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Evaluation of Open and Green Space Systems in the Context of Urban Livability

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Abstract

Urban that has overgrown in recent years have affected human lifestyle and ecological balance in a negative way. Open and green spaces decreased. With this, unhealthy urban conditions occur. Therefore, urban is becoming more unlivable. The aim of this study, starting from the problem of insufficient/unqualified open and green areas in urban, is to show that cities are more livable when the open and green spaces system is designed.

The "top 10 livable cities" ranking the world cities are listed by 6 different institutions and the same cities included in this list are selected. The open and green areas of 4 different selected cities were examined. In the scope, two basic concepts are based on: open-green space systems and urban livability. As a result of the study, it has been seen that open and green space systems affect cities more livable. Therefore, open and green areas are planned systematically for maximum benefit with a sustainable approach. However, systems also need new approaches at some points. At this point, a hypothetical open green space system is proposed in this study. The concept of urban liveability and open and green spaces, an index of urban liveability, are explained. Then, open and green space systems in the literature are clarified with examples. To show the relationship between urban liveability and open green spaces, the research results done by different institutions, the most overlapping cities have been selected according to the top 10 list of most liveable cities list. The value of this study to make itself original and the literature contribution is that at the end of the research, a new open and green system was suggested based on the open and green systems in the literature.

Keywords:
Greenspace planning, liveable cities rank, open and green spaces, urban green system, urban liveability

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INTRODUCTION

Because of the increase in industrialization in the 1960s, the urban population was accelerated. Therefore, there has been an increase in density in cities. Then urban started to grow unexpectedly. Urban infrastructure remained insufficient. The increasing amount of construction has reduced the amount of open space. This decrease has affected the negative way urban ecosystem. Air quality has deteriorated, and natural habitats have decreased. The citizens' lives have also changed with the hard-working conditions and transportation problems. In addition, the number of recreational areas has gradually decreased, and urban have turned into concrete jungles. As a result, urban become unliveable. With the building pressures on open and green spaces and the transformation of these areas into residential areas, legislation concerning construction was insufficient.

In the city planning regulations, there are some problems in looking at open and green areas only in terms of square meters and calculating them by dividing them by a general census. The first problem is the quantitative evaluation of open and green spaces only. This approach ignores the qualitative characteristics of open and green spaces. Another problem is which functions are included in open and green spaces. For example, calculating the per capita amount of open and green areas would be more accurate to calculate only active open and green spaces instead of passive ones like a highway side refuge.

Another problem is that all citizens are different from each other. The way a woman, an older adult, a child, and so uses the city will change; their expectations from and access to open and green spaces will also be different. As it seems, the square meter measurement per capita of open and green space is never enough to calculate open and green space sufficiency.

This study emphasizes that open and green spaces should be systematically designed with a sustainable approach for maximum benefit. Because if open and green spaces are designed systematically, urban will become more liveable. The importance of open and green spaces was recaptured after some crisis, such as a pandemic, earthquakes, global warming. While planning, determining unqualified parcels as open and green spaces and making unqualified grass areas on the bulkhead line to reach the amount of green area per capita does not benefit the public or nature. This approach of planning reduces livability in cities. In addition to this, it also reduces the quality of open and green spaces.

In this study, the concept of urban liveability and open and green spaces, an index of urban liveability, are explained. Then, open and green space systems in the literature are clarified with examples. In the central part of the study, to show the relationship between urban liveability and open green spaces, as a result of the research done by different institutions, the most overlapping cities have been selected according to the top 10 list of most liveable cities list. By making a comparative

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analysis method between these cities, the connections between the open and green areas of the cities were examined. As a result of the comparison, it was seen that the open and green areas were planned systematically. At the end of the study, a new system has been proposed in addition to the open and green space systems in the literature.

URBAN LIVEABILITY

This section explains the concept of liveability and quality of life. Factors and indexes affecting urban liveability are included. Subjective, objective, and mixed techniques used to measure urban liveability are explained. Information about the organizations that make these measurements are given, and the indexes they use are mentioned.

Concept of Liveability

The concept of liveability dates to the Ancient Greek as Aristotle wrote essays about what a good life would be like (Serag El-Din et al., 2013). The concept of liveability does not have a clear definition. Because it varies according to time/space/individual (Oktay, 2007:37). Moreover, it can be said that liveability is part of social, economic, structural, and environmental factors that affect human life (Kuru and Özkök, 2017). In other words, liveability is the comfort and satisfaction of life (Serag, El Din, et al., 2013). The concept of good life changes according to the expectations and cultures of society. In addition, it is difficult to determine a general standard because different needs and expectations occur in different geographies. After all, it is a subjective concept.

The concept of urban liveability fulfills all the necessary conditions for the citizens to live. In other words, it is the state of providing the city's standards or even being above these standards. For example, appropriate infrastructure, adequate recreation areas, education, and health services, and providing access to these services create the perception of a liveable city. The literature seems the same in urban liveability and quality of life. However, the difference between them was created when the word quality came into our lives after the Industrial Revolution. Liveability is a concept that has been used since ancient times (Kuru and Özkök, 2017).

Urban liveability can be divided into personal perception and living environment (Sipahi, 2002). Personal perception can be explained as people being satisfied with their life and feeling happy (Henden, 2018; Mostafa, 2012). It is interested in people's feelings and emotions. It includes education and health status (Salihoğlu, 2012). The living environment includes urbanization by contemporary urban and environmental standards, citizens' rights, and the individual's assessment of urban conditions. It involves the environment in which people live. It includes good air and water quality (Yavuzçehre and Torlak, 2006; Salihoğlu, 2012).

Urban liveability is directly related to the quality of people's lives. The use and plans of spaces, preservation of historical-cultural-natural values, accessibility to services, urban planning, and urban design affect

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urban liveability (Aydemir, 2008). For urban to be liveable, it must carry out healthy urban conditions and be planned by the principles of sustainability (Yavuzçehre and Torlak, 2006). For this reason, urban liveability is not just an issue that concerns politicians and economists. Many topics concern the urban planner and need to be considered in this context. When planning a city or making an urban design, increasing urban liveability should be the primary goal.

Factors Affecting Urban Liveability

When citizens meet their needs to live, they want to live there (Henden, 2018; Keyman, 2016). Therefore, urban living standards should not be confused with urban liveability. Urban liveability is the state of being above the standards (Kozaryn, 2011).

Urban liveability is related to how citizens are affected by social, economic, and physical conditions and consists of interacting these components with each other (Mostafa, 2012). While measuring this interaction, it is calculated whether these values provide for the needs of the citizens (Emür and Onsekiz, 2007).

Economic factors include purchasing power and cost of living criteria such as income status, employment opportunities, food-shelter expenditures, unemployment rate (Emür and Onsekiz, 2007; Yavuzçehre and Torlak, 2006). Social factors include criteria such as lifestyle, age and sex ratio, gender inequality, crime rates, educational status, benefiting from health services, and place attachment (Emür and Onsekiz, 2007; Boylu and Paçacıoğlu, 2016). Psychological factors and urban policy are also included in these criteria (Serag El-Din, 2013). It can be said that business life affects urban liveability because it affects mental health (Demiral, 2001). Physical factors include criteria such as the presence of open and green spaces, transportation network, accessibility, infrastructure, public service, quality of residential areas, protection of the natural and historical environment, urban planning, and urban mobility (Emür and Onsekiz, 2007; Serag El Religion, 2013; Boylu and Paçacıoğlu, 2016).

Even if each economic, social, and physical factor is of different importance, all three must be above the standards to ensure urban liveability (Yıldız 2007). This measurement and comparison should be made to develop urban liveability (Başaran and Çiftçi, 2011). The strengths and weaknesses of the urban should be determined. Then, solutions should be considered to strengthen these weaknesses or how urban liveability can be increased (Karakaya and Aktürk, 2020). These measurements should be made regularly and systematically (Sönmez and İnan, 2019).

Urban Liveability Index

Various indicators are used to determine urban liveability. However, these indicators vary according to research, some internationally accepted common indicators (Marans, 2007). These are generally in

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housing, education, health, environment, security, culture, sports and recreation, transportation, infrastructure, technology, and communication (Sönmez and İnan, 2019; Kozaryn, 2011).

Three different methods are used when measuring urban liveability: Subjective, objective, and mixed- functional structure (Matins, 2007; Yıldız, 2007; Marans, 2007). Liveability is based on objective indicators related to the individual's life and subjective indicators according to perceiving life (Yıldız, 2007). As seen in Table 1 below, the calculation method and criteria used in subjective and objective indexes were evaluated together.

Table 1. Index Types and Criteria (Türksever, 2001; Şenlier et al., 2007; Salihoğlu, 2012.)

Index Types	Methods	Criteria
Objective	-Counts -Published official reports -Environmental measurements -Statistical data	Housing conditions Recreational activities Open and green spaces Residential areas Health facilities, number of physicians Income status Unemployment rate GDP per capita Air quality
Subjective	-Review reports measuring personal perceptions -Subjective assessments -Survey and face-to-face interviews	Expectations, happiness, satisfaction levels Sense of security Life experiences Service quality Accessibility

Subjective measures generally consist of subjective values such as health, safety, peace, happiness, and satisfaction and vary from person to person (Emür and Onsekiz, 2007). An individual's satisfaction with his/her environment affects the quality of life (Yavuzçehre and Torlak, 2006).

Objective measurements include measurable criteria such as numerical values, economic data, and social activity areas of the built and natural environments (Emür and Onsekiz, 2007). For example, data such as death rates, time spent in traffic, environmental pollution measurements, amount of green space per capita are objective measurement forms that affect livability (Güvenç, 1998).

In mixed functional structured measurements, subjective and objective data are used together (Martins, 2007). Studies show that mixed-structured measurements give more accurate results (Parlak, 2011). According to Kuru and Özkok (2017), two different methods should be used for liveable cities. According to Sönmez and İnan (2019), it was emphasized that only objective index or subjective index would not be sufficient alone and should be used together.

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Each index has its advantages and disadvantages. Objective indicators provide convenience when calculating on a large scale. However, finding similar data readily available in another geography can be difficult. If found, the comparison is easy. Using subjective indicators on large scales is costly and long-term. Since subjective indicators will change from culture to culture and society, it may be challenging to reach accurate results (Sönmez and İnan, 2019). While a place in different geography is defined as liveable even though it is challenging to live in, it may be unliveable due to the differences in the perceptions of individuals and societies despite being liveable in another place (Oktay, 2007).

Measuring Urban Liveability

Urban livability is measured annually by various institutions, and its scales can be regional or include all world cities. Indexes were created for these measurements. These are gathered political, social, physical, and cultural environment, public service quality, and accessibility (Kuru and Özkok, 2017; Henden, 2018; Batal, 2016). This part of the study covers the methods and criteria used by research organizations worldwide, not regionally, to measure urban liveability.

Mercer urban quality of life survey

Mercer, an international advisory organization, is research owned by the Human Resources Organization. They analyse liveable cities (Mercer, 2021). It includes a total of 440 cities worldwide. It evaluates these cities according to 39 criteria and ranks them (Kuru and Özkok, 2017). These criteria are political and social, economic, cultural, health-related issues, schools and education, public services and transportation, recreation areas, consumer goods, personal goods, housing, and the natural environment (Mercer, 2021). As seen in this research, the determination of recreational areas as a criterion shows that open and green areas are effective in the quality of urban life.

EUI global liveability ranking

It is research affiliated with the journal 'The Economist.' It is made by the 'Economist Intelligence Unit' organization. It provides consultancy services about the situation of cities at the international level. It regularly lists the world's most liveable cities every year. There are 140 cities in total, and these cities are evaluated according to 30 criteria and five different categories. These are military stability, health, culture, environment, education, and infrastructure (EIU, 2021). There are sports fields under the open and green areas in the environment section (Kuru and Özkok, 2017).

Monocle most liveable cities survey

Monocle, searching for the most liveable city among known cities globally, is a British culture-history-arts magazine. It makes its evaluations according to 11 criteria that should also be in urban planning.

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These are security, health, climate, international connections, public transportation, architectural quality, environment and nature, urban design, business life (Monocle, 2019; Henden 2018).

Numbeo quality of life comparison

Numbeo is a global database system. Every year, it researches livability and lists the cities. It has survey data on quality-of-life indexes, including housing indicators, crime rates, quality of health care, and many other statistics (Numbeo, 2021).

ECA

It is an organization that provides a data set. This set includes healthcare, housing assets, utilities, access to a social network and recreation areas, infrastructure, climate, personal safety, and air quality owned by global cities (ECA, 2020).

Deutsche bank liveability research

It includes 56 cities. According to the liveable cities ranking in 2019, the criteria are safety, environment, pollution, cost of living, happiness, and health services (URLs 1 and 2). In all these studies, it is seen that the existence of open and green spaces is evaluated within the categories of environment, public, and health spaces. The presence of open and green spaces in urban spaces, their density, and the way they access and use these areas increase urban livability (Henden, 2018; Kuru and Özkok, 2017; Sönmez and İnan, 2019).

OPEN AND GREEN SPACES

In this part, the concept of open and green areas and the standards of these areas are given. Ecological, economic, physical, social, and psychological, aesthetic functions of open and green spaces are explained. Open and green space systems are examined as green belt, green wedge, greenheart, and greenway.

Concept of Open and Green Space

Unbuilt areas are called open spaces. For example, water surfaces, urban squares, transport networks, parks are defined as open space (Gül and Küçük, 2001; Önder and Polat, 2012). Open and green spaces are versions of open spaces with vegetation. Areas surrounded by herbaceous and woody plants or combined with a particular part are also defined as open and green areas (Gül and Küçük, 2001). According to Chong et al. (2013), open and green areas are defined as areas with vegetation. For example, forests, cemeteries, national parks are types of open and green areas (Pamay, 1978; Gül and Küçük, 2001). According to the regulation for the preparation of Spatial Plans (2014), in Turkey, open and green areas include neighbourhood and district parks, children's playground, zoo, expo areas, botanical gardens, regional parks, urban squares, picnic areas, and coastal areas. The main idea to be drawn from

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here is that since every green area is an open area, the definition of the green area alone is not used. The correct usage in the literature is open and green space. However, it should not be forgotten that not every open area is green.

Urban open and green spaces are open and green spaces within the city borders. According to Aytaş (2017), these areas contain various landscape features. In addition, urban open and green spaces gain importance in economic and social aspects. According to Bilgili and Gökyer (2012), urban open and green spaces are natural and semi-natural areas where open and green spaces are in cities with human influence. According to Baycan et al. (2009), these areas are defined as plant communities, considered public spaces within the urban areas beneficial for the citizens. From this point of view, urban open and green spaces can be called the city's lungs because they allow the city to breathe.

Considering the urban open and green areas in terms of quantity, it covers the size of these areas and the amount of these areas per capita. In addition, it includes numerical values such as the number of trees, parks, and playgrounds (Gül et al., 2020). In terms of quality, urban open and green spaces include social, cultural, economic, and ecological services. In addition, the selection of plants and materials to be used in open and green areas should be suitable for their context. For a place to be called an open and green space, it is expected to fulfill the functions of open and green space (Gül et al., 2020). For this reason, urban open and green spaces should be looked at in terms of quantity and quality.

Open and Green Space Standards

Open and green space standards are calculated per capita according to the quantity of these spaces (Gül and Küçük, 2001). This measurement emerged in England in the 1800s and is considered a pointer of civilization (Yazgı and Yılmaz, 2017; Gül et al., 2020). While the law enacted in 1956 in Turkey was 7 m^2 per person, the amount of active open and green space per capita specified in the law in 1999 was 10 m^2. The amount is again 10 m^2 accordingly to Turkey's 2014 Spatial Plans Construction Regulation. (Önder and Polat, 2012). However, these standards vary from country to country in the world. Open and green space standards in various countries are given in Table 2.

As can be seen from Table 2, Turkey is behind the world countries in terms of open and green space standards. In addition, Turkey does not even reach the standards in its laws. For example, Istanbul's amount of open and green space per capita in 2018 was 6 m^2 (Gül et al. 2020). Looking at other world cities, It is 40 m^2 in London, 29 m^2 in Edinburgh, 46 m^2 in Cambridge, 38 m^2 in Washington, 48,5 m^2 in Los Angeles, 29 m^2 in Brussels, 25 m^2 in Vienna, 16 m^2 in Munich (Singh et al., 2010; Khan, 2012; Morar et al., 2014; Maryanti, 2016).

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Table 2. Open and Green Space Standards (m^2/person) (Aksoy, 2001; Önder and Polat, 2012)

Country	Urban Park	Neighbourhood Park	Playground	Sports Field	General
Sweden	23	-	5,5	10	87
America	16	4	-	-	80
Britain	40	20	-	10	78
Italy	12	5,5	3	7,5	45
Holland	9	-	-	6,5	45
Poland	5	15	-	7,5	45
France	10	4	3,5	8	35
Turkey	3,5	2	1,5	3	10

In addition, it is not the right approach to look at open and green spaces only numerically. Because the functions and implementation of open and green spaces are also essential, another point is that there are no provisions in the regulations regarding the planning and practice of open and green spaces (Gül and Küçük, 2001; Yazgı and Yılmaz, 2017). This uncertainty complicates open and green space planning, which is left to the personal vision of the city planner or the urbanization policies of local governments. Since it is left only to them, insufficient, scattered, do not have the characteristics of open and green areas, qualitatively deficient open and green areas emerge.

Functions and Classification of Open and Green Spaces

Open and green spaces have many different functions. It is possible to collect these functions in five main categories. These categories are ecological, physical, economic, social-psychological, aesthetic. The ecological function of open and green spaces provides the microclimate in the city. At the same time, it cleans the air of the city. The physical function of open and green spaces is to act as a buffer to prevent an expansion of the city. The economic function of open and green spaces includes areas that can be used for tourism activities, agricultural activities, and the forest industry. In addition, housing rents around the parks were found to be higher. Open and green spaces' social and psychological function prevents stress and regulates human relations. It provides the opportunity to socialize. The aesthetic function of open and green spaces consists of design principles such as order, texture, color created with the plant species used. Such arrangements offer visual quality to urban areas (Gül and Küçük, 2001). It is necessary to plan open and green spaces more effectively in all these functions. It is essential to look at these areas in terms of quantity and quality. If open and green areas are designed systematically, it is seen that they fulfill the functions of open and green areas.

Open and green spaces can differ according to ownership status, usage types, and scales. Open and green areas' ownership status is divided into

three public, semi-public/semi-private, and private areas. Public open and green spaces are freely accessible to citizens. These places are common public areas such as streets, pedestrian roads, parks, children's playgrounds. Semi-public or semi-private open and green spaces are changeover from private to public spaces. Examples of these are courtyards, communal gardens, and parking lots. Private open and green spaces are privately owned areas (Öztürk, 2004; Gül and Küçük, 2001; Gezer et al., 2009).

Open and green areas' usage types are divided into active and passive. Active open and green spaces are open to public use and organized for entertainment, recreation, and health. These areas are playgrounds, playgrounds, fairgrounds, zoo, botanical garden, woodland, picnic areas, and promenade areas. Passive open and green areas are not open to public use, generally arranged for environmental health, protection, and aesthetic purposes. Areas such as orchards, nurseries, poplars, cemeteries, topographical thresholds, green belts, forests, median surfaces of roads are also passive areas (Öztürk, 2004; Gül et al., 2020).

The open and green spaces scales are divided into six groups as in Table 3: region, city, district, neighbourhood, neighbourhood unit, and housing group. Open and green areas include at the regional scale; forests, national parks, regional parks, nature parks, nature protection areas, and the arboretum; at the city scale urban parks, zoos, botanical gardens, and sports facilities; at the neighbourhood scale sports fields, swimming pools, and playgrounds. Open and green areas include neighbourhood parks and school gardens at the neighbourhood scale. Parks, walking, and cycling paths form the open and green areas at the scale of the neighbourhood unit. Open and green areas at the scale of the housing group consist of playgrounds and residential gardens (Aydemir et al., 1999; Gül and Küçük, 2001).

Table 3. Types of Open and Green Spaces (Aydemir et. al., 1999; Gül and Küçük, 2001)

Scale	Types of Open and Green Spaces
Region	Forests, national parks, nature parks, nature reserves, arboretum
Urban	City parks, zoos, botanical gardens, sports facilities
District	Sports fields, swimming pool, playground
Neighborhood	Neighborhood Park, school garden
Neighborhood Unit	Parks, walking and cycling paths
Housing Group	Playgrounds and residential gardens

Open and Green Space Systems

For good urban planning, open and green areas must be designed because they shape the form and physical structure of the urban. Therefore, open and green spaces have an integrative feature that affects the urban morphology (Manavlıoğlu and Ortaçeşme, 2007).

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The systematic planning of open and green spaces is the task of the urban planner. Analysis, synthesis, and design of the appropriate green system should be done on the existing open and green areas. The green system setup should not be ignored in urban plans. In addition, green space plans and master plans should be made simultaneously (Yücesu et al., 2017).

Open and green spaces should be planned from the macro to the micro-scale system. In this context, the quality of open and green spaces and their suitability for the city's identity is another important point. In addition, open and green spaces should be extensive enough and accessible to meet the city's needs (Yücesu et al., 2017).

As a result of the literature review, it is seen that many open and green space systems have been developed. Hellmund and Smith (2006) evaluated all urban and rural systems in their studies. In this study, the green belt, green wedge, greenheart, and greenway systems associated with the city are explained (Table 4).

Table 4. Open and Green Space Systems

Green Belt	Green Wedge	Green Hearth	Green Way
			
Build-up Area Open and Green Spaces	Build-up Area Open and Green Spaces	Build-up Area Open and Green Spaces	Build-up Area Open and Green Spaces

Green belt

As the name suggests, the green belt means the ring surrounding the city consisting of open and green areas (Önder and Öztürk, 2009). With its general definition, the green belt is the integrity of open spaces planned, implemented, and managed for ecological and recreational purposes. It is a continuous belt from the urban area to the rural area. The main principles of green belt planning are as follows: The natural systems shape the green belt's form and boundaries, ecological and integrative planning approach, the creation of the continuity of areas from urban to rural, and the relationship between resources and land uses in the balance of protection and usage (Çulcuoğlu, 1997). The most important implementation of the green belt was made in London (Figure 1). The function found in the green belt is agricultural, wooded, forests, and public open spaces. The length of the green belt in London is 190 km, and it is 30 km from the centre. Its width is 16 km. This green belt has a function that facilitates transportation from other cities on the edge of the city to London, alleviates the traffic between the suburbs and the city, and reduces the heavy traffic in the downtown (Öztürk, 2004).

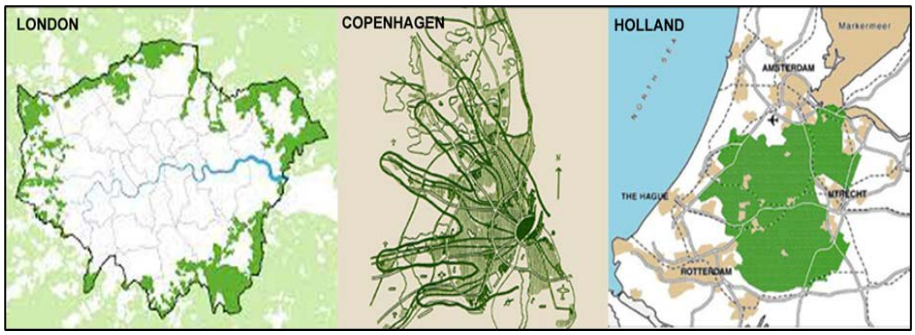

Figure 1. Open and Green Space Systems in London, Copenhagen, and the Netherlands (URL 3,4 and 5)

Green wedge

In the green wedge, open and green areas extend into the city. Besides that, it progresses depending on linear natural structures such as streams and valleys and creates a green texture in the city. It generally takes a wedge shape by narrowing rural areas towards the city centre. It is more accessible than the green belt. In this typology, green areas cannot reach the city centre due to the compact structure in the city centre and stay around the centre. However, if natural linear elements such as streams or valleys pass through the city, it creates a green area potential for the city centre. For example, Washington and Copenhagen (Figure 1) can be shown as green wedges (Öztürk, 2004).

Green hearth

Unlike the green belt, which separates urban and suburban settlements and acts as a buffer, the green heart is an open and green space system that connects cities on a regional scale. In this system, cities are located around a central open space, forming a ring. It is a polycentric planning concept that connects cities of the Netherlands such as Rotterdam, the Hague, and Utrecht (Figure 1). If we consider this typology at the urban scale, the idea of creating a great open space in the city centre will emerge (Öztürk, 2004; Kuhn, 2003).

Green way

The city's open and green areas reach the city centre through corridors. It is very similar to the green wedge in terms of its characteristics. However, the most distinctive difference is that the open and green space enters the city centre with a narrow pedestrian path or park. The importance of green corridors for the city comes to the natural city centre through these corridors. Renn greenway in France can be cited as an example (Scudo, 2006; Arslan et al., 2007).

EFFECTS OF OPEN AND GREEN SPACES ON LIVEABILITY

When urban liveability is examined in terms of economic, social, and environmental aspects, it is seen that open and green spaces are evaluated under the title of environment. Besides that, considering the ecological, economic, aesthetic, social-psychological, and physical functions of open and green spaces, it is evident that each function increases urban liveability. It should be designed as a system to use open

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and green spaces with maximum function and benefit. In that case, the relationship between urban livability and open and green space systems can be mentioned.

Urban Selection and Method

To examine the assumption that open and green space systems affect urban livability, open and green areas of cities with high urban livability have been examined. First, the top 10 cities are listed in the urban livability rankings. While making this list, 6 different research institutions were included. The research organizations are as follows: EUI, Monocle, Mercer, Numbeo, Deutsche Bank, ECA. The cities in the top 10 rankings of these 6 organizations are discussed. The overlap ratios of the top 10 cities in all lists were determined (Table 5). The overlapping cities in the different lists and their overlap rates are as follows: 5/6: Zurich;4/6: Copenhagen; 3/6: Auckland, Wellington, Vienna; 2/6: Helsinki, Adelaide, Tokyo, Geneva, Melbourne, Brisbane, Sydney, Basel.

Table 5. Urban Livability Rankings by Different Organizations (EUI, 2021; Monocle, 2021; Mercer, 2021; Numbeo, 2021; Deutsche, 2021; ECA, 2020.)

	EUI (2021)	Monocle (2021)	Mercer (2019)	Numbeo (2021)	Deutsche (2020)	ECA (2020)
1.	Auckland	Copenhagen	Vienna	Adelaide	Zurich	Copenhagen
2.	Osaka	Zurich	Zurich	Canberra	Wellington	Bern
3.	Adelaide	Helsinki	Vancouver	Wellington	Copenhagen	Hague
4.	Wellington	Stockholm	Munich	Raleigh	Edinburgh	Geneva
5.	Tokyo	Tokyo	Auckland	Zurich	Vienna	Eindhoven
6.	Perth	Vienna	Dusseldorf	The Hague	Helsinki	Stavanger
7.	Zurich	Lisbon	Frankfurt	Madison	Melbourne	Amsterdam
8.	Geneva	Auckland	Copenhagen	Columbus	Boston	Basel
9.	Melbourne	Taipei	Geneva	Austin	San Francisco	Dublin
10.	Brisbane	Sydney	Basel	Brisbane	Sydney	Luxembourg

As shown in Table 5, the highest overlap rate belongs to the EUI institution. Therefore, the top 10 cities belonging to the EUI organization are listed between the years 2015-2021 (Table 6). However, studies for 2020 could not be done due to the Pandemic.

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Table 6. EUI Urban Liveability Ranking by Years (EUI, 2021)

	2021	2019	2018	2017	2016	2015
1.	Auckland	Vienna	Vienna	Melbourne	Melbourne	Melbourne
2.	Osaka	Melbourne	Melbourne	Vienna	Vienna	Vienna
3.	Adelaide	Sydney	Osaka	Vancouver	Vancouver	Vancouver
4.	Wellington	Osaka	Calgary	Toronto	Toronto	Toronto
5.	Tokyo	Calgary	Sydney	Adelaide	Adelaide	Adelaide
6.	Perth	Vancouver	Vancouver	Calgary	Calgary	Sydney
7.	Zurich	Tokyo	Tokyo	Perth	Perth	Perth
8.	Geneva	Toronto	Toronto	Auckland	Auckland	Auckland
9.	Melbourne	Copenhagen	Copenhagen	Helsinki	Helsinki	Helsinki
10.	Brisbane	Adelaide	Adelaide	Hamburg	Hamburg	Zurich

The city selection criteria are made following: The top 3 cities in Other Organizations are found in the EUI's rankings organized by years. In the list made by different organizations, the ones that overlapped 5, 4, and 3 times were considered, and their rankings were found in the list of EUI made by years. If it was included in the list only once, that city was not selected. As a result of this method, the following cities were selected: Auckland, Vienna, Zurich, and Copenhagen.

Urban Studies

The open and green areas of the cities of Auckland, Vienna, Zurich and Copenhagen, which were determined according to the results of the city selection, were examined in line with the information obtained from the literature. The existing open and green areas of these four cities were analyzed with the help of satellite images. Due to the information that can be obtained, the cities' quantitative open and green space presence has been examined. The location coefficient method was used by calculating the ratio of the total area of the city to the area of open and green areas. Then, these four cities' open and green areas were evaluated in terms of system setup, and these cities were compared with each other by taking the mode and arithmetic averages of their rankings in the urban livability ranking.

Auckland

Auckland is in the north of New Zealand (Figure 2). Its area is 1060 km^2 in total. Its population in 2017 was 1,657,000. It is the highest open and green areas among the world cities. It has 591 km^2 of open and green area surface. There is 357 m^2 of open and green space per person (URL-17). Looking at the city on a macro scale, a natural green belt has formed on its peripheries and these forest areas limit the city and act as a buffer. In addition, a part of this forest area has been included in the city limits. Therefore, the location coefficient was found to be 0.55. It has an open and green area about half of its surface area. It is the city with the highest

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location coefficient. When we look at the place where the construction is in the city centre, open and green areas of all sizes have been created. These areas are evenly distributed in the city centre.

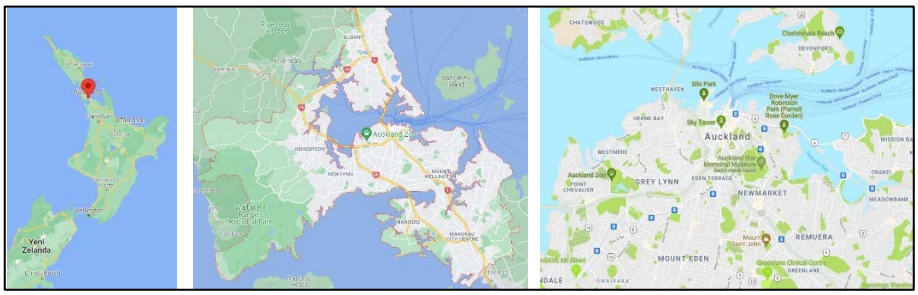

Figure 2. Geographical Location and Open-Green Areas of Auckland
(URL 7 and 8)

Looking at Tables 5 and 6, the city of Auckland; It ranked first in the EUI 2021 rankings, eighth in the Monocle 2021 rankings, fifth in the Mercer 2019 rankings, and again eighth in the EUI 2015, 2016 and 2017 rankings, and it has maintained its place in the lists. His mode overall is eighth. Its average is 6.3. It has been in the top 10 6 times in total.

Vienna

Vienna is in the northeast of Australia (Figure 3). Its area is 415 km^2 in total. Its population in 2019 was 1,900,000. It is the city with the highest population density. It has 114 km^2 of open and green area surface. There is 60 square meters of open and green space per person (URL-20). The forest area in the periphery is not included in the city limits. As seen in Figure 3, there are open and green areas that try to extend from the periphery of Vienna to the centre. When we look at the city on a macro scale, although it resembles a green wedge on its walls, there is no full wedge formation. The location coefficient was found to be 0.27. It has an open and green area about one third of its surface area. Like Auckland, Vienna has created open and green spaces of varying sizes at equal intervals within the city. On the coast, an open and green area extends in the form of a green corridor, although its continuity is interrupted at a certain point.

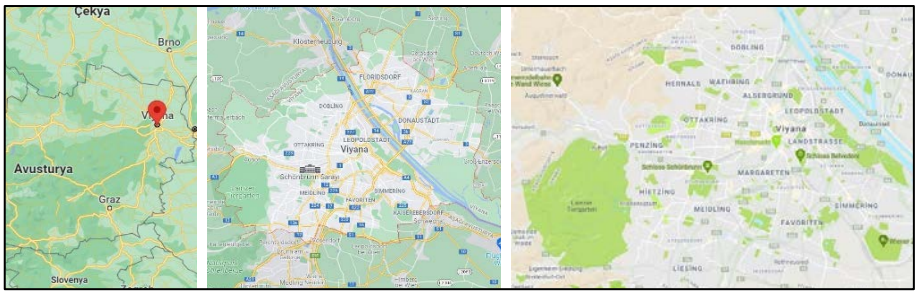

Figure 3. Geographical Location and Open-Green Areas of Vienna
(URL 10 and 11)

Looking at Tables 5 and 6, the city of Vienna; It ranked sixth in Monocle 2021, first in Mercer 2019, fifth in Deutsche Bank 2020, second in EUI 2015, 2016, 2017, and first in EUI 2018 and 2019. Generally, the mode is first and second place. Its average is 2.5. It has been in the top 10 8 times in total. The most livable city in the livability rankings is Vienna.

Zurich

Zurich was in the northeast of Switzerland (Figure 4). Its area is 88 km^2 in total. Its population in 2019 is 403,000. It has 10 km^2 of open and green area surface (URL-23). There is 25 square meters of open and green space per person (Pamay, 1978). It is the city with the least open and green areas per capita. The forest area in the periphery is not included in the city limits. As can be seen in Figure 4, the city borders are limited by passive open and green areas like other cities. When we look at the city on a macro scale, green wedge formation is more common than other cities. The open and green space tried to enter the city by merging with the river. Although there are open and green areas by the river, it is not exactly in the form of a green corridor / road and these areas do not contain continuity. The location coefficient was found to be 0.11. It is the city where the ratio of open and green areas to surface area is the lowest. Open and green areas of homogeneous size were created at equal intervals in the city.

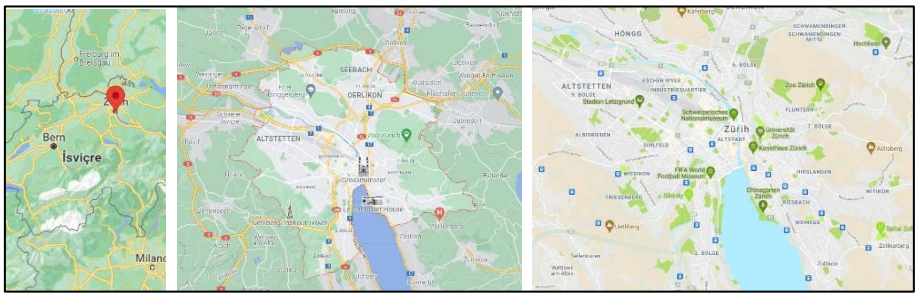

Figure 4. Geographical Location and Open-Green Areas of Zurich (URL 13 and 14)

Looking at Tables 5 and 6, the city of Zurich; It ranked seventh in the EUI 2021 rankings, second in the Monocle 2021 and Mercer 2019 rankings, fifth in the Numbeo 2021 rankings, first in the Deutsche Bank 2020 rankings and tenth in the EUI 2015 rankings. Overall, his mode is second place. Its average is 4.5. It has been in the top 10 6 times in total.

Copenhagen

The city of Copenhagen is located in eastern Denmark (Figure 5). Its area is 89 km^2 in total. Its population in 2017 is 603,000. It has an open and green area of 25 km^2. There is 42 m^2 of open and green space per person (Irmak and Avcı, 2019). The green wedge open and green space system is designed in the city. It is a city that is shown as an example of open and green space systems in the literature. As can be seen in Figure 5, the city borders are limited by passive open and green areas like other cities. When we look at the city on a macro scale, it merges with the river and the open and green space enters the city, forming a green wedge. The location coefficient was found to be 0.47, which has an open and green area approximately half of its surface area. The city centre's open and green areas of different sizes are seen at equal intervals. On the coast, there is an open and green area extending in the form of a green corridor. However, it was cut in the city centre.

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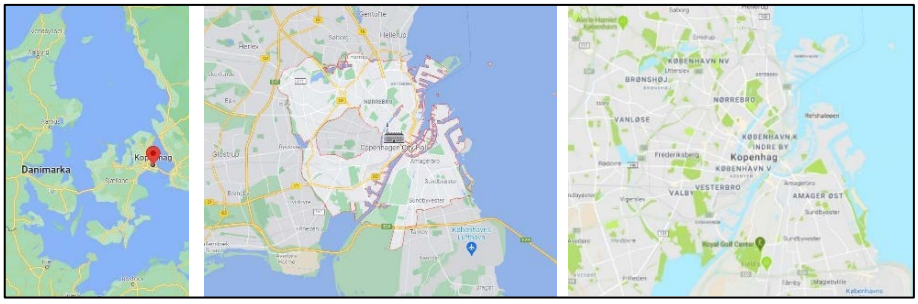

Figure 5. Geographical Location and Open-Green Areas of Copenhagen
(URL 15 and 16)

Looking at Tables 5 and 6, the city of Copenhagen; It ranked ninth in the EUI 2018 and 2019 rankings, first in the Monocle 2021 rankings, eighth in the Mercer 2019 rankings, third in the Deutsche Bank 2020 rankings, and first in the ECA 2020 rankings. Overall, his mode is ninth. Its average is 7.3. It has been in the top 10 6 times in total.

Comparative Analysis and Evaluation

The information obtained within the scope of the research of these four selected cities was compiled by categorizing and Table 7 was created.

Table 7. Comparative Analysis

Urban Name	**AUCKLAND**	**VIENNA**	**ZURICH**	**COPENHAGEN**
Area (km^2)	1.060	415	88	89
Population	1.657.000	1.900.000	403.000	603.000
Population Density (Person/km^2)	1.563	46.341	4.579	6.775
Open and Green Area (km^2)	591	114	10	25
Open and Green Area Per Capita (m^2)	357	60	25	42
Location Coefficient Ratio (0<...<1)	0,55	0,27	0,11	0,47
Livability Average	6,3	2,5	4,5	7,3
Open and Green Systems				

Looking at the comparative analysis in Table 7, it is possible to reach the following conclusions:

-It has been observed that the surface area and population of Zurich and Copenhagen are close to each other. It has been seen that the city with the largest area and population is Auckland. Considering the open and green areas per capita, it can be said that there is no city less than 25 m^2. The location coefficients vary between 0.1 and 0.6. The largest number of

open and green spaces belongs to the city of Auckland. Although the areas of Zurich and Copenhagen are close, the location coefficient of Copenhagen is higher than Zurich, since the amount of open and green spaces changes.

-When we look at open and green spaces in terms of system setup, a change in form from green belt to green wedge is seen in Auckland, Vienna, Zurich and Copenhagen, respectively. In general, open and green areas are evenly distributed in the city. The linear form has been gained in the green corridor in streams and valleys. Green corridors are clearly visible in Vienna and Copenhagen.

-To summarize the open and green spaces of cities, the amount of open and green spaces in Auckland in New Zealand is more than half of the city. Considering its open and green areas, it is noteworthy that it is homogeneously distributed in the city. Many large and small open and green spaces are diversified according to their service capacity. When we look at the city of Vienna, parks are homogeneously distributed in the city center, and larger uses are located on the peripheries of the city. On the other hand, the city of Zurich saw the coastal areas as a potential and put recreational activities in these areas. However, it does not have a continuous design. On the other hand, Copenhagen is famous for its green wedge-shaped system and is shown as an example of open and green space systems. The river passing through the city is also included in the open and green area system.

-If we compare the urban livability rankings according to the arithmetic average results, Vienna is 2,5; Zurich 4,5; Auckland 6.3; Copenhagen is 7.3. Although the amount of open and green spaces per capita is low, Zurich is the only city with higher livability compared to other cities.

Table 8. Comparative Analysis Result Hypothesis Testing

CRITERIA	**1.**	**2.**	**3.**	**4.**
Liveability Ranking Arithmetic Averages *(Out of 10)*	Vienna	Zurich	Auckland	Copenhagen
	2,5	4,5	6,3	7,3
Amount of Open and Green Area *(km^2)*	Auckland	Vienna	Copenhagen	Zurich
	591	114	25	10
Amount of Open and Green Areas Per Capita *(m^2)*	Auckland	Vienna	Copenhagen	Zurich
	357	60	42	25
Location Coefficient *(Ratio of open and green area area to total area)*	Auckland	Copenhagen	Vienna	Zurich
	0.55	0.47	0.27	0.11

In Table 8, to test the hypothesis, it is seen that the four cities, whose arithmetic averages are taken, and their urban livability is ranked, are mostly directly proportional to the location coefficient. However, it can be said that there is no one-to-one direct relationship, that affects it indirectly. The reasons for these can be explained as follows:

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- Indicators are also affected by various factors. It does not only cover open and green areas. Economical such as labour, housing rents; Ranking effect score is low because it includes social issues such as education level. When different criteria come into play or the percentages of these criteria change, there may be some changes in the results.

- The four cities are not the same size and have the same population. The problems brought about by the population and the size of the city affect urban livability.

- While the amount of active green areas in the city centre is low, different results emerge in the per capita calculation when passive and large open and green areas such as forest areas enter the city limits. When making comparisons, it can give wrong results because the forest areas around the city are not included in other cities.

CONCLUSIONS AND RECOMMENDATIONS

As a result of the literature research, it has been seen that the need for open and green spaces is increasing day by day due to dense construction, unplanned growth, and rapid population growth. Moreover, open and green areas are gradually decreasing due to construction pressure. This decrease negatively affects cities both environmentally and socially. As a result, livability in cities is decreasing.

Although livability does not have a clear definition, it does not give precise results when measuring. Because the measurement method may vary according to the researcher and the criteria used in the measurement, this study has tried to include institutions that conduct more than one livability research to reach the most accurate result. Considering the criteria of each research, open and green spaces are in the lower step of the environmental category. The amount of green space per capita directly affects urban livability. To embody four cities selected in the livability rankings are discussed. It has been observed that the amount of open and green areas in these cities is high. For example, Auckland's amount of open and green space in New Zealand is more than half of the city. When we look at its open and green spaces, it is remarkable that it is homogeneously distributed in the urban. All sizes open and green areas are diversified according to their service capacity. When we look at the city of Vienna, parks are homogeneously distributed in the city center, and more extensive uses are located on the peripheries of the city. On the other hand, Zurich saw the coastal areas as potential and placed recreational activities. Copenhagen is a city that is famous for its 'green finger' plan, which is shown as an example of open and green space systems.

As it is known, open and green spaces have many functions. These functions can have different derivatives in different sources or be grouped into five in general. Economic, ecological, aesthetic, social-psychological, and physical functions benefit the city and its inhabitants. As a result of the research in the literature, it has been seen that when

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open and green areas are planned systematically, these functions are more effective than the sum.

The open and green space systems that have been discussed in the literature so far are those that are considered as urban; green belt, green wedge, green formal/mesh, green heart and green road/corridor. The common purpose of these systems is to solve the open and green space problem in cities and to shape the urban macro form. These systems can be summarized as follows:

- While the green belt acts as a buffer, the green road/corridor acts as a router.
- The green wedge has developed with the star city form. Open and green spaces extend hierarchically from rural to urban areas.
- The green heart can be applied between cities and the city centre.
- The green road/corridor acts as a connector. It ensures the continuity of open and green spaces with each other.

There are many open and green space systems. Even though these systems diversify within themselves, they need new approaches at some points. At this point, based on the results of this thesis, suggestions for open green space systems have been developed. It is thought that this system proposal, which includes parts of the green belt, green wedge, green road and green heart systems, will bring a new perspective to urban open and green spaces.

However, systems also need new approaches at some points. That is why they need variety. At this point, a hypothetical open green space system is proposed in this study (Figure 6).

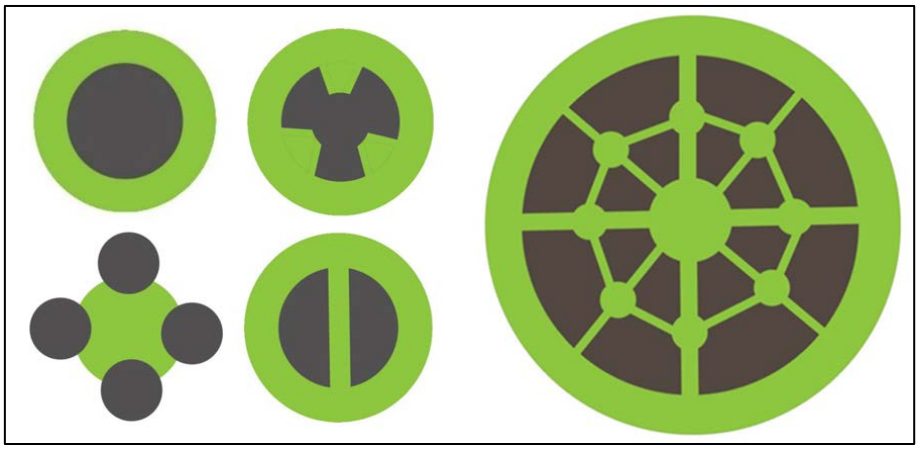

Figure 6. Open and Green Field System Recommendation

This system can remind of a spider net. There is a city park downtown. The open and green space with the transportation axes is integrated into the radial macro form. It does not always have to be a transport link. It can also be adapted if a water surface passes through the city or in places with coastlines. There are pedestrian connections. At intersections, there can be public spaces or neighbourhood parks. A green belt prevents the

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city from developing unformed and acts as a buffer (Figure 6). In the downtown, there is a reduced-scale central park. There are structures such as municipal service areas, city centre business areas, and public buildings around this park. All roads in the city form a green corridor with boulevards and descend from the edge to the centre. Integrating with pedestrian roads, transportation axes, road afforestation, and linear parks has been implemented. Active and public medium-sized open and green spaces are located at the intersection points of the proposed green roads in each neighbourhood.

This suggestion is purely hypothetical. It is an adaptable system proposal even if it is applied to real life, even if property, urban policies, cost, topography, and many more problems are encountered. It can be applied in medium-sized cities with the themes of sustainability and ecology. This proposal system design aims to increase access to open and green spaces. While doing this, open and green space hierarchy was considered, and open and green spaces were diversified. While determining the types of open and green areas, they must be public and active spaces.

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Resume

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