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Creation of an urban park New ASD index with a spatial distribution coefficient (Case study: region 1 of Tehran)

Creación de un parque urbano Nuevo índice ASD con un coeficiente de distribución espacial (Estudio de caso: región 1 de Teherán)

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RESUMEN

The literature study demonstrates how GIS uses techniques like network analysis and fuzzy logic to carry out analyses in accordance with spatial balance. The aforementioned analytical techniques are technically difficult and costly since they need a large database. This study aims to measure geographical disparity, which indicates the lack of access to park services, identify circumstances where population demand is the main driver of demand, and identify general causes for the lack of service. Los resultados del estudio GIS sugieren que el rango de advertencia se muestra en los parques con un nuevo índice ASD de -25> nuevo ASD> 170, mientras que el rango se muestra en los parques con un nuevo índice ASD de 2000> nuevo ASD> 74250. Además, demuestra cómo el escenario de oferta y demanda para parques pequeños y muy cerca unos de otros es adverso. Esto se debe a que los parques más pequeños tienen menos capacidad para atraer visitantes de otros lugares.

Palabras clave: Accesibilidad espacial; medida de disparidad espacial; servicio de parques urbanos.

ABSTRACT

The literature study demonstrates how GIS uses techniques like network analysis and fuzzy logic to carry out analyses in accordance with spatial balance. The aforementioned analytical techniques are technically difficult and costly since they need a large database. This study aims to measure geographical disparity, which indicates the lack of access to park services, identify circumstances where population demand is the main driver of demand, and identify general causes for the lack of service. The results of the GIS study suggest that the warning range is displayed in the parks with new ASD index of -25> new ASD> 170, while the range is displayed in the parks with a new ASD index of 2000> new ASD>74250. It also demonstrates how adverse the supply and demand scenario is for parks with tiny areas and close proximity to one another. This is because smaller parks have less ability to draw visitors from far away.

***Keywords**:* Spatial accessibility; spatial disparity measure; urban park service.

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1. INTRODUCTION

The collapse of the distribution system of the Budakh urban service hubs is one of the most significant effects of the recent fast urbanization and physical expansion of Iranian cities. In particular, parks and green areas contributed to the social disparity in access to municipal services for inhabitants. Environmental justice studies are very concerned with the spatial equality of parks. Numerous metrics have been used to evaluate park access, but few studies have looked into how traffic patterns affect park accessibility (1).

Park green spaces (PGSs) are crucial local land use assets that may improve urban residents' quality of life and contribute to population health in a number of different ways (2). Park green spaces are important public infrastructures because they provide urban residents with benefits like leisure, a better quality of life, and the chance to observe environment. Uneven access to these green spaces is a long-standing issue in metropolitan environments, as PGSs are frequently dispersed unevenly. Concern over the geographical disparity between PGSs's offerings and inhabitants' requirements has grown in industrialized countries. (3).

The application of urban green space standards varies from city to city. According to the World Health Organization (WHO), each one of the cities is recommended to provide at least 9 square meters of accessible, safe, and functional urban green space for each individual. It also suggests that the ideal amount of urban green space can be generously provided up to 50 square meters per person (4).

According to this viewpoint, every city in the world should have as its primary goal the proper provision of urban green space, notably above and above the minimal needs. This is crucial because thriving cities are those that provide their inhabitants the greatest green space (1).

According to a 2016 quality of life research, Vienna is the world's most livable city. There are 7.1 million people living there, and 120 square meters of urban greenery. Each person of Singapore, the third-most populous city in the world, has access to 66 square meters of urban green space (5).

People in densely populated areas find access to parks convenient when their high desire for green spaces is satisfied. According to earlier study, the population's need must be met for the park's geographical distribution to be in line with accessibility requirements. (6-8).

The Literature review of the research shows that techniques such as network analysis and fuzzy logic are used in GIS to perform analyzes in accordance with spatial balance. From a technical point of view, the aforementioned analytical methods require a large database, which will cause a lot of expenses. The purpose of this study is to calculate the Area of supply and demand (ASD) index of urban parks based on the use of 1- spatial distribution justice factor 2- spatial weight. (ASD) as an evaluation indicator to emphasize the scarcity and / or oversupply of park services previously proposed by Lee and Hong (2013) (9). They calculated the ASD only with the spatial weight coefficient, while in this article the authors use it as a coefficient along with the spatial weight in calculating the ASD by calculating the distributive justice index.

Therefore, in this research first, the concept and dimensions of the supply and demand approach are explained using different sources and data about parks in Tehran Region 1, then by analyzing 4 indicators for measuring the distributive justice of parks and spatial weight, their supply and demand are examined.

1. The amount of access of residents of urban unit services (Wi)
2. The distance of blocks from the service (Dij)
3. The efficiency of each service (Gj)
4. Population of blocks (Pi)

By measuring the criteria and characteristics expressed by GIS, explaining the relationship between them, and addressing the research questions, this paper will attempt to measure the information and quantitative and descriptive data of the environment in the process of converting data into the form of digital information in GIS.

The central claim of this study is: How can the distribution of supply and demand for green spaces in cities be explained by the actual services provided by urban parks? This study attempts to define and specify two theoretical notions in the second section. Distributive justice first expresses the variables and the formula used to calculate them. The space weight index for each of the parks is then determined. The procedure for calculating the index is described in the third portion. In Section 4, the suggested index is created by understanding the analytical findings of planning principles and is empirically applied to Tehran's area 1. The study's shortcomings are discussed in the last part, along with suggested research subjects.

2. MATERIALS AND METHODS

2.1. Methodology

This study is an information modeling research. For that purpose, it's practical and developmental research to measure the degree of the supply shortage or demand excess for urban park facilities. In other words, the present study uses situational weight index and distributive justice for ASD. This research is mixed regarding data collection methods, relies on library methods to review resources, and extracts the required parameters to create a database based on reference land information. at last, to check and calibrate digital information and maps, 50 maps have been used to view and capture geographic coordinates. This research will be dependent on the modeling analysis method and using GIS analysis functions. The analysis of input data, including qualitative and quantitative information, is performed using standard coding and weighting methods. In this paper, we utilize the ASD index used by Lee and Hong (2013) (9) to measure under or over-supply levels for urban park services. An innovative aspect of this paper is the Distributive Justice Index, which will be discussed in detail later. This research approach is that each park will have more or less impact due to spatial characteristics, except for the area and distance from the blocks. Figure 1 summarizes the process of ASD calculation and application of the analytical results. ASDi, which is the quantitative difference between supply and demand in park services per unit area ('area' hereafter), is defined as follows:

$$ASD_i = P_i - \frac{Si}{pcpa} \quad [1]$$

Pi = population
Si = refer to actual park-service supply in area i,
PCPA = represents the per capita park area stipulated in relevant rules and regulations (e.g., The Law on Urban Parks, Greenbelts, etc.); therefore, Si in Equation in this paper, the actual park services provided for areas i or j are affected by two indicators, which are defined as follows:

$$S_i = \sum_{j=1}^{k} Sij \quad [2]$$

$$S_{ij} = A_j \times SW_{ij} \times E_{ik} \quad [3]$$

$$SW_{ij} = \frac{1}{dij^{\beta}} \ , \beta > 0 \quad [4]$$

$$E_{ik} = \sum f\,(W_i, D_{ij}, G_j, P_i) \quad [5]$$

Ai = refers to the area of park j,
Dij = the straight-line distance between area i and park j.

To measure the spatial justice of urban parks, mathematical relationships and formulas have been used in this research, which is mostly presented by Dadashpour and Rostami Used to measure the spatial justice of parks (Ai) (10). Distributive justice in parks includes the following characteristics:

a. The amount of access of residents of urban units to services (Wi),
b. The distance of blocks from services (Dij),
c. The efficiency of each service (Gj),
d. The population of the blocks (Pi) is combined.

This index is calculated in the form of relation number (1); the difference in this relation is that the disturbance factor for the blocks adjacent to the parks is eliminated while measuring spatial justice.

The main concern of this research is to develop ASD with respect to the spatial disparity between supply and demand and investigate its empirical applicability. Furthermore, when the centroids of the spatial units represent many starting points to divide a large area into small spatial units for analysis, computing network distances among all of the starting points (residential locations) and ending points (park locations) will be quite difficult and also time-consuming. For this specific reason, using the straight-line distance helps us to focus on the methodological highlight proposed in this study.

As pointed out by Equation [2], Si is the cumulative value of the service size provided by (K) parks (S_{ij}) (SW_{ij} denotes spatial weight). In Equation [2], Sij is inversely proportional to spatial weight (SW_{ij}) on the straight line between i and j, meaning the area of park j is allocated to residential location i. Similarly, the aggregated services supplied by k parks distributed in the area indicate the actual supply level of park services in area i. This research was used by combining the positional weight index and distribution justice for ASD to explain the new ASD index Equation [6].

$$\text{New ASD} = P_i - \frac{Aj \times (\frac{1}{dij^{\beta}}) \times \sum f\,(Wi, Dij, Gj, Pi)}{pcpa}, \ \beta > 0 \quad [6]$$

2.2. Literature review

The prime purpose of the article "Understanding recreation demands and visitor characteristics of urban green spaces: A use of the zero-inflated negative binomial model" is to understand the recreational needs and characteristics of visitors to urban green spaces. In this paper, Kim et al (2021) (11) propose a specific type of comprehensive reconstruction of the Sapphire area. During redevelopment, the spatial arrangement of urban green spaces should be investigated to provide fair recreational opportunities that meet visitors' recreational needs and characteristics. This study focuses on 29 large urban green spaces in the Sapporo city area and aims to understand the issues mentioned earlier by using the individual travel expense method.

Gyorgy Csomós et al (2021) (12), in the paper "Measuring Socio-Economic Inequalities in Green Space Availability in Post-Socialist Cities," use three post-socialist Hungarian cities as case studies. The relationship between different types of residential areas in terms of age, examines the education, level of people revenue, and the availability of urban green spaces.

To do this, they introduce a combined demand-supply index that contains specific urban green space availability indicators. The results show significant differences in UGS availability between different socio-economic groups and different types of neighborhoods in the studied cities. These results also show that environmental justice remains a concern for urban planning in post-socialist cities despite the efforts of local governments to provide dwellers with equal access to urban green spaces.

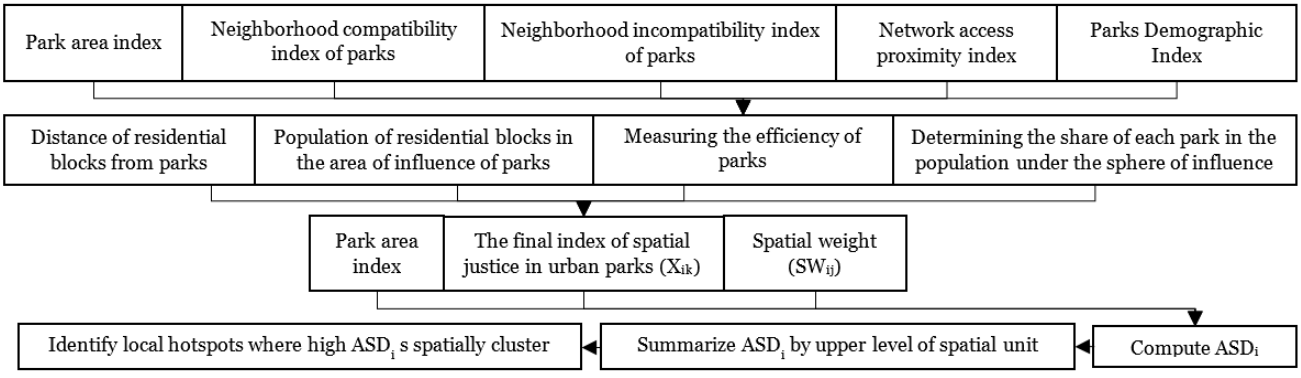

Figure 1. Analytical framework for calculating ASD.

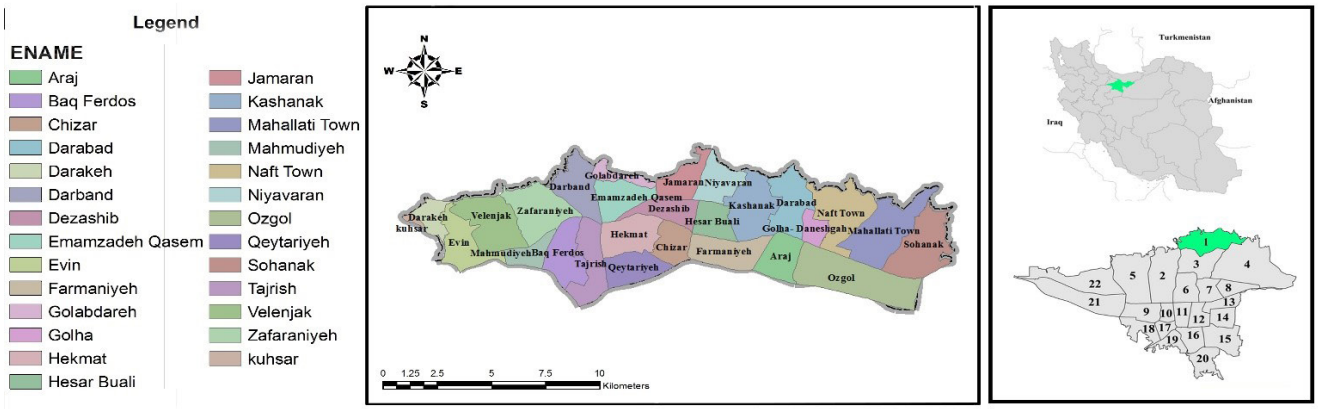

Figure 2. Spatial location of neighborhoods in region 1 of Tehran.

Shuying Zhang et al (2021) (13), in the article named "Characteristics of spatial-temporal distribution and the evolutionary mechanism of urban parks in Beijing, China," first analyzed the dynamic evolution of urban parks in Beijing by comparing the characteristics of spatial distribution at three different time points in 2005, 2010 and 2017. In addition to changes in number and area, spatial structure and access are also used by direction distribution methods, core density estimation, and network analysis. Then the three-factor analysis method is used to explain the evolution mechanism. Stability factors, dynamic factors, and random factors play a critical role in the spatial development of urban parks through the constraint mechanism, supply demand mechanism, and incentive mechanism discretely.

In their article, Diao, Hu & He (2021) (14) declares that there are significant differences between vulnerable groups in terms of age and revenue and each one of the residents. Urban parks have no special value; however, the distribution of comprehensive parks, neighborhood parks, and small pleasures is unequal for all residents and vulnerable groups. In addition, the value of urban parks can be affected by the scale of the park, where the number of urban parks has a positive impact on access per capita and a negative impact on the Gini coefficient among all residents and vulnerable groups. In other words, there is no fundamental correlation between the number of parks and the proportion of available park which is shared in vulnerable groups. In general, the effect of the park scale on park equity is evident, and policymakers and planners are recommended for public health and environmental equality in urban communities.

Li and assistants conducted another study. Large urban parks, extracted from the vast amount of anonymous cellular signaling data as two fast indicators of recreational use efficiency of large urban parks for 11 cities in the Beijing-Tianjin-Hebei (BTH) area. The results show significant differences between cities in terms of park visits and service areas. Afterward, they carry out Hierarchical Linear Regression (HLR) models to investigate the relationship between two indicators, fourteen city-wide factors, and park-specific factors for 206 samples of large urban parks. The maximum writing clarity must be pursued, trying to use the.

2.3. Case study

Tehran is the capital and largest city of Iran and the largest city in Tehran Province. With a population of around 9 million in the city and around 16 million in the larger metropolitan area of Greater Tehran, Tehran is the most populous city in Iran and Western Asia, and has the second-largest metropolitan area in the Middle East, after Cairo. It is ranked 24th in the world by metropolitan area population.

The metropolis of Tehran is divided into 22 municipal districts, each with its own administrative center. Of the 22 municipal districts, 20 are located in Tehran County's Central District, while districts 1 and 20 are respectively located in the counties of Shemiranat and Ray. Although administratively separate, the cities of Ray and Shemiran are often considered part of Greater Tehran.

Northern Tehran is the wealthiest part of the city, consisting of various districts such as Zafaraniyeh, Jordan, Elahiyeh, Pasdaran, Kamranieh, Ajodanieh, Farmanieh, Darrous, Niavaran, Jamaran, Aghdasieh, Mahmoodieh, Velenjak, Qeytarieh, Ozgol and Ekhtiarieh. While the center of the city houses government ministries and headquarters, commercial centers are located further north.

Region 1 of Tehran Municipality is located at the northeastern tip of this city and is considered the northernmost point of Tehran. This region is limited to the Alborz mountain range from the north, Evin region from the west, Ayatollah Sadr Highway from the south, and Lavasanat from the east.

According to the census of 2016, District One of Tehran has a population of 428,457 people, and according to the divisions of the municipality, it has 27 neighborhoods. Four hundred thirty-seven parks are located in this area. According to the division of hierarchical parks, Tehran Region 1 has 20 regional parks and 417 parks in the district and neighborhood, all of which are under study in this study. Figure 2 and 3 shows the location of neighborhoods in Zone 1, and Table 1 indicates the number of parks by type and the sum of their area by neighborhood.

3. THEORETICAL FRAMEWORK

3.1. Spatial justice and landscape planning

Numerous ideas of landscape design place a strong emphasis on a planning procedure separate from urban social and spatial systems. The substance of landscape planning is reduced as a result of this viewpoint. Planning without a topic or substance is akin to having no idea or intellectual foundation, which prevents you from using your full potential. Justice is one of the essential principles to reach a great city. To study a just in each

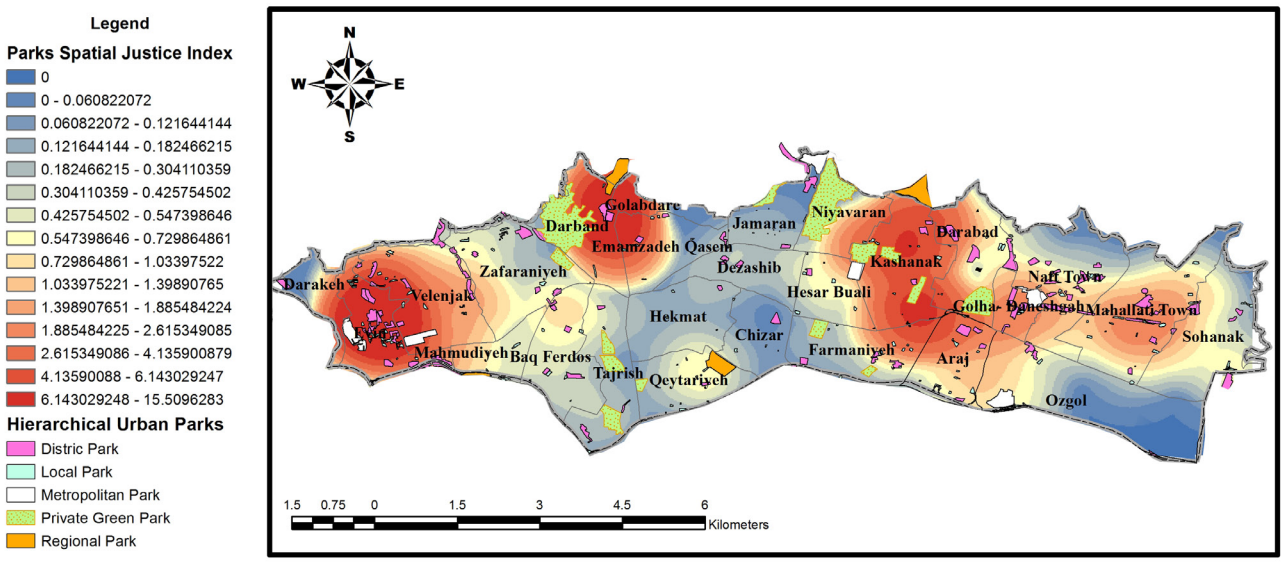

Figure 3. Spatial location of neighborhoods in region 1 of Tehran.

Table 1. Information on the frequency of parks and population by Local in region 1.

	Zaferanie	Dezashib	Darake	Darband	Dar abad	Hekmat	Hesar Bo Ali	Jamaran	Tajrish	Bagh ferdos	Evin	Emam zadeh ghasem	Ozgol	Araj
Population	27112	12491	714	10241	12527	33299	12141	8169	14330	1835	11521	19745	26333	15100
Local parks	18	1	0	4	16	3	1	15	3	8	29	7	14	12
District park	8	3	0	2	7	1	8	2	3	8	16	3	1	3
Metropolitan park	0	0	0	0	0	0	1	1	0	0	2	0	1	0
Regional park	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Total area of parks (m²)	102238	22839	0	158270	2357	340288	85057	126476	34036	80851	489699	34802	117691	75201
	Golha	Golab dare	Kashanak	Chizar	Velenjak	Hezar sang	Niavaran	Mahmodie	Mahalati	Gheitarie	Farmanie	Shahrak naft	Sohanak	
Population	5294	1135	2793	1746	21629	0	9351	7947	2660	18511	16750	1650	7	
Local parks	6	1	13	4	27	0	2	6	26	9	10	9	9	
District park	4	0	4	1	9	2	0	0	6	1	4	15	4	
Metropolitan park	0	0	0	0	2	0	0	0	0	0	0	0	0	
Regional park	0	0	1	0	0	0	0	0	0	1	0	0	0	
Total area of parks (m²)	73871	1353	178612	22116	317410	36620	3422	7133	105995	117199	56197	179397	61810	

City, it is necessary to examine the three components of equality, diversity, and democracy as essential elements of a just city. Order, public health, urban management, and city quality of life were the main concerns of post-industrial revolution urban planners and landscape architects. The major characters of this narrative were mostly urban planners who incorporated elements of equality, society, modernism, and new ethics with novel urban living forms. (15).

3.2. Land devaluation, gentrification, and urban greening

The current scientific and dominant political narratives around municipal interventions for land (re)development and urban greening park creation, waterfront restoration, or greenway Construction emphasize the ecological, social, health, and economic benefits. In this context, landscape planners and investors, along with urban city planners and political decision-makers, play an essential role in producing a green city and, in return, helping to boost a city's image as livable and desirable, which means "urban greenery" (16). Tensions and contradictions arise from subsequent inequalities that result from the effects of this unbalanced spatial development. The same concerns about the moral authority of greening can be applied to evaluating communication planning approaches for urban sustainability planning (17).

While avoiding top-down decision-making, the communication and dialogue-oriented planning approaches should encourage involvement and inclusion, foster agreement on

Table 2. Factors determining the spatial distributive justice index of parks.

Index	Communication	Definition
Measuring Spatial Justice	$Ai= \sum f (Wi, Dij, Gj, Pi)$	• Spatial Justice of Parks (Ai) • The amount of access of residents of urban units to services (Wi) • The distance of blocks from the service (Dij) • Efficiency of each service (Gj) • Population of blocks (Pi)
Determining the share of each park in the population under the sphere of influence	$W_i = \sum_{n=1}^{\infty} B_i$	• The number of residents enjoying the services of the parks around them (Bi)
Measuring the efficiency of parks	$G_i= (Z_1M_i+Z_2T_i+Z_3N_i+Z_4Q_i+Z_5S_i)$	• Compatibility of parks with adjacent uses (Mi) • Incompatibility of services with adjacent uses (Ti) • Proximity to the access network (Ni) • Resilience of the applicant population (Qi) • Park area (Si)
Demographic elasticity of services	$Q_j= \frac{S}{GSPC}$	• Parks Area (S) • Green Space Per Capita (GSPC)
	$q_j= \frac{Qj - \sum Bij}{Qj}$	• Service threshold population and nearest(Qj) • The number of residents enjoying the services of the parks around them(Bi)
Park area Index	$S_j= \frac{Si}{\sum_{i=1}^{n} Si}$	• Park area (Si) • Park Area Index (Sj)
Performance indicators of parks	$G_a= \frac{\sum Gi}{n}$	• The efficiency of each park(Gi)
Criteria for the availability of urban parks	$X_{ik}= \frac{\sum_{i=1}^{n} \frac{Qi}{Dij}}{N} \times \sum_{n=1}^{\infty} B_i$	• The distance of parks from the residential blocks of the neighborhood (Dij) • Traction(Gj) • Number of residents with park services(Bi)

sustainability planning goals and tactics, and assure lasting choices and plans (18-21). However, the moral weight that urban greening carries as well as the desire for a green city's worldwide appeal have the potential to dominate agenda-setting, which would have extremely unsettling repercussions for the design of a just green city.

Greening aims can help to reduce the emphasis on asymmetric power relations and disputes over scarce resources, which run the danger of reenacting unfair results. This is similar to the notion of "public goods" and the assumed distributed advantages of access. (22). In this case, the unfair outcomes revolve around the mid-and long-term access to the benefits of urban (green) life.

Recent research on ecological or environmental gentrification has revealed that a combined approach of environmental cleanup, land restoration, and the construction of green amenities is progressively reconfiguring urban districts for residents who are wealthier and whiter. (23, 24).

3.3. Spatial disparity definition

The state of demand serves as the cornerstone of our methodology for identifying ground-breaking growth prospects. Our tried-and-true method is always changing, but it often necessitates identifying demand segments and studying them in depth to comprehend the requirements of a multidimensional framework. Analyzing the gap between ecosystem service provision and demand might offer pertinent insights for enhancing human well-being in metropolitan contexts.

Different demographic groups have varying degrees of accessibility to public goods, which is explored in some studies as a geographical inequality. In this study, the amount of under- or oversupply for urban park services is determined using the ASD index of Lee and Hong (2013) (9).

The research's clever use of the Distributive Justice Index is one of its strongest points. The effectiveness of each park may be understood with the aid of this index, which is based on the index determined by calculations done in the supply and demand model. In other words, this study integrates the location quality of parks with the fairness of spatial distribution in the supply and demand model. The size and distance from residential blocks are not the only criteria used to evaluate parks. The methodology of this study assumes that each park will be more or less beneficial depending on its spatial qualities, with the exception of its location and distance from the blocks.

Because of this, the definition of spatial disparity in this work is completely different: it is the geographical difference between the levels of supply and demand for park services in a geographic unit (for instance, a 100 m 100 m square grid).

For every unit:

- The size of the entire population represents demand,

Service availability, which is quantified based on the gravity model, serves as a representation of supply.

4. DISCUSSION

Mathematical calculations and formulae, which the authors adjust to meet the particular characteristics of the parks, will be employed in this study to quantify the spatial fairness of an urban park.

The following are indicators: calculating the proportion of each park in the population within its sphere of influence; evaluating the effectiveness of parks; calculating the distance between residential blocks and parks; and calculating the population of residential blocks within a park's sphere of influence. Table 2 provides the required communication and metrics for assessing the parks' spatial fairness.

4.1 Urban park landscaping supply and demand

The urban area of Tehran (region 1) was split into a lattice of 100 square meters by 100 square meters for the experimental assessments, and the ASD of each network was determined. The legislation on urban parks, greenways, etc. categorizes these parks into the following groups:

The most effective locations in the park are displayed in Table (2). The differences between places where regional parks are located and areas around the parks contribute to the large final divergences of the parks' spatial justice.

The ultimate spatial justice index of parks in relation to their effectiveness is improved and expanded by neighborhoods.

1. The Local Park,
2. The District Park,
3. The Metropolitan Park,
4. The Regional Park.

In many large parks in the immediate vicinity, residents of less densely populated areas are supplied with a high level of service availability due to the active interaction between residents and parks.

On the other hand, residents of densely populated areas with few desirable parks nearby may lack services. Larger populations (higher demand) lower park size-to-distance ratios (low supply) increase the spatial disparity. Therefore, the spatial disparity is inversely proportional to accessibility.

The map in Figure 5 shows the ASD values for unit areas suffering from a park services supply shortage, resulting from a park-service level that does not correspond to the size of demand population in the areas with affirmative values in Equation [1] of all the lattices Figure 6 within the city. In Figure 5, the unit areas (lattices), where the actual parking service supply to the demanding population is inadequate, are marked in reddish tones; darker spots point out greater excessive demands or more people who are not supplied with the park services.

The closer a large urban park is located around area i, the higher the actual park-service supply, which means accessibility to parks is great in area i. Another way to look at it is that if a park is large but located far away, the low accessibility is offset by its size. In short, access to a small and nearby park can be comparable to the accessibility of a large park located far away.

Therefore, in addition to the repulsion due to spatial factors such as distance, the attraction due to non-spatial factors such as park size (area) should be taken into account when assessing accessibility to the park (25).

Figure 5 shows the distribution of population and parks in the Region 1 of Tehran. The population distribution represents the number of people in the square grids on the choropleth map, where parks have symbols of various sizes depending on their area.

Calculating the ASD based on the population (demand) and parks (supply) distribution makes it possible to identify an area and its residents that the proper park services are not provided.

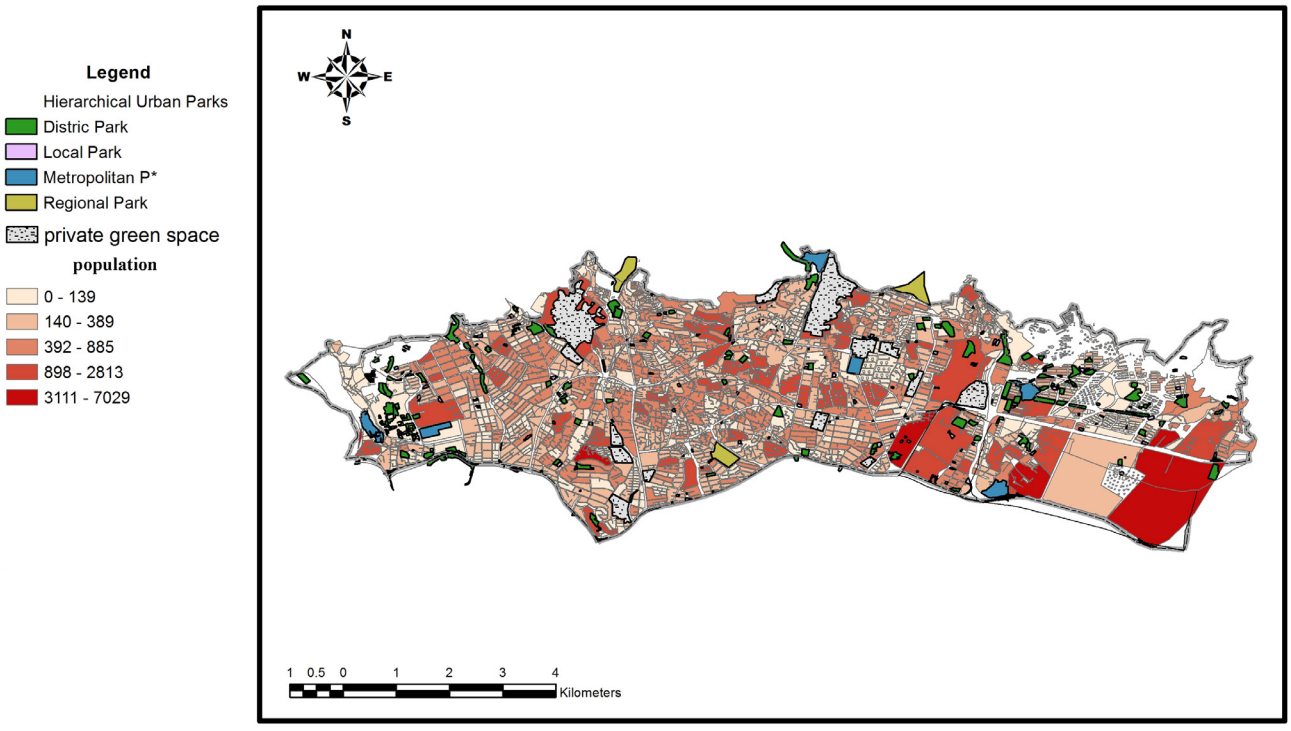

Figure 4. Distribution of population and urban parks in Region 1 of Tehran.

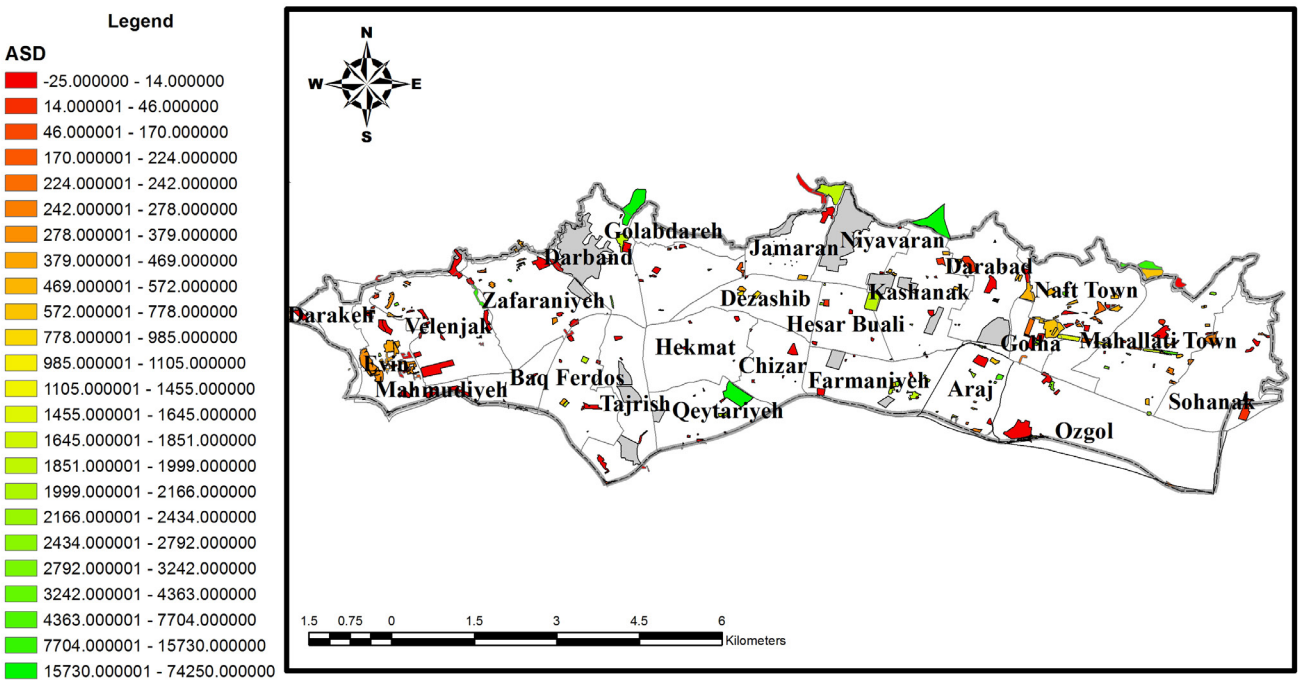

Figure 5. New ASD distribution in Region 1 of Tehran.

This result can be applied to prioritize the construction of new parks in areas suffering from supply shortages despite high demand from residents. Interestingly, the methodological basis for derivation of Equation [1] is related to the dissimilarity index (D) introduced by Duncan and Duncan (1955) (26).

The index D is defined as follows:

$$D = \frac{1}{2P}\sum_{i=1}^{n} \left| Pi\_si \times \left(\frac{P}{S}\right) \right| \quad 0 \leq D \leq 1 \quad [7]$$

While PCPA in Equation [1] is the stipulated criterion in institutional regulations, P/S denotes the inverse number of the empirical per capita park area defined as the ratio of the total population to service availability measured in square meters. If the stipulated per capita criterion is permitted in the empirically derived term, P/S may be considered as the quantity inversely equivalent to the per capita park area in Equation [1] (PCPA).

For this argument, the element of D, equal to $P_i - S_i \times (P/S)$, is similar to ADS_i. The interpretation is that the closer the index (D) is to one, the more problematic the area is with respect to the overall spatial disparity between supply and demand. This indicates that some localities with high ADSi values contribute significantly to the overall tendency.

In Figure 6, those unit areas (lattices) with inadequate supply of actual park-service against demand-side population are marked in reddish tones, darker spots indicating greater excessive demands, or more people that are not supplied with park services.

Table 3. The average value of the spatial difference and the D-index in terms of supply and demand in the neighborhoods in Region 1 of Tehran.

	Zaferanie	Dezashib	Darake	Darband	Dar abad	Hekmat	Hesar Bo Ali	Jamaran	Tajrish	Bagh ferdos	Evin	Emam zadeh ghasem	Ozgol	Araj
New ASD	987	242	0	414.75	886.18	1080.75	9055.83	37.43	1660.5	1636.7	535.78	707.57	1520.2	889.3
D index	0.12	0.05	0	0.054	0.45	0.26	0.058	0.08	0.175	0.1	0.12	0.08	0.21	0.09
	Golha	Golab dare	Kashanak	Chizar	Velenjak	Hezar sang	Niavaran	Mahmodie	Mahalati	Gheitarie	Farmanie	Shahrak naft	Sohanak	
New ASD	9851.75	1135	2495.5	985.5	1401.7	0	242	1202.4	1860.1	5827.54	1378.8	1326	1279.7	
D index	0.19	1	0.03	0.06	0.21	0	0.05	0.36	0.2	0.34	0.06	0.11	1.125	

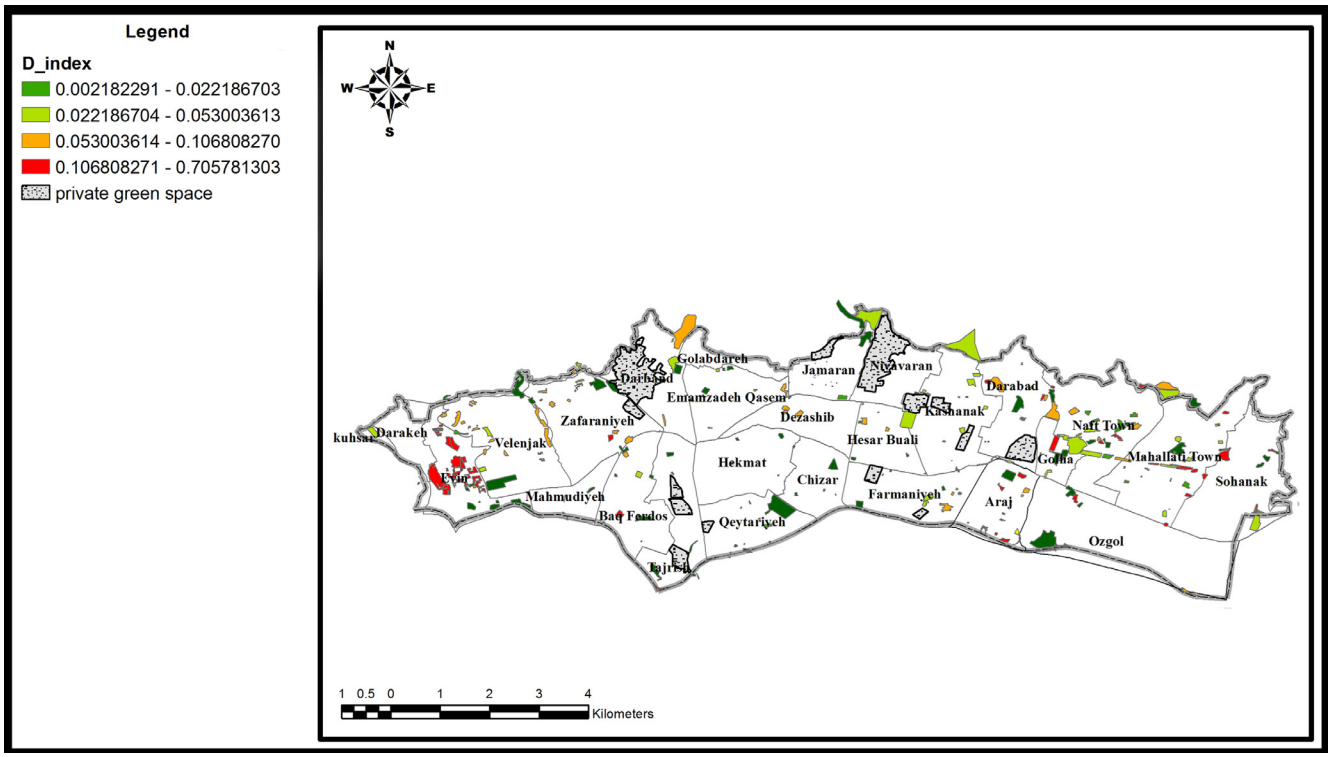

Figure 6. D index distribution for park in Region 1 of Tehran.

5. CONCLUSION

This study suggested using the geographical discrepancy between the supply of nearby parks (service area) and the demand of residents (population) in addition to the coefficient of space distribution to determine access to nearby parks. The supply and demand for parks in the original ASD model were exclusively based on Figure 4 highlights the locations within the target region where there is a glaring discrepancy between supply and demand. In other words, it is challenging to interpret Figure 3's depiction of the spatial range in which ASD values are dominantly distributed as spatial planning information.

Particularly in Jamaran, Niavaran, Dezashib, Evin, Araj, Emam Zadeh Ghasem, and other highly populated places, it appears that there are several parks dispersed throughout. In contrast, the geographical distribution of ASD reveals that regions with a lot of parks are surrounded by dark, reddish-toned grids, which indicates a lot of inadequacy. The dark reddish-toned locations in Figure 5 should be given priority for building new parks in order to reduce the discrepancy between supply and demand. Their spatial weight, which depended on the separation between neighborhoods and parks.

By contrasting the spatial distribution coefficient with the ASD, this study has really evaluated the parks based on their spatial qualities, in addition to their distance from the population centers. Consider two parks A and B that share a space at terms of Population attraction, A at the ideal location and B in the undesirable location are not equivalent, and their ASDs are dissimilar. When ASD was first developed, only distance mattered; hence, if A and B parks were located at the same distance from the same population block, their ASD indices would be fairly similar. Therefore, Spatial disparities exist in densely populated areas compared to the availability of service.

According to the empirical research, when population demand and service availability are high, geographical discrepancies may even be more pronounced. Because inhabitants in highly populated regions may experience a shortage of services despite the presence of several parks nearby, city planners should take into account places where demand exceeds supply when deciding where to create new parks.

The findings of the new ASD may be clearly understood because they are expressed in square meters, which should indicate the amount of individuals in need of more parking spots or those at danger of park shortages. Planners may readily determine the size of parks that should be more prevalent in priority and low supply locations according to the per capita green space parameter, which enables the demand unit to be equivalent to supply. By figuring out the geographic reach of the park services, the study' findings may be achieved. Planners might support their claims concerning the placement of additional parks by recognizing spatial inequity based on the planning data collected using legal standards.

The analytical procedure of new ASD estimate may be simply adapted to apply to multiple social groups, even if different social groups were not taken into account in the study, unlike prior research that looked at ethnic subclasses to highlight park service imbalance among different ethnic groups. For instance, certain Tehrani landscape architects could be interested in researching spatial inequity with regard to, say, handicapped individuals, various age groups, or men and women individually.

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