of APSM per capita (APMSPer) and Quantitative Deficit of APSM (QuD) are:

APSM per capita (APMSPer)
APMSPer = ∑APSM / inhab
APMSPer = 18047,7 m^2 / 14,815 inhab
APMSPer = 1,22 m^2 / inhab

Quantitative Deficit (QuD)
QuD = MIAPSM – APMSPer
QuD = 15 m^2/ inhab. – 1,22 m^2 / inhab
QuD = 13,78 m^2/ inhab

Regarding the child population (0-9 years old), there are 2413 infants in Commune #9 (DANE, 2022). The sum of APSM with the presence of children's scenarios (∑CAPSM) is 1403,49 m^2. With these data, the calculation of the Children APSM per capita (CAPMSPer) and Quantitative Deficit of child APSM (QuDC) indicators is:

Children APSM per capita (CAPMSPer)
CAPMSPer = ∑CAPSM / infants inhab
CAPMSPer = 1403,49 m^2 / 2413 infant inhab
CAPMSPer = 0,58 m^2 / infant inhab

Children APSM Quantitative Deficit (QuDC)
QuDC = MIAPMS – CAPMSPer
QuDC = 15 m^2 / inhab – 0,58 m^2 / infant inhab
QuDC = 14,42 m^2 / infant inhab

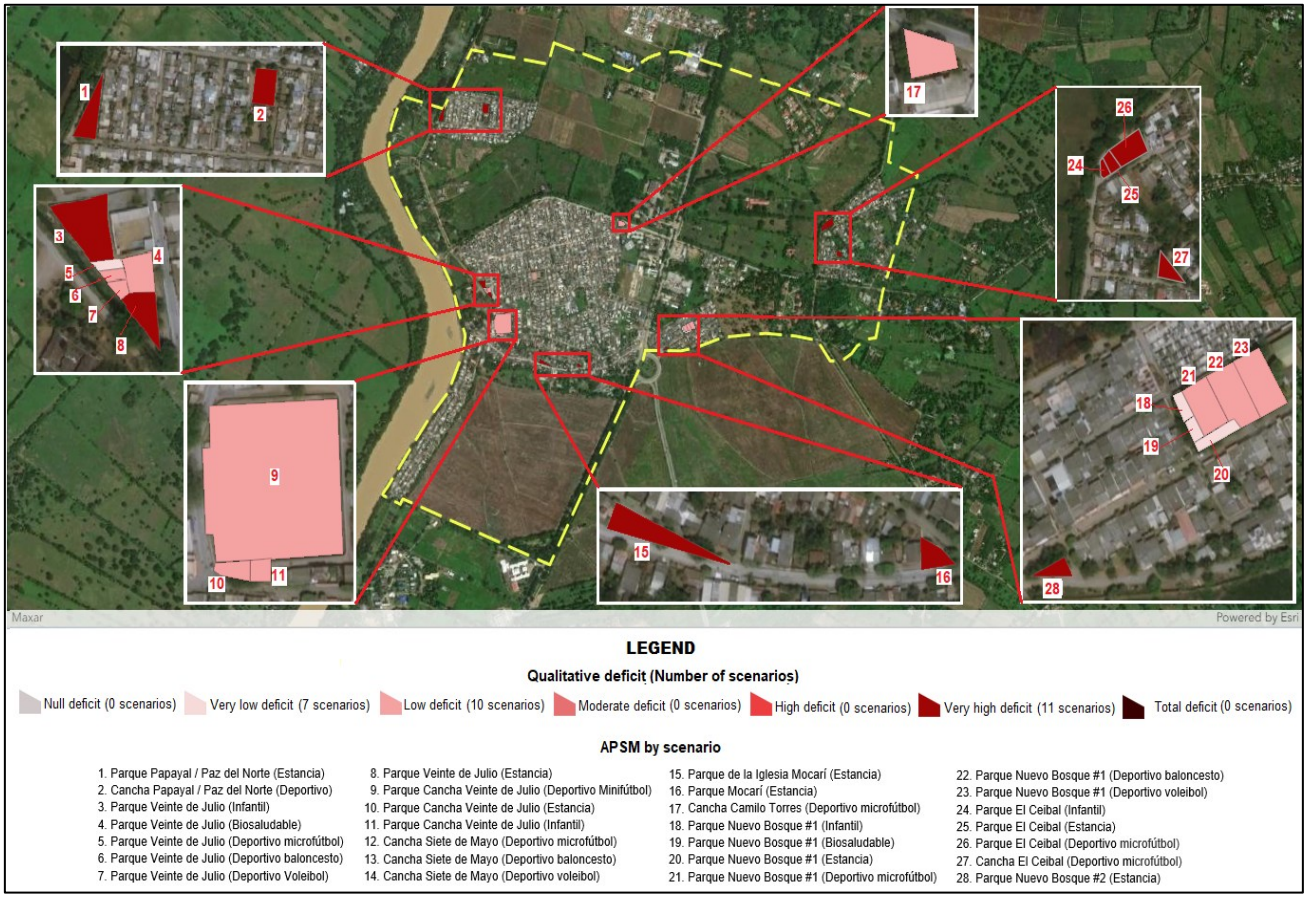

FIGURE 3. State of conservation of the APSM: Qualitative Deficit Individualized by scenarios present in the APSM
Source: Dashboard for visualizing data collected with the Field Geoform (Jiménez-Caldera *et al.*, 2024)

The results show that there is insufficient space according to the number of inhabitants. The general deficit of 13.78 m^2 $inhab^{-1}$ indicates a APSM requirement of 204177,30 m^2. The situation is more critical when it is scaled to the child population since the deficit increases to 14,42 m^2 $inhab^{-1}$, equivalent to a surface requirement for children's APSM of 34791,51 m^2.

3.1.3.2 Total area of APSM concerning the total urbanized area

The urbanized area of Commune #9 is 1822711,11 m^2 and the total area of the APSM in this sector is 18047,70 m^2. Therefore, the percentage of APSM concerning the total urbanized area is 0,99%. Considering that 15% of the urban surface should be allocated to open public spaces (UN-Habitat, 2020), there is insufficient APSM that would require 255253,76 m^2 of new APSM.

3.1.4. Pedestrian accessibility based on proximity

Pedestrian accessibility was determined by defining 400 m influence areas from each APSM along access routes, revealing substantial gaps in coverage. Large sections of 'Paz del Norte', 'Palma Verde', and 'Siete de Mayo' neighborhoods lack nearby APSMs, highlighting initial socio-spatial injustices in accessibility (FIGURE 4A). Accessibility issues extend to bio-healthy, children's, and stay scenarios, which are significantly underserved across these neighborhoods, while sports venues demonstrate better accessibility throughout the urban area

(FIGURES 4B, C, D, and E). Notably, 'Palma Verde' and large parts of 'Paz del Norte' and 'Siete de Mayo' have poor accessibility to all types of scenarios. 'Camilo Torres' fares slightly better with good access only to sports venues. Including APSM conditions in the analysis (those with null to moderate deficits), it reveals that extensive urban sectors, serving large populations, are excluded due to the lack of adequately maintained APSM (FIGURES 5A, B, C, D, and E). The overall distribution of APSM shows that only 27.6% of the urban area has suitable access to various APSM types, decreasing to 23.3% when focusing on well-conserved scenarios (FIGURE 5E). This indicates an inequitable spatial arrangement of APSM in Commune #9.

FIGURE 4. Accessibility to the APSM of Commune #9.
Note: percentages estimated regarding the total urbanized area (1,822,711.11 m^2)

FIGURE 5. Real accessibility to the APSM of Commune #9.
Note: percentages estimated regarding the total urbanized area (1,822,711.11 m^2)

3.1.5. Community participation

3.1.5.1 Profile of users and perception of insecurity and satisfaction

In total, 226 people voluntarily filled out the community participation (CG) web geoform designed to optimize and facilitate the data collection process on relevant variables to plan and manage APSM: 102 in Cancha El Bosque Park, 80 in the Parque Veinte de Julio, and 44 in the Cancha Siete de Mayo. TABLE 7 shows data on the sociodemographic profile of the participants:

TABLE 7. Sociodemographic profile of users. Source: data collected with the Crowdsourcing Geoform (Jiménez-Caldera *et al*., 2024)

Age	**Park Cancha El Bosque**		**Park Cancha Veinte de Julio**		**Cancha 7 de Mayo**	
	# persons	**%**	**# persons**	**%**	**# persons**	**%**
0 -5	0	0,00	0	0,00	0	0,00
6 – 11	0	0,00	1	1,25	0	0,00
12 – 18	15	14,71	20	25,00	14	31,82
19 – 26	19	18,63	15	18,75	16	36,36
27- 59	65	63,73	44	55,00	13	29,55
> 60	3	2,94	0	0,00	1	2,27
Males	59	57,84	46	57,5	34	77,27
Females	43	42,16	34	42,5	10	22,73
Total	102	45,13	80	35,40	44	19,47
Average	30		28		25	
Minimum	13		10		14	
Maximum	67		55		70	
Mode	33		15		18	

Participation was highest in sports scenarios (FIGURE 6 AND TABLE 8), the only type present in all three studied APSMs. This also affected the male/female participation ratio, though females were more prevalent in bio-health scenarios. Cancha 7 de Mayo is exclusively for sports activities.

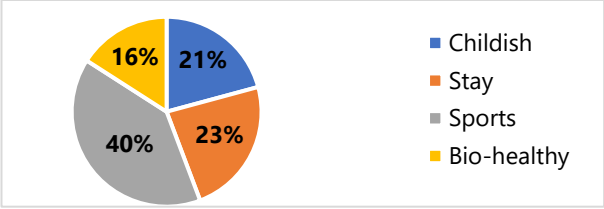

FIGURE 6. Proportion of participating users by scenario. Source: data collected with the Crowdsourcing Geoform (Jiménez-Caldera *et al.*, 2024)

TABLE 8. Users by scenarios and gender. Source: data collected with the Crowdsourcing Geoform (Jiménez-Caldera *et al.*, 2024). M: male; F: female

Scenarios	Park Cancha El Bosque				Park Cancha Veinte de Julio				Cancha 7 de Mayo			
	M	F	%M	%F	M	F	%M	%F	M	F	%M	%F
Children	8	21	27,6	72,4	10	8	55,6	44,4	0	0	0	0
Stay	6	19	24,0	76,0	14	14	50,0	50,0	0	0	0	0
Sports	19	4	82,6	17,4	19	4	82,6	17,4	35	9	79,6	20,5
Bio-health	10	15	40,0	60,0	3	8	27,3	72,7	0	0	0	0

Data indicate that most users consider APSM Parque Cancha El Bosque and Cancha Siete de Mayo to be safe. However, Parque Veinte de Julio is viewed as unsafe by 69.8% and currently unsafe by 23.8% (FIGURE 7)

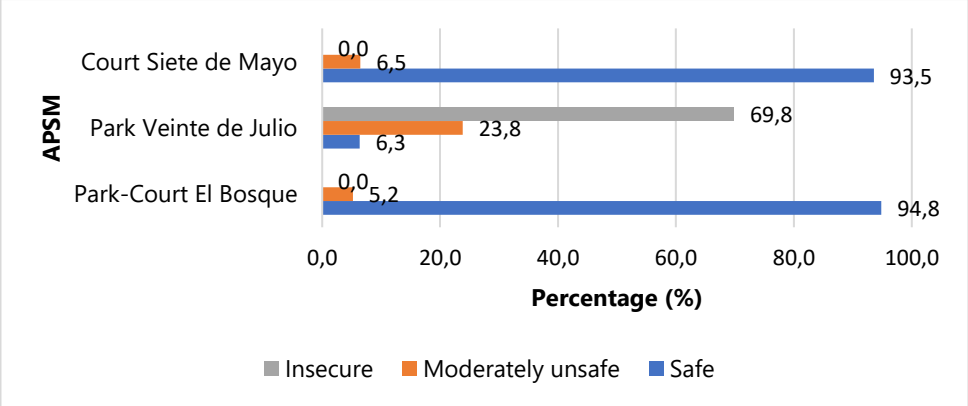

FIGURE 7. General qualification of security/insecurity in the APSM. Source: data collected with the Crowdsourcing Geoform (Jiménez-Caldera *et al.*, 2024)

Among those who rated Parque Veinte de Julio as unsafe, 42.1% were women and 57.8% were men. The perceived insecurity stemmed from fear to robbery, presence of strangers, lack of police, unpleasant odors, debris damage, gang fights, and the presence of people consuming or selling illegal or illicit drugs. Regarding visit motivation, less than 30% cited meeting their needs as the reason, with most referencing proximity to their homes as the primary factor (FIGURE 8). Yet, 92% of respondents (151 people) reported satisfaction with the city's APSM. Of the 13 people dissatisfied

(8%), 11 were men and 2 women, citing reasons such as distance from home, lack of space diversity, poor maintenance, absence of preferred scenarios, preference for private spaces like shopping centers, overuse, and insecurity. The most visited APSM were two notable areas, Ronda de Sinú Linear Park and La Villa Olímpica, known for their size (over 5 ha) and unique features. Ronda de Sinú offers a distinct microclimate on a riparian forest along the Sinú River, and La Villa Olímpica includes specialized facilities like an Olympic swimming pool and professional sports courts. Both locations feature children, sports, stay, and bio-health scenarios.

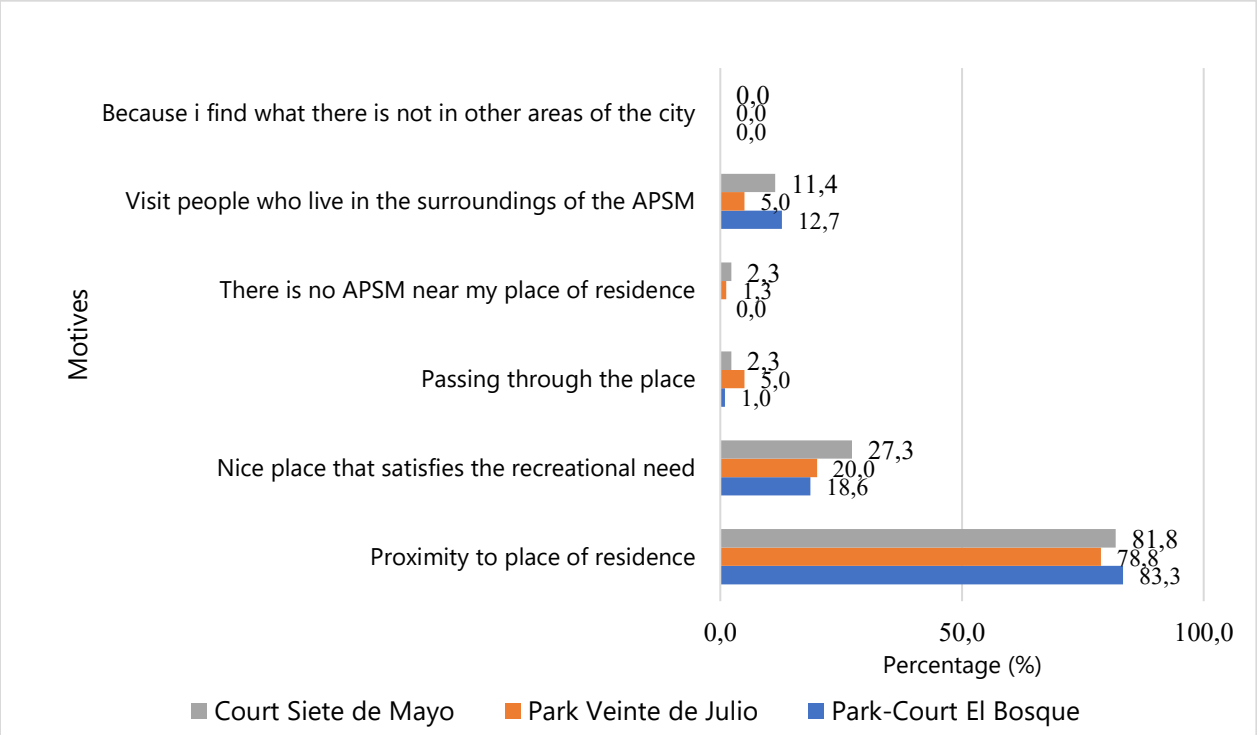

FIGURE 8. Motives for visiting APSM. Source: data collected with the Crowdsourcing Geoform (Jiménez-Caldera *et al.*, 2024)

Data on the state of conservation from the Field Geoform and Crowdsourcing Geoform show variable conditions across 5 of the 15 scenarios, validated by visual field inspections (TABLE 9). Both tools facilitated the automated calculation of the Individualized Qualitative Deficit indicator for each APSM scenario. Field validations confirm that where variations in conservation exist, the assessments by users and experts generally align. This highlights socio-spatial injustices, particularly affecting real pedestrian accessibility, which relies on APSM being in good condition.

TABLE 9. Comparison between IQD estimated with Field Geoform and Crowdsourcing Geoform. Source: data collected with the Field Geoform and the Crowdsourcing Geoform (Jiménez-Caldera *et al*., 2024)

	APSM by scenario	Deficit by Field Geoform	Deficit by Crowdsourcing Geoform	*In situ* validation
1.	Park Veinte de Julio (Children)	Very high deficit	Very high deficit (100,0%)	Very high deficit
2.	Park Veinte de Julio (Bio-health)	Low deficit	Very low deficit (81,8%) Very high deficit (9,1%) Low deficit (9,1%)	Low deficit
3.	Park Veinte de Julio (Stay)	Very high deficit	Very high deficit (96,4%) Without estimation (3,6%)	Very high deficit
4.	Park Veinte de Julio (Sport)	Very low deficit	Very low deficit (46,7%) Very high deficit (40,0%) Low deficit (6,7%) Without estimation (6,6%)	Very low deficit
5.	Park Veinte de Julio (Sport)	Low deficit	Very high deficit (100,0%)	Very high deficit
6.	Park Veinte de Julio (Sport)	Low deficit	Without estimation	Low deficit
7.	Park Nuevo Bosque #1 (Children)	Very low deficit	Very high deficit (58,8%) Very low deficit (32,4%) Low deficit (4,9%) Without estimation (3,9%)	Very high deficit
8.	Park Nuevo Bosque #1 (Bio-health)	Very low deficit	Very high deficit (52,0%) Very low deficit (24,0%) Low deficit (16,0%) Without estimation (8,0%)	Very high deficit
9.	Park Nuevo Bosque #1 (Stay)	Very low deficit	Very high deficit (84,0%) Very low deficit (16,0%)	Very high deficit
10.	Park Nuevo Bosque #1 (Sport)	Low deficit	Very low deficit (94,2%) Low deficit (5,8%)	Low deficit
11.	Park Nuevo Bosque #1 (Sport)	Low deficit	Very low deficit t (100,0%)	Low deficit
12.	Park Nuevo Bosque #1 (Sport)	Low deficit	Without estimation	Low deficit
13.	Cancha Siete de Mayo (Sport)	Very low deficit	No deficit (64,0%) Very low deficit (24,0%) Very high deficit (12,0%)	Very low deficit
14.	Cancha Siete de Mayo (Sport)	Very low deficit	No deficit (75,0%) Very low deficit (16,7%) Very high deficit (8,3%)	Very low deficit
15.	Cancha Siete de Mayo (Sport)	Very low deficit	Very high deficit (100,0%)	Very high deficit

The in-situ validation conducted by a public space expert focused on whether the community-reported subjective perception of deterioration in APSM was impacting the effective use of these spaces for recreational activities. While conservation status assessments can vary due to subjective impressions, the community input through crowdsourcing served as an alert system, highlighting areas where deterioration levels were perceived as potentially disruptive to recreational use. This approach allowed us to validate in the field whether the community's perception aligned with physical conditions that might hinder public use. Thus, the expert's assessment helped confirm whether the reported subjective deterioration had a tangible impact on the usability of these spaces.

4. Discussion

It has been demonstrated that urban sustainability is a multidimensional condition that involves evaluating and implementing actions in the territory with the aim of balancing settlements and their social, environmental, and economic conditions (Díaz-Osorio & Medina-Ruiz, 2019). The approach to a sustainable city seeks to minimize the impact on nature, without neglecting the comprehensive and articulated fulfillment of social, economic, cultural, and political objectives (Rojas, 2005; Egger, 2006; Jenks & Jones, 2010). Open and freely accessible public spaces constitute structural systems of sustainable cities, allowing for the articulation between environmental and social components (Chiesura, 2004; Pérez-Arévalo & Caballero-Calvo, 2021; Restrepo, 2017; Shen *et al*., 2017; Wojnarowska, 2016). Their multiple uses facilitate social benefits such as recreation and the reduction of urban stress (Cohen, 2018), as well as ecological benefits such as the absorption of heat and carbon dioxide, pollution reduction, stormwater runoff control, and biodiversity preservation (Wray *et al*., 2005; Jenerette *et al*., 2007; Hernández, 2008; Natural England, 2010; Terraza *et al*., 2016; Castelao *et al*., 2019).

Currently, major organizations such as the World Health Organization (WHO) promote the Healthy Cities approach, recognizing health risks inherent to the urban lifestyle. Among the programs and planning objectives, the provision of scenarios for the development of activities that contribute to improving the health conditions of citizens must prevail (Salas *et al*., 2016). In cities, inequity in the distribution of services or access to important resources for the population leads to the manifestation and maintenance of individual and social inequalities: social and spatial injustices (Toscana, 2017). Decision-making processes affect the urban spatial configuration (Soja, 2010; Lezama & Domínguez, 2006). The lack of relevant variable analysis complicates these processes (Jimenez *et al*., 2022; Wolch *et al*., 2014).

We agree with some authors who argue that the spatial justice approach and other associated concepts such as equity or optimal location, refer to the spatial arrangement of important urban infrastructures based on proximity or accessibility (Santana, 2012; Kirby, 1983). The identification of distribution patterns has caused the concept of justice or spatial equity to evolve towards socio-spatial justice (Gutierrez *et al*., 2020). Thus, analyses of APSM distribution based on accessible distances, articulated with social variables, have been implemented, facilitating the identification of new types of imbalances that denote manifestations of socio-spatial injustices. For example, the distribution has been determined based on accessible distances to various types of APSM to find the arrangement of public spaces in urbanized sectors according to the general satisfaction of the population (Jiménez & Garnica, 2014; Jiménez & Durango, 2021). In addition, a proximity-based distribution has been developed in relation to space coverage per inhabitant and according to the location of places of residence (Mayorga & Hernández, 2018; Giraldo & Vásquez, 2021). Likewise, the spatial equity of the location of public spaces has been evaluated in relation to the urbanized areas with the highest population concentration and poverty levels (Gutiérrez *et al*., 2020).

The disproportionate distribution of various types of APSM in the study area does not promote the equitable satisfaction of the population, one of the precepts of sustainable urban planning, that promotes heterogeneous and multifunctional distribution of APSM (Cedeño, 2006; Páramo & Burbano, 2013; Muñoz *et al*., 2019). This disproportion also goes against the principle of social justice of sustainable development, which aims for equal conditions regarding the quality of life (Lezama & Domínguez, 2016). Both of them are essential for achieving the corresponding Sustainable Development Goal. Few were the users of the three APSM under study who claimed to satisfy their recreational needs in these spaces. However, the vast majority agreed on the positive satisfaction generated by the APSM in the city. Data agrees with the premise that no APSM unit manages to satisfy every citizen but the sum of APSM should satisfy the tastes and behaviors of

all (UN-Habitat, 2020). The proximity to places of residence was the main reason for visiting for most of the users, which confirms the importance of proximity as a factor that conditions the intention to use public spaces (Neuvonen *et al*. Al., 2007; Lofti and Koohsari, 2009). Paradoxically, in the study area, the lack of proximity to the APSM denotes unequal distribution, a key factor for governments to reduce inequalities and reallocate benefits (United Nations, 2015). The eradication or mitigation of these inequalities should focus on reducing the proximity gaps towards a complete net of APSM (Garnica & Jiménez Caldera, 2014). In Commune #9, isolated from the rest of the city, the insufficiency of APSM reduces the possibility of satisfying the recreational needs of citizens (Garnica & Jiménez, 2014; UN-Habitat, 2020) and highlights the necessity of an articulated system of public space able to meet the needs of the local population.

The requirement for more public areas demonstrated by the high quantitative deficit is an opportunity for urbanists and planners to promote new heterogeneous spaces, including the creation of large green areas. These, additionally, fulfil an important ecological role associated with the absorption of heat and carbon dioxide, the reduction of pollution, the control of stormwater runoff, the recharge of the aquifer mantle, the regulation of temperature and the preservation of biodiversity (Sorensen *et al*., 1998; Hough, 1998; Mazari, 1999; Falcón, 2007; Cohen, 2018; Pérez-Arévalo *et al*., 2023). These are the spaces to find harmony or balance between the natural and the socially constructed environments of the city (Garnica & Jiménez Caldera, 2014; UN-Habitat, 2020).

The process of data collection allowed us to demonstrate how variable the manifestations of socio-spatial injustices can be, especially when it comes to the state of conservation of the APSM. This more objectifiable variable adds to other perception-related factors that also affect the intention to use public spaces such as perception or feeling of insecurity (Cisneros & Cunjama, 2011; Ovares & Quirós, 2013; Olivarría *et al*., 2015; Espinoza *et al*., 2017). Our findings show that many people, despite feeling unsafe in the APSM (as in the case of Parque Veinte de Julio), take risks to satisfy their needs. Nevertheless, research on the insecurity variable implies consulting also the population that, living in the surroundings, decided not to visit these spaces.

5. Conclusions and challenges

The manifestations of socio-spatial injustice presented in Commune #9 concerning the disposition of the APSM allowed us to establish general guidelines for the formulation of a proposal for the adequate spatial organization of these spaces that go in line with basic precepts of urban sustainability. We demonstrated that it could guide the decision-making processes of urban management to mitigate or eradicate socio-spatial injustices. We concluded that existing APSMs must be intervened aiming at the diversification of the functions they provide to society. This implies the redesign of homogeneous APSMs seeking the presence of the four key typologies (children's settings, stay, sports and bio-health) and meeting the needs of the community. The intervention must also respond to the need to improve the poor state of conservation. We found potential areas for the construction of a new APSM, which must be identified to respond to the high quantitative deficit. The location of these areas is a strategic factor to improve the proximity between the places of residence and the APSM. We strongly agree that the construction of the new spaces requires to be based on a participatory and inclusive design process that considers the true needs of the community. The set of APSMs of Commune #9 must include green areas seeking the balance between the natural and the socially constructed environments. These zones must be large enough to guarantee ecological values. The questionnaires on the perception of insecurity and level of satisfaction incorporated in the participatory tool for data collection (Crowdsourcing Geoform), should also be implemented in the areas of influence of the APSM. In this way, people who do not use these spaces, either because they do not satisfy recreational needs, or because they are perceived

as unsafe, will be able to provide relevant data for urban analysis.

Finally, strategies must be designed and implemented to guarantee security in the APSM and its surroundings, since insecurity conditions the intention to use the spaces. It is important to highlight that the success in the detection of socio-spatial injustices from the APSM evaluation was due, to a large extent, to the level of detail and complexity of the designed system of variables and the efficiency of the implemented tools. The APSM planning and management processes of cities must be strengthened with the potential of these interactive geoinformatics tools that allow and facilitate the recurring, massive, and organized collection of the demanded inputs. The generation of knowledge demonstrates the viability of the use of this type of geoinformatics tool to gather data on the physical-spatial conditions around the APSM, taking advantage of the experiences of the citizens. Research should continue to demonstrate the imperative need for APSM planning and management processes based also on the analysis of qualitative data, which are not measurable through geospatial modellings, such as perception and satisfaction.

6. References quoted

ARELLANA, J.; SALTARÍN, M.; LARRAÑAGA, A. M.; ALVAREZ, V. & C. A. HENAO. 2020. "Urban walkability considering pedestrians' perceptions of the built environment: a 10-year review and a case study in a medium-sized city in Latin America". *Transport reviews*, 40(2): 183-203.

ANNERSTEDT VAN DEN BOSCH, M.; MUDU, P.; USCILA, V.; BARRDAHL, M.; KULINKINA, A.; STAATSEN, B. & A. I. EGOROV. 2016. "Development of an urban green space indicator and the public health rationale". *Scandinavian Journal of Public Health*, 44(2): 159-167.

BONILLA, J.; LÓPEZ, D. & C. E. SEPÚLVEDA. 2014 "Estratificación socioeconómica y la información catastral. Introducción al problema y perspectivas a futuro". In: C. E. SEPÚLVEDA RICO & D. LÓPEZ CAMACHO& J. M. GALLEGO ACEVEDO (eds.), *Los límites de la estratificación: en busca de alternativas* [online]. Editorial Universidad del Rosario / Alcaldía Mayor de Bogotá D.C., Colombia, pp. 23-39. Avalaible: https://doi.org/10.7476/9789587385373.0004.

BYRNE, J. & N. SIPE. 2010. "Green and open space planning for urban consolidation-A review of literature and best practice". *Issues Paper*, 11: 1-63.

CÁRDENAS O'BYRNE, S. 2017. "Medir el uso del espacio público urbano seguro". *Sociedad y Economía*, 33: 34–54. Avalaible: https://doi.org/10.25100/SYE.V0I33.5620.

CARMONA, M. 2019. "Principles for public space design, planning to do better". *Urban Design International*, 24(1), 47–59. Avalaible: https://doi.org/10.1057/S41289-018-0070-3.

CASTELAO, G. F.; GÓMEZ, J. & N. B. FINELLI. 2019. Distribución de espacios verdes públicos y calidad de vida: Análisis comparativo en tres municipios de la provincia de Santa Fe. *XXI Jornadas de Geografía de La UNLP*, Ensenada, Argentina. Construyendo Una Geografía Crítica y Transformadora: En Defensa de La Ciencia y La Universidad Pública (9 al 11 de octubre).

CEDEÑO PÉREZ, M. C. 2006. *Relaciones sociales y prácticas de apropiación espacial en los parques públicos urbanos. (El caso del Parc de Les Planes de L'Hospitalet de Llobregat-Barcelona)*. Universitat de Barcelona. Tesis de Doctorado

CISNEROS, J. & E. CUNJAMA. 2011. "El color del miedo bajo el desorden del paisaje urbano en la Ciudad de México y la zona metropolitana". *Revista Criminalidad*, 53(1): 275-292.

CHIESURA, A. 2004. "The role of urban parks for the sustainable city". *Landscape and Urban Planning*, 68(1): 129-138.

COHEN, S. 2018. *The Sustainable City*. Columbia University Press, New York Chichester, West Sussex. Avalaible: https://doi.org/10.7312/cohe18204.

DEPARTAMENTO ADMINISTRATIVO NACIONAL DE ESTADÍSTICA (DANE). 2022. "Proyecciones de población". Avalaible: https://www.dane.gov.co/index.php/. [Consulta: abril, 2023].

DEPARTAMENTO ADMINISTRATIVO DE LA DEFENSORÍA DEL ESPACIO PÚBLICO (DADEP). 2020. Observatorio del Espacio Público de Bogotá. Reporte técnico de Indicadores de Espacio Público 2020. Avalaible: https://observatorio.dadep.gov.co/. [Consulta: diciembre, 2022].

DÍAZ-OSORIO, M. S. & M. MEDINA-RUIZ. 2019. *Concepto de compacidad urbana en el contexto de borde urbano*. En D. A. ARIAS-CAICEDO; J. J. CASTIBLANCO-PRIETO; M. CASTILLO-DE HERRERA; M. S. DÍAZ-OSORIO; I. F. MEDINA-ARBOLEDA; M. MEDINA-RUIZ; . . . & A. Y. VALLEJO-RIVAS (eds.), *El borde urbano como territorio complejo. Reflexiones para su ocupación*, (1a ed.). Universidad Católica de Colombia. Bogotá, Colombia. Avalaible: https://hdl.handle.net/10983/26147.

DZIEKONSKY, M.; RODRÍGUEZ, M. J.; MUÑOZ, C.; HENRÍQUEZ, K.; PAVÉZ, A. & A. MUÑOZ. 2015. "Espacios públicos y calidad de vida: Consideraciones interdisciplinarias". *Revista Austral de Ciencias Sociales*, 28: 29-46.

EGGER, S. 2006. "Determining a sustainable city model". *Environmental Modelling & Software*, 21(9): 1235-1246. Available: doi:10.1016/j.envsoft.2005.04.012.

ESPINOZA DURÁN, J.; HUGO MÉNDEZ ESTRADA, V. & J. MONGE-NÁJERA. 2017. "Percepción de seguridad, uso y mantenimiento de los parques municipales en Costa Rica, según el sexo de los usuarios". *UNED Research Journal*, 9(1): 65-71.

FERRARI, G.; WERNECK, A. O.; DA SILVA, D. R.; KOVALSKYS, I.; GÓMEZ, G. & A. RIGOTTI. 2020. "Is the perceived neighborhood-built environment associated with domain-specific physical activity in Latin American adults? An eight-country observational study". *International journal of behavioral nutrition and physical activity*, 17(1): 1-14.

FALCÓN, A. 2007. *Espacios verdes para una ciudad sostenible*. 1° ed. Gustavo Gili. . Barcelona, España.

GARNICA, R. & J. E. JIMÉNEZ-CALDERA. 2014. "La calidad de vida urbana y la dimensión físico-espacial del espacio público: aportes metodológicos para el ordenamiento territorial de Montería". *Perspectiva Geográfica*, 18(2): 257-280. Avalaible: https://doi.org/10.19053/01233769.2678.

GIRALDO-OSPINA, T. & L. R. VÁSQUEZ-VARELA. 2021. "Distribución e indicadores de cobertura y accesibilidad del espacio público en Manizales, Colombia". *Cuadernos de Geografía: Revista Colombiana de Geografía*, 30(1): 158-177.

GUTIÉRREZ-LÓPEZ, J. A.; QUENGUAN-LÓPEZ, L. F. & M. A. BETANCOURT-CARVAJAL. 2020. "¿Equidad en la dotación de espacio público en Bogotá?." *Revista de Arquitectura*, 22(1): 18-29.

GUZMÁN, L. & C. CISNEROS. 2019. "La ciudad en los ODS y la agenda 2030. Especial referencia al caso del manejo del espacio público en Colombia". *Revista Eurolatinoamericana de Derecho Administrativo*, 6(2): 189-223.

HEAL CITIES CAMPAIGN & CHANGELAB SOLUTIONS. 2016. *Los sistemas completos de parques*. Avalaible: https://www.changelabsolutions.org/. [Consulta: octubre,2022]

HERNÁNDEZ, J. 2008. "La situación del arbolado urbano en Santiago". *Revista de Urbanismo,* (18): 1-8. Avalaible: https://doi.org/10.5354/ru.v0i18.272.

HINO, A. A. F.; REIS, R. S.; RIBEIRO, I. C. PARRA, D. C. BROWNSON, R. C. & R. C. FERMINO. 2010. "Using observational methods to evaluate public open spaces and physical activity in Brazil". *Journal of Physical Activity and Health*, 7(s2), 146-154.

HOUGH, M. 1998. *Naturaleza y ciudad: planificación urbana y procesos ecológicos*. Gustavo Gili. España.

HUNTER, R. F.; CLELAND, C.; CLEARY, A.; DROOMERS, M.; WHEELER, B. W.; SINNETT, D.; .... & M. BRAUBACH. 2019. "Environmental, health, wellbeing, social and equity effects of urban green space interventions: A meta-narrative evidence synthesis". *Environment International*, 130: 1-20. Avalaible: https://doi.org/10.1016/j.envint.2019.104923.

JENERETTE, G. D.; HARÍAN, L. S.; BRAZEL, A.; JONES, N.; LARSEN, L. & W. L. STEFANOV. 2007. "Regional relationships between surface temperature, vegetation and human setdement in a rapidly urbanizing ecosystems". *Landscape Ecology*, 22: 353-365.

JENKS, M. & C. JONES. 2010. *Dimensions of the Sustainable City*. Springer, London, England.

JIAN, I. Y.; LUO, J. & E. H. CHAN. 2020. "Spatial justice in public open space planning: Accessibility and inclusivity". *Habitat International*, 97: 102-122.

JIMÉNEZ-CALDERA, J. & G. DURANGO. 2021. "Diagnóstico y planificación del espacio público urbano. Análisis espacial soportado en la participación ciudadana". *Bitácora Urbano Territorial*, 31(2): 257-283. Avalaible: https://doi.org/10.15446/bitacora.v31n2.86738.

JIMÉNEZ-CALDERA, J. & R. GARNICA. 2016. "Metodología para la Medición del Déficit Cualitativo de Espacio Público en Colombia". *Revista de Urbanismo*, 35: 69-99. Avalaible: https://doi.org/10.5354/RU.V0I35.42481.

JIMÉNEZ-CALDERA, J.; SERRANO-MONTES, J. L.; PÉREZ-ARÉVALO, R.; RODRIGO-COMINO, J.; SALVATI, L, & A. CABALLERO-CALVO. 2022. "A Conceptual Model for Planning and Management of Public and Meeting Areas in Colombia". *Land*, 11: 1-21. Available: https://doi.org/10.3390/LAND11111922.

JIMÉNEZ-CALDERA, J.; DURANGO-SEVERICHE, G. Y.; PÉREZ-ARÉVALO, R.; SERRANO-MONTES J. L.; RODRIGO-COMINO, J. & A. CABALLERO-CALVO. 2024. "Methodological Proposal for The Inclusion of Citizen Participation in the Management and Planning of Urban Public Spaces". *Cities*, 150: 1-19. Available: https://doi.org/10.1016/j.cities.2024.105008.

KIRBY, A. 1983. "Neglected factors in public services research: A Comment on 'Urban Structure and Geographical Access to Public Service's. *Annals of the Association of American Geographers*, 73(2): 285-295.

KNAPP, S.; KÜHN, I.; MOSBRUGGER, V. & S. KLOTZ. 2008. "Do protected areas in urban and rural landscapes differ in species diversity?". *Biodiversity Conservation,* 17: 1.595-1.612.

KÜHN, I.; BRANDL, R. & S. KLOTZ. 2004. "The flora of German cities is naturally species rich". *Evolutionary Ecology Research* 6: 749-764.

LEZAMA, J. L. & J. DOMÍNGUEZ. 2006. "Medio ambiente y sustentabilidad urbana". *Papeles de Población*, 12(49): 153-176.

LOFTI, M. & M. KOOHSARI. 2009. "Analyzing Accessibility Dimension of Urban Quality of Life: Where Urban Designers Face Duality between Subjective and Objective Reading of Place". *Social Indicators Research*, 94: 417-435.

LOW, S.; TAPLIN D. & S. SCHELD. 2005. *Rethinking Urban Parks: Public Space and Cultural Diversity*. University of Texas Press. New York, USA. Available: https://doi.org/10.7560/706859.

MAYORGA, J. M. & L. HERNÁNDEZ. 2018. "Medición de la cobertura y la accesibilidad del espacio público en Bogotá, Medellín y Cali". *Cuadernos de Vivienda y Urbanismo*, 11(22): 1-14.

MAZARI, M. 1999. *Espacios abiertos en la Ciudad de México*. GDF–UNAM. México

MORO, S. 2011. "Una metodología sistemática para el análisis de los espacios públicos". *Question*, 1(30): 1-18.

MEHTA, V. 2014. "Evaluating public space". *Journal of Urban design*, 19(1): 53-88.

MUÑOZ-VANEGAS, P.; QUIZHPE-MARÍN, M. y X. SALAZAR-GUAMÁN. 2019. "Uso y percepción del espacio público, una mirada desde la población: el caso de Cuenca, Ecuador". *Revista de Urbanismo*, 41: 1-19

MURCIA DAZA, W. J. 2009. *Espacio público y calidad de vida urbana: la intervención del espacio público como estrategia para el mejoramiento de la calidad de vida urbana: caso de estudio: Valle de Villalobos (Pitalito-Huila)*. Pontificia Universidad Javeriana. Bogotá, Colombia. Tesis de Maestría.

NATURAL ENGLAND. 2010. *'Nature Nearby' Accessible Natural Greenspace Guidance*. Avalaible: http://www.ukmaburbanforum.co.uk/. [Consulta: november, 2022]

NEUVONEN, M.; SIEVÄNEN, T.; TÖNNES, S. & T. KOSKELA. 2007. "Access to green areas and the frequency of visits. A case study in Helsinki". *Urban Forestry and Urban Greening* 6 (4): 235-247.

OLIVARRÍA, F.; GONZÁLEZ, M. & LÓPEZ, L. 2015. "Violencia hacia las mujeres en el espacio urbano y la seguridad ciudadana". En: *Equidad de sexo: análisis y actualidades*, capítulo 3, pp. 44-57. ITSON, México.

OLIVEROS, L. 2017. Del espacio público planeado a los espacios públicos vivos y vividos: reflexión sobre la planificación de los espacios públicos en Bogotá. *IX Seminario Internacional de Investigación En Urbanismo*, pp. 1-13. Barcelona, España.

OVARES FALLAS, V. & J. QUIRÓS LORÍA. 2013. *Evaluación de las características físicas y sociales del espacio público y su influencia en la percepción de inseguridad en el cantón de Montes de Oca, Costa Rica*. Trabajo de grado de Licenciatura en Psicología. Universidad de Costa Rica. Costa Rica.

PÁRAMO, P. & A. M. BURBANO A. 2013. "Valoración de las condiciones que hacen habitable el espacio público en Colombia". *Territorios*, (28): 187-206.

PÁRAMO, P.; BURBANO, A.; JIMÉNEZ-DOMÍNGUEZ, B.; BARRIOS, V.; PASQUALI, C.; VIVAS, F. & E. MOYANO. 2018. "La habitabilidad del espacio público en las ciudades de América Latina". *Avances en psicología latinoamericana*, 36(2): 345-362.

PÉREZ-ARÉVALO, R. & A. CABALLERO-CALVO. 2021. "Human Capital in Latin-American 'Creative Cities': The Case of Barranquilla (Colombia)". *Sociologia Urbana e Rurale,* 126: 79-96. Avalaible: https://doi:10.3280/SUR2021-126005.

PÉREZ-ARÉVALO, R.; SERRANO-MONTES, J. L.; JIMÉNEZ-CALDERA, J. E.; RODRIGO-COMINO, J.; SMITH, P. & A. CABALLERO-CALVO. 2023. "Facing climate change and improving emergency responses in Southern America by analysing urban cyclonic wind events". *Urban Climate*, 49: 1-14.

REPÚBLICA DE COLOMBIA. 1998. *Decreto 1504 de 1998*. Santafé de Bogotá, D.C. Colombia, 4 de Agosto de 1998

REYES PÄCKE, S. & I. FIGUEROA ALDUNCE. 2010. "Distribución, superficie y accesibilidad de las áreas verdes en Santiago de Chile". *EURE*, 36(109): 89-110.

RESTREPO, D. 2017. *Espacio público como estructurante de las ciudades y el territorio*. Universidad Nacional de Colombia. Medellín, Antioquia, Colombia. Tesis de Maestría.

RODRIGO-COMINO, J.; SEELING, S.; SEEGER, M. K. & J. B. RIES. 2021. "Light pollution: A review of the scientific literature". *The Anthropocene Review*, 10(2): 367-392.

ROJAS, R.; GAONA, T.; ARREDONDO, J.; PEÑA, C.; CORONA, E.; VENEGAS, F. & O. BAEZA. 2005. *Planeación urbana y regional: un enfoque hacia la sustentabilidad*. Universidad Autónoma de Baja California - Plaza Valdés PYV Editores. Baja California, México.

ROMERO CHÁVEZ, C. R. 2016. *Espacios públicos y calidad de vida. Estudio de caso en Tijuana, Baja California*. El Colegio de la Frontera Norte, A. C. México. Tesis de Maestría en Acción Pública y Desarrollo Social.

SANTANA RIVAS, D. 2012. "Explorando algunas trayectorias recientes de la justicia en la geografía humana contemporánea: de la justicia territorial a las justicias espaciales". *Cuadernos de Geografía: Revista Colombiana de Geografía*, 21(2): 75-84.

SALAS-ZAPATA, L.; LÓPEZ-RÍOS, J. M.; GÓMEZ-MOLINA, S.; FRANCO-MORENO, D. & E. MARTÍNEZ-HERRERA. 2016. "Ciudades sostenibles y saludables: estrategias en busca de la calidad de vida". *Revista Facultad Nacional de Salud Pública*, 34(1): 96-104.

SEDANO, E.; CHUNG-ALONSO, P. & M. S. D. R. COVARRUBIAS-RUESGA. 2021. "La justicia espacial y su aplicabilidad en espacios públicos de México". *Revista de Arquitectura*, 23(2): 24-35.

SEGOVIA, O. & R. JORDÁN FUCHS. 2005. *Espacios públicos urbanos, pobreza y construcción social*. Naciones Unidas. Santiago de Chile

SHEN, Y.; SUN, F. & Y. CHE. 2017. "Public green spaces and human wellbeing: Mapping the spatial inequity and mismatching status of public green space in the Central City of Shanghai". *Urban Forestry & Urban Greening*, 27: 59-68.

SMITH, B. 1991. The use of geographic information systems in development planning in Latin America". In Yearbook. *Conference of Latin Americanist Geographers*, pp. 337-342. University of Texas Press. Texas, USA.

SOJA, E. W. 2010. *Seeking spatial justice* (Globalization and Community, Vol. 16). University of Minnesota Press. USA.

SORENSEN, M.; BARZETTI, V.; KEIPI, K. & J. WILLIAMS. 1998. *Manejo de las áreas verdes urbanas*. Documento de buenas prácticas. BID, Washington, D.C. USA.

TAVARES, S. G.; SELLARS, D.; MEWS, G.; DUPRÉ, K.; CÂNDIDO, C. & S. TOWLE. 2020. "Public health and well-being in public open spaces through climate responsive urban planning and design". *The Journal of Public Space*, 5(2): 1–6. Available: https://doi.org/10.32891/JPS.V5I2.1279.

TERÁN, A.; VÁZQUEZ, I. & A. ZICCARDI. 2012. "Pobreza urbana, segregación residencial y mejoramiento del espacio público en la Ciudad de México". *Sociologías*, 14: 118-155.

TERRAZA, H.; RUBIO BLANCO, D. & F. VERA. 2016. *De ciudades emergentes a ciudades sostenibles: comprendiendo y proyectando las metrópolis del siglo XXI. De ciudades emergentes a ciudades sostenibles: comprendiendo y proyectando las metrópolis del Siglo XXI*. Ediciones ARQ. Providencia, Santiago Chile

TOSCANA, A. 2017. "En busca de la justicia espacial". *Política y cultura*, (48): 209-213.

UN-HABITAT. 2020. *City-wide public space strategies: a guidebook for city leaders: advance review copy*. United Nations Human Settlements Programme, UNON Publishing Services Section. Nairobi.

UNITED NATIONS. 2015. Hábitat III - Desarrollo Sostenible. Temas Hábitat III - 11 – Espacio Público. En: Conferencia de las Nacionales Unidas sobre la Vivienda y el Desarrollo Urbano Sostenible (Spanish). 29: 1-8. Nueva York, USA.

VERGARA-PERUCICH, F. & M. ARIAS-LOYOLA. 2021. "Community mapping with a public participation geographic information system in informal settlements". *Geographical Research*, 59(2): 268-284.

VILLANUEVA, K.; BADLAND, H.; HOOPER, P.; KOOHSARI, M.; MAVOA, S.; DAVERN, M. & S. GOLDFELD. 2015. "Developing indicators of public open space to promote health and wellbeing in communities". *Applied Geography,* (57): 112-119.

WANG, J. 2009. "Analysis of problems in urban green space system planning in China". *Journal of Forestry Research*, 20:1, 20(1): 79-82. Avalaible: https://doi.org/10.1007/S11676-009-0014-2.

WOJNAROWSKA, A. 2016. "Model for assessment of public space quality in town centers". *European spatial research and policy*, 23(1): 81-109.

WOLCH, J. R.; BYRNE, J. & J. P.NEWELL. 2014. "Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough.'". *Landscape and Urban Planning*, 125: 234–244. Avalaible: https://doi.org/10.1016/J.LANDURBPLAN.2014.01.017.

WRAY, S.; HAY, J.; WALKER, H. & R. STAFF., 2005. "Audit of the Towns, Cities and Development Workstream of the England Biodiversity Strategy". *English Nature research report number* 652. English Nature, Peterborough.

ZAMANIFARD, H.; ALIZADEH, T.; BOSMAN, C. & E. COIACETTO. 2019. "Measuring experiential qualities of urban public spaces: users' perspective". *Journal of Urban Design*, 24(3): 340-364.

Lugar y fecha de finalización del artículo:
Montería, Depto. Córdoba, Colombia; junio, 2023
Revisión: noviembre, 2024