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Full Length Research Paper

Determination of the efficiency of green areas in Erzurum City

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In urban areas, replete with environmental problems, people need open green areas in order for them to recreate themselves. In this study, the green area amount in Erzurum city centre was determined and its efficacy was evaluated using GIS. The study was carried out in three districts and 73 neighbourhoods. The land use classification was performed on Quickbird image in 2005 and it was determined that the residential area is 1343.5 ha, the vegetated area with trees is 582.9 ha, the park area is 25.5 ha and the sport area is 30.2 ha. However, efficacy of the green areas was determined by finding their effective areas.

Key words: GIS, ecological planning, Erzurum, park areas, play grounds, sport areas.

INTRODUCTION

Very serious ecological problems caused by rapid industrialisation and urbanisation have brought together consistently increasing environmental problems. Conservation of the nature and lands we live on is only possible with seeking, developing and implementing the use of alternatives.

Recreational potentials of urban areas should be determined considering mainly their physical (climate, topography, geology, hydrology, soil, flora and fauna resources, etc.), visual, archaeological and cultural characteristics in addition to their ecological vulnerability, existent urban tissue and land use features. This process is the first stage in the formation of urban green system (Aydemir, 1999).

One of the most important materials that show the existent land use types in an area is the land use charts. In the future, landscape elements will probably be damaged by conscious or unconscious human activities. This damage can only be foreseen by the use of accurate land use charts and maintaining the diversity in production and biologic environments (Hobbs, 1999).

Such kinds of charts have been widely used all over the world for various purposes. For instance, Attwell (2000) used this chart in a Denmark town to increase the green area amount; whereas Espejel et al. (1999) used it in Mexico to prevent the hazards of industrial areas on cultivated ones, and Black et al. (1988) used it in Palouse (Washington) to demonstrate the change in natural environment. However, Oduwaye (1998) used it in Nigeria to show the accuracy of urban planning efforts, while Vlist (1998) used it in Netherlands, Yiğitcanlar ve Arkoc (2007) used it in Almanya, Altinoluk (2006) used it in Odemis (Turkiye), Aksoylu et al. (2005) used it in Eskisehir (Turkiye), Madanipour (2006) used it in Tahran (Iran), Muradov (2006) used it in Alanya (Turkiye), Guler (2006) used it in İzmir (Turkiye) and Sahin (2005) used it in Canakkale (Turkiye) to determine how the imple-mented land use plans affected rural and conserved areas.

Open green spaces in cities have physical, technical, climatologic, recreational, hygienic, social, aesthetic, psychological and economic effects (Oztan, 1968; Bayraktar, 1973; Kaymakli, 1990; Akinci, 1996). Therefore, these areas should be well formed and distributed, and should provide the required opportunities for their users (Nasuh, 1993). Standards of open green areas are determined by density, distribution and qualities of population and recreation types.

These standards may vary for different countries and cities. For instance, in Turkey, actively used green area amount must be 10 m^2 (at least 2.114 m^2 for playground

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and 5 m^2 for the park area) according to the regulation in 1999, while it must be 40, 24, 45, 25 and 40 m^2 in the USA, Germany, Australia, France and Britain, respectively (Anonymous, 1988). In this respect, studies about green areas showed that Turkish cities are very far away from the standards. For example, Kotran (1991) found the green area rate to be 0.42 m^2 per person in Ankara, whereas Bozkurt (1994) found it to be 0.98 m^2 in Antakya. Likewise, Onder (1997) found it to be 2.1 m^2 in Istanbul, while Zengin (2001) found it to be 4.25 m^2 in Erzincan and Demirkır (1996) found it to be 0.7 m^2 in Edirne.

Parks can be classified according to their sizes, activity opportunities, effective areas (distance) and people they serve. City parks are for the use of all city people; therefore they must be efficient in quantity and quality (Uysal, 1997). Various suggestions were put forward for the size and effective areas of parks by different authors, for example, Bayraktar (1973), Pamay (1979), Aydemir et al. (1993), Altunkasa (2004) and Ersoy (1994). For instance, Bayraktar (1973) suggested that neighbourhood parks should be at least 6 to 8 ha and 28 ha at most, and their service area should contain at least 400 m proximity, 800 m optimum, and 1600 m at most. Pamay (1979) stated that neighbourhood parks should be in a size that can provide the ratio of 2.5 m^2 per person, for at least 400 da. Ersoy (1994) stated that park areas affect an area in a maximum range of 800 m. As such, Altunkasa (2004) collected the standards in Turkey and other countries in a planning attempt and stated that demographic structures should be considered in playground planning; that is, in neighbourhoods where the number of children is large, playgrounds should be in a walk-distance. In this respect, ages of children are divided into four categories (0 to 2.3 to 6.7 to 11 and 12 to 15). For the 0 to 2 age group, playgrounds should be 30 m away from residences, while for the 3 to 6 age group, it should be 30 to 70 m, for the 7 to 11 age group, it should be 100 to 150 m, and for the 12 to 15 age group, it should be 350 m (Uz and Cabuk; 2006).

Same standards were developed for sport areas. Gallion and Eisner (1986) and Bakan and Konuk (1987) stated that the distance of sport facilities should be between 400 and 2400 m. In another study, this distance was suggested to be 600 m in Stockholm (Anonymous, 1988).

For a healthy urban development, basic planning element is inventory in works, while for the city of Erzurum, such studies have been carried out since the preparation of the development and application plans in 1972 by various authors such as Eymirli (1994), Polat (2000), Yılmaz and Bulut (2003) and Bulut and Demir (2005). However, Al-Qudah (2006) and Zakaria (2006) determined the changing values of park areas, sport areas and playgrounds. On the other hand, in this respect, no study was carried out by using GIS method in evaluating green area amount in the city.

In this research, studies related to the open and green space city planning system in a number of elements composed of a combination of continuous and functional rearrangements in forming a system that can integrate the deployment, were intended to ensure the aesthetic and technical principles of the area. Indeed, the maps that generated the need for open and green space were identified as having enough quarters to make planning decisions. As a result of this study, the city of Erzurum and the adjacent area of the city within the boundaries of existing land uses, attributes and distributions, are put in this context, while the presence of green space in the city and the adequacy of a variety of functions have been identified. More so, suggestions have been made by the "geographic information systems" and the maps on urban planning creation.

MATERIALS

The study was conducted in the centre of Erzurum with an average elevation of 1850 m in the east of Turkey and its location, which is 39°55′E and 4°16′N, is situated in the Eastern Anatolian Region of Turkey. In the city, there are 4 districts and 80 neighbourhoods; however, since the usage of the Quickbird image (17 × 17 km), which included only three of these districts, the study has been concerned with 3 districts and 73 neighbourhoods (Figure 1). Existent parks in 2005 were detected on the satellite image via Geomedia 5.2 software and their conditions were evaluated for the populations of the neighbourhoods. Consequently, suggestions about the places of parks and playgrounds were presented. A total of 73 districts from the province of Erzurum city center, showing their spatial distribution, were obtained from a graphical map of Erzurum Metropolitan Municipality. However, the State Statistics Institute was used for the detection of green areas per capita, on the basis of the 2004 population data from neighborhoods in the province of Erzurum (Anonymous, 2004).

METHODS

Geographic information systems were used to determine the research of green areas. The processing steps used for the evaluation of open green areas by Erzurum province is shown in Figure 2.

First, goals were set and then the literature coverage was reviewed. This research was obtained from maps, documents and data. One to one observation, analysis and interviews were used to collect data from the city.

Available during the evaluation of the data as a priority area within the boundaries of the contiguous 73, were pieces analyzed on the basis of the neighborhood. At this stage, the geographic information systems and the digital topographic map of the city have been provided primarily on the prepared substrate with AutoCAD software and Netcad, while the registration method and the world coordinates rectifier have been placed. Then, the real-dimensional maps of the panels found on the zoning maps of the data obtained with only a single copy of the input provided by the study, are processed. Afterwards, the district boundaries found on the map obtained by processing the divided city neighborhoods also created maps for each neighborhood, with the GIS software. For many, the names of neighborhoods featured on the map of numbered districts are described in Table 1 with code numbers. Following the creation of neighborhood maps, GIS data with charts and tables converted from the data were classified and interpreted. However, parking areas, children's playgrounds, sports fields and r esidential

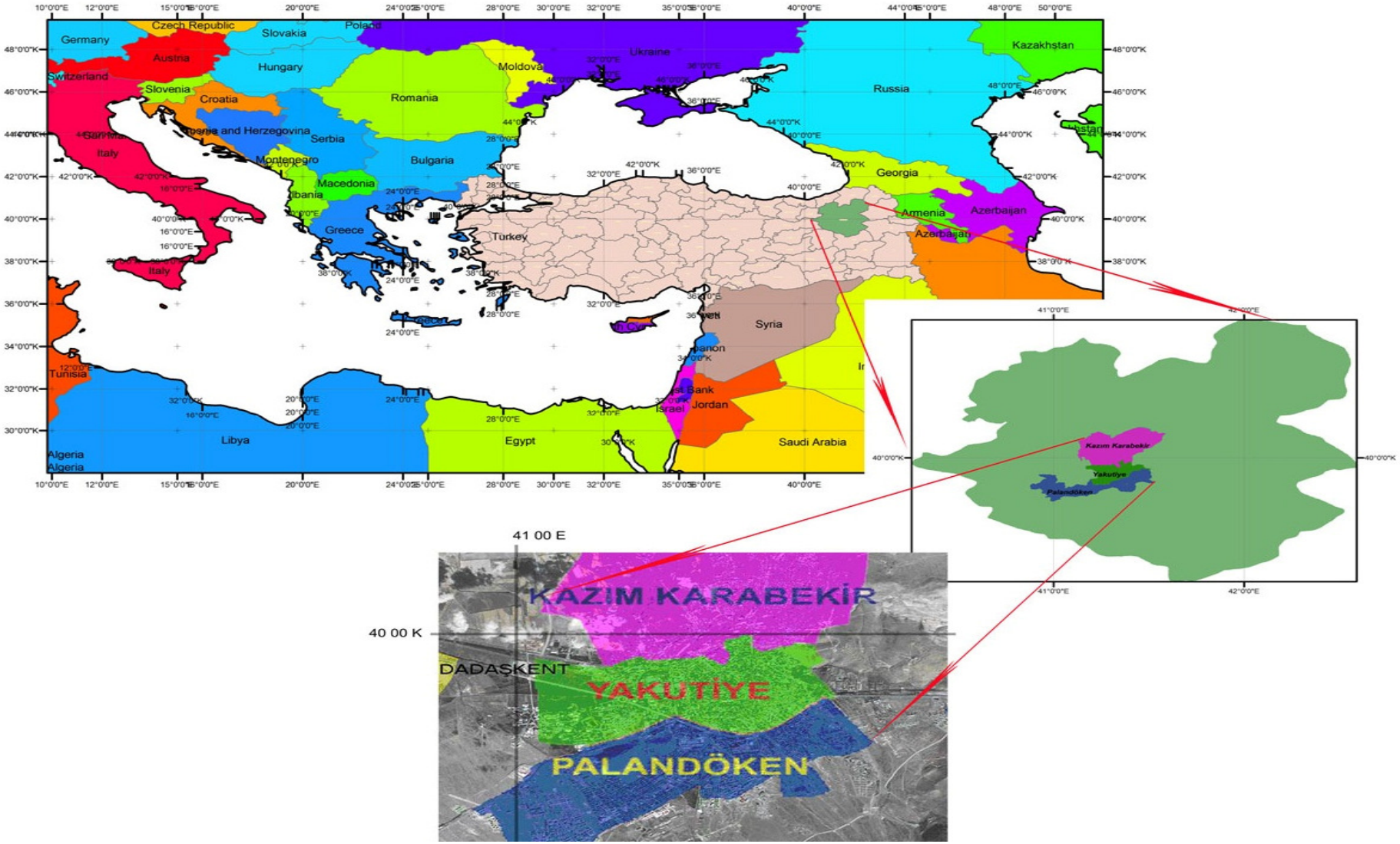

Figure 1. Study area.

areas, belonging to the entire city and which covered the existing land use maps were developed. Green space in urban green areas, created with the GIS software data entry during the progress of mapping and assessments of maps, is divided by categories. Subsequently, the adequacy of green areas, and the green areas needed to

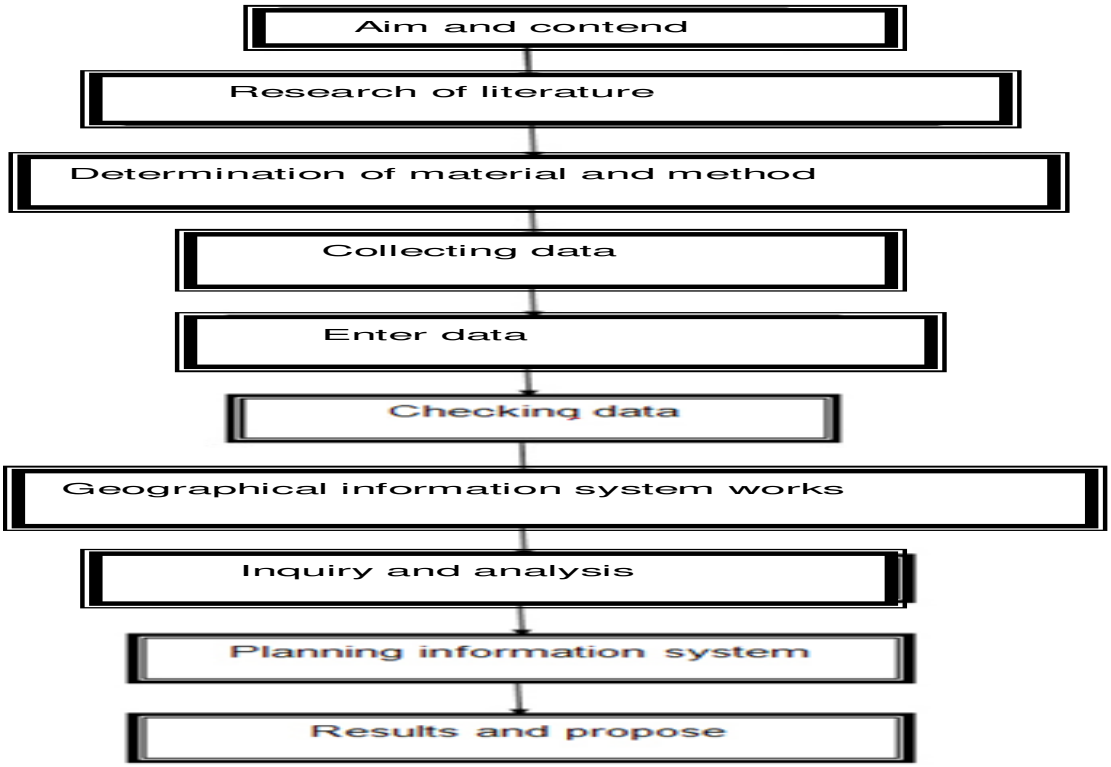

Figure 2. Phases of the study.

determine the position of the "buffer zone" technique were employed. The buffer zone technique, based on the radius of the green fields of transport on the population, and each built around a green area with the information obtained from the observation of the distribution of the domain radii and the city, is a technique to be determined. Accordingly, the radius effect and buffer zone, is available in the remaining areas of the address space, and it shows that, the outer parts of these areas show places where the green areas are needed.

Findings

Land use classification was performed on the image, and according to the results, it was determined that the residential area is 1343.5 ha, the vegetated area with tree is 582.9 ha, the park area is 25.5 ha and the sport area is 30.2 ha (Figure 3). Consequently, the total amount of green area was found to be 638.6 ha.

The most densely populated area was found to be Sukrupasa neighbourhood (code number 14), while the least was Caferiye neighbourhood (code number 24) (Figure 4). The largest child number in this group was found to be in Sukrupasa neighbourhood (code number 14), while the lowest was still found in Caferiye neighbourhood (code number 24).

Among the studied neighbourhoods, Huseyin Avni Ulas (code number 63) neighbourhood was found to have the largest park surface area with seven parks; moreover, the smallest park area is 1608 m^2 in Erzurum, while the largest park is 49617 m^2 (Table 1). The largest park area per person is found in Lalapasa (code number 42) neighbourhood (23.37 m^2), while the lowest is found in Abdurrahmangazi (code number 58) neighbourhood (0.14 m^2) (Figure 5).

Due to the lack of standards in regulating the preparation of development plans for playgrounds, in this study, playground accessibility standards, which were used by Uz and Cabuk (2006) and suggested by Bakan and Konuk (1987) were also used (Figure 6). When the representative areas of playgrounds were considered, it was seen that Yakutiye district is not efficient. In addition to the absence of playgrounds in this district, especially the neighbourhoods of Veyisefendi (code number 54), Habibefendi (code number 32), Mehdiefendi (code number 43), Rabiahatun (code number 47), Kırmacı (code number 39), Sehitler (code number 13) and Alipasa (code number 16), playgrounds in other neighbourhoods are very far from this district.

It was stated in the literature that a park in a neighbourhood serves its close proximity in a distance of 400 m (Bayraktar, 1973).

Nonetheless, Figure 7 presents the accessibility of local people to parks.

In Figure 8, the representative area of the sport areas was determined to be in a distance of 750 m or between 11 and 15 min-walk (Aydemir, 1999). When this fact was considered, Kazım Karabekir district was found to be deficient for sport areas. This deficiency was relatively seen in Yakutiye district, especially Kuloğlu (code number 41), Lalapasa (code number 42), Cedit (code number 26) and Topcuoğlu (code number 52) neighbourhoods.

RESULTS AND SUGGESTIONS AND CONCLUSION

In order for cities to have well balanced physical and organic structures, there should be open green spaces efficient in both quantity and quality in and around them. These areas should be well distributed and should provide many opportunities for their users. GIS methods can be used to determine whether or not these areas are efficient in quantity and quality and in the performance of

Table 1. Distribution of park areas for neighbourhoods and population.

	Code number	Neighbourhoods	Population (Anonymous. 2000)	0-14 years old (Anonymous. 2000)	Number of parks	Park area (m^2)	Park area per person (m^2/person)
Kazim Karabekir	1	Abdurahmanağa	1614	556			
	2	Aşağisanayi	8513	3322			
	3	Aziziye	6389	2523			
	4	Barbaros Hayrettin Paşa	4229	1593	1	1608.9	0.38
	5	Çağlayan	4131	1516			
	6	Edip Somunoğlu	2673	905			
	7	Eminkurbu	2573	958			
	8	Gaziler	6850	2442			
	9	Ibrahim Hakki	758	298			
	10	Istasyon	7379	2300			
	11	Kavak	3349	1033			
	12	Mecidiye	952	350			
	13	Şehitler	3718	1496			
	14	Şükrüpaşa	19315	6595	2	9454.2	0.49
	15	Yukarisanayi	7708	3014			
Total			80397	28901	3	11063.1	0.13
Yakutiye	16	Alipaşa	3453	1021			
	17	Aşağiköşk	2553	792			
	18	Aşağimumcu	2885	741			
	19	Aşağiyoncalik	1578	541			
	20	Atalar	2635	819	2	49617.4	18.8
	21	Atatürk	11280	1535			
	22	Ayazpaşa	1869	549			
	23	Bakirci	1075	330			
	24	Caferiye	429	106			
	25	Camikebir	948	331			
	26	Cedit	778	209			
	27	Çirçir	3646	1076			
	28	Dere	741	222			
	29	Dervişağa	836	296			
	30	Emirşeyh	985	289			
	31	Gez	11198	2719	1	18781.7	1.67

Table 1. Contd.

	32	Habibefendi	2025	731			
	33	Hacicuma	997	308			
	34	Hasanibasri	4569	1653			
	35	Ibrahimpaşa	693	184			
	36	Kadana	1205	424			
	37	Karaköse	1111	296			
	38	Kazim Karabekir	5485	1547	1	34147.4	6.22
	39	Kirmaci	3938	1314			
	40	Köseömerağa	687	236			
	41	Kuloğlu	739	133			
	42	Lalapaşa	518	141	1	12106.6	23.37
	43	Mehdiefendi	2457	758			
	44	Mirzamehmet	790	331			
	45	Muratpaşa	3688	921			
	46	Narmanli	957	307			
	47	Rabiahatun	2537	875			
	48	Sultanmelik	912	305			
	49	Şeyhler	1782	549			
	50	Taşmescit	3092	1044			
	51	Terminal	7375	2443			
	52	Topçuoğlu	2187	560			
	53	Vaniefendi	559	181			
	54	Veyisefendi	9111	3025			
	55	Yeğenağa	2292	816			
	56	Yukarimumcu	1780	527			
	57	Yukariyoncalik	1429	355			
		Total	114508	31540	5	114653.1	1.00
	58	Abdurahmangazi	15531	5369	1	2114.7	0.14
	59	Adnan Menderes	9676	2945	2	6380.6	0.65
	60	Haciahmetbaba	6740	1823	1	3248.3	0.48
	61	Hacisalihefendi	6611	1793	1	9767.5	1.47
Palandöken	62	Harput	3506	1232			
	63	Hüseyin Avni Ulaş	7571	2433	7	11657.7	1.54
	64	Kazim Yurdalan	9232	3588			
	65	Maksutefendi	3265	1366			
	66	Mehmet Akif Ersoy	8174	2003	3	45071.2	5.51

Table 1. Contd.

67	Osman Bektaş	9078	2713	3	9949.6	1.09
68	Osmangazi	16645	5499	3	6879.7	
69	Palandöken	2762	1202			
70	Solakzade	9655	2638	3	34621.5	0.41
71	Şehit Ismail Aksu	5840	1517			
72	Yukariköşk	5806	1600			
73	Yunus Emre	16129	5382			
Total		139937	43103	24	129690.8	0.09
General total		334842	103544	32	255407	0.76

their functions. Using this method, surface charts showing the distribution of green areas can be prepared and the green area amount per person can be calculated. By overlapping the probable accessibility maps, land properties, land values and distribution of green areas and suitable park areas can be determined in the sites where these areas are absent under existent conditions.

There are 73 neighbourhoods and 32 parks in the study area and the largest park is in Palandöken (24 unit) district, while the smallest is in Kazim Karabekir (3 unit) district. Existent open and green spaces in the city are very far away from the formation of a green area system in the city in respect of their size and distribution. In addition, they cannot meet the needs of the local people. Park areas per person are 0.13 m^2 in Kazim Karabekir district, 1.00 m^2 in Yakutiye district and 0.03 m^2 in Palandöken district. In general, the total surface area of playgrounds was determined to be 26,093 m^2. When this value is divided by the number of children (103,544) in the city, the playground area per child is found to be 0.25 m^2.

Park area per person was found to be 0.76 m^2 in the city, with a suggested value of 10000 m^2 for 1000 people (Uzun, 1993). From this point of view, there is a need for a park area of 3093,013 m^2 in the city, 126.9 ha of which should be formed in Palandöken, 103 ha in Yakutiye and 79.2 ha in Kazim Karabekir district.

In Erzurum province, the Atalar (code number 20) and Lala Paşa (code number 42) zoning districts were specified in the regulation (10 m^2) of other media assets to meet the measure of green space amount.

Among the neighbourhoods in the city, only Kazim Karabekir (code number 38) and Mehmet Akif Ersoy (code number 66) neighbourhoods can meet the standard of 5 m^2 park area mentioned in development plan. However, these park areas are not complete and well distributed, but they are cut off and in small size among the apartment buildings. Since the neighbourhoods in Yakutiye district are old settlements, buildings are very close to each other. In this district, there is no park except for some around historical structures. In newly developing areas, away from the historical core of the city (for instance Palandöken district), the areas of playgrounds and parks are relatively increased. Settlements, such as Veyisefendi (code number 54), Habibefendi (code number 32), Mehdiefendi (code number 43), Rabiahatun (code number 47), Kirmaci (code number 39), Şehitler (code number 13) and Alipaşa (code number 16) neighborhoods, found in the center of the old buildings, are very close to each other and due to the functional density, green areas are sparse in these areas. However, Adnan Menderes away from the city center (code number 59), Haci Ahmed Baba (code number 60) and Haci Salih Efendi (code number 61), showing the development of new neighborhoods such as the amount of green space, were greater than the old-agency neighborhoods. Away from the city center, the existing green areas, which are the aesthetic coastal neighborhoods, are used to re-plan and design the required equipment. In the province of Erzurum, in order to ensure a healthy economic situation in the distribution of green space and green area, a distribution balance between old and new residential units should be provided. According to the data obtained from the municipal district of Palandöken, the number of children's play area was found to be more than others. As such, maps showed the areas of analysis related to transportation and buildings that are easily accessible to children using the areas planned for children's play areas. In addition, the center of the city (the neighborhoods in other words), the first residential areas and the children's play areas are not available due to building productions. Children's play area and playground, and more importantly, the number of children per children's

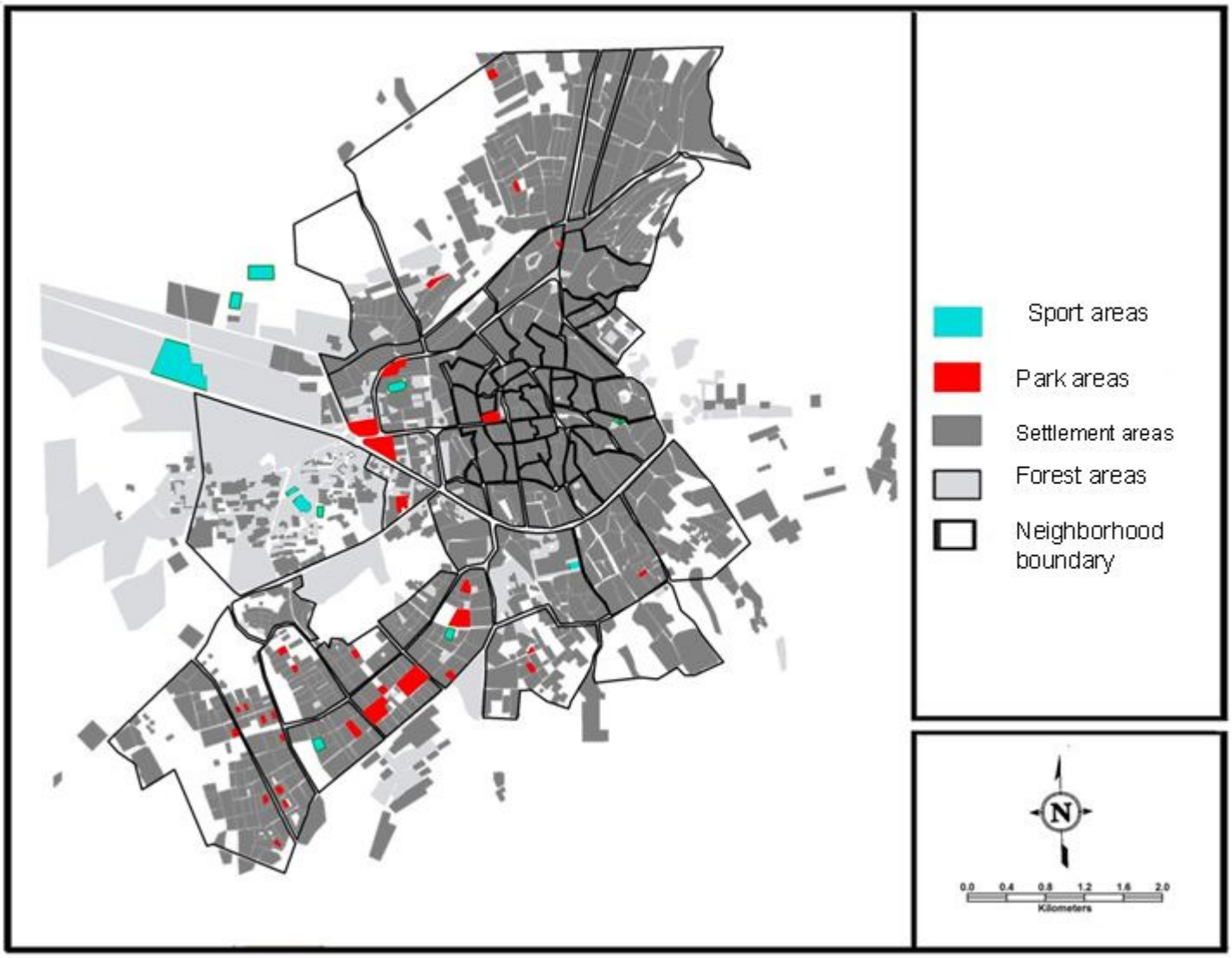

Figure 3. Land use classification in Erzurum city.

play area addressed for each of the districts within the boundaries of accessibility should be designed for children's playground. If the province of Erzurum is examined, it can be seen mostly that there are sports fields in Atalar (code number 20) and Atatürk (code number 21) neighborhoods.

Master development plans and the city's ecological, social, economic and cultural characteristics, should be taken into account and should be planned and designed. Determination of appropriate areas to meet the needs of the city, as well as the design architect for the city planners, landscape architects and sociologists, such as the different professional disciplines should take part in the planning and implementation stages. Their potential use for each area should be opened, while inappropriate land use should be avoided. Scientific and technical criteria applied to land use plans must be kept always in the foreground. In the planning and implementation of green space, the city must take into account the human, social and demographic structure. According to population projections made of green areas, nature should be designed to meet the needs. Walking distance from the border, especially for the elderly ones and children, and the planning stages of the standards for the disabled should be taken into consideration. Children's play areas, site selection, floor coverings, planting, security etc. were carried out in accordance with appropriate planning and design principles. However, design transfer of open spaces for future generations is an important criterion. In this context, awareness on the need to ensure sustainability should be raised by the people on planned areas and protection of natural greenery. Also, local government and civil society organizations, information and awareness-raising activities on the protection of

Figure 4. Population distribution according to the neighbourhoods.

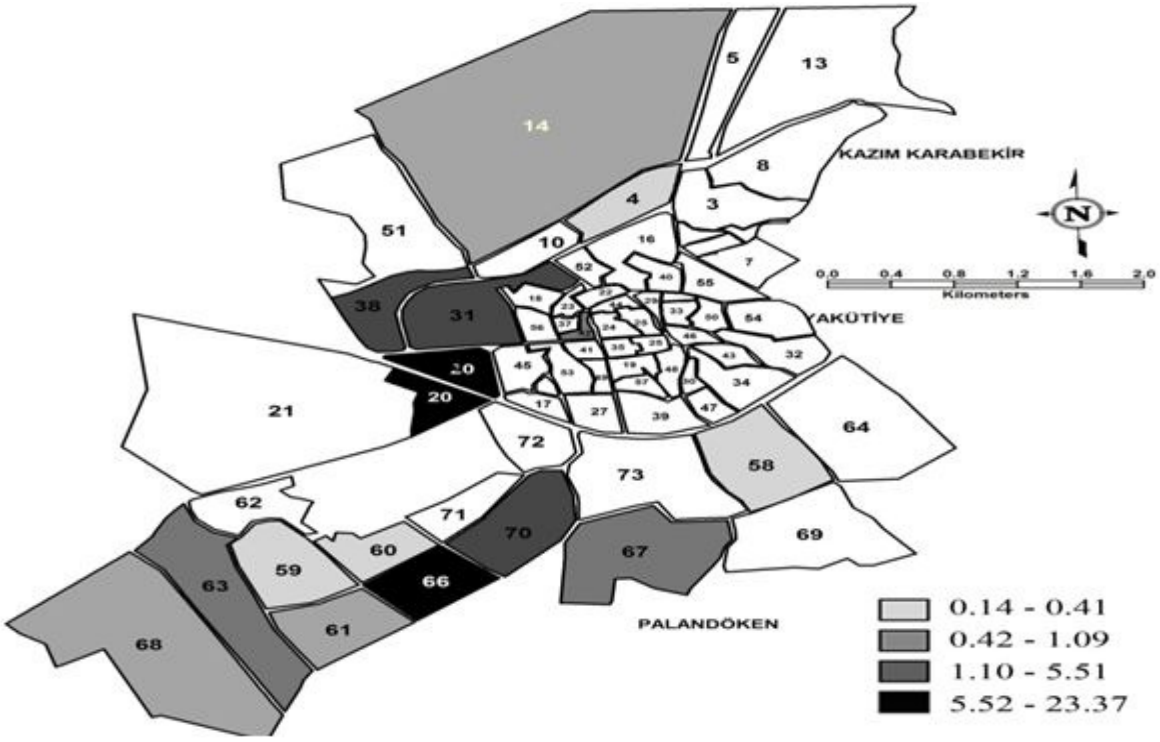

Figure 5. Park areas per person according to neighbourhoods (m^2/person).

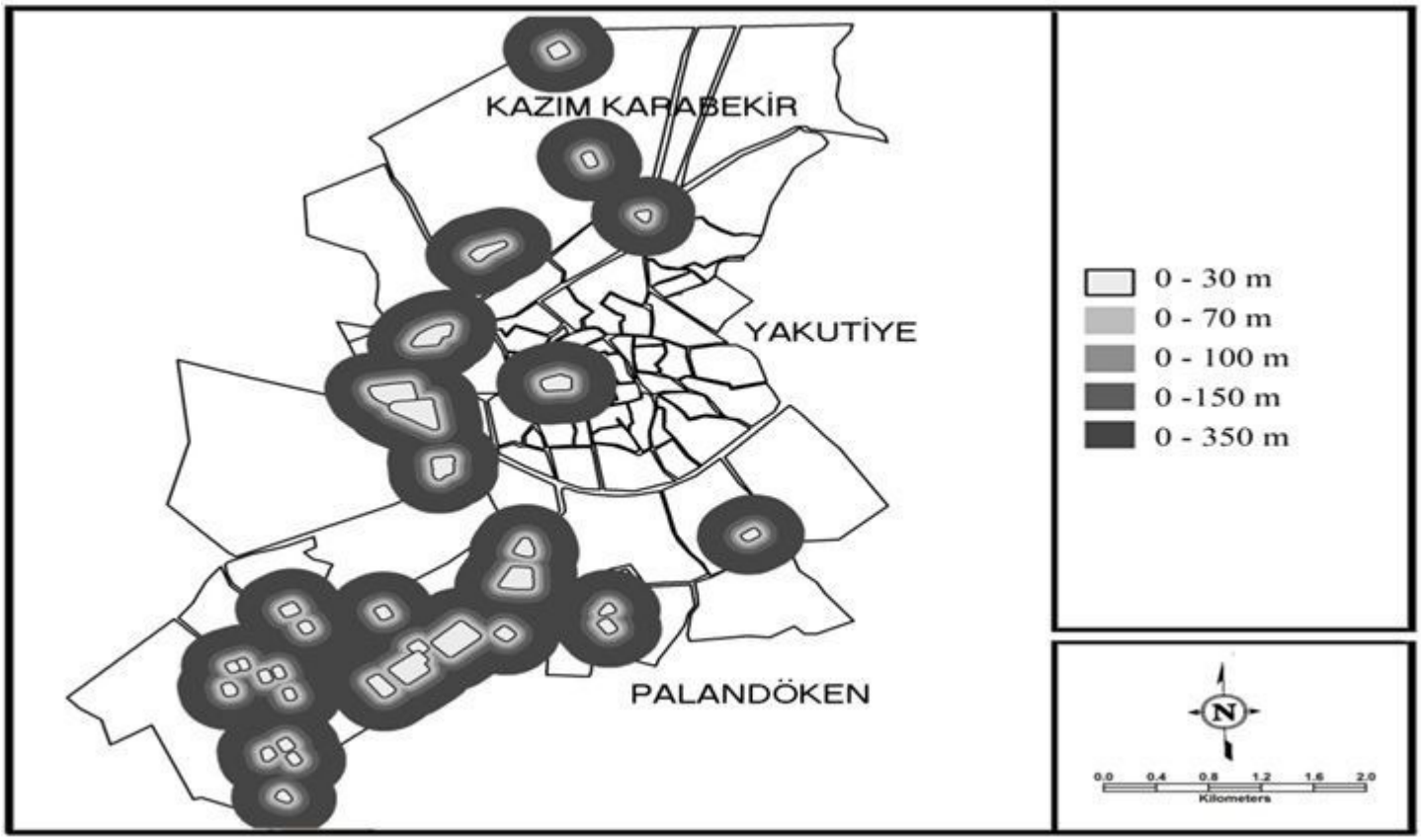

Figure 6. Accessibility of neighbourhoods for children.

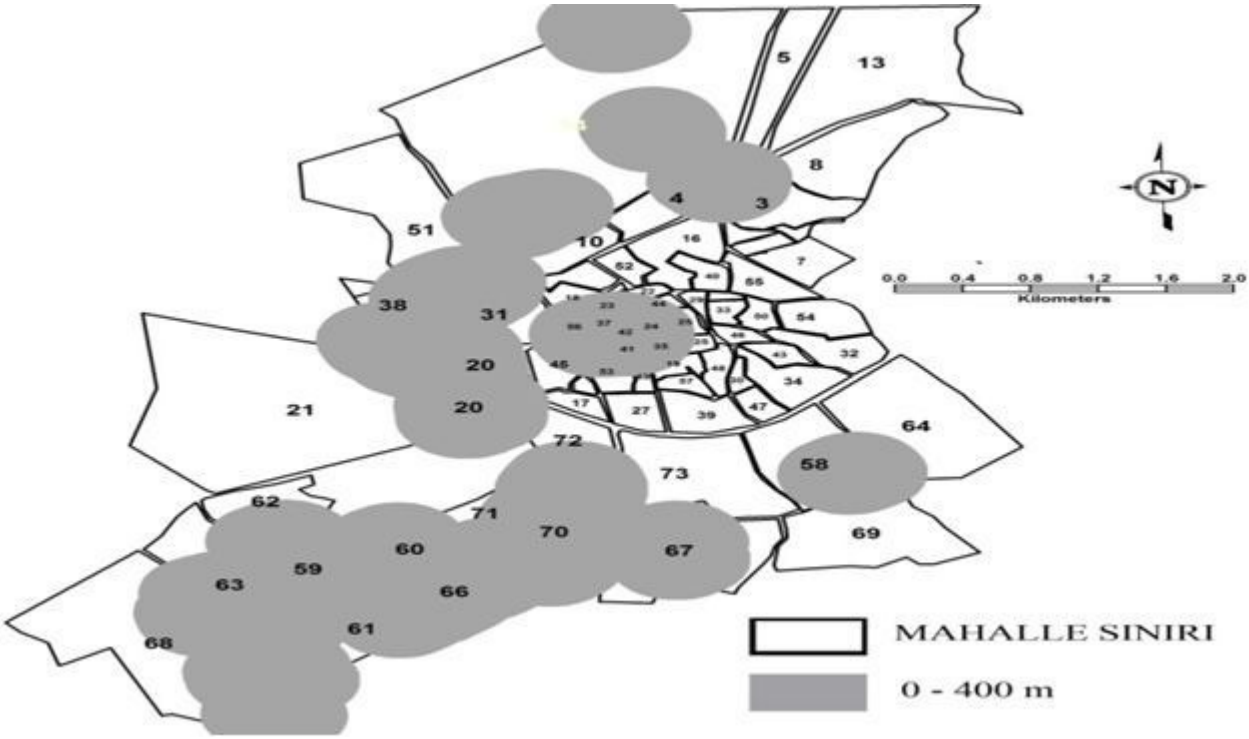

Figure 7. Service area of parks for local people.

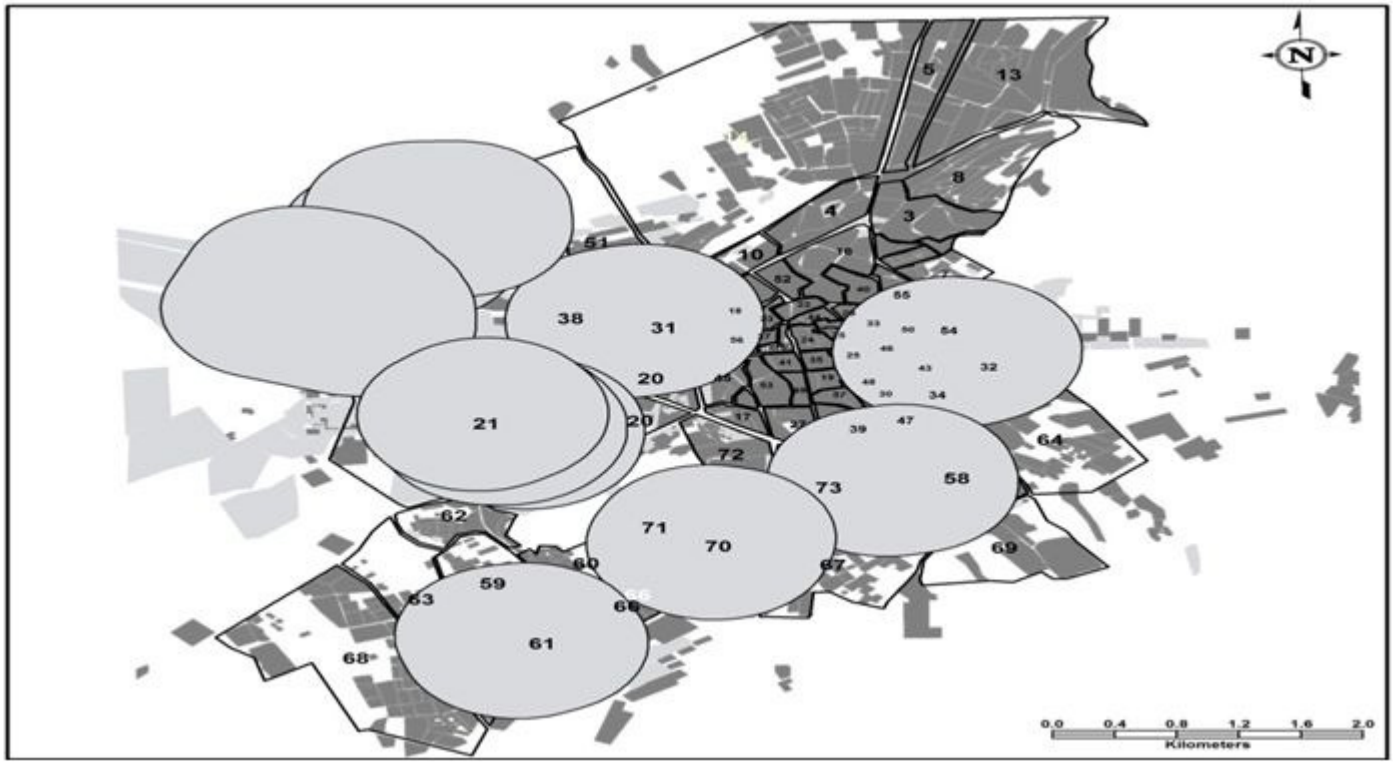

Figure 8. Service area of sport areas.

green areas must take an active role.

Development and application plans should be prepared considering the ecologic, social, economic and cultural properties of the city. Rate of green areas should be increased especially in the neighbourhoods where few or no playgrounds are present. Predetermined development plans should be completely applied to leave more green areas for the city people. Problems caused by the absence of car-parks on main arteries can be solved by constructing underground or multi-storey auto-parks.

In the newly developing Palandöken district, areas of front yards should be increased and they should be designed to form a buffer zone for disturbing the effects of busy roads. By constructing underground auto-parks, these areas can be turned into green areas.

Each city has unique standards caused by its natural and social structure. It is impossible to determine the place and size of effective green areas without these standards. In addition, these standards may change with time. Nevertheless, this should be considered in future studies.

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