

# Categories of residential spaces by their accessibility to urban parks – indicator of sustainability in human settlements Case study: Bucharest

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**Abstract:** - Urban parks size, spatial distribution and endowments represent essential indicators used for measuring the sustainability of urban environments and the quality of life in residential spaces. The paper assesses the deficit of urban parks in Bucharest by delimitating categories of residential spaces according to their accessibility to the city parks. We have set categories of residential spaces with poor access to urban parks and considered them to be priority intervention areas for urban rehabilitation in this aspect. Deficient access to Bucharest urban parks was correlated with development of new residential areas, as these tend to further increase the high density of built space and consequent traffic congestion. Identifying critical areas that lack good access to urban parks allows city public authorities to draw adequate measures to improve or to avoid worsening of the situation in a city with numerous environmental issues and an unpredictable future evolution.

**Key-Words:** - accessibility, housing, residential areas, urban parks, urban sustainability, Bucharest, Romania

## 1 Introduction

Urban parks are important components of the urban infrastructure improving the quality of life [1], [2] offering ecological and social services to the population (recreation, leisure, better population health state) [3], increasing the economical, social and aesthetical value of urban ecosystems [4], [5], offering reserve space for future town-plan projects [6] and for conserving biological diversity [7]. The size of urban parks represents an important indicator for assessing the sustainability [8] and competitiveness of urban ecosystems [9], their availability is an expression of the housing quality [2].

For these reasons, the degradation of quality and decrease of surface for urban parks are major threats to the quality of large urban ecosystems [10] as they accentuate pollution [11], increase the costs of recreation and leisure services [5], [12], undermine the general population health state [13] and are involved the emergence of social segregation problems [14], [15], [16].

Bucharest is the largest city in Romania, and it represents a characteristic situation at national level regarding the tendency of qualitative and quantitative degradation of green spaces [17]. Most of the Romanian cities are in the situation of needing to recover their deficit of green spaces, having as a target 20 square

meters per inhabitant until 2010, set by the European Union (Fig. 1).

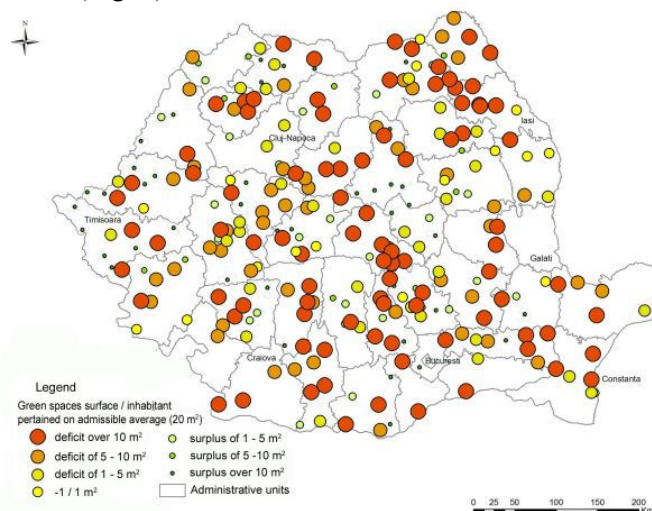


Fig. 1 – Green spaces deficit in Romanian urban environments in 2008

Bucharest is situated in the Romanian Plain (altitude of 70-90 meters), on loess deposits, with low slopes. The climate is continental temperate with excessive nuances, strongly influenced by the urban environment (multi-annual average temperature 11.2 °C, average annual rainfall of 615 mm, absolute maximal temperature 42.5°C). The hydrographical network is heavily modified (the canalization of the Dambovitza river,

establishment of lakes on Colentina). The soils are largely anthropic [18]. Bucharest has a surface of 238 km<sup>2</sup>, a stable population of 1.9 million inhabitants, plus an estimated 500,000 commuters [19].

Regarding its territorial evolution, Bucharest shows urban sprawl type phenomena: fast rising of new residential and commercial areas around the city, restructuring of industrial areas from the inner city (Fig. 2) and periphery and their replacement with large commercial centers and/or residential spaces; increasing density of built spaces to the detriment of open spaces; segregation regarding endowments and services between luxury and peripheral areas of the city [17].



Fig.2 – Restructured industrial areas inside Bucharest – Tricodava

Recent territorial changes in Bucharest city, including the increase of residential areas with poor access to green spaces, were fueled by the administrative and legislative void, by the downfall of the heavy industry and the interest of many investors of entering a large under regulated market, emerged after the fallout of communism (December 1989) [20].

This determined qualitative and quantitative changes of urban green areas. Among the most frequent forms of aggression of Bucharest urban parks, we have to notice the emplacement of buildings and equipments, inadequate car parking, vandalism against trees and endowments, uncontrolled depositing of domestic wastes. The crisis in managing green spaces is determined by a series of factors, the most important ones being: the lack of funds necessary for restoring green spaces, the expansion of built surfaces, retrocession of private propriety, the development of some economical activities, species mismatching [18].

## 2 Problem Formulation

Evaluating and classifying types of residential spaces

after their accessibility to urban parks are an important stage in territorial sustainable planning, as it is a factor conditioning public investments, as well as the dynamic of the real-estate market [21].

Knowing the status between residential spaces and urban parks helps taking measures to avoid the congestion of green spaces [22], decreases the environmental costs in urban ecosystems [23], adapts and optimally locates endowments according to visitors' requirements and urban-planning regulations [24], ensures a correct distribution of the natural and leisure services between different green spaces [25].

The politically-administrative plans promoted in Bucharest (Urban Master Plan, 1999-2009 and the Local Environmental Action Plan, 2007), besides their ambitious objectives to reduce the decline and to create new green spaces on un-structured industrial areas, abandoned spaces, brown fields haven't succeeded in stopping un-controlled urban development or the process of transforming public green surfaces into private properties [26].

Once called "*the city of gardens*", Bucharest transformed in only 20 years in a real urban semi-desert, the green surface decreasing with 34.5 % between 1990 and 2008 (from 3471.2 ha to 2274.4 ha) [17], while the households and population increased with 10 % [27] (Fig. 3). 679.2 ha (29,9 % of the green surfaces) is occupied by parks and public gardens, resulting an index of 3,51 m<sup>2</sup>/inhabitant [26]. The most important decrease (over 60 %) was recorded in the south of Bucharest (sectors 4 and 5), where the deficit of green spaces was already high (Fig. 4).



Fig.3 – Urban parks – residential areas relation in Colentina - a compact urban quarter of Bucharest

In the same time, residential areas had a strongly ascendant dynamics, developing especially on former open spaces [28]. The spatial development of residential areas was completed by a tendency of vertical

development, initially through 4 floors buildings, then 9 and 10 floors, in the present reaching 20 floors. These new residential surfaces accentuated the real deficit of public green spaces.

An urban environment can function sustainable only if equilibrium exists between good quality oxygenating surfaces and constructed surfaces [8], [29].

Starting from this hypothesis we have identified areas with green spaces deficit (situated at over 3 km from municipal importance parks or at over 1 km from quarter parks, areas with access to crowded parks, or with access to parks with degraded endowments), that are characterized by social and environmental problems, with repercussions on the housing quality of residential areas (Fig. 5).

Their delimitation and classification allows identifying urban areas that require: urgent measures of urban rehabilitation; interdiction and/or restriction for introducing new buildings; rerouting of visitor's flow, or creation of new urban parks.



Fig.4 – Central areas with low accessibility to urban parks and high intensity of environmental degradation sources in Bucharest city (Lizeanu Street)

For the real-estate market, knowing the rapport between residential surfaces and green surfaces becomes an indicator of increasing importance, as it stabilizes through economical mechanisms [30].

## 2.1 Spatial distribution of urban parks

In Bucharest, urban parks represent the main supplier of leisure services and regulator between natural and built space [28].

Considering the attractiveness indicators (table I), in Bucharest can be identified five main categories of urban parks:

- *Parks of metropolitan importance* (fig. 6, 7) represented by parks of large dimensions, receiving visitors from Bucharest's neighborhoods (1-2% of the

total number of visitors), recording flows of over 5000 visitors / weekend day, with diverse and attractive endowments (playgrounds, restaurants, sports facilities, etc.), in which numerous cultural-artistic events are organized, and with a favorable position in the metropolitan profile (access provided by the public transportation network).

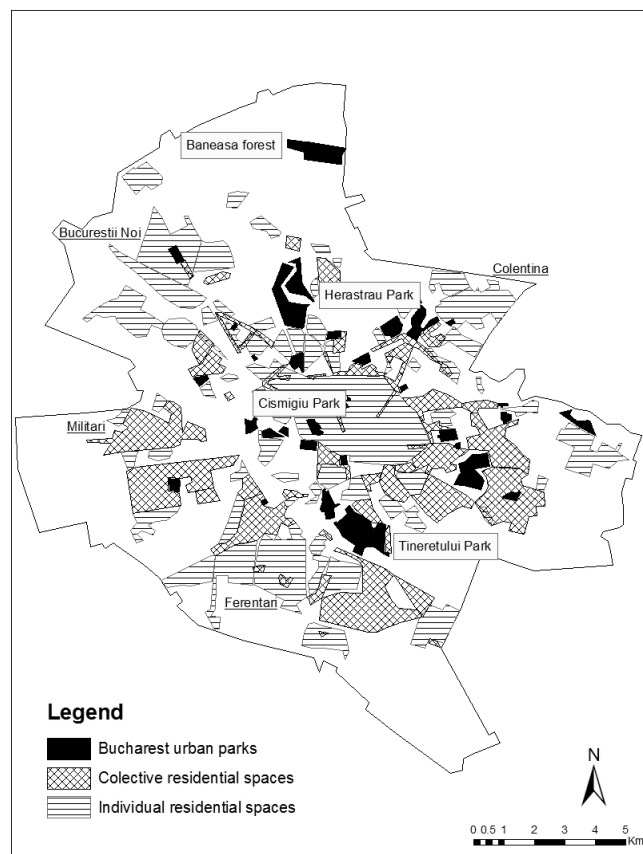


Fig.5 – Urban parks distribution in relation with Bucharest's residential areas

- *Parks of municipal importance*, also with large dimensions, with visitors flows of 2000 – 5000 per weekend day, and with a monopolistic position at quarter level (for example Plumbuita Park for the Colentina quarter) but in the same time a relatively reduced accessibility from other parts of the city.

- *Quarter parks with medium attractiveness* corresponding to small and average sized parks, with recently reconditioned endowments and visitors flows of 1000 – 2000 visitors per weekend day, and also to small parks (Ioanid, Gradina Icoanei), with reduced surfaces but with important visitors flows in relation with the parks surface (under 1000 visitors per weekend day). These parks show frequently problems related with congestion. The dimension of their attractiveness area is quite small, limited only to the area with maximum accessibility.

- *Quarter parks with reduced attractiveness*, corresponding to small parks, with peripheral position, a lack of endowments and/or a high level of the criminality. Visitors' flows are below 1000 visitors per weekend day, restrictiveness factors having strong effects.



Fig.6 – Herastrau Park - The main urban park of Bucharest city with metropolitan attractiveness

- *Quarter parks with reduced attractiveness*, corresponding to small parks, with peripheral position, a lack of endowments and/or a high level of the criminality. Visitors' flows are below 1000 visitors per weekend day, restrictiveness factors having strong effects. For example, in the case of the Izvor Park, its reduced attractiveness is justified by the presence in the proximity of a metropolitan importance park (Cismigiu Park), by the reduced degree of covering with forestry vegetation (15.3 %) and the lack of endowments. In the case of Opera and Gara de Nord parks, the lack of endowments and the reduced level of security generate significant limitations of the visitors' number.



Fig. 7 – Tineretului Park – Green “oasis” between the central area of Bucharest and peripheral quarters

- *Transit parks*, situated in the proximity of inter-modal nodes, large commercial centers, administrative institutions or the intersection of public transportation lines. Visitors' flows are important, the duration of the visit is reduced (10-15 minutes), due to the lack of leisure and recreation opportunities, but the attractiveness area is large.

The spatial distribution of urban parks isn't regular, being noticed an agglomeration of urban parks in Bucharest's northern and eastern parts (alongside Colentina).

In the same time, Bucharest's west and south are characterized by an accentuated deficit of urban parks, as here are concentrated the most important collective housing quarters (Drumul Taberei, Militari, Berceni, Eroii Revolutiei) (Fig. 5).

Table I

Attractiveness indicators for Bucharest urban parks in relation with residential areas (2002)

Park/Attractively area size	% the city surface	% residential surfaces	% Bucharest population
Herastrau Vechi	22.2	65.4	71.2
Herastrau Nou	25.0	73.6	80.1
Cismigiu	17.1	50.4	57.0
Tineretului	7.0	15.9	16.5
Carol	15.0	44.1	46.5
Plumbuita	2.7	8.0	6.3
Drumul Taberei	4.0	11.8	19.3
Circului	1.0	2.9	3.2
Gradina Icoanei	0.6	1.7	0.7
Crangasi	1.7	5.1	3.8
Sebastian	3.2	9.5	10.3
Floreasca	2.3	6.7	5.1
Lia Manoliu	8.4	0.6	7.0
Morarilor	0.3	0.9	1.5
Ioanid	0.6	1.7	0.7
Tei	1.2	3.5	4.7
Eroilor	0.2	0.6	0.2
Unirii	12.6	37.0	31.5
Obor	4.1	12.0	14.5
Gara de Nord	1.7	5.0	2.0
Izvor usual	1.1	3.3	3.1
Operei	0.2	0.6	0.2
<i>Average</i>	3	9	9
<i>Maximum</i>	25	73.6	80.1
<i>Minimum</i>	0	1	0
<i>Standard deviation</i>	4.3	12.2	12.4
<i>Median</i>	2	4	4

## 2.2 Present relation between green and residential areas in Bucharest

In Bucharest, residential areas have suffered a special spatial and structural dynamics, with adjustments

according to requirements, economics dynamic, residential mobility or plans promoted at national or local level by state institutions or private economical agents [20], [27].

In 2002, in Bucharest were inventoried about 780,000 housings, most of them (80.8 %) being found in large residential ensembles (blocks of flats built during communist era).

Most of the population lives in large housing ensembles (82.8 %), over-lapping mostly areas with parks deficiencies (table II).

Table II

Categories of residential habitats in Bucharest (2002)

Categories of residential habitats	Household -number-	Habitat % from total	Population habitats % from total
Central urban type	55,000	7.1	4.9
Urban parcels type	20,000	2.6	2.3
Homogenous frontal type	35,000	4.5	4.0
Blocks	630000	80.8	82.8
Rural type	25,000	3.2	3.8
New rural type	15,000	1.9	2.3

Rural type housings have a reduced percent of the total in Bucharest, but they generate a high impact upon the quality of urban endowments (including parks) (table II).

### 2.3 The role of new residential projects and the accentuation of green spaces deficit

The liberalization of the real-estate market allowed the un-precedent development of the private sector housing construction [20].

Currently, there are over 200 residential projects developed, with building's heights of more than 10 floors, most of them being localized in the northern and eastern part of Bucharest (Fig. 8).

The projects are concentrated in areas with good accessibility to urban parks, but which are overcrowded. These residential spaces, besides their housing function, don't create the infrastructure that will generate services necessary for maintaining a high standard of living, and instead are inserted on the already present infrastructure. For example, the housings from the micro-quarters Garden and Planorama (fig. 9) will be serviced by the Plumbuita Park that already has problems of overcrowding and poor quality of the park's infrastructures.

Their finalization will bring an extra number of visitors in nearby parks, with direct consequences on endowments quality and presented services.

## 3 Residential areas categories function of accessibility to urban parks

The size of the attraction areas is variable, depending on the presence of residential spaces, existing endowments and accessibility. Therefore, the average surface of parks influence areas in Bucharest is of 13.34 km<sup>2</sup> ([0.45; 59.42], SD 17.95, median 2.5), meaning that each parks' attraction area covers an average of 4.3 % from Bucharest's surface and 12.2 % from residential areas.

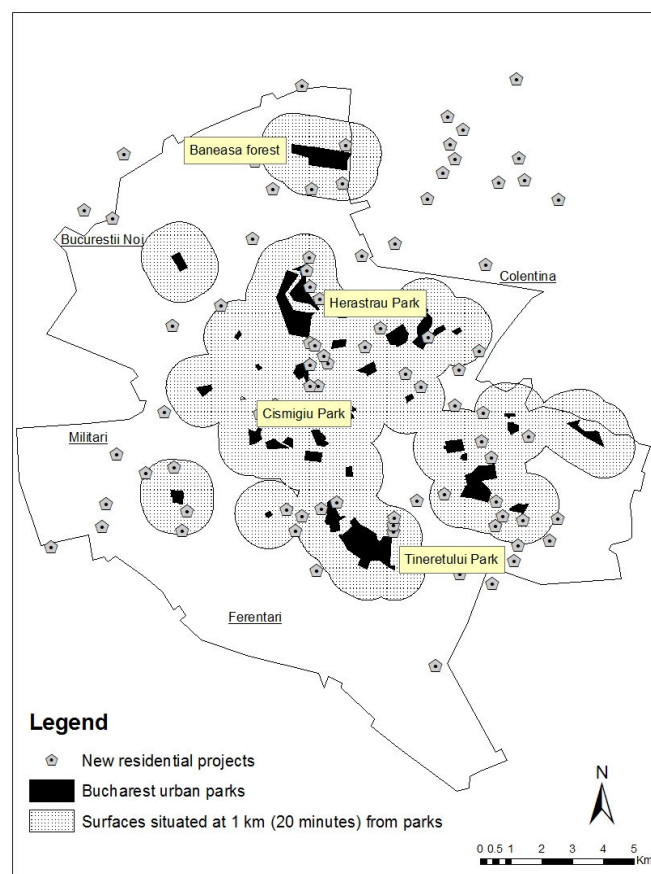


Fig. 8 – Correlation between urban parks and new residential projects in Bucharest

The largest attraction areas belong to parks of metropolitan importance and those situated in the proximity of attractive functions (city-halls, large commercial spaces, inter-modal hubs).

Herăstrău Vechi (59.4 km<sup>2</sup>, 65.4 % of residential spaces surfaces) and Herastrau Nou (52.8 km<sup>2</sup>, 73.4 %) parks beneficiate from the highest attractiveness, determined by the easy accessibility through numerous public transportation lines and the fact that they beneficiate from multiple endowments (Fig. 10).

Large influence areas have also transit parks (Unirii – 29.7 km<sup>2</sup>, Obor – 9.7 km<sup>2</sup>), where visitors come from all over Bucharest, since they are inter-modal hubs or because they have infrastructure endowments of

municipal importance (e.g. Sector 2 city hall in the Obor Park).



Fig. 9 – New residential project Planorama with overcrowding effect on nearby urban parks

In the case of parks servicing quarters, the dimension of the attraction areas is conditioned by the size of these quarters. For example, Plumbuita (7.7 km<sup>2</sup>) and Tineretului (12.9 km<sup>2</sup>) parks service relatively small areas in comparison with their surface, over-lapping Colentina and Andronache, respectively Berceni quarters, but these are areas characterized by high values of the population density.

Quarter parks have reduced influence areas (under 10 km<sup>2</sup>), over 80% of the visitors coming from an area situated at no more than 2 km from the park. Thus, Sebastian park with an influence area of 7.7 km<sup>2</sup> has most of its visitors (95%) coming from a surface of 1.66 km<sup>2</sup> (Fig. 10). A similar situation is represented by the Obor Park - transit type, situated in an important commercial and administrative zone, where the dimension of the influence area is of approximately 9.7 km<sup>2</sup>, but 95% of the visitors come from only 1.02 km<sup>2</sup>.

The dimension of the attraction area doesn't depend directly of the parks' surface (0.22 correlation), due to the fact there are parks with deficient endowments or accentuated insecurity (Operei), servicing quarters with reduced population density (small surface of the influence area) and central ones (high surface of the influence area).

After classifying residential spaces in Bucharest according to their access to urban parks, the following categories with deficient access to parks (Fig. 11, 12) were identified:

- residential areas situated at more than 3 km from parks of metropolitan and municipal importance (6 % of the total residential spaces in Bucharest) (fig. 13), corresponding to peripheral areas (Bucurestii Noi, Soseaua Chitila, Alexandriei, Progresului quarters, the

southern parts of the Aparatorii Patriei, Berceni and Ferentari) with predominantly rural types of housings; from these spaces the access to parks is difficult and the unbalances between constructed surfaces and open spaces are acute;

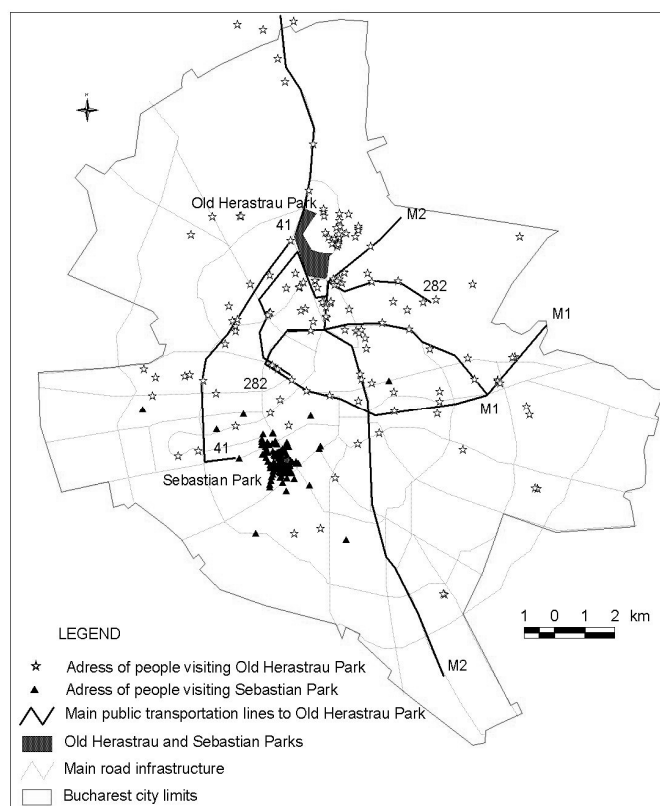


Fig. 10 – Attractiveness differences between a metropolitan park (Old Herastrau) and a quarter park (Sebastian).

- residential areas situated at more than 1 km from any category of urban park (24 % of all residential spaces in Bucharest), corresponding to periphery areas (with acute green spaces deficit), to the Vitin, Militari, Ferentari, Berceni, Colentina quarters and to some components of the Drumul Taberei quarter. Rural type housing is predominant in peripheral areas while block-of-flats are specific to the quarters, communist era old.

- residential areas with access to overcrowded parks (48 % of the residential spaces) are found in the central area, the Drumul Taberei and Rahova quarters (Fig. 13). In their case, the number of parks visitors is already high, their recreation value being diminished.

- residential areas with access to parks with poor infrastructure or with high level of insecurity (2 % of the residential spaces in Bucharest), corresponding to spaces situated in the proximity of the Izvor, Gara de Nord, Verdi or Plumbuita parks (Fig. 14, 15). These parks have a doubtful ownership status, or are situated in the proximity of areas that generate insecurity (for example, Gara de Nord – North Rail station).

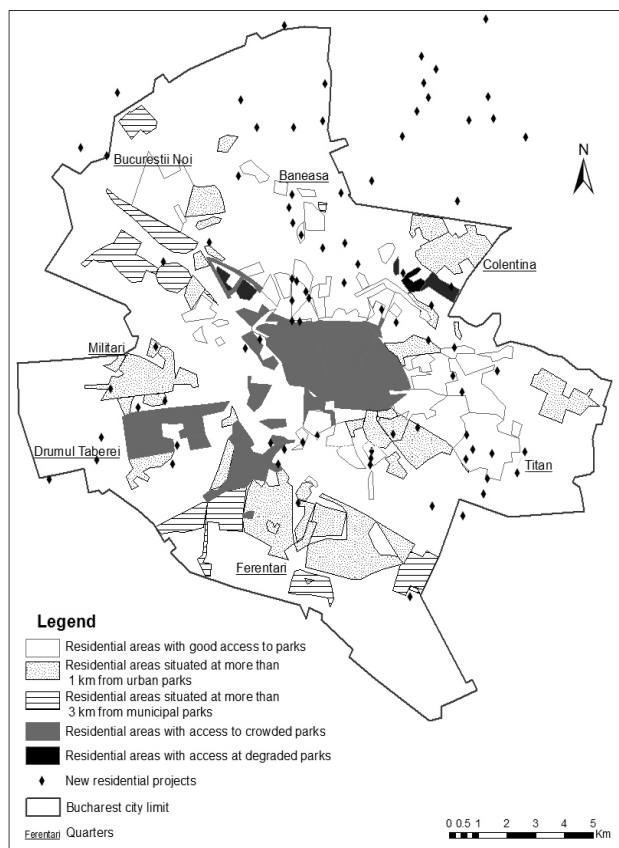


Fig. 11 – Categories of residential areas with deficient access to urban parks

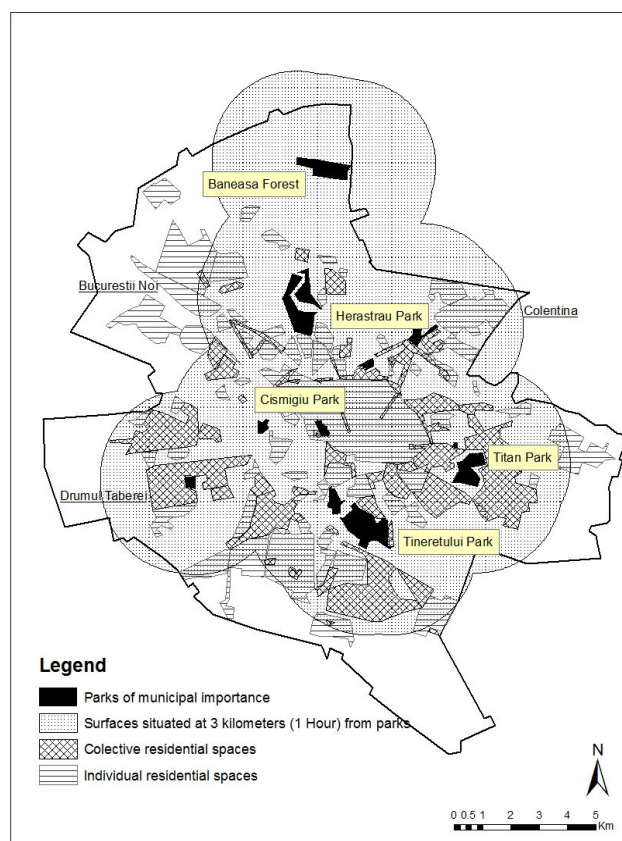


Fig. 13 – Residential areas accessibility to parks of metropolitan and municipal importance in Bucharest

The reduced frequency of maintenance works and deficient endowments determine low values of pedestrian circulation in certain areas of the parks. To this is added the fact that some parks are crossed by different communications ways (railroads, roads), the lack of public lights on certain alleys, the presence of un-covered underground installations (sewer holes, excavations, abandoned sanitary groups etc), the high number of feral dogs.

Analyzed parks are characterized by deficiencies recorded in their endowments: lack of sanitary points for according the first aid; the reduced number of sitting places in shaded or isolated areas; the small number of public toilets or their inappropriate placement in relation with other uses.



Fig. 14– Congestion of Bucharest urban parks in weekend

Fig. 12 – Parks with degraded endowments - Plumbuita

Residential areas with good accessibility to urban parks represent almost 20 % of the total, being found mainly in the northern and eastern parts of Bucharest (Fig. 16).

#### 4 Conclusion

Residential spaces with deficient access to urban parks represent priority areas for urban rehabilitation [29], [32], their functionality being affected by the unbalance induced by the heavy development of built spaces [33], [34]. In order to avoid the expansion of these areas is necessary to correlate the space offer with the environment's support capacity for new residential areas [35], [36]. Also, in the southern and western parts must be introduced financial incentives for diminishing current unbalances.

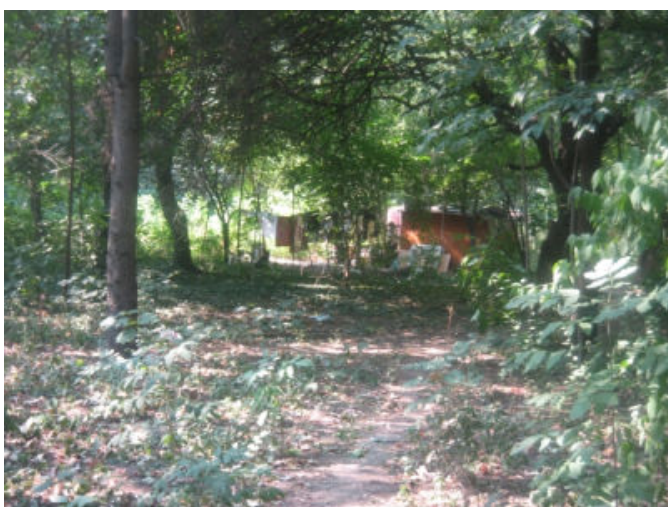


Fig. 15 – Insecurity induced by under-privileged social categories in Bucharest urban parks – Verdi Park

The reconversion of former industrial platforms and barren fields can offer solutions for the expansion of green spaces surfaces in Bucharest, as most of them are in a process of reassignment [36].

Adjusting endowments and eliminating restrictiveness factors isn't always possible [37]. Problems related with congestion can be resolved only by providing more similar services in other accessible locations [38], action that cannot be sustained by the lack of space adjustable for these functions.

Also, endowments such as sport fields, dog spaces, restaurants haven't been considered in the parks initial plans, and therefore building them can generate new problems (noise, insalubrities, aesthetic degradation), even if a large percent of the visiting population requires them.

Evaluating the attractiveness of parks allows also allocation of financial resources proportional with the category and services offered by the parks in the urban ecosystems.



Fig. 16 – Residential area with good accessibility to urban parks - Kiseleff Quarter

In conclusion, the attractiveness of Bucharest urban parks to its population is high, determined not by the good quality of the services they present, but by the accentuated deficit of green spaces and the specialization of visitors' preferences. Thus, urban parks have become the main recreation spaces for many inhabitants of Bucharest (especially families with children under 7 years, or elder persons), representing the most convenient option from a sanitary and financial point of view.

The study argues that the current qualitative and quantitative offer of urban parks is deficient, concerning the current economical and social framework and the visitor's profile. The study presents real support for ecourban planning and public investment strategies for current and potential parks.

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