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Assessing Accessible Open and Green Areas for Emergency Gathering and Temporary Shelter: The Case of Lefkoşa, TRNC

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Abstract

This study focuses on the potential of accessible open and green areas (OGAs) to serve as gathering spaces and temporary shelters during emergency response to disasters such as flood, earthquake, storm, terrorism, battle, etc. Specifically, the city of Lefkoşa in Northern Cyprus (TRNC) is studied in this context. A systematically constructed approach is employed, starting with the identification of the Dense Urban Core (DUC) within an 800 m access zone of OGAs and with a population density of more than 260 ha based on the Lefkoşa Urban Development Plan (LUDP). The study then determines the OGA requirements for gathering and temporary shelters during and after disasters, based on the floor area ratio, maximum building footprint ratio and projected population density given by LUDP. As a result of the study, the OGA requirements within the scope of the DUC were calculated to be minimum of 92 ha for gathering places, and minimum of 687 ha for temporary shelters. In this context, the city's disaster resilience index of the city is determined respectively to be 0.46 and 0.10. It is expected that this study will contribute to the integration of urban OGA development plans with disaster management efforts.

Keywords: *Disaster management, gathering, temporary shelter, urban planning, green area, stay-in-place.*

Erişilebilir Açık ve Yeşil Alanların Acil Durum Toplanma ve Geçici Barınma Amaçlı Kullanımı: KKTC Lefkoşa Örneği

Öz

Bu çalışmada, taşkın, deprem, fırtına, terör, savaş vb. afetler karşısında bir acil durum müdahalesi olarak, erişilebilir açık ve yeşil alanların (AYAs) toplanma ve geçici barınma sağlayabilme olanakları, KKTC Lefkoşa kenti için ortaya konulmuştur. Sistematik olarak yapılandırılmış bir yaklaşımla, öncelikle Lefkoşa İmar Planına (LIP) göre, AYA'lara 800 m erişim zonunda yer alan ve nüfus yoğunluğu 260 ha üzerinde olan Yoğun Kent Çekirdeği (YKÇ) belirlenmiştir. Ardından, LIP kapsamında ön görülen yapı-arsa oranı, yapı taban alanı oranı ve net nüfus yoğunluğu temelinde hesaplanan nüfus için, afet sırasında ve sonrasında toplanma ve geçici barınma için AYA ihtiyacı saptanmıştır. Araştırma sonucunda, YKÇ kapsam alanında AYA ihtiyacı; toplanma için en az 92 ha ve geçici barınma alanları için 687 ha olarak hesaplanmıştır. Bu bağlamda, kentin afete dirençliliği de sırasıyla 0.460 ve 0.100 olarak belirlenmiştir. Bu çalışmanın, kentsel AYA gelişim planlarının, afet yönetimi çalışmalarıyla bütünleştirilmesine katkı sağlaması beklenmektedir. Özellikle afetlerde ya da herhangi bir acil durumda yerinde kal ya da tahliye kararının alınabilmesinde, çalışma yol gösterici olabilir.

Anahtar Kelimeler: *Afet yönetimi, toplanma, geçici barınma, kent planlama, yeşil alan, yerinde-kal.*

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1. Introduction

Open green spaces are one of the most crucial urban components in creating healthy, functional, and aesthetically pleasing environments. Recent industrialization, rapidly increasing population, and the rise in disaster events have heightened the significance of green spaces (Doğan & Küçük, 2009).

The components of urban open and green area (OGA) are classified at a wide range of spatial scales, ranging from the building level to the regional scale, including pocket parks, neighbourhood parks, district parks, and city parks, but each is an integral part of the integrated OGA system. Each OGA component performs multiple functions. In this context, these components can also serve as easily accessible gathering and living spaces in disaster management. The key aspect is to integrate each OGA component from the lower scale to the higher scale in urban plans. Such an approach makes landscape planning indispensable prior to urban planning (Şahin et al., 2023).

Emergency gathering and temporary shelter areas are of critical spatial importance in preventing or reducing casualties during disasters, meeting urgent needs, systematically managing the disaster situation, and restoring normal life as quickly as possible. In particular, the earthquakes that occurred in Kahramanmaraş on 6 February 2023 which affected 11 provinces in Türkiye, highlighted the importance of the urban OGA system and elements that can be used as post-earthquake gathering places in urban areas.

In this context, in addition to various studies related to the design of urban streets and squares, green network (greenways), green infrastructure planning (or stormwater and sediment management areas), diversity, sufficiency, quality, quantity, standards of OGAs, it has become even more important to determine the quantities of these OGAs in cities at different scales, such as city, district, neighbourhood, and community levels, in relation to their covered population and accessibility.

Emergency gathering and temporary shelter areas are safe areas that people urgently need to reach during and after a disaster and are not exposed to disaster risks (Çınar et al, 2018). These areas are places where information is provided to those affected by the disaster, where support teams work together, and where people are directed to temporary shelter areas set up after the disaster.

Gathering areas can also be used as pre-evacuation areas. Five basic criteria are taken into account when identifying emergency assembly areas: accessibility, connectivity to the road network, usability and versatility, ownership and spatial size (Tarabanis & Tsionas, 1999; JICA, 2002; Aksoy et al., 2009).

In this context, OGA components offer significant opportunities for disaster management. For example, in Turkish provincial disaster management plans, parks, gardens, and recreational areas are considered safe spaces and are therefore defined as "gathering areas." In addition, provincial urban planning identifies gathering areas are designated as urban open spaces, green areas, and public spaces with recreational qualities.

According to various publications, the most appropriate distances for pedestrian access to different types of OGAs are as follows: Children's gardens and playgrounds: 400 m/10 minutes, neighbourhood, and community parks: 800 m/20 minutes, city parks: 1200 m/30 minutes. These guidelines suggest the distance and time it should take for people to access these OGA types by walking, ensuring that they are easily accessible to the community (Manlun, 2003; Altunkasa, 2004; Aydemir, 2004; Önder & Polat, 2012).

The European Communities Urban Audit Report (European Communities, 2000) recommends an ideal walking time of 15 minutes to urban green spaces (Gül et al., 2020); The Trust for Public Land (TPL), on the other hand, has adopted 10 minutes (800 m) as the benchmark for this value. In addition to accessibility, a number of other criteria are considered when linking green areas with emergency gathering and shelter sites. Table 1 lists the criteria of minimum per capita gathering site size, minimum enclosed shelter area size, standard/ideal gathering area size, maximum accessibility distance, and time as found in some of the basic literature reviewed in the article.

Table 1. Important criteria for determining emergency and temporary sites

Minimum shelter site size per person (m^2/person)	Minimum enclosed shelter size (m^2/person)	Minimum shelter site size (m^2)	Standard shelter site size (m^2)	Minimum amount of open and green area (m^2)	Maximum accessibility distance (m) and time (min)	Source
10 m^2		100 m^2 (For min. 10 people)	>5000 m^2 Ideally 50.000 m^2	-	-	(Çelik, Özcan & Erdin, 2017)
Gross minimum 1.5 -2 m^2/person (For standing gathering)		9-10 m^2	-	500 m^2	500 m - 15 min	(JICA, 2002)
Based on the building block, minimum 2 m^2		-	-	-	500 m - 15 min	Tarabanis & Tsionas, 1999)
-	3.5 m^2	-	-	-	-	(Sphere, 2011)

The frequency of disasters is reported to be increasing worldwide due to the effects of climate change, with an average of at least one disaster occurring every day and affecting a significant number of people. According to EM-DAT:

- Between 1900 and 2023 (up to June 19, 2023), 16.636 natural disasters have occurred.
- Although the number of natural disasters related to climate change has increased since the 1960s, the number of deaths has decreased as a result of the measures taken.
- Between 1900 and 1960, around 16 million people lost their lives due to natural disasters, whereas between 1960 and 2020, despite the increase in the world's population, this number is around 4 million.

The increasing number of disasters and the decreasing number of casualties can be attributed to the improved resilience of settlements. By considering the potential disaster risks of a particular landscape, spatial planning efforts can create more resilient cities.

Survivors of disasters need gathering areas in order to stay safe, meet their basic needs, reduce their losses, and continue their lives. Evacuation areas and roads also play a critical role in providing access to these safe areas. It is highly important to consider OGAs that provide ecological, economic, and social benefits to the city, in terms of their potential for serving as gathering, shelter, evacuation, and health facilities during and after disasters. It can be observed that in some cities with high disaster risk, disaster parks (e.g., Japan's Tokyo Rinkai Disaster Prevention Park, Hikarigaoka Park) are located. Additionally, cities undergoing rapid and unplanned growth as a result of a rapid population growth are turning into areas with low living standards. Consequently, the availability of public green areas with essential ecological, recreational, and socio-psychological functions, which are crucial for creating a high-quality urban living environment, is gradually decreasing over time (Bolatoğlu & Özkan, 2013). According to The World Health Organization (WHO) the minimum green area per person in cities should be at least 9 m^2, and the ideal area should be 10-15 m^2 (Erzurumlu-Sandal et al., 2017). However, these figures need to be reviewed, taking into account the potential of safe gathering and shelter areas in OGAs, which could be crucial in emergency situations in disaster-prone cities. The 2002 JICA (Japan International Cooperation Agency) report recommended that "pre-evacuation areas," expressed as such, should be allocated at least 1.5 m^2 per person, and they should be located at each neighbourhood unit. In their study by Tarabanis & Tsionas (1999), recommend that the net usable area per person in gathering areas should be at least 2 m^2 on a building block basis.

In planning post-disaster temporary shelter areas, reference is often made to the United Nations High Commissioner for Refugees' (UNHCR) Emergency Handbook (2007) and/or the publications of the Sphere Association publications, including "The Sphere Handbook: Humanitarian Charter and

Minimum Standards in Humanitarian Response" (2018). In these guidelines, the minimum shelter site required per person after a disaster is calculated by identifying all the requirements up to the necessary fire safety distance within the camp. Accordingly, in emergency situations, green areas should be planned for individuals can use as gathering and shelter should be planned, including infrastructure, social facilities, and shelter spaces, with a minimum of 45 m² per person (İnan & Korgavuş, 2017; Chrysoulidis, 2019).

2. Materials and Methods

2.1. Materials

Nicosia, the most populated city of Northern Cyprus, has the distinction of being the most important cultural, industrial, commercial, and transportation centre (Eyileten, Esendağlı & Selim, 2022). The main materials for this study consist of parks and a woodland being the components of OGAs in the capital city of Turkish Republic of Northern Cyprus (TRNC), Lefkoşa, on the Mediterranean island of Cyprus. The primary data source is the Lefkoşa Urban Development Plan (LUDP) and related reports prepared by the Urban Planning Department of the TRNC (LUDP, 2012).

Floods and earthquakes are among the most devastating natural disasters for Cypress Island. Despite the risk of flooding, many areas of Lefkoşa city are still situated close to frequently flooded rivers. On 26 February 2010, a prolonged period of heavy rainfall caused the Kanlıköy and Gönyeli ponds to almost overflow, resulting in water damage to the spillways after evacuation. On 9 December 2014, a short but heavy rainfall caused the Çınarderesi (Jinar) stream to overflow, affecting main roads and several houses in Gönyeli and Yenikent. The city of Lefkoşa was also severely affected by the large volume of water during this event (Zaifoğlu, 2018).

Cyprus lies in the second largest earthquake-prone region on Earth, but in a less active segment. Nevertheless, archaeological, and historical evidence indicates that Cyprus has experienced devastating earthquakes in the past, leading to the destruction of its towns on multiple occasions (Kyriakides et al., 2005; Azizi et al., 2023; Akgün et al., 2016), including Lefkoşa (Kyriakides et al., 2005). The seismic source on the island of Cyprus is represented by the Ovgos fault, which cuts through the capital city, Lefkoşa, in an east-west direction (Alevkayalı & Dindar, 2022). The island of Cyprus, located in the eastern Mediterranean, has a notable historical record of man-made disasters in the form of battle, which have been extensively documented throughout its settlement history (Atun, 2005; TRNC MFA, 2023).

2.2. Methods

In this study, the establishment of accessible gathering and temporary shelter facilities within a distance of 800 m is planned as an emergency response in the event of floods, earthquakes, wars, and similar situations. The methodology of the study consists of the stages provided in Figure 1.

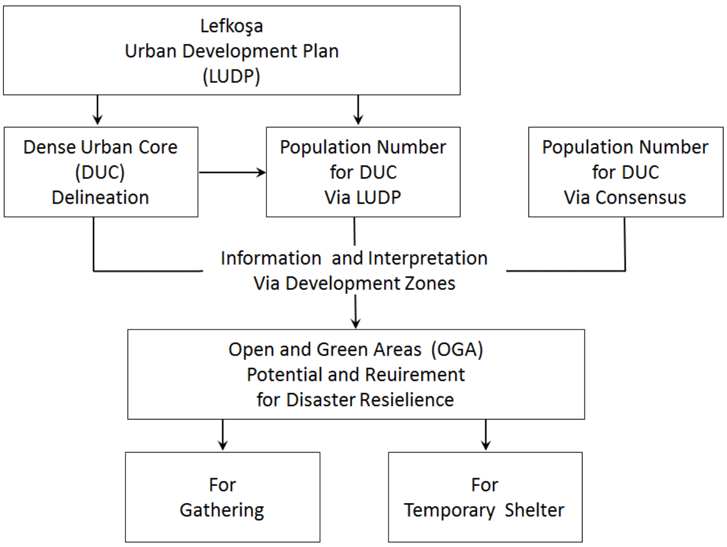

Figure 1. The stages of the methodology

Following the literature review and the creation of a Geographical Information System (GIS) database in accordance with the aim and scope of the study, in order to carry out the relevant analysis, the first step was to define the study area, which was then named Lefkoşa's Dense Urban Core (DUC). The analysis excluded the Central Business District, the Inner Walled City Conservation Area, and low and medium population density areas within the DUC. The DUC areas within an 800m buffer of accessible OGAs were then identified. The total population was then determined based on the floor area ratio, maximum building footprint ratio and projected population density provided by the LUDP (Lefkoşa Urban Development Plan). In the final phase of the study, the spatial requirements for OGAs were assessed and the urban resilience of the population was analysed, with particular attention to those lacking gathering and shelter facilities during disasters. The steps applied in calculating the potential of Open Green Areas (OGAs) for gathering and temporary shelter are outlined as follows:

- Population that OGAs can provide temporary shelter for people = Total OGA (ha) / 0.0045 (ha)*0.0045 ha (45 m2) is the required area per person for temporary shelter facilities (İnan & Korgavuş, 2017).
- Population that OGAs can provide gathering site for people = Total OGA (ha) / 0.0010 (ha)*0.0010 ha (10 m2) is the required area per person for gathering spaces (Table 1).
- Real Shelter (people) = Population that OGAs can provide gathering site for people / 2*

*2: It is assumed that at least 50% of OGAs are allocated to vegetation.

- Population without Temporary Shelter Opportunity (people) = Population (people) - Real Shelter (people)
- OGA Requirement for Shelter (ha) = Population without Temporary Shelter Opportunity (people) x 0.0045 (ha)
- Urban resilience ratio in terms of temporary shelter potential = Real Shelter (people) / DUC population

The methodological approach for each stage is detailed in the findings section.

3. Findings and Discussion

3.1. "Dense Urban Core" (DUC) Delineation

To determine the study area boundary, an 800 meters buffer was first applied to the urban centres (not rural areas) within the official LUDP boundary. The population within this zone, which has access to rural and natural areas on the outskirts of the city, was not included in the study area boundary. During and/or after disasters, it was assumed that the population in these areas could easily evacuate to a location 800 m outside the city. The remaining area after excluding these zones from the LUDP formed the spatial framework of the study. Within this framework, the areas of high population density were identified. According to the Lefkoşa Urban Development Plan (LUDP), the New Urban Development Zones with a floor area ratio of 1.20-1.40 and a population density of 195-260 persons/ha are the medium density areas. In this study, these designated New Urban Development Zones have also been considered as high-density areas. However, all other medium and low-density areas were not included in the population calculations for gathering and temporary shelter purposes, as they would contain urban voids and include existing and planned green spaces. The resulting urban development area was called the Dense Urban Core (DUC) and constituted the study area (Figure 2).

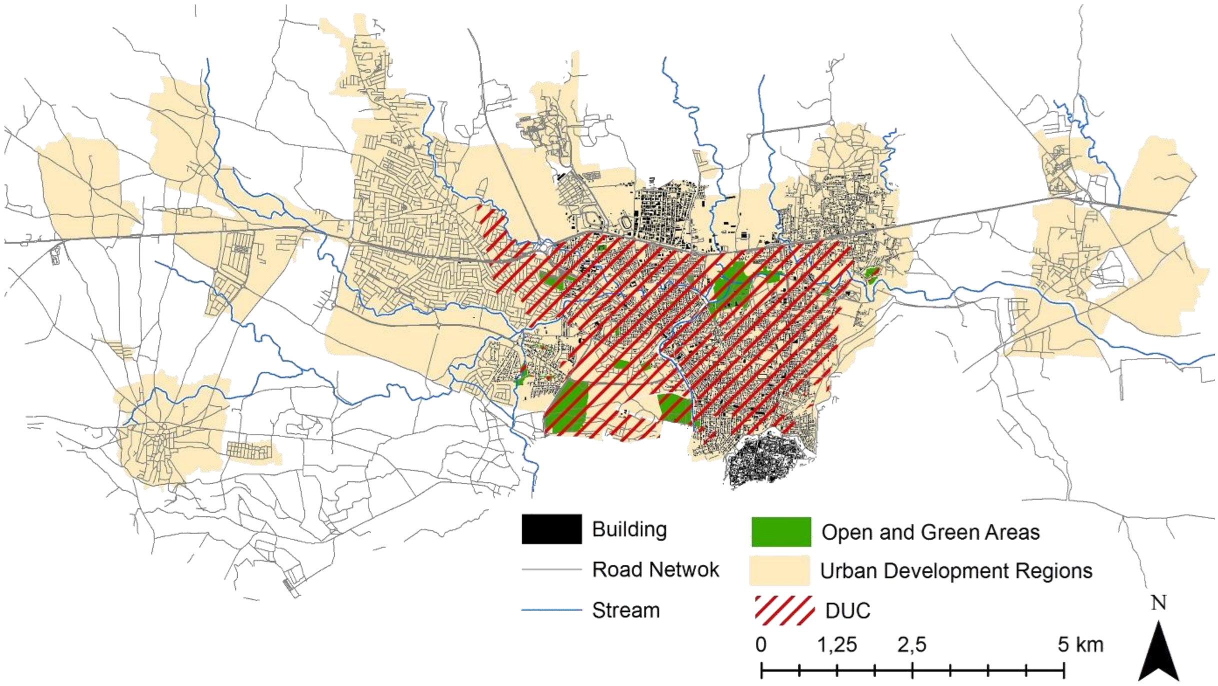

Figure 2. Dense urban core as the study area boundary (Base map source: LUDP, 2001)

The subsequent stages after DUC have been determined are given below:

- The 800 m accessibility zone was delineated for each OGA's component (parks and a woodland) within the DUC, and then these zones were merged and mapped (Figure 3). The existing and planned residential development areas within this merged zone were derived from identified with reference to the LUDP (Figure 4).

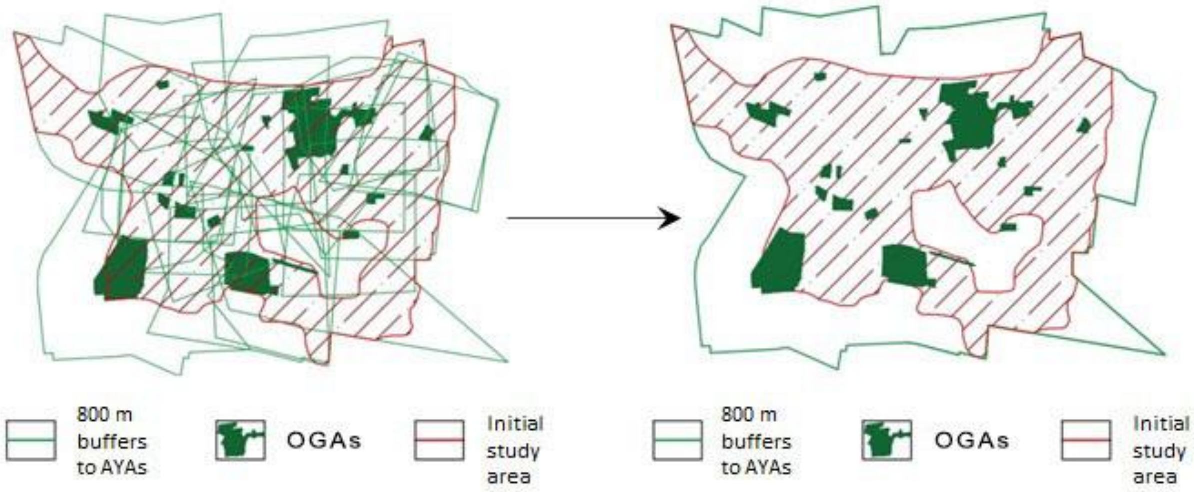

Figure 3. 800 m accessibility distance to existing OGA's components in the study area (without scale)

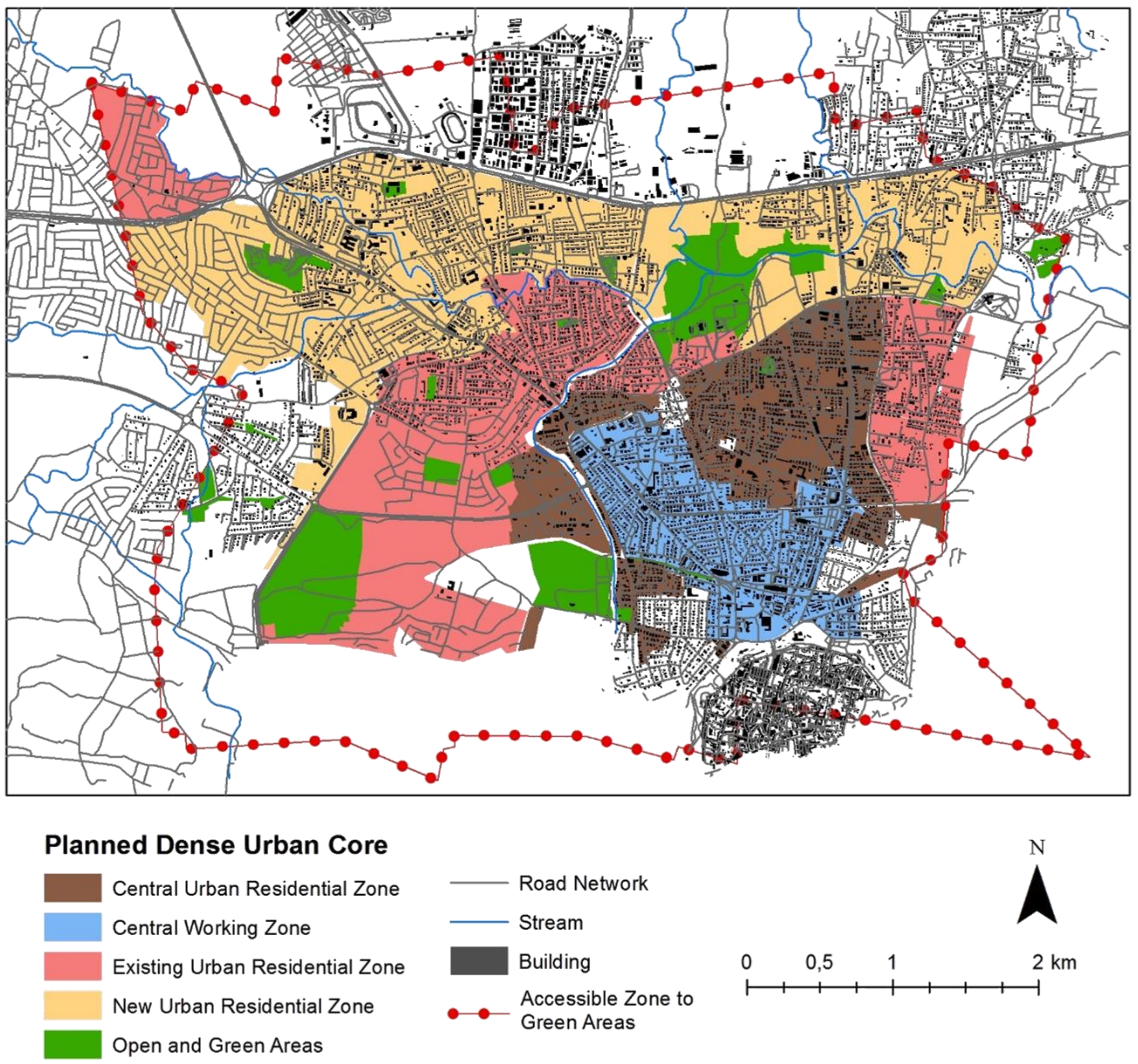

Figure 4. Study area and urban development zones within DUC (LUDP, 2012)

- The areas characterized by low and medium population density, as specified in the urban plan, have been excluded from the analyses focused on determining the population in need of gathering and temporary shelter due to their provision of open space opportunities.
- Areas located within the 800 m accessibility boundary of OGS's components and defined as high-density development zones according to the LUDP were designated as the study area for gathering and temporary shelter needs analyses (Figure 4).
- The Central Working Zone (CWZ) and the Historic City Centre Protection Zone, which are located within the high population density area, were excluded from the analysis. There is a lack of information about the current population within the CWZ during working hours. In addition, it is uncertain how much of the population in the existing and planned high density residential zones, which constitute the study area, will be part of the CWZ population during the day. With regard the CWZ with dense but low-rise buildings, site-specific research should be conducted for it on the potential use of green areas immediately adjacent to the city walls for gathering and sheltering purposes during and after disasters.
- The industrial zones located in the northern part of the city, according to the LUDP (Local Urban Development Plan), are not included in the analysis due to similar uncertainties regarding the population in the CWZ (Central City Wall Zone). The northern boundary of the study area is formed by Dr. Fazıl Küçük Boulevard.

3.2. Population

Population data is required to determine the size of gathering and temporary shelter areas within the study area. Estimates were conducted in two stages, as follow:

- This study focuses on long-term OGA requirements, determined the maximum population numbers for different zones within DUC based on the floor area ratio, maximum building footprint ratio and projected population density provided by the LUDP. Optaining the maximum possible population number is of paramount importance for facilitating effective long-term disaster management.
- The most recent official population data available for Lefkoşa is from the last census in 2011 (LUDP, 2012; Erengin, 2019). In the study, the DUC population from the 2011 census was compared and interpreted with the population number calculated according to the 2012 LUDP.

3.2.1. Population data based on neighbourhood and village from the 2011 Census of LUDP and the population data according to the 2012 LUDP

Since there has been no recent census in Cyprus, the population data from the year 2011 has been considered in this study. According to the 2011 Census, the population of the Central District of Lefkoşa is 82,929. 72% of this urban population lives in the city (Erengin, 2019). Within the DUC of the Central District of Lefkoşa, there are 12 neighbourhoods and one village (Figure 5). Nine of these neighbourhoods (Küçük Kaymaklı, Ortaköy, Yenişehir, Kızılay, Marmara, Göçmenköy, Köşküçiftlik, Kumsal, & Çağlayan) are located entirely within the DUC. Considering only these neighbourhoods, according to Table 2, 61% (44,213 people) of Lefkoşa's urban population lives within the DUC (Table 3). According to LUDP (2012), considering the floor area ratio, maximum building footprint ratio, and projected population density provided by LUDP, the potential maximum population of the same area would be 169,919. When compared to the data obtained from the 2011 Census, it can be noted that the DUC could potentially accommodate approximately 3.5 times its current population in the long term, according to the LUDP.

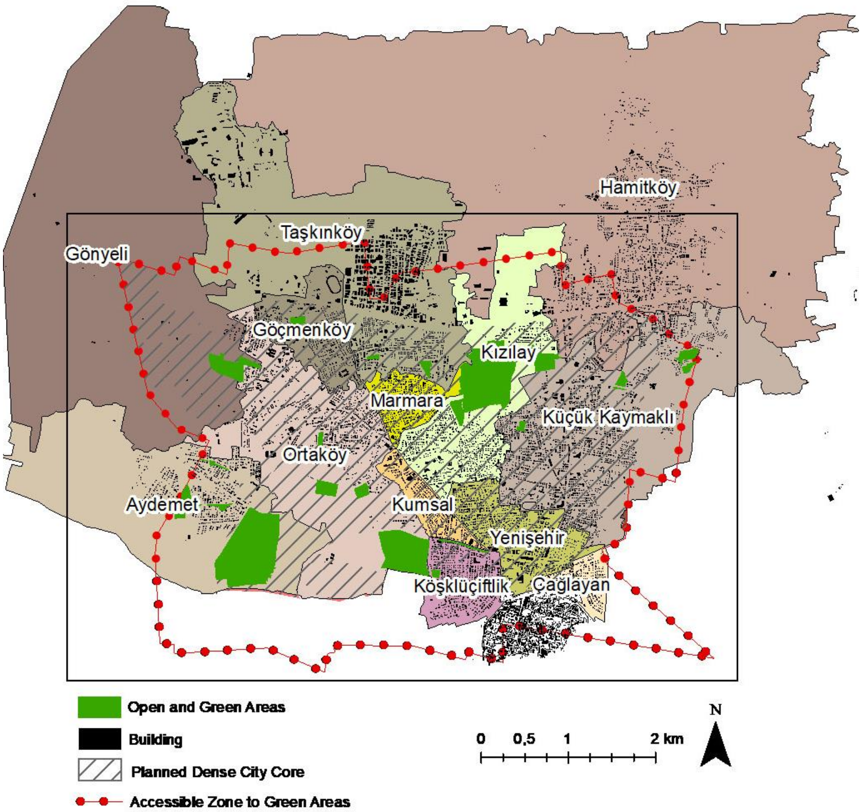

Figure 5. The neighborhoods within the spatial scope of DUC

Table 2. Populations of neighbourhoods and village within DUC (Erengin, 2019) (Highlighted neighbourhoods are fully located within the boundaries of DUC).

District	Bucak-Sub- District	Urban Neighborhood/Town	Population (2011)
Lefkoşa	Merkez	Gönyeli (B)	11.671
		Küçük Kaymaklı	10.572
		Ortaköy	8.868
		Taşkınköy	3.847
		Yenişehir	3.715
		Kızılay	3.535
		Marmara	3.081
		Göçmenköy	3.003
		Köşklüçiftlik	2.939
		Aydemet	2.314
		Kumsal	1.855
		Çağlayan	1.307
District	Sub-district	Villages	Population
Lefkoşa	Merkez	Hamitköy	5.338

3.2.2. Possible maximum population

The calculation of the maximum potential population in the long term was determined based on the information from the LUDP (2012) report, as shown in Table 3. The density of residential development in Lefkoşa is controlled by the floor area ratio. Although the calculation of this ratio is simple, accurate and effective, it is not directly related to the number of inhabitants. However, if a connection is made between the floor area ratio, the floor area ratio and the population density defined in the LUDP, the total building area can be easily determined (LUDP, 2012). This link has been evaluated in this study for the calculation of the potential maximum future population. Based on the data provided in the 2012 LUDP, and taking into account the floor area ratio, maximum building footprint ratio and projected population density provided by the LUDP, the potential maximum population was determined for different development areas within the study area.

Table 3. Factors used to define population number for DUC (LUDP, 2012) and calculated population number.

Planned Dense Urban Core Type	Floor Area Ratio	Footprint Ratio (%)	Net Density (people/ha) *	Density Class	Surface Area (ha)	Population Number
Central Urban Residential Zone	1.60-1.80	50	300	High	333	49.968
Existing Urban Residential Zone	1.40-1.60	50	265	High	439	58.154
New Urban Residential Zone	1.20-1.40	50	230	Medium	537	61.796
Total					1.309	169.919
*Average value						

3.3. Open and Green Areas Potential for Emergency Gathering and Temporary Shelter

In this study, the potential of OGAs for gathering and temporary shelter purposes was calculated in accordance with the following fundamental principles of emergency policy:

1. Shelter-in-place: The aim is to enable disaster survivors to gather and shelter within a maximum distance of 800 m from their homes during and after a disaster. The decision to

shelter-in-place or evacuate is one of the most critical decisions in disaster management (Zaenger et al., 2010, Chu & Singh Joy, 2010; Belflower, 2013).

2. Public OGAs: Only public OGAs (parks and a woodland) were included in the assessment.
3. No one behind: It is assumed that there will be no loss of life after the disaster and that the community and public institutions have high level of disaster preparedness. No distinction has been made for high-risk groups (such as infants, pregnant women, and the elderly). Conducting demographic analyses can help to identify the priority population groups that need assistance in gathering and finding temporary shelter during emergencies. On the other hand, it is essential to maintain the policy of "leaving no one behind".
4. The soft and hard landscape ratios for parks was set at 50% in this study. The calculations were performed by excluding the use of woodland for temporary shelter.

The population lacking gathering and temporary shelter facilities during and after a disaster is a factor that reduces urban resilience. The steps applied in in the calculation OGAs potential for gathering and temporary shelter have been computed as outlined in the methodology.

In order to calculating the existing gathering and shelter potential and the demand, the total surface area of OGAs was first calculated. The minimum area considered for green areas is 0.5 ha, which is used in the calculation of the Urban Green Index by the World Health Organization (2017). Within the study area, the smallest green area size is 0.66 ha.

The potential open and green areas for emergency gathering and temporary shelter within the boundary of Lefkoşa DUC were presented respectively in Table 4 and 5.

Table 4. Open and green areas potential for emergency gathering

Source	OGA	DUC Area (ha)	OGA (ha)	Total DUC population person)	Gathering (number of person)	Reel Gathering (number of person)	Population Without Gathering Opportunity	Resilience Ratio
LUDP 2012	Parks and woodland	1309	156	169.919	156.000	78.000	91.919	0.46
	Parks	1309	108	169.919	108.000	54.000	115.919	0.32
2011 Census	Parks and woodland	1309	156	45.000	156.000	78.000	-	1.73
	Parks	1309	108	45.000	108.000	54.000	-	1.20

Table 5. Open and green areas potential for emergency temporary shelter

Source	OGA	DUC Area (ha)	OGA (ha)	Total DUC population person)	Temporary Shelter (number of person)	Reel Temporary Shelter (number of person)	Population Without Temporary Shelter Opportunity	Resilience Ratio
LUDP 2012	Parks and woodland	1309	156	169.919	34.667	17.333	152.585	0.10
	Parks	1309	108	169.919	24.000	12.000	157.919	0.07
2011 Census	Parks and woodland	1309	156	45.000	34.667	17.333	27.667	0.39
	Parks	1309	108	45.000	24.000	12.000	33.000	0.27

4. Results and Recommendations

This study only includes urban parks and a woodland as OGA components that could provide gathering and temporary shelter options in a disaster situation. However, there are several other types of OGA. University campuses could provide significant shelter opportunities. In this context, the inclusion of other public and private open green spaces in the calculations would expedite the identification and resolution of potential deficiencies. The Prime Minister's Office of the TRNC publishes emergency gathering areas, mainly consisting of school buildings, on its website (SSTB, 2023). Identifying which urban OGAs can be used for gathering and shelter purposes during disasters or emergencies is a specific stage of the study and this stage must be included in the calculations conducted during this process. Factors such as landslides, floods, river overflow, proximity to fault lines, vegetation density, and other criteria may limit the use of green areas.

In the literature, there are many studies in which different methods are used to determine emergency assembly and shelter areas and their adequacy (Gerdan & Şen, 2019; Gökgöz et al., 2020; Şirin & Ocak, 2020; Aşıkkutlu et al., 2021; Kalkan, 2022). However, the method of this study for the Nicosia sample area is a unique study in terms of taking into account the 800 m access distance to open green spaces, urban development areas and the potential maximum population density that the city will reach.

The study assumes that there are no casualties after the disaster and that both the community and public institutions are highly prepared for disasters. No distinction was made for high-risk groups (such as infants, pregnant women and the elderly). However, the evaluation of population data in disaster management, based on the demographic characteristics of each settlement, is another specific area that requires further research. For example, Azizi et al., (2023) determined structural damage percentages of 29% and 43%, respectively, under two earthquake scenarios developed based on the geological structure, seismicity, soil properties, and building records for the Republic of Cypress in the the south of island. The necessary gathering and sheltering needs for the disaster in question should be calculated in line with the determined percentages.

The results of the study can be evaluated locally for the city of Lefkoşa, and the study method can be evaluated in general for the decision to stay in place or evacuate in the context of urban disaster management. In the traditional top-down approach to disaster management, the decision to stay in place or evacuate is undoubtedly not solely related to the gathering and sheltering potential of open and green spaces. Legislation, disaster forecasting, transportation, adequate life-saving supplies, backup generators (Belflower, 2013), as well as concerns about the safety of people's property, emotional attachments to place, mistrust of unknown new places, and the country's population policy also influence this decision.

Traditional top-down emergency responses can be problematic because disasters have widespread impacts that cannot be addressed all at once. This suggests that relying solely on top-down methods can sometimes exclude community participation and leave communities more vulnerable to disasters (Comfort, 1999; Allan & Bryant, 2014). The most effective recovery processes use a bottom-up approach, drawing on expertise from a range of sources, including communities themselves. Communities can be provided with valuable knowledge about their local environment (especially open and green spaces) and available resources, which can be life-saving. They often use this knowledge to manage their own recovery, particularly in the early days after a disaster when external assistance may not arrive immediately (Allan & Bryant, 2014).

The resilience of cities can be strengthened if there are enough open and green areas, and if these areas are integrated into the daily life of the community (in other words, if the connection between the place and the community is established). In such cases, earthquake survivors can take matters into their own hands in the early days of a disaster, creating temporary gathering and shelter areas, as well as access to water and food. This study is valuable in both the top-down and bottom-up approaches, and at the same time has the potential to integrate both scales.

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Author Contribution and Conflict of Interest Declaration Information

All authors contributed equally to this manuscript. There is no conflict of interest.

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