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An Evaluation in Terms of Native Woody Taxa with Threatened Status and Conservation Strategies in the Flora of Hatay Province

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ABSTRACT

Cities started to form the settlement of human beings. There is intense pressure on natural resources due to the increasing urbanization in recent years. The natural vegetation that forms in the area where it is located without any human-induced effects is in danger of extinction due to unconscious and overuse. In this context, with climate change emerging all over the world, environmental pollution threatens biodiversity at a national, regional, and urban scale. However, the genetic resources of countries are of international importance. Turkey flora of the location, topography, has a high level of biodiversity due to climatic differences, etc. natural factors. Likewise, the flora of Hatay province has a high level of floristic diversity, especially with the contribution of the Amanos Mountains; Many herbaceous and woody taxa are natural or endemic. Preservation of biodiversity is as important as its existence. In this context; Conservation strategies based on the conservation of the species or population in (in situ) and outside (ex-situ) of its location are accepted. With this study, the native woody species found in the flora of Hatay province were determined based on the "Flora of Turkey" work of Davis (1965-1986); The threatened status of these species has been determined by taking into account IUCN data. Accordingly, it was determined that 13 taxa belonging to 11 families in the flora of Hatay province have threatened status at NT (1), VU (1), LC (9), DD (2) levels. As a result, Hatay province has been accepted as a part of the urban green areas conservation strategies to protect these species. It has been demonstrated that if it is organized as areas with an important potential in the protection of biodiversity, it will contribute to the city scale.

Anahtar Kelimeler:
Biyoçeşitlilik,
Koruma stratejisi,
Doğal bitki örtüsü,
Hatay.

ÖZ

İnsanoğlunun yerleşik düzene geçmesiyle birlikte kentler oluşmaya başlamıştır. Son yıllarda da artışı devam eden kentleşme nedeniyle doğal kaynaklar üzerinde yoğun bir baskı görülmektedir. Bulunduğu alanda insan kaynaklı hiçbir etki olmadan oluşan doğal bitki örtüsü de bilinçsiz ve aşırı kullanım nedeniyle yok olma tehlikesiyle karşı karşıyadır. Bu kapsamda tüm dünyada ortaya çıkan iklim değişikliği ile birlikte çevresel kirlilikler ülkesel, bölgesel ve kentsel ölçekte biyoçeşitliliği tehdit etmektedir. Oysa, ülkelerin genetik kaynakları uluslararası düzeyde öneme sahiptir. Türkiye florası da konumu, topoğrafyası, iklimsel farklılıklar vb doğal etmenler nedeniyle yüksek düzeyde biyoçeşitliliğe sahiptir. Aynı şekilde Hatay ili florası özellikle Amanos Dağları'nın katkısıyla yüksek düzeyde floristik çeşitliliğe sahip olup; otsu ve odunsu pek çok takson doğal ya da endemiktir. Biyoçeşitliliğin varlığı kadar korunması da önemlidir. Bu kapsamda tür ya da populasyonun bulunduğu yerde (in situ) ve bulunduğu yer dışında (ex situ) korunmasını esas alan koruma stratejileri kabul görmektedir. Bu çalışma ile Hatay ili florasında bulunan doğal odunsu türler Davis (1965-1986)'in "Flora of Turkey" eseri temel alınarak belirlenmiş; bu türlerin tehlike statüleri IUCN verileri göz önünde bulundurularak ortaya konulmuştur. Buna göre Hatay ili florasında bulunan 11 familyaya ait 13 taksonun NT (1), VU (1), LC (9), DD (2) düzeylerinde

tehlike statüsüne sahip olduğu belirlenmiştir. Sonuç olarak bu türlerin korunması amacıyla Hatay ili kentsel yeşil alanları koruma stratejilerinin bir parçası kabul edilmiştir. Biyoçeşitliliğin korunmasında önemli bir potansiyele sahip alanlar olarak düzenlenmesi halinde kent ölçeğinde katkı sağlayacağı ortaya konulmuştur.

1. Introduction

Cities started to form with the settlement of human beings. Due to the rapidly increasing urbanization in recent years, intense pressure has been faced on natural resources. This situation has caused the deterioration of natural balance, environmental problems, and threats in the biological life chain. An increase in water and energy consumption, an increase in carbon emissions, and greenhouse gas emissions, and the resulting climate change resulted in the reduction of natural resources and loss of their qualities [1-5]. In the 21st century, the environmental effects resulting from climate change, which made itself felt more particularly at the regional scale, caused the natural plant population to decrease [6]. Plants have many important roles in the ecosystem. These are climate regulation, carbon dioxide absorption, purification of water and air, being a food source, building material and providing fuel, etc. can be counted as. However, plants face human-induced threats such as habitat degradation, invasive species, resource overuse, and climate change [7]. In this context, the natural vegetation that is exposed to anthropogenic effect at a very high level should be recognized, monitored, and taken under protection. For example, the Mediterranean vegetation has been severely damaged by various civilizations throughout the ages [1].

Threats to biodiversity continue to increase around the world [8,9]. Ekim et al. (2000) stated that According to the IUCN categories of 181 species in Turkey "critically -CR", 843 species "endangered-EN", also 13 plant species "extinction- EX". It has been revealed that it has status of 1457 species are "vulnerable-VU", 470 species "conservation depend-CD", 347 species are "near threatened-NT", 769 species are "least concern-LC", 514 species are "data deficient-DD" [2]. This case is very high in terms of flora biodiversity is an indication of how important the presence of Turkey's protected areas.

According to the IUCN, for an area to gain a protection status, it must bear some protection goals (conservation of genetic diversity and species, maintaining the contribution to improving environmental conditions, sustainable use of natural resources, maintaining cultural and traditional symbolic remains, etc.). These goals are aimed at eliminating or reducing human-induced negativity on natural habitats. The destruction or alteration of habitats causes species to face extinction [2]. Although there is a protected area understanding in our country that dates back to the 1970s, the "protected area" policy and management understanding has still not been in line with developed country standards [10]. According to Plachter (1991), nature conservation duties include the protection of the existence of all species, protection of biotopes, and protection of natural resources such as water, soil, and air as part of the ecosystem. However, the main goal is to protect nature completely [11].

The World Conservation Strategy 4, which was introduced in 1981, was prepared by the conservation organization (IUCN, FAO, WWF, UNEP). The main goals of the strategy are; Conservation of systems that support life, conservation of genetic diversity, and balancing the use of species and ecosystems. The strategy that supports the conservation of rare species first includes regulations for the conservation of species and varieties. In this context, it is aimed to determine and classify protected areas or species/species to be protected and to put forward the appropriate protection strategy. For this purpose, individuals or communities to be protected are protected with 2 basic strategies, which prevent processes and effects that may disrupt the living space in their location. Within the scope of these strategies, species or populations are taken under protection in their habitats (in situ) or in areas where suitable habitats are created (ex-situ) by moving from where they are located [2,8,9,12]. Ex-situ conservation strategy, which is based on the protection of plant species outside of their natural habitats, is generally considered appropriate for species that are endangered or have this potential. In this context, it is known that seeds, tissues, cells, or DNA materials of many plants are under protection in approximately 1750 gene banks in the world. In situ conservation is considered important for the protection of ecosystems and natural habitats, and therefore natural species [12]. Plants are protected by ex-situ method in botanical gardens and arboretums with tree collections, which are thought to have a very important role in preserving biodiversity in the future. It is known that the endangered species among approximately 105 000 species are protected in this way [7-9].

Although the in situ conservation strategy is accepted as the best method for the protection of habitats, it is not completely sufficient for the protection of natural species. It is known that its use together with an ex-situ conservation

strategy gives better results, especially in the conservation of rare and endangered species. The reason for this is that ex-situ protection is provided at the taxon level. Suitable living space is created for the plant and the production of the plant is provided. The size and density of the population are kept under control; plants are provided to be healthy. In another way, seeds are stored in the seed bank. It is an effective method in protecting natural populations. Within the scope of ex-situ protection, by producing with seeds and cuttings; In addition to transporting the plant to a physically safe area, the continuity of the species is also ensured by freezing pollen and tissues in liquid nitrogen [13]. In situ conservation strategy is used to protect many populations; However, it is predicted that it would be more appropriate to support it with ex situ conservation strategies since it is not sufficient alone. In this context, seed banks are very valuable as they contribute to the protection of high amounts of plants in a small area. Because it will contribute to obtaining valuable materials for future habitat restoration programs. Besides, seed banks are accepted as they allow sharing on a global scale [6].

2. Conservation Strategies

In-Situ Strategy

In-situ conservation strategy is the conservation of species in their natural habitats or ecosystems. However, since natural areas face many different threats, protection may not be easy here. Development, determination, and management of these areas are important issues. In this context, it is necessary to fight especially invasive species [14]. According to data from Turkey in 2019 a total of 3.5364.898 hectares are located within the Ministry of Agriculture and Forestry in 1633 protected areas (Table 1). These areas are; "Nature Park", "Nature Monument", "Nature Reserve", "Wildlife Development Area", "Wetland", "Gene Protection Forest", "Urban Forest", "Seed Gardens", "Seed Stands", "Conservation Forests ”and“ National Park ”status. Some of these are discussed in detail below.

Table 1. According to the 2019 data of the protected areas in Turkey [15]

	Nature Park	**Nature Monument**	**Nature Protection Area**	**Wildlife Development Area**	**Wetland**	**Gene Protection Forests**	**Urban Forest**	**Seed Gardens**	**Seed Stands**	**Conservation Forests**	**National Park***
Number (pieces)	247	116	30	82	82	325	134	202	315	55	45
Covered Area (ha)	106.836	9.389	46.726	1.159.480	998.794	43.016	10.198	1.471	41.567	251.493	895.928

*Hakkari Cilo and Sat Mountains National Park wss added in September 2020

National Park: National parks are scientifically and aesthetically important internationally and nationally important, rare natural and cultural resource values, as well as protected areas for recreation and tourism. Those under protection in terms of natural plant communities owned by National Parks are also in Turkey. Some of those; Yozgat Çamlığı National Park, Karatepe-Aslantaş N.P., Soğuksu N.P., Uludağ N.P., Dilek Peninsula N.P., Spil Mountain N.P., Honaz Mountain N.P. It is also known that species endangered at various levels are protected in these areas [11]. Some examples of this are given. *Taxus baccata* protected in the LC category according to IUCN criteria in the Yedigöller National Park located in the province of Zonguldak; There are natural forests of *Cedrus libani*, which are endangered and protected in the VU category according to IUCN criteria, in Kızıldağ National Park located within the borders of Isparta province. *C.libani* also creates pure forests in the Beydağları Coastal National Park located in Antalya province. *Ostrya carpinifolia*, which is protected in the LC category according to IUCN criteria in Uludağ National Park located in the province of Bursa, forms mixed forests with some other species. *Quercus coccifera* and *Nerium oleander*, which are protected in the LC category according to IUCN criteria, have a wide distribution in Marmaris National Park, located in the province of Muğla. In Küre Mountains National Park, *O. carpinifolia* and *Taxus baccata*, and *Buxus sempervirens*, which are protected in the LC category according to IUCN criteria, show distribution [11, 16].

Ex- Situ Strategy

The material collected in ex situ conservation methods must be stored and stored outside the natural habitat (seed bank, living collections, etc.). It was preferred more in the 1970-1980s [6].

Botanical Garden / Arboretum: Botanical gardens are defined as the place where plants are found for scientific research, protection, education, and exhibition. However, in 2018, BGCI updated the definition of the botanical garden, declaring that it should have the feature of "protecting rare and threatened plants, complying with international policies and emphasizing ethical initiatives". The first botanical garden was the "Pisa University Botanical Garden" designed by Luca Ghini in 1543. Botanical gardens of this period generally serve the purpose of academic studies on medicinal plants. Later, it was started to be established in universities, especially within the pharmacy faculties. In the 17th century, plant production was started in botanical gardens, in other words, the continuity of the species began. There are botanical gardens established by municipalities and individuals in the 19th and 20th centuries. In this process, botanical gardens gain a conservation-oriented structure and support the in-situ conservation strategy [14]. Arboretums are protected areas with woody (tree and shrub) plant collections [9]. There are 1775 botanical gardens and arboretums in 148 countries all over the world [14]. Botanical gardens and arboretums in Turkey, mostly government agencies, universities, were founded by foundations and individuals. Istanbul University includes a Seed Bank within the Alfred Heilborn Botanical Garden, Ege University Botanical Garden, Çukurova University Ali Nihat Gökyiğit Botanical Garden, Eskişehir Anadolu University Botanical Garden, Balıkesir University Botanical Garden, Süleyman Demirel Botanical Garden, Ata Botanical Garden, Karaca Arboretum, Atatürk Arboretum, Muğla Yunus Emre Arboretum are important ex-situ conservation areas in our country. Özçelik et al. [17] reported that there are a total of 800 plant species, including herbaceous and woody, in the Süleyman Demirel Botanical Garden, which was established on an area of 260 da. Satıl et al. [18] reported that there are 216 taxa in Balıkesir University Botanical Garden established in an area of 190 da. Among them is *Cedrus libani*.

Gene / Seed Bank: In Turkey, as in the world has contributed to ensuring the continuity of the species faced with the threat of disappearence. It contributes to research and development studies on these species and to raising awareness on the sustainability of plant resources [14]. In ex situ conservation methods, the material collected for genetic diversity is stored or produced outside of its natural habitat. In the seed banks, seeds are stored under certain cold-dry conditions. It is preferred because it is economical in terms of area, low maintenance cost, and it is protected from external factors [6]. When the conservation strategies of plant resources are evaluated in terms of both in-situ and ex-situ conservation; It is known that both strategies alone may not be sufficient. For example, one of the conservation methods such as Gene Bank, Plant Gardens, National Parks, etc. alone does not solve this problem. Important species or species within the borders of the National Park can be exposed to a wide variety of effects; comprehensive protection is not possible [2]. For this reason, in-situ and ex-situ conservation strategies should be designed to complement and strengthen each other. For this purpose, botanical gardens make an important contribution to integrated plant protection as they are areas with the ability to identify, reproduce, and grow plant species [14].

This study aims to determine the taxa that have a danger status among the woody species found naturally in the flora of Hatay province and to evaluate the potential of Hatay province for the protection of these species. The contribution of the urban green areas of the city of Hatay to the protection of biodiversity was evaluated with the study. It is thought that this study will guide the works of local administration and public institutions on this issue.

3. Result and Discussion

Natural woody taxa found in the flora of Hatay province; It was determined based on "Flora of Turkey" prepared by Davis (1964-1980) [19]. These taxa and their theatened status are in Table 2; Information about protection forms of the populations belonging to taxa, threat factors, threats are given in Table 3. In this context, 13 natural woody taxa with danger status were identified in the flora of Hatay province. 2 of these taxa are open seeds and 11 are angiosperms. At the same time, 7 of them develop in tree form and 6 in bush form. These taxa should be under protection in different statuses according to IUCN standards. The most striking taxa with its status are *Abies cilicica* subsp. *cilicica* (NT) and *Cedrus libani* (VU). The populations of both taxa tend to decrease. It is predicted that they faced very intense destruction due to the precious nature of their wood. *Abies cilicica* subsp. *cilicica*, cutting its wood for different purposes, eating seedlings and young shoots by goats, plateau tourism, diseases and sudden deaths due to extreme temperatures in the summer are the most important factors in the decline of the population. Also, forest fires are an important factor in this destruction. The fire risk is very high in the region due to the extreme temperatures in the

summer. *Cedrus libani*, recreational activities (winter sports etc.), plateau tourism, eating of seedlings, and young shoots by goats, drought, plant diseases are important measures. When all other taxa are considered, only *Taxus baccata* populations tend to increase. When the protection forms are evaluated, it is seen that most of them are taken under ex-situ protection.

Table 2. Nature woody taxa with hreatened status in the flora of Hatay province [16, 19].

Latin Name	**Threatened Status ***	**Latin Name**	**Threatened Status ***
Abies cilicica subsp. *cilicica*	NT	*Buxus sempervirens*	LC
Cedrus libani	VU	*Quercus coccifera*	LC
Taxus baccata	LC	*Ostrya carpinifolia*	LC
Prunus laurocerasus	LC	*Populus alba*	LC
Sorbus domestica	LC	*Ulmus glabra*	DD
Styrax officinalis	LC	*Vitex agnus-castus*	DD
Nerium oleander	LC		

*NT: Near Threatened; VU: Vulnerable; LC: Least Concern; DD: Data Deficient

Table 3. Protection styles of populations; threat factors; Information on threats [16]

Latin Name	**Population Status**	**Threats**	**Threat Statements**	**Conservation Format**	**Some Protected Areas**
Abies cilicica subsp. *cilicica*	Decrease	Recreational activities, tourism activities, forestry activities, fire, drought, change in habitat	Cutting wood for different purposes, eating seedlings and young shoots by goats, plateau tourism, diseases and sudden deaths due to extreme temperatures in the summer are other important threats.	Ex-Situ In-Situ	National Park, Nature Reserve, Nature Reserve
Cedrus libani	Decrease	Recreational activities, tourism activities, forestry activities, drought, urban and industrial development, military exercises, war, animal husbandry, plant diseases	Droughts caused by winter sports and the damage caused by goats and climate change are important measures.	Ex-Situ In-Situ	World Heritage Site, National Nature Reserves, Gene Banks

Taxus baccata	Increase	Collection of the plant, forestry activities	It is affected by changes in forest management.	Ex-Situ In-Situ	In European countries, it is under protection in National Parks and Botanical Gardens Collections within the scope of EU Habitats Directive.
Prunus laurocerasus	Stabile	Non-wood use, livestock, fire, dam construction	Increase in agricultural activities and changes in the water regime are important threats.	Ex-Situ In-Situ	Strict Nature Reserve, Gene Banks, Botanical Garden Collections
Sorbus domestica	No data	Forestry activities	Human-induced degradation, silviculture practices and changes in habitat also threaten the existence of the species.	Ex-Situ	Collections in Botanical Garden and Arboretum.
Styrax officinalis	Stabile	There is no information available.	-	Ex-Situ	Collections in Botanical Garden and Arboretum.
Nerium oleander	No data	There is no information available.	-	-	-
Vitex agnus-castus	No data	Hunting activity	The plant is considered to be threatened, provided that it is collected from nature.	Ex-situ In-Situ	Natura 2000 sites, Botanical Gardens, Arboretums.
Buxus sempervirens	Stabile	Livestock activity	It is threatened by fungal diseases, increases in grazing land in livestock, use of wood, increase in ornamental value, drought.	Ex-situ In-Situ	Gene Banks, Natura 2000 sites, Areas covered by the EU Habitats Directive, Botanical Gardens, Arboretums.
Ulmus glabra	No data	Residential areas, wood cutting	Disease-causing pathogens, habitat loss due to urbanization, hybridization in nature	Ex-situ In-Situ	Gene Banks, Areas covered by the EU Habitats Directive, National Parks, Botanical Gardens, Arboretums
Quercus coccifera	Stabile	Agriculture and fisheries, livestock farms, fire	Human-induced activities, fires	Ex-situ	Collections in Botanical Garden and Arboretum.
Ostrya carpinifolia	No data	unknown	-	-	-

Populus alba	Decrease	Urban-industrial development, agriculture-fishing, forestry activities, dam construction, pressures on natural ecosystems, diseases	Although it has a high self-renewal feature, it is adversely affected by the flow pattern of the water.	In-situ	Areas covered by the EU Habitats Directive, Natura 2000 sites.

According to the data of 2019, information on protected areas in Hatay province is shown in Table 4. When the information on protected areas is evaluated in terms of the province of Hatay; It is seen that there are areas with all statuses except "National Park" and "Conservation Forests". Both flora and fauna members are taken under protection in all these areas. When the conservation strategies are evaluated based on species, it is seen that the in-situ conservation strategy is applied in these areas. In particular, the "Gene Protection Forest" belonging to the species *Cedrus libani*, whose conservation status is "VU", draws attention. When evaluated based on the area, Natural Parks, Onat Plane Nature Monument, Nature Conservation Areas, Wetlands, Urban Forests are protected natural structure; In other words, it appears as areas where many natural plant species are taken under protection. For this reason, it is possible to say that there is a conservation approach in both species and area scale in Hatay province, which is very rich in terms of biological diversity. When evaluated on the basis of species, it was determined that some other natural woody species (*Buxus balearica*, *Pinus brutia*, *P. nigra*, and *Fagus orientalis*) were also taken under protection in Gene Protection Forests, Seed Gardens and Seed Stands in Hatay province.

Hatay native woody taxa located in the flora also Forest Management Directorate in different regions depends on Turkey, the Forest District Office / Chief owned areas (seed stands, seed garden, gene conservation forest) is protected (Table 5). The protected taxa are *Abies cilicica*, *Cedrus libani*, *Sorbus domestica*, *Taxus baccata*, *Ulmus glabra*, *Quercus coccifera*, and *Ostrya carpinifolia*.

Table 4. Information on protected areas in Hatay province according to 2019 data [15]

Conservation Status	**Protected Areas in Hatay Province**		
	Name	**Covered Area (ha)**	**Establishing and listing Date**
Nature Park	Belen Geçidi Nature Park	44.71	09.04.2014
	Şahin Tepesi Nature Park	90.70	15.05.2018
Nature Monument	Hassa Lav Tüpü Caves	1.189	26.09.2019
	Onat Çınarı Nature Monument	0.10	06.05.2003
Nature Protection Area	Habib-i Neccar Nature Protection Area	119.26	31.12.1993
	Tekkoz-Kengerlidüz Nature Protection Area	182.23	29.05.1987
Wildlife Development Area	Hatay Altınözü Wildlife Development Area	13.565	16.10.2005
	Hatay Mountain Gazelle Wildlife Development Area	13.288	25.12.2019
	Hatay-İskenderun-Arsuz Wildlife Development Area	26.076	5.10.2006
Wetland	Gölbaşı Lake	792	19.04.2017
Gene Protection Forests	*Buxus balearica* Forest	6.20	2002
	Cedrus libani Forest	160.9	2002
Urban Forest	Kırıkhan Urban Forest	106.10	04.05.2015
	Yayladağı Urban Forest	34	29.01.2016
Seed Gardens	Antakya-Serinyol (*Pinus brutia*)	3.60	1977
	Antakya-Kırıkhan (*Pinus brutia*)	4.60	2004

	Antakya-Kırıkhan (*Pinus brutia*)	1.70	2004
Seed Stands	İskenderun-Arsuz (*Pinus brutia*)	125.50	1970
	Antakya-Yayladağı (*Pinus brutia*)	110.30	1973
	İskenderun-Uluçınar (*Pinus nigra*)	129.00	1991
	Dörtyol-Ufacık (*Fagus orientalis*)	70.90	2014
Conservation Forests	Not available.		
National Park	Not available.		

Table 5. Species in the flora of Hatay province and in the conservation areas affiliated to Regional Forestry Directorates and their protection status [15]

Conservation Status	Plant Name	Forest Regional Directorate	Forest Management Directorate / Chief	Publication / Registration Date	Area (ha)
Seed Stand	*Cedrus libani*	Muğla	Fethiye-Çaldağ	1989	301.20
		Eskişehir	Afyonkarahisar-Sultandağı	1984	112.60
		Konya	Ermenek-Kazancı	1986	65.20
			Ermenek-Laçin	1986	45.80
		Antalya	Kaş-Karaçay	1975	152.80
			Elmalı-Çığlıkara	1984	104.20
			Kumluca-Söğütcuma	1984	221.00
			Finike-Aykırıçay	1984	77.00
			Kumluca-Akdağ	1987	121.50
			Kaş-Gömbe	1997	362.30
		Isparta	Eğirdir-Yukarıgökdere	1976	156.00
			Isparta-Kızıldağ Milli Parkı	1984	225.00
			Isparta-Kızıldağ Milli Parkı	1984	55.00
			Isparta-Senirkent	1984	314.00
			Gölhisar-Dirmil	1986	41.30
		Adana	Pozantı-Körkün	1987	173.80
		Mersin	Mersin-Arslanköy	1981	72.00
			Bozyazı-Kozağacı	1981	81.90
			Anamur-Abanoz	1992	242.80
		Kahramanmaraş	Andırın-Elmadağ	1972	109.70
		Amasya	Erbaa-Çatalan	1972	283.60
	Abies cilicica	Antalya	Akseki-Yarpuz	1984	180.50
		Isparta	Bucak-Uğurlu	1981	127.60
Seed Garden	*Sorbus domestica*	Balıkesir	Balıkesir-Ilıca	2018	1.30
	Cedrus libani	Denizli	Çal-Çardak	1995	2.80
		Muğla	Seydikemer-Akçay	1990	8.60
		Isparta	Dinar-Dinar	1991	7.20
		Eskişehir	Eskişehir-İnönü	1990	8.50
			Eskişehir-Kırka	2005	4.60
		Antalya	Akseki-İbradi	1990	12.50
		Mersin	Mut-Mut	1990	7.20
		Kahramanmaraş	Kahramanmaraş-Elmalar	1995	2.70

Gene Conservation Forest	*Taxus baccata*	İstanbul	Demirköy-Kurudere	2010	121.50
		Denizli	Acıpayam-Alcı	2019	4.90
		Eskişehir	Afyonkarahisar-Sultandağı	2015	36.30
		Adana	Kadirli-Bağdaş	2019	2.90
		Zonguldak	Dirgine-Aksu	2019	10.80
			Bartın-Gölderesi	2019	41.90
	Cedrus libani	Denizli	Tavas-Konak	2000	283.50
		Muğla	Dalaman-Kavacık	1999	321.10
		Konya	Beyşehir-Beyşehir	1993	12.60
			Karaman-Ereğli	2006	24.20
		Antalya	Finike-Aykırıçay	1998	117.90
			Elmalı-Çığlıkara	2016	82.70
			Elmalı-Çığlıkara	2016	60.20
		Isparta	Gölhisar-Dirmil	1999	164.10
			Bucak-Karlık	1999	122.90
		Adana	Feke-Maran	1998	78.60
			Feke-Aytepesi	1998	136.90
			Feke-Mansurlu	1998	117.80
			Saimbeyli-Ayvacık	1998	177.40
		Mersin	Mut-Dağpazarı	1998	193.50
			Mut-Çamlıca	1998	97.90
			Anamur-Kesmece	1998	105.80
			Anamur-Abanoz	1998	148.40
		Hatay	Antakya-Hassa	2002	160.90
		Kayseri	Kayseri-Sarız	2019	113.00
		Amasya	Niksar-Köklüce	1991	54.20
			Erbaa-Çatalan	2014	148.10
	Ulmus glabra	Adana	Adana-Ceyhan	2007	11.20
	Abies cilicica	Adana	Saimbeyli-Ayvacık	2014	135.80
		Mersin	Tarsus-Cehennemdere	1996	70.10
		Kahramanmaraş	Onikişubat-Başkonuş	2012	81.90
		Antalya	Akseki-Akseki	2011	41.60
		Kahramanmaraş	Kahramanmaraş-Hartlap	2014	67.50
			Andırın-Akifiye	2016	167.60
		Kayseri	Kayseri-Tomarza	2016	89.70
	Quercus coccifera	Denizli	Çameli-Yaylacık	2012	53.70
	Ostrya carpinifolia	Antalya	Finike-Demre	2014	226.30
		Kahramanmaraş	Kahramanmaraş-Hartlap	2014	130.40
		Zonguldak	Yenice-Kavaklı	2010	52.80
		Kastamonu	Cide-Şehdağ	1999	52.00

4. Conclusion and Suggestions

The study was carried out to determine the natural woody species and their conservation status in the province of Hatay, whose flora is very rich in biodiversity. As a result, a total of 13 woody taxa that grow naturally in the provincial borders of Hatay and have various levels of threatened status were determined. These taxa develop in tree and shrub form. In the protection of these taxa in the flora of Hatay province, it is seen that an in-situ conservation strategy is applied. Also, these taxa are protected by an ex-situ conservation strategy in various scopes within the Ministry of Agriculture and Forestry. For this purpose, recommendations have been made on the following issues:

* By establishing a Botanical Garden or Arboretum in the province of Hatay; taxa both naturally occurring and must be taken under protection should be established in the city's flora and collections of examples of Turkey and the world.

* The parks within the municipality boundaries should be planned as a botanical garden or arboretum as a whole.

* The campus areas of Iskenderun Technical University and Hatay Mustafa Kemal University, which are universities in the province of Hatay, should be designed as Botanical Garden or Arboretum due to the green space they provide to the city. For this purpose, campus plants should be determined; Attention should be paid to the presence of collections of taxa with various levels of protection status in the flora of Hatay province.

* In green belt studies to be carried out in the province of Hatay, the use of woody taxa that are naturally found in the urban flora and need to be protected should be planned together with other species.

Competing Interest / Conflict of Interest

The authors declare that they no conflict of interest. The none of the authors have any competing interests in the manuscript.

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Identifying Leisure Perceptions and Activities of EFL Teachers in Home Isolation during the Covid-19 Pandemic

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ABSTRACT

This study explores the thoughts and perceptions of EFL teachers in Turkey on leisure activities during the Coronavirus pandemic, the frequency of their participation in such activities and how their characteristics influence these perceptions. For this purpose, an online questionnaire was filled by a total of 939 EFL teachers working in primary, intermediate and high schools across Turkey. The majority of the EFL teachers are female (85.4%), married (67.8%), middle-aged (68.3%), and have a child or more (59.7%). Most of them hold bachelor's degrees (89.9%) and have 0-20 years of teaching experience (90.8%). EFL teachers' perception was generally positive during the stay-at-home or isolation. Many claimed that as the stay-at-home has increased their leisure activities. Some stated that such activities were a must during the lockdown. Others declared that the lockdown has helped their personal development, and that such leisure time has impacted their family relationships. Moreover, the abundance of free time was "a good opportunity to rest" for the majority, "It is a good opportunity for hobbies" and "It is a good opportunity to participate in social, cultural and professional events" for different groups that participated in the questionnaire. The study revealed that teachers frequently spent time on social networks, kept up to date with the news regularly, watched movies/TV series, listened to music and read books. The answers revealed that the least oft-mentioned leisure activities are online festivals and exhibitions, playing instruments, online hobby courses, online theatres, and knitting. Older, experienced and married and female EFL teachers with children mostly spent more time with their kids and cared for their plants. The study concludes by recommending courses on free-time management and online PD activities for the teachers. Additionally, it advises that pursuing postgraduate education should be incentivized through workplace policies.

Anahtar Kelimeler:
Covid-19,
İngilizce Öğretmeni,
Boş Zaman Aktivitesi,
Algı,
Türkiye.

ÖZ

Bu çalışma, Türkiye'deki İngilizce öğretmenlerinin Koronavirüs salgını sırasındaki boş zaman etkinlikleri hakkındaki düşüncelerini ve algılarını, bu tür etkinliklere katılma sıklığını ve özelliklerinin bu algıları nasıl etkilediğini araştırmaktadır. Bu amaçla, Türkiye genelinde ilkokul, ortaokul ve liselerde görev yapan toplam 939 İngilizce öğretmeni tarafından çevrimiçi bir anket doldurduldu. İngilizce öğretmenlerinin çoğunluğu kadın (% 85,4), evli (% 67,8), orta yaşlı (% 68,3) ve bir veya daha fazla çocuğu var (% 59,7). Çoğu lisans derecesine (% 89,9) ve 0-20 yıllık öğretmenlik deneyimine (% 90,8) sahiptir. EFL öğretmenlerinin evde

kalma veya izolasyon sırasında algısı genellikle olumludur. Birçoğu, evde kalmanın boş zaman aktivitelerini artırdığını iddia etmiştir. Diğerleri, evde kalmanın kişisel gelişimlerine yardımcı olduğunu ve bu tür boş zamanların aile ilişkilerini etkilediğini belirtmiştir. Ayrıca, bos vakit çokluğu, katılımcıların buyuk cogunlugu için 'dinlenmek için iyi bir fırsat', farklı gruplar içinse "Hobiler için iyi bir fırsat" ve "Sosyal, kültürel ve mesleki etkinliklere katılmak için iyi bir fırsat" anlamına gelmektedir. Araştırma, öğretmenlerin sosyal ağlarda sık sık vakit geçirdiğini, haberleri düzenli olarak takip ettiklerini, film/dizi izlediklerini, müzik dinlediklerini ve kitap okuduğunu ortaya koymuştur. Katılımcıların verdiği cevaplar, en az bahsedilen boş zaman etkinliklerinin çevrimiçi festivaller ve sergiler, çalma aletleri, çevrimiçi hobi kursları, çevrimiçi tiyatrolar ve örgü olduğunu ortaya koymuştur. Daha yasca büyük, deneyimli ve evli olan kadın ingilizce öğretmenleri çoğunlukla çocuklarıyla daha fazla zaman geçirmiş ve bitkileri ile ilgilenmişlerdir. Çalışma, öğretmenler için boş zaman yönetimi ve çevrimiçi mesleki gelisim etkinlikleri hakkında kurslar önererek sonuçlanmaktadır. Ayrıca, lisansüstü eğitime devam etmenin işyeri politikaları yoluyla teşvik edilmesi gerektiğini tavsiye etmektedir.

1. Introduction

Coronavirus disease (Covid-19) pandemic, firstly seen in Wuhan, China [1] and declared as a Public Health Emergency of International Concern [2], has posed a very serious threat to many countries across the world. Several countries around the world shut down schools with the purpose of limiting the spread of the Covid-19 virus. On 12 March 2020, Turkey had announced their suspension of face-to-face education in the schools of Ministry of National Education effective from 16 March 2020 [3] as a precautious measure against the spread of the Covid-19, and thus the stay-at-home for teachers like many other people had started.

As the teachers, who enjoy an exalted status in the society, have a stressful job in terms of working conditions, it is very important that they spend their leisure efficiently [4]. An effective management of their leisure increases their work productivity, has positive effects on their health and also the accomplishment of their learners [5]. Furthermore, participation of teachers in a leisure activity increases their happiness, provides a sense of achievement and improves social relationships [6].

Leisure is crucial in pursuing man's fate [7]. It is a free time shaped and occupied based on our own interests and choices. By indulging in leisure activities, people can get motivated, experience new impressions, expand their knowledge, restore their energy, and develop their abilities and interests [8]. In a broad sense, leisure activities are coined as exercise and social activities participated during leisure [9]. Leisure activities can be split into two main categories: active and passive [10]. Passive leisure activities can be considered as the best alternative way by employees required to stay at home during the Covid-19 pandemic.

To date, there are mostly local-scale studies on the participation of different branch teachers in leisure activities but no study on the participation of EFL teachers in passive leisure activities across Turkey. The aim of the current study is to find out (i) the perceptions of EFL teachers in Turkey on stay-at-home and leisure, (ii) the frequency of participation in leisure activities in home isolation, and (iii) the effects of the characteristics of EFL teachers on stay-at-home, leisure perception and leisure activities.

2. Material and Method

The study focuses on EFL teachers working primary, intermediate and high schools in all the provinces across Turkey (Figure 1). The total number of EFL teachers in Turkey is 70,814 [11]. The data are obtained via an online questionnaire. The number of respondents in the questionnaire was 383 with a 5% margin of error based on a heterogenic population and the total number of EFL teachers [12]. However, to get more reliable results, the questionnaire was completed by a total of 939 respondents in the last week of May, 2020 (the lockdown duration was about two months by then).

Figure 1. The location of Turkey

The questionnaire mainly encompasses three sections (stay-at-home, leisure perception and leisure activity). Stay-at-home (SH) includes 16 items with a 3-point Likert scale (disagree, undecided, agree). The 16 items are as follows: (SH1) Stay-at-home increased my working efficiency; (SH2) Stay-at-home positively affected my personal development; (SH3) Stay-at-home positively affected my health; (SH4) Stay-at-home positively affected my family economy; (SH5) Stay-at-home made me feel energetic; (SH6) Stay-at-home has increased my happiness; (SH7) Stay-at-home positively affected my international meetings and projects; (SH8) Stay-at-home positively affected my family relationships; (SH9) Stay-at-home positively affected my social relationships; (SH10) Stay-at-home made me use my time rationally; (SH11) Stay-at-home has increased my leisure; (SH12) Stay-at-home required leisure activity; (SH13) Stay-at-home was enjoyable for me; (SH14) Stay-at-home was beneficial for me; (SH15) I look positively towards the stay-at-home and (SH16) I would like to increase the stay-at-home if possible.

Leisure perception (LP) consists of 7 items with a 3-point Likert scale (disagree, undecided, agree). The 7 items are as follows: (LP1) It is a good opportunity to rest; (LP2) It is a good opportunity for hobbies; (LP3) It is a good opportunity to participate in social, cultural and professional events; (LP4) It is the time when I do not do work; (LP5) It is the rest of the lessons; (LP6) It is the time spent with the family and (LP7) It is the time spent with the friends.

Leisure Activity (LA) contains 28 items with a 5-point Likert scale (never, rarely, sometimes, usually, always). The 28 items are as follows: (LA1) I did sports regularly; (LA2) I followed the news regularly; (LA3) I followed scientific publications regularly; (LA4) I read books; (LA5) I read newspapers; (LA6) I read magazines; (LA7) I listened to

music; (LA8) I listened to radio; (LA9) I played a musical instrument; (LA10) I played chess, etc.; (LA11) I watched movies/TV series; (LA12) I watched documentaries; (LA13) I spent time on social networks; (LA14) I played computer games; (LA15) I attended online professional courses/webinars; (LA16) I attended online hobby courses; (LA17) I was busy with online international projects; (LA18) I attended online foreign language meetings; (LA19) I attended online museum tours; (LA20) I attended online concerts; (LA21) I did online shopping; (LA22) I attended online festival; (LA23) I attended online exhibition; (LA24) I attended online theatre; (LA25) I spent my time with my kids; (LA26) I did knitting; (LA27) I cared for my plants and (LA28) I looked after my pets.

In reliability analysis, the reliability coefficients for stay-at-home, leisure perception and leisure activity are 0.87, 0.63 and 0.80, respectively. Descriptive analysis, t-test, one-way analysis of variance and Duncan test are done. Whether there is a difference between the means of all the characteristics of EFL teachers in terms of stay-at-home and leisure perceptions and leisure activity are evaluated for a significance level of 0.05. All statistical analyses were performed using SPSS (Statistical Package for the Social Sciences) [13].

3. Result and Discussion

The frequencies for the characteristics of EFL teachers are given in Table 1. The vast majority of the respondents are female (85.4%). The number of married and single respondents is 637 and 302, respectively. The ages of respondents vary from 23 to 59 years old, and the middle-aged (31-50) represent the majority (68.3%). EFL teachers mostly have Bachelor's degrees (89.9%). A research [5] conducted on the participation of teachers in leisure activities in Düzce-Turkey showed that 90% of teachers had a bachelor's degrees.

More than half of the respondents have 1 and 2 children (55.9%), and also work in intermediate schools (57.5%). The vast majority of EFL teachers have less than 20 years of teaching experience. The majority of the respondents (90.6%) have a free time over 30 minutes per day. Tok and Balçık [14] stated that teachers in intermediate schools in Denizli, Turkey had 60-120 minutes of leisure duration per day. The majority of EFL teachers (32%) working in secondary schools have 30-60 minutes per day. In this regard, Przepiorka and Blachnio [8] emphasized that stimulation seeking, self-discipline, and hedonistic attitude had a positive correlation with leisure management.

Table 1. Characteristics of EFL teachers (N = 939)

	f	**%**		**f**	**%**
Gender			**Child Status**		
Female	802	85.4	Yes	561	59.7
Male	137	14.6	No	378	40.3
Marital Status			**Number of Children**		
Married	637	67.8	0	378	40.3
Single	302	32.2	1	256	27.3
Age			2	269	28.6
20-30	268	28.5	3	31	3.3
31-50	641	68.3	4	5	0.5
Over 51	30	3.2	**Teaching Experience**		

Education			0-10	466	49.6
Bachelor	844	89.9	11-20	387	41.2
MA	88	9.4	21-30	71	7.6
PhD	7	0.7	Over31	14	1.5
School Type			**Leisure Duration**		
Primary	168	17.9	Under 30 minutes	88	9.4
Secondary	540	57.5	30-60 minutes	317	33.8
High	231	24.6	60-120 minutes	284	30.2
			Over 120 minutes	250	26.6

As considered the mean values of stay-at-home (Table 2), EFL teachers mostly agree on item SH11 (Stay-at-home has increased my leisure), item SH12 (Stay-at-home required leisure activity), item SH2 (Stay-at-home stay positively affected my personal development), and item SH8 (Stay-at-home positively affected my family relationships). Güzel et al. [15] stated that the respondents would do leisure activities as soon as stay-at-home period finishes. On the other hand, they disagreed on items SH7 (Stay-at-home positively affected my international meetings and projects) and SH9 (Stay-at-home positively affected my social relationships). The current study shows that EFL teachers feel undecided about items SH3 (Stay-at-home positively affected my health), SH4 (Stay-at-home positively affected my family economy), SH5 (Stay-at-home made me feel energetic), SH6 (Stay-at-home has increased my happiness), SH8 (Stay-at-home positively affected my family relationships) and SH10 (Stay-at-home made me use my time rationally). In contrast to this result, Güzel et al. [15] reported that the respondents in Turkey were impacted negatively in the context of economic, psychological, social, and physiological, and positively in terms of family relations, happiness, and spending time during home isolation. Wei et al. [16] also found that passive leisure activities such as watching TV and Internet surfing) had a positive effect on happiness.

As seen in Table 2, all the characteristics of EFL teachers apart from education and school type affect items SH11 (Stay-at-home has increased my leisure) and SH12 (Stay-at-home required leisure activity) ($p < 0.05$). Education has an effect on the most items of stay-at-home. Male, married and older EFL teachers with PhD and no child working in primary schools agree on the items of stay-at-home. Although the number of children and teaching experience are impactful on a few items, it is difficult to make a clear decision about which one is more agreeable.

Table 2. Means for the items of stay-at-home (SH) and effects of the characteristics of EFL teachers. G: Gender, A: Age, E: Education, MST: Marital status, CST: Child status, NUC: Number of child, ST: School type, TEX: Teaching experience.

		Probability							
Items	**Mean**	**G**	**A**	**E**	**MST**	**CST**	**NUC**	**ST**	**TEX**
SH1	1.9[a]	0.98	**0.02**	**0.00**	0.15	**0.01**	0.54	0.27	0.58

SH2	2.4	0.23	0.19	0.09	**0.03**	**0.00**	0.06	0.85	**0.02**
SH3	2.1	0.29	0.63	0.23	0.14	0.92	0.90	0.43	0.60
SH4	2.2	**0.04**[b]	0.22	**0.02**	0.55	0.90	0.24	0.59	0.76
SH5	1.6	0.97	**0.03**	**0.00**	0.17	0.54	0.79	0.73	0.29
SH6	1.8	0.89	0.11	**0.01**	**0.00**	**0.02**	0.32	0.79	0.58
SH7	1.5	0.88	**0.01**	**0.00**	0.10	0.11	**0.03**	**0.01**	0.46
SH8	2.4	0.43	0.05	0.36	**0.00**	**0.00**	**0.01**	0.74	0.30
SH9	1.5	0.70	**0.01**	**0.00**	0.81	0.90	0.56	0.85	0.35
SH10	1.9	**0.01**	**0.02**	0.10	0.25	0.51	0.24	0.66	**0.01**
SH11	2.5	**0.00**	**0.00**	0.92	**0.00**	**0.00**	**0.00**	0.29	**0.00**
SH12	2.5	**0.01**	**0.00**	0.97	**0.00**	**0.00**	**0.01**	0.74	**0.01**
SH13	2.2	0.19	0.32	**0.04**	**0.01**	0.93	0.79	0.92	0.73
SH14	2.3	0.47	0.07	0.11	0.28	0.59	0.92	0.58	0.21
SH15	2.1	0.61	0.68	**0.01**	**0.01**	0.53	0.94	0.94	0.89
SH16	1.7	0.81	0.75	**0.00**	**0.02**	0.31	0.60	0.50	0.70

[a]: Higher means indicate that stay-at-home had more efficient. [b]: The related characteristic of EFL teachers had a significant effect on the related item of stay-at-home.

Table 3 shows the mean values of leisure perceptions of EFL teachers. They mostly agree on item LP1 (It is a good opportunity to rest), LP2 (It is a good opportunity for hobbies) and LP3 (It is a good opportunity to participate in social, cultural and professional events). It is found that they are undecided in terms of the other four items.

All the other characteristics of EFL teachers apart from gender and education have an effect on different items (Table 3; $p < 0.05$). Age, child status and number of child affect items LP1 (It is a good opportunity to rest) and LP2 (It is a good opportunity for hobbies). As expected, while older EFL teachers agree more on item LP1 (It is a good opportunity to rest), youngers agree more on item LP2 (It is a good opportunity for hobbies). Marital status, child status and teaching experience are efficient on items LP6 (It is the time spent with the family) and LP7 (It is the time spent with the friends). Married EFL teachers with child and medium teaching experience agree more on items LP6 (It is the time spent with the family) and LP7 (It is the time spent with the friends). On the other hand, EFL teachers with no or few children agree more on item LP2 (It is a good opportunity for hobbies).

Table 3. Means for the items of leisure perception (LP) and effects of the characteristics of EFL teachers. G: Gender, A: Age, E: Education, MST: Marital status, CST: Child status, NUC: Number of child, ST: School type, TEX: Teaching experience.

		Probability							
Items	**Mean**	**G**	**A**	**E**	**MST**	**CST**	**NUC**	**ST**	**TEX**
LP1	2.7[a]	0.80	**0.02**[b]	0.84	0.95	0.11	0.47	0.69	0.29
LP2	2.9	0.93	**0.03**	0.81	0.26	**0.04**	**0.02**	0.17	0.67
LP3	2.8	0.78	0.35	0.40	0.32	0.29	0.07	0.36	0.50
LP4	2.0	0.09	0.54	0.67	0.87	0.52	0.43	**0.04**	0.36
LP5	2.0	0.50	0.86	0.11	0.34	0.98	0.65	0.37	0.90
LP6	1.9	0.80	0.32	0.62	**0.00**	**0.02**	0.07	0.17	**0.01**
LP7	1.8	0.25	0.92	0.10	**0.04**	0.66	0.10	0.55	**0.00**

[a]: Higher means indicate that leisure time perception had more efficient. [b]: The related characteristic of EFL teachers had a significant effect on the related item of leisure time perception ($p < 0.05$).

EFL teachers indicate that they frequently participate in leisure activities including Items LA13 (I spent time on social networks), LA2 (I followed the news regularly), LA11 (I watched movies/TV series), LA7 (I listened to music) and LA4 (I read book) (Table 4). Similarly, a study [17] investigating the participation of teachers in leisure activities in Halfeti-Şanlıurfa suggested that spending time with family, listening to music and visiting friends and relatives were the most fequent leisure activities. Tok and Balçık [14] reported that teachers working in secondary schools in Denizli frequently read books, and spent time with their friends in their leisure. A research [4] conducted on the participation of teachers in leisure activities working in primary schools in Kırıkkale showed that they highly preferred passive leisure activities including reading books-newspapers, watching TV and listening music. Gültekin et al. [18] found that classroom teachers working in primary schools mostly read books as a leisure activity. Muthoni [6], studying leisure activities of female teachers in Nairobi-Kenya, indicated that the most popular leisure activity was watching television. A study, which leisure activities are explored in Turkey, America, Germany, England, China, Australia, revealed that Turkish, American and British people frequently watched television rather than other passive leisure activities whereas German, Australian and Chinese people mostly participated in active leisure activities such as sports [19].

In the current study, EFL teachers indicated that they sometimes did sports (LA1). In fact, doing physical activity regularly during stay-at-home is a crucial strategy for avoiding health problems because long-term home-isolation can increase inactivity and lead to depression and anxiety [20].

The least participated leisure activities are LA22 (I attended online festival), LA9 (I played a musical instrument), LA16 (I attended online hobby courses), LA23 (I attended online exhibitions), LA24 (I attended online theatres), LA17 (I was busy with online international projects) and LA26 (I did knitting). Aşkın [5] stated that teachers in Düzce-Turkey rarely participated in online artistic activities.

The results show that EFL teachers sometimes attended online professional courses/webinars (LA15). This result of the study demonstrates that teachers have a significant responsibility for their professional growth and development. Similarly, in a previous study by Alfaki [21] revealed that the teachers were anticipated to undertake the responsibility for their own PD to keep themselves constantly up to date and to reflect on their teaching skills for their ongoing PD.

Items LA7 (I listened to music), LA9 (I played a musical instrument), LA11 (I watched movies/TV series), LA13 (I spent time on social networks), LA14 (I played computer games), LA20 (I attended online concerts), LA25 (I spent my time with my kids) and LA27 (I cared for my plants) are affected by the vast majority of the characteristics of EFL teachers (Table 4). Older, experienced, married and female EFL teachers with children participated in leisure activities

coded LA25 (I spent my time with my kids) and LA27 (I cared for my plants). EFL teachers with PhD mostly participate in leisure activities coded LA1 (I did sports regularly), LA3 (I followed scientific publications regularly), LA4 (I read book), LA5 (I read newspaper), LA6 (I read magazine), LA14 (I played computer games), LA15 (I attended online professional courses/webinars), LA20 (I attended online concerts), LA22 (I attended online festival), LA23 (I attended online exhibition and LA24 (I attended online theatre).

Although the number of children and school type are influential on few items, it is difficult to make a clear decision on which one is more agreeable. Likewise, Muthoni [6] reported that number of children and school type did not have a significant influence on leisure activities.

Table 4. Means for the items of leisure activity (LA) and effects of the characteristics of EFL teachers. G: Gender, A: Age, E: Education, MST: Marital status, CST: Child status, NUC: Number of child, ST: School type, TEX: Teaching experience.

		Probability							
Items	**Mean**	**G**	**A**	**E**	**MST**	**CST**	**NUC**	**ST**	**TEX**
LA1	2.5[a]	0.74	**0.02**	0.22	**0.00**	**0.01**	0.12	0.48	0.03
LA2	3.8	0.60	0.17	0.41	0.49	0.81	0.79	0.71	0.54
LA3	2.9	0.23	0.52	**0.00**	0.44	0.56	0.40	0.16	0.56
LA4	3.6	**0.00**[b]	0.21	0.15	0.06	0.11	0.70	0.50	0.68
LA5	2.5	**0.02**	**0.00**	0.16	0.09	0.05	**0.02**	0.44	0.00
LA6	2.3	0.58	0.23	0.08	0.73	0.25	0.18	0.38	0.14
LA7	3.7	0.25	**0.00**	0.43	**0.00**	**0.00**	**0.01**	**0.03**	0.00
LA8	2.7	0.27	**0.04**	0.37	0.07	**0.02**	**0.02**	0.41	0.66
LA9	1.5	**0.00**	**0.03**	**0.01**	**0.04**	**0.03**	0.10	0.07	0.01
LA10	2.3	0.38	0.48	0.37	0.32	0.57	0.32	0.08	**0.23**
LA11	3.8	0.05	**0.00**	0.81	**0.00**	**0.00**	**0.00**	**0.02**	**0.05**
LA12	3.0	**0.00**	**0.02**	0.09	0.17	0.71	0.67	0.27	0.07
LA13	4.0	0.37	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.00**	0.00
LA14	1.8	**0.00**	**0.00**	0.72	**0.00**	**0.00**	**0.00**	0.16	0.01
LA15	2.9	0.55	0.07	**0.00**	0.46	0.23	0.68	**0.02**	0.27
LA16	1.5	0.20	0.25	0.25	**0.00**	**0.00**	**0.00**	0.50	0.20
LA17	1.6	0.66	**0.01**	**0.00**	0.22	0.07	0.28	**0.00**	0.00

LA18	1.9	0.56	0.77	**0.00**	0.06	0.13	0.86	0.06	0.86
LA19	2.2	**0.00**	0.05	0.07	0.87	0.97	0.61	0.26	0.01
LA20	2.0	**0.02**	**0.01**	0.07	**0.00**	**0.00**	**0.00**	0.74	0.01
LA21	3.0	0.05	**0.00**	0.54	0.64	0.19	0.65	0.07	0.00
LA22	1.3	0.71	0.34	0.40	**0.01**	0.05	0.15	0.34	0.25
LA23	1.5	0.15	0.20	**0.00**	0.08	0.35	0.95	0.56	0.52
LA24	1.5	0.26	0.16	0.06	**0.04**	0.56	0.41	**0.01**	0.46
LA25	3.2	0.40	**0.00**	0.48	**0.00**	**0.00**	**0.00**	**0.00**	0.00
LA26	1.6	**0.00**	0.81	0.72	0.34	0.14	0.70	0.17	0.43
LA27	2.8	**0.00**	**0.00**	0.99	**0.00**	**0.02**	**0.01**	**0.01**	0.14
LA28	2.0	0.60	0.30	0.64	**0.04**	0.07	0.22	0.18	0.55

[a]: Higher mean indicate that related leisure activity had more efficient. [b]: The related characteristic of EFL teachers had a significant effect on the leisure activity ($p < 0.05$).

4. Conclusions

The study showed that EFL teachers mostly perceived stay-at-home as "Stay-at-home has increased my leisure", "Stay-at-home required leisure activity", "Stay-at-home stay positively affected my personal development", and "Stay-at-home positively affected my family relationships". Also, they considerably have the leisure perceptions including "It is a good opportunity to rest", "It is a good opportunity for hobbies" and "It is a good opportunity to participate in social, cultural and professional events". The study revealed that they frequently spent time on social networks, followed the news regularly, watched movie/TV series, listened to music and read books. The least oft-mentioned leisure activities are online festival, playing the musical instrument, online hobby courses, online exhibition, online theatre, being busy with online international projects and knitting. EFL teachers with PhD mostly did sports regularly, followed scientific publications regularly, read book, newspaper and magazine, played computer games, attended online professional courses/webinars, attended online concerts, online festival, online exhibition and online theatre. Considering these conclusions as a whole, the study sheds light on very important information for both EFL teachers and authorities from Turkish Ministry of Education because it has a wide sampling across Turkey. In this sense, the courses on leisure management and online PD activities should be held for the teachers. They should be supported and encouraged for pursuing their postgraduate education through policies that incentivize personal and educational development. It is recommended that similar researches should be conducted with the inclusion of teachers with different branches across Turkey for the development of the educational system.

Competing Interest / Conflict of Interest

The authors declare that they no conflict of interest. The none of the authors have any competing interests in the manuscript.

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Analysing the Land Use Alteration's Impact in the District of Belen (Hatay) on the Natural and Built Environment by using Corine Data

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ABSTRACT

Pieces of land around the world have been physiologically affected by the changes that have occurred to meet basic needs such as industry, transportation, and settlement since ancient times. These changes also reveal differences in land cover. Land classes concerning nature can be evaluated in four categories: built areas, green areas, semi-natural areas, and natural areas. This study was carried out to reveal the change over time in the existing land use classes of Belen district of Hatay, located in the south of the Eastern Mediterranean. Belen has been chosen as the study area due to its strategic importance for the economy of the city and its diversity in terms of land classification. The study was carried out in 3 stages. In the first stage, the related literature was reviewed; studies on land classes of other cities by using CORINE data were brought together. In the second stage, the spatio-temporal change of the land use classes of Belen district between 1990-2018 was revealed by the analysis of the CORINE Land Cover (CLC) data. Thus, Belen's land use classes were evaluated under the titles of "Built Areas, Agricultural Areas, Natural Areas, Wetlands, and Water Bodies"; quantitative-qualitative data are presented within the scope of urban fabric, agricultural structure/forest existence, and changes in protected areas. In the third stage, all data were evaluated and recommendation were made regarding the alteration's effects in the field over the course of 28 years on the natural and built environment. As a result of the study, it has been observed that the changes in the district of Belen are particularly important for the persistence of the biodiversity/ecological balance on the natural and protected areas. For this reason, in future decisions to be made for the urban, importance should be given to the conservation of agricultural areas, stabilization of natural-semi natural area, and the cooperation of local administrations and public institutions with the experts of the subject to ensure the sustainability of the protected areas.

Anahtar Kelimeler:
Arazi örtü sınıfları
Yapılı çevre,
Doğal çevre,
CORINE.

ÖZ

Dünya üzerindeki arazi parçaları antik çağlardan bugüne sanayi, ulaşım, yerleşim gibi temel ihtiyaçların karşılanması amacıyla ortaya çıkan değişimlerden fizyolojik olarak etkilenmiştir. Bu değişimler arazi örtüsünde de farklılıklar ortaya çıkarmaktadır. Doğa ile ilişkili olarak arazi sınıfları yapılı alanlar, yeşil alanlar, yarı-doğal alanlar ve doğal alanlar olmak üzere dört kategoride değerlendirilebilmektedir. Bu çalışma Doğu Akdeniz'in en güneyinde yer alan Hatay'ın Belen ilçesinin mevcut alan kullanım sınıflarının zaman içerisindeki değişimini ortaya koymak amacıyla yapılmıştır. Belen, kentin ekonomisi için stratejik öneme sahip olması ve arazi sınıflandırması açısından çeşitlilik göstermesi nedeniyle çalışma alanı olarak seçilmiştir. Çalışma 3 aşamalı olarak yürütülmüştür. İlk aşamada konu ile ilgili literatür taranmış; CORINE verileri kullanılarak diğer

kentlerin arazi sınıflarına yönelik yapılan yapılan çalışmalar bir araya getirilmiştir. İkinci aşamada Belen ilçesinin 1990-2018 yılları arasındaki arazi sınıflarının zamansal-mekansal değişimi CORINE Land Cover (CLC) verilerinin analizi ile ortaya konmuştur. Böylece, Belen'in arazi sınıfları "Yapılı Alanlar, Tarım Alanları, Doğal Alanlar, Islak Alanlar ve Su Kaynakları" başlıkları altında değerlendirilmiş; kent dokusu, tarımsal yapı/orman varlığı ve korunan alanlardaki değişimler kapsamında nicel-nitel veriler sunulmuştur. Üçüncü aşamada ise elde edilen tüm veriler ile alandaki 28 yıllık süreçteki değişimin doğal ve yapılı çevre üzerindeki etkileri değerlendirilerek öneriler sunulmuştur. Çalışma sonucunda Belen ilçesinde yaşanan değişimlerin özellikle doğal ve korunan alanların biyoçeşitlilik/ekolojik dengesinin devamlılığı açısından önemli olduğu görülmüştür. Bu nedenle kentin gelecekteki büyümesine yönelik alınacak kararlarda tarımsal alanların korunması, doğal-yarı doğal alan örtüsünün stabilizasyonu ve korunan alanların sürdürülebilirliğinin sağlanması noktasında yerel yönetimler ve kamu kurumları konunun uzmanları ile birlikte hareket etmesi hususuna önem verilmelidir.

1. Introduction

Considering the change in the world from ancient times until today, land plots are areas open to physiological change. However, this change may be due to time or may result from factors that trigger the change. Monitoring the size and causes of the change has become important for the protection of environmental balance and the persistence of natural systems. Complex structures related to nature are defined in four main categories as natural systems, built-up areas, green areas, semi-natural areas, and natural areas. Buildings and their immediate surroundings define built-up areas, areas reserved for recreational use, green areas, regions with ecological balance exposed to human influence, semi-natural areas, and regions that have not been subjected to any intervention and preserve their ecological balance define natural areas. [1-10]. It is known that the feature that separates natural areas and built areas from each other is the effect of interventions in the natural process. External interventions that may occur outside of the changes due to the temporal process led to the change of the covering the land, leading to the definition of the concept of land cover [11-18]. The first people made changes in natural areas such as agricultural lands, forests, and pastures in a way to continue their lives, and made the beginning of external interventions. In today's conditions, the acceleration of urban development with the increase of population [19-22], increasing life expectancy [23-26], consumption rates [27-29], and technological developments in various fields [30-32] have led to a complete change in the use case. These changes, which take place to meet basic needs such as industry, transportation, and settlement, are experienced in every region of the world. As a global phenomenon, the change in land cover affects all entities such as people [33-36].

Feranec et al. [37] put forward the countries with the highest/lowest change in their study, where they determined the land cover classification of European cities between 1990 and 2000. As a result of the research, while the country with the highest rate of urbanization is the Netherlands; It has been determined that the natural and built environment in Slovenia has experienced the least change. Conservation and enhancement of the Czech Republic and Irish farmland; Portugal supports practices within the scope of deforestation and afforestation works and increasing natural areas. Kucsicsa et al. [38] found that Romania's land cover changed in the direction of the increase in the built environment. They determined that this situation will cause the separation of landscape areas, the destruction of biodiversity, and the occurrence of natural disasters, which will negatively affect the ecological structure. Martínez-Fernández et al. [39] determined in their studies that there were land changes in agricultural lands, natural and semi-natural areas of Spain between 1985-2012. As a result of the study, the change of land cover classes included in natural systems for various reasons emerged as a global problem; On the other hand, it seems possible that cities can eliminate change with the approaches they follow. It is observed that land uses have changed in many urban examples in our country, depending on the external factors that occur as a result of human activities. According to the research data of the European Environment Agency, 25,000 hectares of agricultural land, 37,000 hectares of semi-natural land, and 55,000 pastures have been destroyed in Turkey. It is observed that agricultural lands are negatively affected especially within the land use classes [40,41]. This issue is also taken into account in our country in terms of urban planning to preserve the current state of land uses and to minimize their changes. Kaya and Gorgun [42] analyzed the transformation of agricultural areas close to residential areas, transportation axis, and industrial areas into built areas in their study in the Balıkesir-Bandırma region. Ikiel et al. [43] found that the Mugla-Datca coastal city, which is not suitable for settlement due to its rugged land, has decreased agricultural areas, semi-natural areas, and forest areas due to its commercial structure due to agricultural production and tourism opportunities. Sonmez et al. [44], in their study in Antalya-Kemer, stated that the area of urban use due to tourism and secondary housing use in the region has increased; and decreases in the number of beaches, dunes,

and agricultural lands. Detecting the change of land cover ensures the protection of productive natural areas, the controlled growth of the built environment, and the progress of the economy of the region [45].

This study aims to reveal the change and the reasons for Belen's existing land use classes over time. The obtained data for this purpose are evaluated within the scope of built areas, agricultural lands, natural and semi-natural areas. The study results are aimed to guide the decisions to be taken on Belen's urban development.

2. Material and Method

The study area is the Belen district of Hatay, located in the southernmost of the Eastern Mediterranean (Figure 1). Constituting Hatay's commercial axis, Belen has strategic importance for the city's economy. At the same time, it was chosen as a study area due to its diversity in terms of land classification. Belen is the only region where the Amanos Mountains pass through, enabling road transport between the Middle East and Europe from the Ottoman period to the present. Belen's proximity to the sea also provides access to the sea transportation of the existing highway [46]. The diversity of the land use classes of the district increases its ecological value due to its natural vegetation, fertile soils, protected areas (Belen Nature Park), and climate characteristics. This situation directs urban development; The high growth potential makes natural areas and agricultural lands open to external intervention. Especially the fact that the route called "Belen Gecidi" kept the economic structure of the city alive caused the development of the region over time [47].

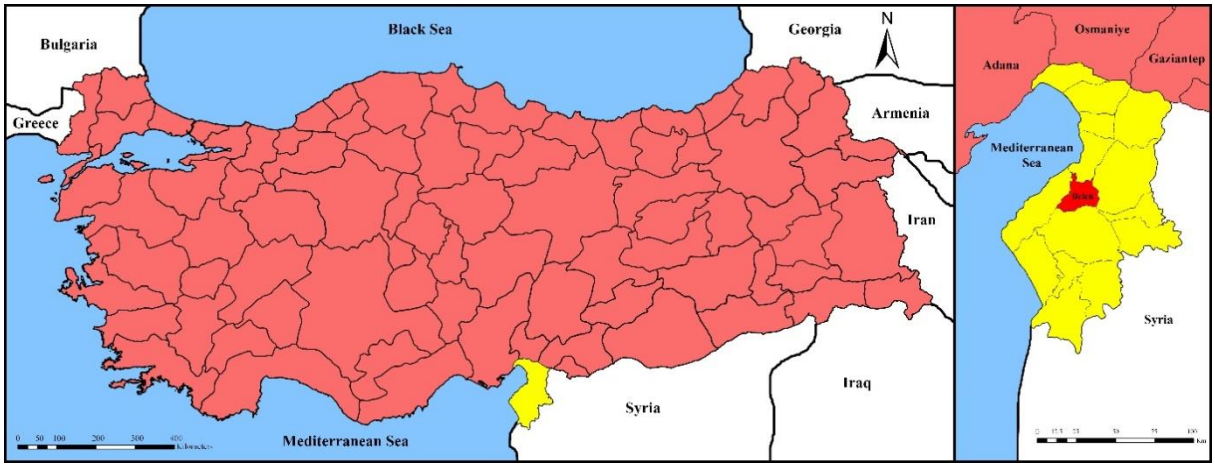

Figure 1. Study area

The study, which was carried out to determine the effect of the change in the use of the area on the natural and built environment, reveals the spatio-temporal change of Belen district between 1990-2018 with the analysis of the CORINE Land Cover (CLC) data [48]. In this context, the study was carried out in 3 stages. In the first stage, the literature was reviewed; studies using CORINE data have been brought together. In the second stage, the Civil and Administrative Boundaries of Belen district, which is of ecological, economic, and cultural importance, were determined and intersected with the CORINE maps for 1990, 2000, 2012, and 2018 in the ArcGIS 10.5.1 software program. At this stage, land classes have been revealed using Corine data. Thus, the quantitative-qualitative data of Belen on "Built Areas, Agricultural Areas, Natural Areas, Wetlands, and Water Bodies" were obtained (Table 1). Since there is no wetland within the scope of the district, the results have been evaluated under the headings of built areas, agricultural areas, and natural areas; The scope of these titles are determined as urban texture, agricultural structure/forest property, and protected areas. Numerical data on all field uses are presented. In the last stage, the effects of the change in the field on the natural and built environment were evaluated with all the data obtained; recommendations are made.

Table 1. CORINE land cover classes

Level 1	**Level 2**		**Level 3**	
1.Artificial surfaces	1.1	Urban Fabric	1.1.1	Continuous urban fabric
			1.1.2	Discontinuous urban fabric
	1.2	Industrial, commercial and transport units	1.2.1	Industrial or commercial units
			1.2.2	Road and rail networks and associated land
			1.2.3	Port areas
			1.2.4	Airports
	1.3	Mine, dump and construction sites	1.3.1	Mineral extraction sites
			1.3.2	Dump sites
			1.3.3	Construction sites
	1.4	Artificial, non-agricultural vegetated areas	1.4.1	Green urban areas
			1.4.2	Sport and leisure facilities
2. Agricultural areas	2.1	Arable land	2.1.1	Non-irrigated arable land
			2.1.2	Permanently irrigated land
			2.1.3	Rice fields
	2.2	Permanent crops	2.2.1	Vineyards
			2.2.2	Fruit trees and berry plantations
			2.2.3	Olive groves
	2.3	Pastures	2.3.1	Pastures
	2.4	Heterogeneous agricultural areas	2.4.1	Annual crops associated with permanent crops
			2.4.2	Complex cultivation patterns
			2.4.3	Land principally occupied by agriculture, with significant areas of natural vegetation
			2.4.4	Agro-forestry areas
3. Forests and semi-natural areas	3.1	Forests	3.1.1	Broad-leaved forest
			3.1.2	Coniferous forest
			3.1.3	Mixed forest
	3.2	Shrub and/or herbaceous vegetation associations	3.2.1	Natural grassland
			3.2.2	Moors and heathland
			3.2.3	Sclerophyllous vegetation
			3.2.4	Transitional woodland shrub
	3.3	Open spaces with little or no vegetation	3.3.1	Beaches, dunes and sand plains
			3.3.2	Bare rocks
			3.3.3	Sparsely vegetated areas
			3.3.4	Burnt areas
			3.3.5	Glaciers and perpetual snow
4. Wetlands	4.1	Inland wetlands	4.1.1	Inland marshes
			4.1.2	Peat bogs
	4.2	Coastal wetlands	4.2.1	Salt marshes
			4.2.2	Salines
			4.2.3	Intertidal flats
5.Water bodies	5.1	Inland waters	5.1.1	Water courses
			5.1.2	Water bodies
	5.2	Marine waters	5.2.1	Coastal lagoons
			5.2.2	Estuaries
			5.2.3	Sea and ocean

3. Result and Discussion

In the study, which was carried out to determine the effect of the change in the land use of Belen district on the natural and built environment, and in which the spatio-temporal change between 1990-2018 was revealed by using the CORINE Land Cover (CLC) data; all data were evaluated by years. According to the obtained data, the changes are presented as maps in Figure 2 and Figure 3; Quantitative data are presented in Table 2 and Table 3.

When the changes in land cover between the years 1990-2000 are evaluated, it is seen that the built environment has spread towards the forest areas in the northwest of the region and on the connecting roads between the residential areas and neighboring districts. The growth in residential areas (24,94 ha) shows that the city is preferred as a living space. Current progress in terms of transportation and settlement will indicate that the natural and built areas of the region will undergo a spatial change in the future. The economic growth of Belen draws attention in terms of agricultural production activities as well as its contribution to the transportation network on a regional scale. Agricultural production is mainly carried out in the form of irrigated and dry field agriculture. However, its status in the product type and existing area classification has changed minimally. Accordingly, these areas, which have turned into vineyards and garden agriculture, are located both in the vicinity of the residential areas and in the east and southwest of the region. The spatial changes that occurred in the land cover classification occurred mostly in natural and semi-natural areas. When evaluated in terms of forest areas; it was determined that coniferous forests (217,65 ha) and mixed forests (767,68 ha) experienced regional area loss, while broadleaf forests (166,67 ha) increased really. In this context, while there is an increase in the land cover in the form of bushes in the northern parts of the region; there is an increase in the number of broadleaf forests in the southern parts of the region. The reasons for the change between the number of plants in bush form and forest lands can be explained as the development or drying of the natural vegetation. However, anthropogenic effects (forestry activities, agricultural land acquisition, etc.) are also considered to be involved in the process. The transformation of forest areas into shrubs (944,66 ha) occurs with the mass change of land plots and the inclusion of burning areas (49,87 ha) in forest land. Besides, there are natural meadows (1.019,37 ha) and areas covered with sparse vegetation (110,52 ha) in the northern parts of the region. The existence of these areas can be associated with the livestock activities that constitute the agricultural production structure of the district.

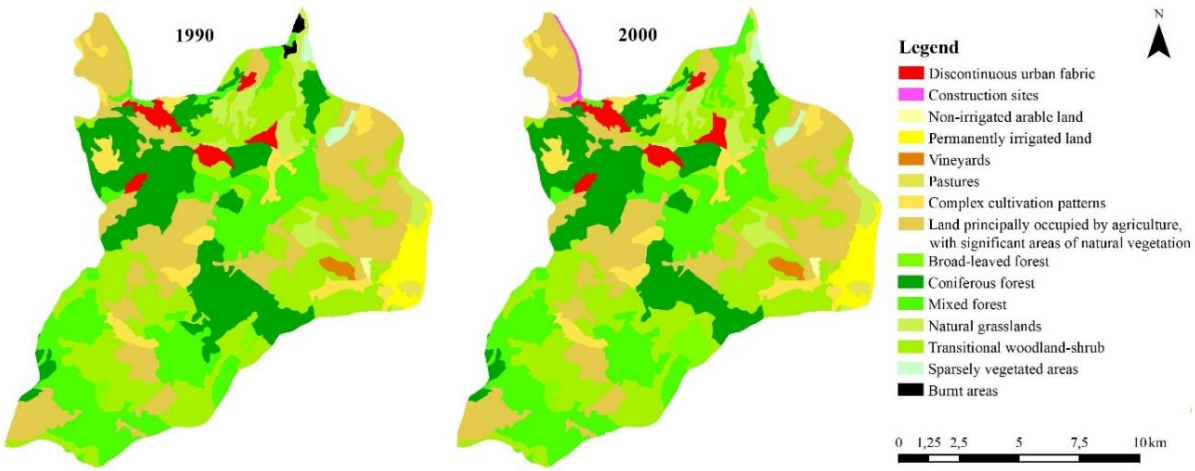

Figure 2. The Change in the Land Use of Belen Between 1990-2000.

Table 2. Numerical Data on Change in Land Use.

	1990	2000	2012	2018
112: Discontinuous urban fabric	368,11	393,04	560,10	560,10
121: Industrial or commercial units	-	-	174,76	184,41
122: Road and rail networks and associated land	-	-	35,10	35,10
133: Construction sites	-	61,52	-	-
211: Non-irrigated arable land	25,47	25,47	497,46	497,46
212: Permanently irrigated land	424,42	424,42	-	-
221: Vineyards	80,82	80,82	-	-
222: Fruit trees and berry plantations	-	-	11,93	11,93
223: Olive groves	-	-	636,71	636,71
231: Pastures	47,47	47,47	71,56	61,96
242: Complex cultivation patterns	949,98	949,98	1.134,50	1.134,50
243: Land principally occupied by agriculture, with significant areas of natural vegetation	4.245,38	4.246,49	3.616,42	3.616,42
311: Broad-leaved forest	129,80	296,48	240,27	398,04
312: Coniferous forest	3.164,64	2.946,99	5.804,09	5.637,69
313: Mixed forest	4.267,12	3.499,43	1.023,66	1.021,85
321: Natural grasslands	1.019,37	1.019,36	558,45	558,49
324: Transitional woodland-shrub	5.163,88	4.219,24	4.083,55	4.091,07
333: Sparsely vegetated areas	110,52	110,52	29,34	29,34
334: Burnt areas	49,86	-	-	-

Between the years 2000-2012, in terms of Belen's land use classes, changes took place in the built environment, agricultural areas, natural and semi-natural areas. With the openning of the road (35,10 ha), which was under construction in 2000, the settlement areas developed towards the agricultural areas in the northwest of the district; existing settlements are also developed on scrublands (167,06 ha). Also, the existence of an industrial facility (174,16 ha) operating in agricultural lands with private vegetation areas in the east of the district caused the built environment to grow in the area. During this period, significant changes were experienced in agricultural production classes. Especially, continuously irrigated agricultural lands (424,42 ha) connected to the fertile lands of the region disappeared completely, while non-irrigated arable lands (471,99 ha) and mixed cultivation areas increased. Besides, agricultural lands covered with special vegetation cover (630,07 ha) experienced massive land losses as industrial facilities, residential areas and agricultural production turned to orcharding. The transformation of existing vineyards into orchards (11,93 ha) and olive groves (636,71 ha) in horticultural agriculture and the location of these areas around the industrial facility show that the regional economy has developed with the agriculture-industry relationship. In natural and semi-natural areas, the land use class varies widely. Especially in mixed forest lands, mass area (2.475,77 ha) is lost, while the area increases are observed in coniferous forests (2.857,10 ha). The mixed/broad-leaved forests around the agricultural lands located in the center and south of the region in 2000 became coniferous forests in 2012. Among the reasons for this change in the diversity of tree species can be drying out, being cut down due to fire or forestry activities. It was observed that some of the shrub lands (135,69 ha) in the southern parts of the region were transformed into agricultural lands and some of them into forest areas. Natural grasslands, which are another part of semi-natural areas, were located only in the northern parts of the region in 2000, but as of 2012, they lost about half of their existing area (460,92 ha) and spread to the east and west of Belen. This spreading contributed to the covering of the surface areas by causing positive results in terms of areas covered with sparse vegetation (81,18 ha).

When the land cover map of 2018, which is the latest CORINE data, is evaluated, there is a minimal increase in industrial areas (9,65 ha) within the scope of built areas, while there is a small amount of area loss in pastures (9,60 ha) within the scope of agricultural areas. The change in the 6 years is seen as area loss in coniferous forests (166.4 ha) and area increase in broad-leaved forests (157,77 ha). In addition, there is an increase in area (7,52 ha) in shrub lands. Therefore, it is observed that the continuous change in natural and semi-natural areas still maintains its persistence.

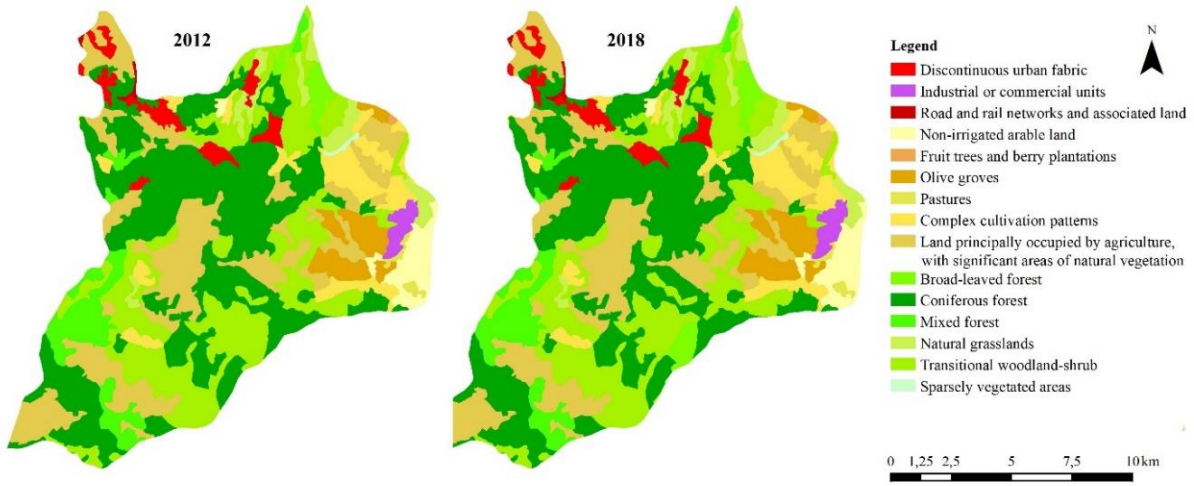

Figure 3. The Change in the Land Use of Belen Between 2012-2018

When the land cover class changes of Belen district are evaluated for 28 years, it is observed that significant area increases are realized in the built environment such as urban texture (191,99 ha), industrial areas (194,41 ha), connection zones (35,10 ha) of the region. The development of the built environment is on land covers with high ecological value such as production areas, forests, maquis and shrublands, meadows, and pastures around the city. In the urban growth process, the biggest loss in the production areas was experienced with the transformation of lands with high ecological value (628,96 ha) reserved for agriculture into industrial and residential areas. Significant differences have emerged in natural and semi-natural areas with the change of agriculture due to the built environment. The change in the production demand in the region with the development of the industrial structure caused the cover class of the land used for field agriculture (424,42 ha) to be included in the unused land (497,46 ha) class and the mixed cultivation areas (184,52 ha) to increase. The persistence of production continued as orchards with fruit (11,93 ha) and olive groves (636,71 ha). While there is a general decrease (503,98 ha) in forest lands, there are also losses in tree masses. Especially in mixed forests (3.245,27 ha), significant losses are experienced, while there are mass increases in coniferous forests (2.473,05 ha). It develops positively with the significant change in the temporal process of scrublands and their inclusion in forests and agricultural lands. In addition, the existence of areas with sparse vegetation and natural meadows, the reintegration of burnt areas (49,85 ha) into the natural structure play a pioneering role in maintaining biological balance and preserving the existing landscape values. Although areas with sparse vegetation cover (81,18 ha) are included in the meadows over time, the existing meadows (460,88 ha) are experiencing field losses.

Table 3. Developed land structures of Belen district by CORINE data between 1990 and 2018

Land structure	Parameter	Change
Built-up areas	Discontinuous urban fabric	+191,99
	Industrial or commercial units	+194,41
	Road and rail networks and associated land	+35,10
	Construction sites	-
Arable Farming	Non-irrigated arable land	+497,46
	Permanently irrigated land	-424,42
	Pastures	+14,49
	Complex cultivation patterns	+184,52
	Land principally occupied by agriculture, with significant areas of natural vegetation	-628,96
Horticulture	Vineyards	-80,82
	Fruit trees and berry plantations	+11,93

	Olive groves	+636,71
Forest land	Broad-leaved forest	+268,24
	Coniferous forest	+2.473,05
	Mixed forest	-3.245,27
Transition zone to forest	Natural grasslands	-460,88
	Transitional woodland-shrub	-1.072,81
	Sparsely vegetated areas	-81,18
	Burnt areas	-49,86

4. Conclusions and Recommendations

When the spatial change in land use classes between 1990-2000 is examined; the highest variation was in natural meadows, shrub areas, and mixed forests, respectively. However, it is thought that the built environment will develop depending on the time and cause a change in terms of natural/semi-natural areas. The change in the built environment between the years 2000-2012 is regarded as a turning point for Belen, in the form of agricultural production, the class change of natural and semi-natural areas, and issues related to the ecological structure of the region. According to the data of 2018, it is observed that the continuous change in natural and semi-natural areas still maintains its continuity.

The development of the built environment in Belen district continues on high ecological value land covers such as production areas around the city, forests, and shrub lands, meadows, and pastures. These structures, which form a transition between forest land and residential areas, should be considered due to their contribution to biodiversity and hence the ecological value of Belen. In the urban growth process, the biggest loss among the production areas was experienced with the transformation of lands reserved for agriculture but with high ecological value into industrial and residential areas. When the land use classes are evaluated in terms of forests, the losses in mixed forests and the increase in coniferous forests are especially important in Belen Nature Park, which is a protected area located within the boundaries of the district.

As a result, it has been revealed that Belen, which is an important settlement area at regional and urban scale in terms of ecological, economic, and agricultural indicators, shows changes in the direction of increase and decrease in terms of urban texture, forest areas, and agricultural areas according to the land use classification. These changes are important in terms of the landscape architecture professional discipline, especially in terms of the persistence of biodiversity/ecological balance of natural and protected areas. For this reason, the effect of the change in the built environment on the natural structure should be minimized. In the decisions to be taken for the future growth of the city, local administrations and public institutions should act together with the experts of the subject in terms of protection of agricultural areas, stabilization of natural/semi-natural areas, and ensuring the sustainability of protected areas.

Competing Interest / Conflict of Interest

The authors declare that they no conflict of interest. The none of the authors have any competing interests in the manuscript.

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We declare that all Authors equally contribute.

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Determination of Comfort Areas According to the Wind Chill Index of the Central Anatolia Region

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ABSTRACT

Environmental and atmospheric conditions are very important for human life. The importance of climatic conditions is undeniably high for people to perform their daily activities comfortably. Among the climatic elements, temperature, wind, precipitation, and humidity are the main factors affecting comfort status. Climate-based indexes have been developed to determine the comfort zones of people. In this study, by using the wind chill index, one of these indices, the comfort condition of the Central Anatolia Region throughout the year was determined. For this purpose, the temperature and wind speed values of the Central Anatolia Region were used for the Windchill index. In July and August, the wind speed increased in places in Salt Lake and its surroundings and the east of the region. It is seen that the temperature values in the region fall below 0°C in winter. Apart from this, temperature values in the region are above 0°C in summer, spring, and autumn seasons. Depending on the temperature and wind speed values, in April, May, June, September, and October in the Central Anatolia Region, areas in the "no risk" and "zero" category have been identified in the entire region according to the Windchill index. Especially in the whole winter season (December, January, February, and in the first month of spring in March), especially in the south and east of the region, some areas fall into the "low risk" and "medium risk" category. and they must wear thick clothing, otherwise, hypothermia and subsequent frostbite deaths may occur.

Anahtar Kelimeler:
İç Anadolu Bölgesi,
Wind Chill,
Biyoklimatik Konfor,
Sıcaklık,
Rüzgar.

ÖZ

Çevresel ve atmosferik şartlar insan yaşamı için oldukça önemlidir. İnsanların günlük yaşamdaki aktivitelerini konforlu gerçekleştirebilmeleri için iklim şartlarının önemi yadsınamaz derecede fazladır. İklim elemanlarından sıcaklık, rüzgâr, yağış ve nem konfor durumunu etkileyen başlıca etmenlerdendir. İnsanların konfor alanlarının belirlenebilmesi için iklim eksenli indeksler geliştirilmiştir. Bu çalışmada da bu indekslerden rüzgâr üşüme sıcaklığı indeksi (Wind chill) kullanılarak İç Anadolu Bölgesi'nin yıl boyunca konfor durumu tespit edilmiştir. Bu amaçla Wind chill indeksi için İç Anadolu Bölgesi'nin sıcaklık ve rüzgâr hızı değerleri kullanılmıştır. Temmuz ve Ağustos aylarında Tuz Gölü ve çevresi ile bölgenin doğusunda yer yer rüzgâr hızı artmıştır. Bölgedeki sıcaklık değerleri ise kış mevsiminde 0 °C'nin altına düştüğü görülmektedir. Bunun dışında da bölgede yaz, ilkbahar ve sonbahar mevsimlerinde sıcaklık değerleri 0 °C'nin üzerinde seyretmektedir. Sıcaklık ve rüzgâr hızı değerlerine bağlı olarak İç Anadolu Bölgesi'nde Nisan, Mayıs, Haziran, Eylül ve Ekim aylarında Wind chill indeksine göre bölgenin tümünde "risk yok" ve "sıfır" kategorisine giren alanlar tespit edilmiştir. Özellikle kış mevsiminin tamamında (Aralık, Ocak, Şubat ve ilkbaharın da ilk ayında (Mart) özellikle bölgenin güneyinde ve doğusunda "düşük risk" ve "orta risk" kategorisine giren alanların varlığı görülmektedir. Bu aylarda belirtilen alanlarda yaşayan insanların çok uzun süre açık alanda kalmamaları ve kalın giysiler kullanmaları gerekmekte aksi takdirde hipotermi ve sonrasında da donmaya bağlı ölümler görülebilmektedir.

1. Introduction

With the increase in the welfare of people, their desire for a comfortable life has also increased. The comfort conditions that affect the quality of life in almost every activity, from daily life to business life, are very important today. The fact that people who live in the physical environment has caused environmental characteristics to have profound effects on all human activities [1-13]. The suitability of the climatic conditions of a region is an important factor that is considered today. Space where people can live comfortably is called the comfort zone. To determine the comfort zone correctly, conditions such as temperature, relative humidity, radiation, and wind must first be determined and determined [14-20]. In determining the comfort zones, Olgyay used combinations depending on these values in his study conducted in 1973 by evaluating the temperature from 21.0ºC to 27.5ºC, relative humidity as 30-65%, and wind speed as 5m/s [21-27]. Temperature and relative humidity are used in most climatic indices and bioclimatic comfort studies, and sometimes only the wind parameter is used [22-32]. Thermal comfort indices play an important role in bioclimatic studies. These indexes are based on the measurement of people's reactions to meteorological parameters. Nowadays, several thermal comfort indexes have been developed using various meteorological parameters [28-33]. The basis of these indexes is human body temperature and meteorological parameters. The internal temperature of the human body is 36.5-37ºC. If the body loses more of the heat produced, the internal body temperature will drop. With the falling internal temperature, the body shows a shivering reflex as a reaction. Although the body temperature continues to decrease, the body goes into hypothermia. In addition to the decrease in temperature, wind also has a great effect on the decrease of body internal temperature. The wind chill index was developed to determine the comfort conditions of people with combinations between temperature and wind. In 1945, the Windchill index was developed by Siple and Passel to examine the effect of the temperature in the shade and the cooling power of the wind. Therefore, they started experiments in Antarctica [34,35]. As a result of experiments, they developed formulas that calculate the cooling power of the atmosphere [36]. The foundations of the wind chill index were laid in this way. It is known that wind speed is very important in addition to low temperatures in high cooling rates, and in extreme conditions such as -25ºC temperature and 49 km/h wind speed, the cooling power reaches a minimum of 19-20 cal/cm^2 [36]. In this respect, the relationship between temperature and wind, as well as the relationship between temperature and humidity, appears to be an effective combination in determining human comfort zones. Air, which is the subject of our study, is an important factor that directly affects human health [40].

In this study, the determination of comfort zones according to the Windchill index developed based on the low temperature and wind conditions that people are exposed to in the Central Anatolia Region are discussed. The formula of the wind chill index is the most common formula used by many foreign researchers and different disciplines [37-39]. The wind chill index formula is widely used by foreign researchers and the wind chill index in the scarcity of studies related to the selection index in Turkey has been an important factor. The high altitude and the low-temperature values and the suitable wind conditions have been important factors in the selection of the area. However, this index can be used frequently in the Eastern Anatolia Region as well as in the Central Anatolia Region and can contribute to the management and determination of human activities.

2. Material and Method

The wind chill is defined as the temperature value calculated by taking the average of the effect of outdoor temperature on the human body and the wind speed [36]. The feeling of coldness, which is felt more on windy days in winter, negatively affects climate comfort. Figure 1 shows the Relation of Wind Chill Index, Temperature, and Wind Speed. Central Anatolia Region selected as the study area is located between 41°04”91", 36°9’03” Northern latitudes and 29°71'21", 38°43'32" East longitudes (Figure 2). After the Central Anatolia Region with 163 057 km², Eastern Anatolia in Turkey to have the largest surface area is Zone 2. On the other hand, with its population of 12,705,812, it is the Region with the highest population after the Marmara Region. The average temperature and wind speed data of the region were obtained from the site https://www.worldclim.org/. Wordclim is a database that shares high spatial resolution satellite images and climate data obtained from terrestrial stations on a global scale. Providing data used in mapping and modeling climate data, the platform provides a base for many climate studies. The data in the cellular data format with a spatial resolution of approximately 1 km^2 provides monthly temperature, precipitation, wind speed, and solar radiation data from 1970 to the present. The wind speed and temperature data obtained for our study area were calculated using the cellular data calculation module in ArcGIS Pro software and the Wind Chill Index and the results obtained were mapped. The wind chill Index is below:

$$WCI = 0.323\left(18.9\ 7\sqrt{V} - V + 37.62\right)(33 - T)$$

In equality;
WCI: Wind Chill Index (W/m^2)
V: Wind Speed (km/h)
T: Air Temperature (°C)
It has been formulated. Wind Chill Index value is calculated in relation to air temperature and wind speed. The values obtained as a result of the calculations are categorized according to the risk level for the human body (Table 1). The risk level scale specified in the table was mapped according to the wind chill index results and visualized.

Table 1. Wind chill Index Classification

Wind Chill Index	**Risk Level**	**General Feel Condition**
Between 0 to -9°C	**Low Risk**	Feeling uncomfortable. Feeling cold.
Between -10 to -27°C	**Medium Risk**	Risk of hypothermia and freezing if left outside for long periods without uncomfortable cold and adequate protection.
Between -28 to -39°C	High risk (Skin exposed to cold can freeze within 10-30 minutes)	High risk of frostbite and numbness of the face and limbs and cold bites. High risk of hypothermia if outside for long periods without adequate clothing or cold protection.
Between -40 to -47°C	Very High Risk (Skin exposed to cold can freeze within 5 to 10 minutes)	Very high frost risk. High risk of frostbite and high risk of hypothermia if outside for long periods without adequate clothing or cold protection.
Between -48 to -54°C	**Severe Risk** **(Skin exposed to cold can freeze within 2 to 5 minutes)**	Serious frostbite risk. The freezing time of the face and limbs is too short. Risk of severe frostbite and severe hypothermia if outside for long periods without adequate clothing or cold protection
Between -55 and cooler	**Extreme Risk (Skin exposed to cold can freeze in less than 2 minutes)**	Outdoor conditions are dangerous for human life.

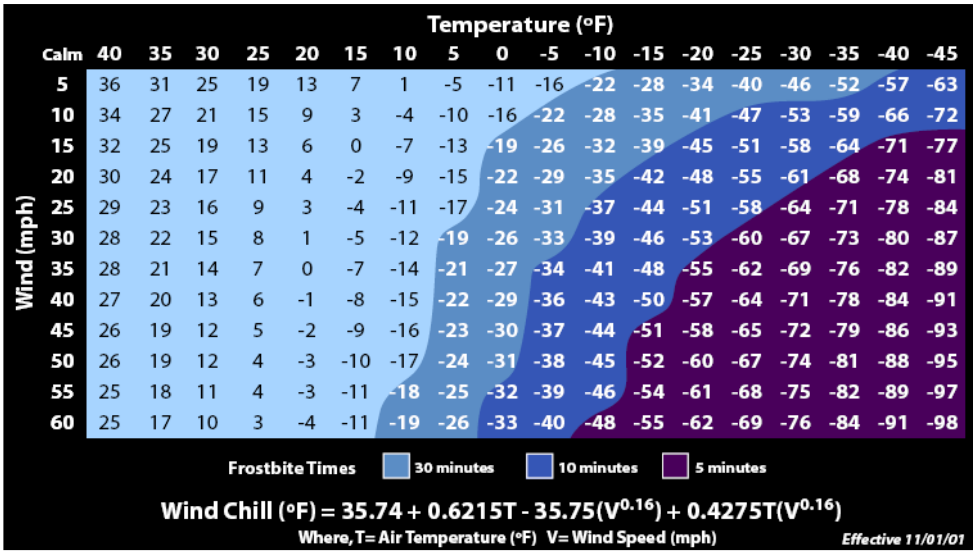

Figure 1. Relation of Wind Chill Index, Temperature and Wind Speed
Source: https://www.sciencebase.com/science-blog/what-is-wind-chill-index.html

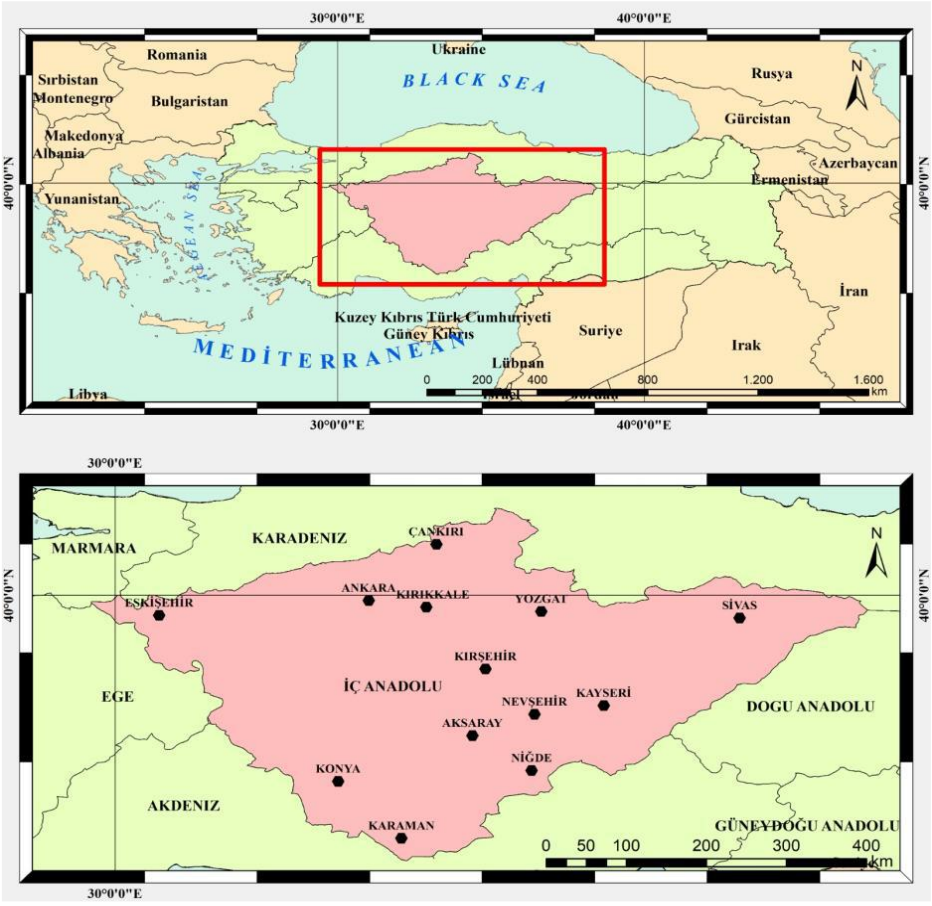

Figure 2. The location of Study Area

3. Results

The western and inner parts of the region have a flat appearance in terms of topography, especially around Konya Plain and Salt lake. Mountainous and rugged areas in the region are seen in the south and west. Erciyes and Hasan Mountains in the south, Tahtalı, Binboğa, Tecer Mountains and Uzunyayla plateau in the west have an elevated and rugged structure. (Figure 3) In the Central Anatolia Region, which has a flat structure with its inner parts surrounded by mountains due to its general morphological structure, the typical continental climate is dominant, where there is a high-temperature difference between summer and winter, and precipitation is generally seen in winter. The decrease in temperature during the winter season, the increase in wind speed, and the decrease in the type of precipitation in the form of snow made it necessary to carry out wind chill analysis in the region.

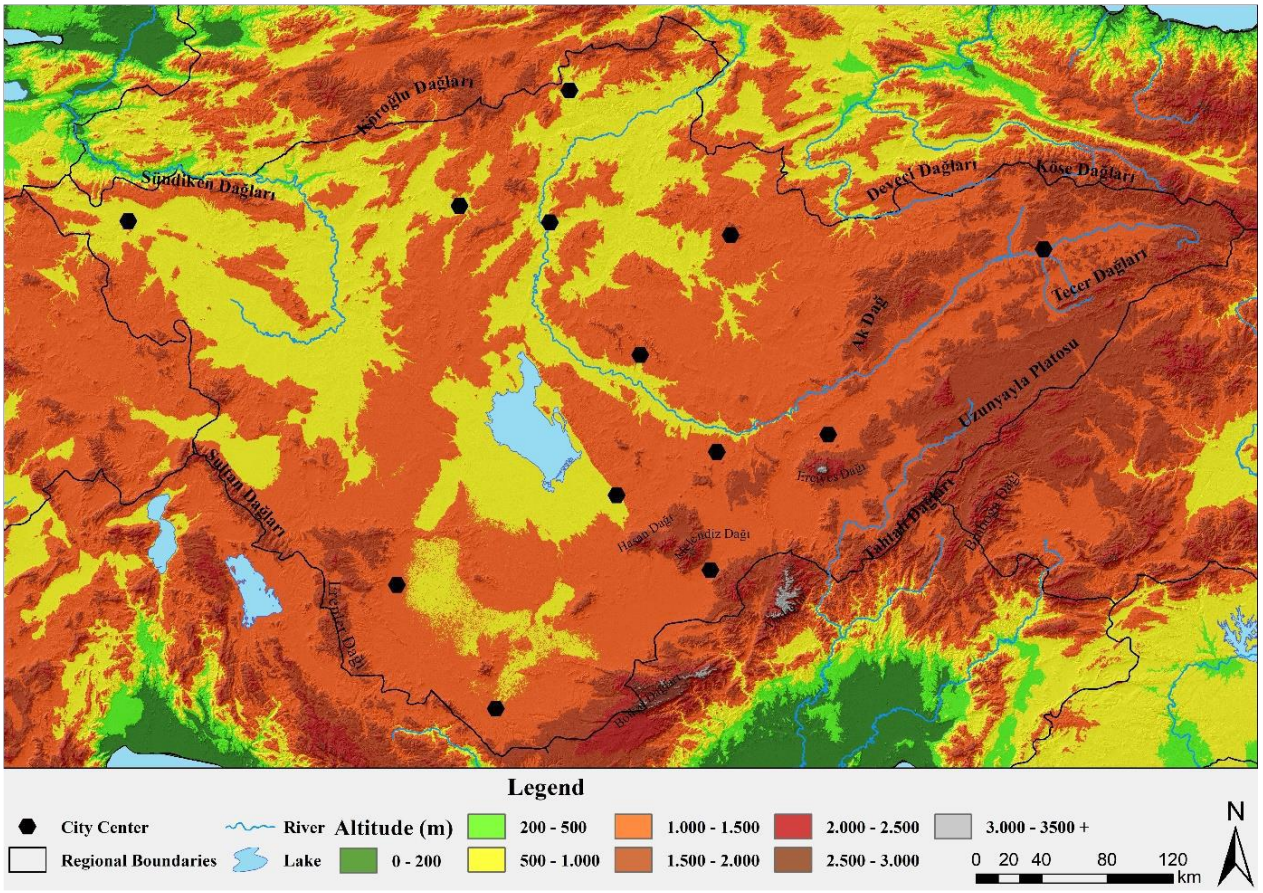

Figure 3. Elevation Map of the Study Area and its Surroundings

When the monthly average wind speed is evaluated, it has been determined that the wind speed varies within the region according to the months. In the region where the wind speed varies between 1 m / sec - 5 m / sec per hour, it has been determined that the fastest flowing values are around Salt Lake in the inner parts of the region, in Uzunyayla Plateau, around Erciyes Mountain, Akdağ and Elmadağ in July and August. It is October, November, December, and January when the wind speed is the lowest. However, in these months, in the high parts of the Erciyes, Hasan, and Melendiz Mountains, the passing speed reaches 5 m / sec per hour. In general, it has been determined that the areas with the highest wind speed in the region are high, while the areas with the lowest wind speed are low areas along the Kızılırmak valley (Figure 4).

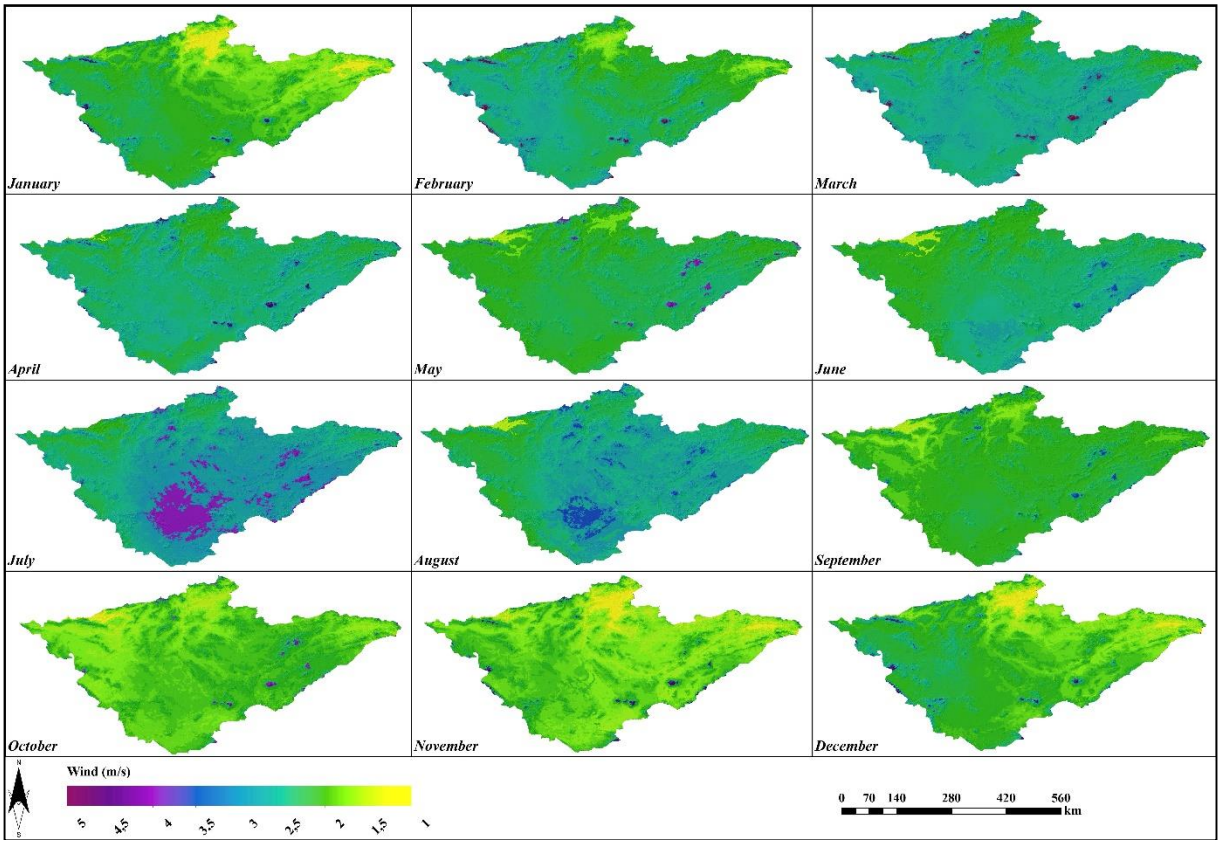

Figure 4: Annual Wind Speed Map of the Study Area

Looking at the temperature conditions; It has been determined that there are important differences between winter and summer in the Central Anatolia Region. The coldest month is January and the hottest month is July. When the annual average temperature in the region is evaluated, it has been found that it is high in Konya, Aksaray, and Eskişehir Plains, whereas it is low in the fields where Erciyes, Ak, and Tecer Mountains are located. When the temperature values of the region are evaluated monthly, it was observed as 0 ºC in the whole region in January. In July and August, it was observed that it was above 16 ºC except for the high peaks of the mountains. Temperatures in February and December were found to be between -2 and 6 oC, showing a great similarity. It was determined that the temperatures were between 0 and 8 ºC in March and between 4 and 14 ºC in April. (Figure 5).

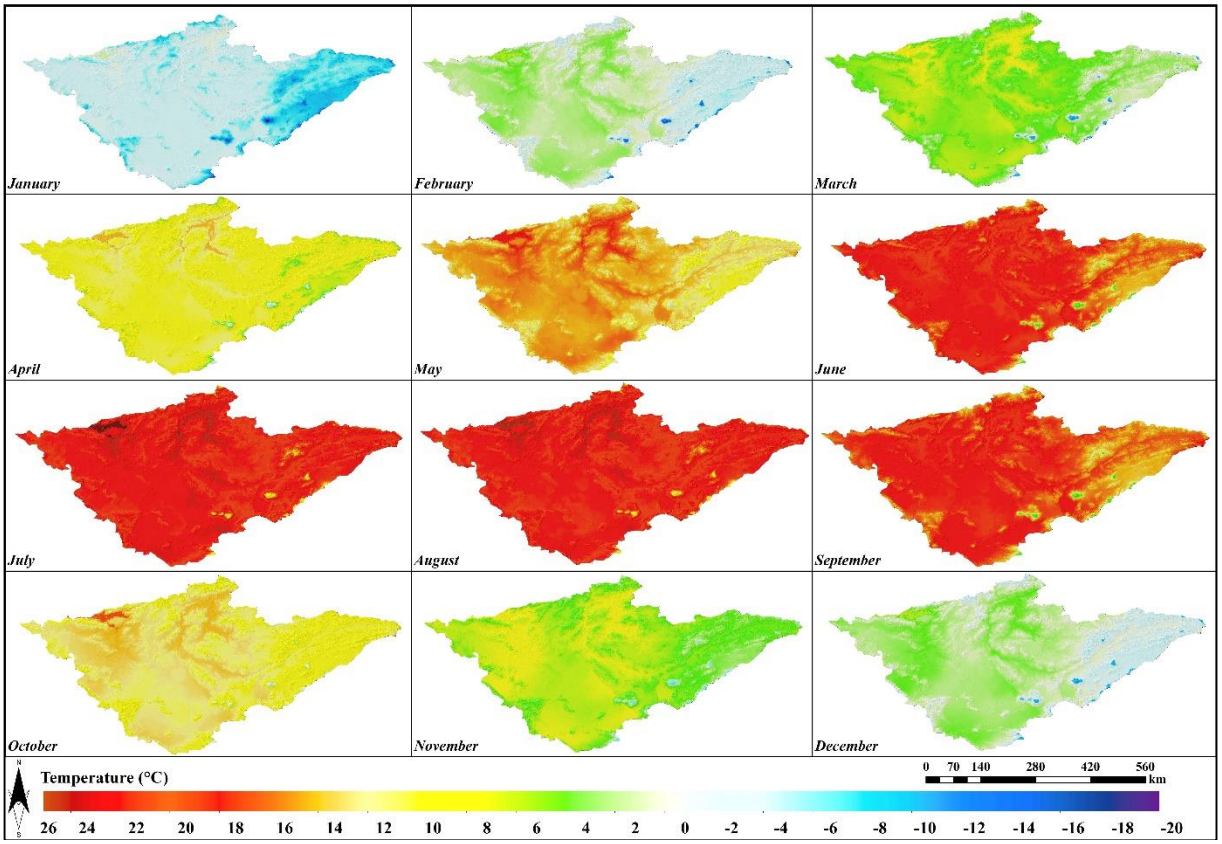

Figure 5. Annual Temperature Map of the Study Area

When the Central Anatolia Region wind chill index is evaluated according to the risk scale, it has been determined that low-grade and medium-risk areas are concentrated in the winter months (Figure 6). In December, January and February, it was determined that there are low and medium-risk areas in the low areas on the west side of the region and all areas except Konya plain. It is seen that Sivas, Kayseri, Niğde, and Çankırı are low and medium risk areas, especially in winter. The main reason for this is the high altitude in these areas. Also, the areas with Erciyes, Hasan, Melendiz, Ak, Tecer Mountains, and Uzunyayla Plateau are classified as medium risk according to the wind chill index comfort status. In this classification, the risk is expressed as hypothermia and freezing if the person is left outside for a long time. Low-grade risk has also been identified around Aksaray and Konya. It was determined that there was uncomfortable weather in these areas in January. Considering the month of February, Ak, Tecer, and Hınzır and the high parts of Erciyes, Hasan, and Melendiz Mountains in the east of the region and a large part of Sivas and Kayseri and certain regions of Niğde are included in the medium-risk classification. Aksaray, Konya plains, and Cihanbeyli and Haymana Plateaus have been identified as the regions where the temperature is 0 ºC. By March, the high parts of the Erciyes, Hasan, Melendiz Mountains are in the middle-risk group, while the high parts of the Ak and Tecer Mountains are in the low-risk category. In this month, Konya, Aksaray and Eskişehir Plains and Kızılırmak Valley were identified as places that do not carry any risk in terms of wind chill. It has been determined that there is no risk in terms of wind chill throughout the Central Anatolia Region from April to November. During this period, it has been determined that there is a low-risk factor at the points close to the summit of Mount Erciyes only in April and November. When it comes to December, it was determined that the risk situation reappeared after 1.500 meters of altitude. Especially, medium-level risk has been detected again starting from 2,500 m altitude of Erciyes, Hınzır, Ak, and Tecer Mountains. The mountainous morphological structure of the region has caused the elevation to be high, so it has been observed that the settlements on the foothills and the settlements around the high areas are in low and medium-risk groups.

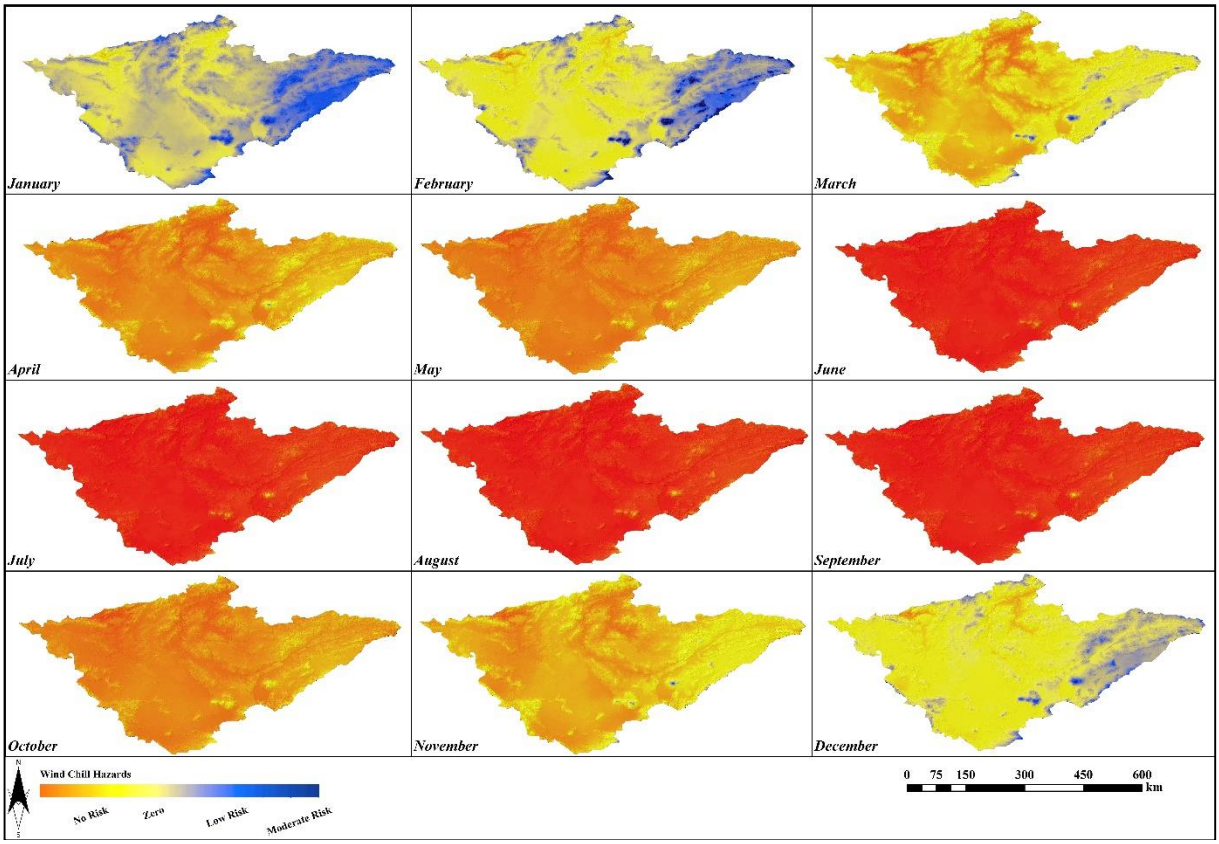

Figure 6:Windchill Index Status of the Study Area

4. Conclusions

The thermal conditions of the Central Anatolia Region, which have different elevations and different climatic conditions, change seasonally. Especially in January, it is seen that the temperature values in the region fell below 0ºC. In December and February, the temperature values in the east of the region are below 0 ºC. The most important reason for this is the high altitude in the east of the region. Apart from that, the wind conditions also vary in the region of 1-2.5 m / s during these months. In March, April, and May, the wind speed in the region increased up to 3.5-4 m / s, and the temperature values varied between 4 ºC and 18 ºC in these months. Temperature values in the region increased considerably in June, July, and August and reached up to 26 ºC. The wind speed has also increased up to 4.5-5 m / sec on the Konya Plain and its surroundings, especially in July and August. In September and October, the temperature values in the region tended to decrease by 10 ºC, from time to time to -6 ºC in November. In the wind values, a speed of 1-1.5 m / sec in the north of the region and 4-4.5 m / sec in places in the east has been observed. Looking at these values, seasonal differences are observed in the comfort zones according to the Windchill index of the Central Anatolia Region. Especially in the winter season, "medium risk" and occasionally "low risk" regions have been identified in the east of the region. Apart from this, "no risk" and "zero risks" groups were determined in the region in other months. The high altitude of the region, low temperature and high wind speed, and the continental climate cause difficult winter conditions. Accordingly, in determining the comfort zones of the region according to the Windchill index, people living in cities and settlements have been affected by this situation at a "medium risk" level. People who stay outside without protection for a long time at the "medium risk" level will be exposed to hypothermia and freezing events. It is vital that people living in "medium risk" regions, which are seen especially during the winter months, do not stay in unprotected areas for a long time. Human life needs to determine the comfort areas according to the wind chill index at the local level in Central Anatolia and Eastern Anatolia, where winter conditions are difficult in our country. It is expected that this study will guide other studies in which comfort zones will be determined according to the wind chill index and contribute to the literature.

Competing Interest / Conflict of Interest

The authors declare that they no conflict of interest. The none of the authors have any competing interest in the manuscript

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Analysis of Sufficiency and Accessibility of Active Green Areas in Cukurova

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ABSTRACT

In this study, the adequacy and accessibility of active green areas in Adana Province Cukurova district were tried to be determined by using field study, GIS, and numerical data. For this purpose, active green areas in 10 urban neighborhoods of the Cukurova district were determined. These areas are neighborhood parks, playgrounds, and neighborhood parks. By comparing the neighborhood areas where these active green areas are located, population data, and the area of active green areas, their suitability, and adequacy with green space standards were determined. Only 1 neighborhood in the study area complies with the total green space standards. 9 neighborhoods are not sufficient in terms of active green areas. The fact that the per capita values of active green spaces are far below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization in urban scale, clearly shows the effectiveness of the Development Plans on active green areas. It has been observed that accessibility to active green areas is not sufficient in the Cukurova district. This shows that the green areas in the district are not distributed regularly.

Anahtar Kelimeler:
Aktif Yeşil Alan,
Çukurova,
CBS,
Yeterlilik,
Ulaşabilirlik .

ÖZ

Bu çalışmada, Adana ili Çukurova ilçesindeki aktif yeşil alanların yeterliliği ve ulaşabilirliliği arazi çalışması, CBS ve sayısal veriler kullanılarak tespit edilmeye çalışılmıştır. Bu amaç için, Çukurova ilçesinin şehir vasfındaki 10 mahallesindeki aktif yeşil alanlar belirlenmiştir. Bu alanlar mahalle parkı, çocuk parkı ve semt parklarıdır. Bu aktif yeşil alanların bulunduğu mahalle alanları, nüfus verileri ve aktif yeşil alanlarının yüzölçümleri kıyaslanarak, yeşil alan standartlarına uygunluğu ve yeterliliği belirlenmiştir. Çalışma alanında sadece 1 mahalle toplam yeşil alan standartlarına uymaktadır. 9 mahallede aktif yeşil alan açısından yeterli değildir. Aktif yeşil alanların kişi başına düşen değerlerin Çevre ve Şehircilik Bakanlığı'nın kent ölçeğinde önerdiği 10 m² /kişi normunun çok altında kalması, aslında İmar Planlarının aktif yeşil alan üzerindeki etkinliğini açık olarak göstermektedir. Çukurova ilçesinde aktif yeşil alanlara ulaşabilirliliğinin de yeterli olmadığı görülmüştür. Bu da ilçede yeşil alanların düzenli bir şekilde dağılmadığını göstermektedir.

1. Introduction

The green areas we see and use in our cities today have emerged as a solution to the problems caused by industrial cities. One of the solutions proposed to solve the multidimensional problems caused by the rapid urbanization that emerged with industrialization was to create more open and green spaces in cities [1-12]. However, the ever-increasing urban population prevents the production of open and green areas from being successful and the dimensions of the problem are increasing day by day. In most of the big cities that are the scene of industrialization and urbanization movements, the increasing building density and unplanned development of other needs with the population increase, the

disconnection with rural areas, the unconscious consumption of the existing open and green areas, and the mechanization of life negatively affect the people of the city psychologically and cause them to wear out. [13-27]. It is a fact that the possibilities of cities, which are getting more and more intense in terms of structure and people, in terms of green areas are becoming more and more inefficient. The proportion of open-green areas reserved for construction within the urban fabric emerges as an important factor in healthy urbanization. Active and passive green spaces are important in terms of the needs and life of the city, which is trying to survive in the deteriorating environmental conditions. Among different urban uses, green areas have the characteristics of improving the physical structure of the city, adding aesthetic value to the city, meeting recreational needs, increasing the air quality, and providing the ecological balance [19-23,28-35]. The need for green areas has been felt in every period of history. This need continues today. Green areas are one of the factors that determine the structure of a city. Coordination among those dealing with the physical layout, such as geographers, city and regional planners, landscape architects, is a must to obtain green space systems with a well-resolved connection to the city as a whole [36].

According to Öztan [36] (1968), the functions of green spaces are listed as follows;

• Green areas provide the physical balance of a city and act as a buffer between different areas that show disagreement in terms of the settlement, trade, and industrial characteristics.
• It is a balance element that reduces the density of buildings and people in the city or controls the settlement spread towards the peripheral belt.
• Green spaces have an important role in light, air, noise, and pedestrian safety. Green areas in the city provide safety in terms of traffic for people by separating vehicle traffic from pedestrian, recreation, and residential areas. Green areas also have a feature of absorbing or dispersing noise.
• Green areas add microclimatic properties to a city. In general terms, the temperature in green areas is 6.5°C warmer in winter and 10°C cooler in summer compared to urban areas.
• Green areas provide convenience for circulation. One of the most important functions of a city's green areas is to provide entry and easy movement for vehicle and pedestrian traffic. It provides convenience for people and vehicles to enter buildings and streets near green areas.
• While green areas provide an outdoor space organized for recreational purposes, they create a physically organized space for special activities at certain times of the year. These areas prepare all possibilities for active and passive recreation of people.
• Green spaces create an interest in the organic system in cities. These areas are among the geometric building patterns of the cities and eliminate monotony. It enables all elements of the city to be connected. It should ensure that one open area is connected to another by tree-lined paths, building greenery, and small open spaces.
• Green spaces establish a balance between a person in the city and his surroundings in terms of measure. The most important feature of the building and the open green areas around it is that it has brought the human-environment element relationship into an appropriate measure by alleviating the pressure of the building masses on people.
• Green areas serve the city aesthetically. Green areas are especially valuable as an aesthetic asset that removes the dryness of the city, gives it vitality and color with the voluminous greenery of the trees inside.
In short, in our rapidly growing cities, the importance of green areas in terms of ecological and aesthetics, as well as socio-cultural and economic, is increasing day by day. Therefore, it is necessary to investigate the adequacy, accessibility, and usability of the existing green areas in the city. In this study, the current active green areas of Adana Cukurova district, one of the important tourism centers of our country, and the adequacy and accessibility of these areas according to the population density of Cukurova will be determined. It is aimed that the results obtained will guide local administrations, city planning, and development studies.

2. Material and Method

Study Area and Its Boundaries

Cukurova district is one of the central districts of Adana province. It is located between 37°09' North Latitudes and 35°14' East Longitudes. Cukurova; is located between the districts of Karaisalı in the north, Seyhan in the south, Sarıçam in the east, and Tarsus in the west (Figure 1). Since Çukurova district is located in the Mediterranean region, it is under the influence of the Mediterranean climate and for this reason, the summers are hot and dry, and the winters are rainy and warm. The southern part is lowland and flat, while the northern part is forested and hilly.

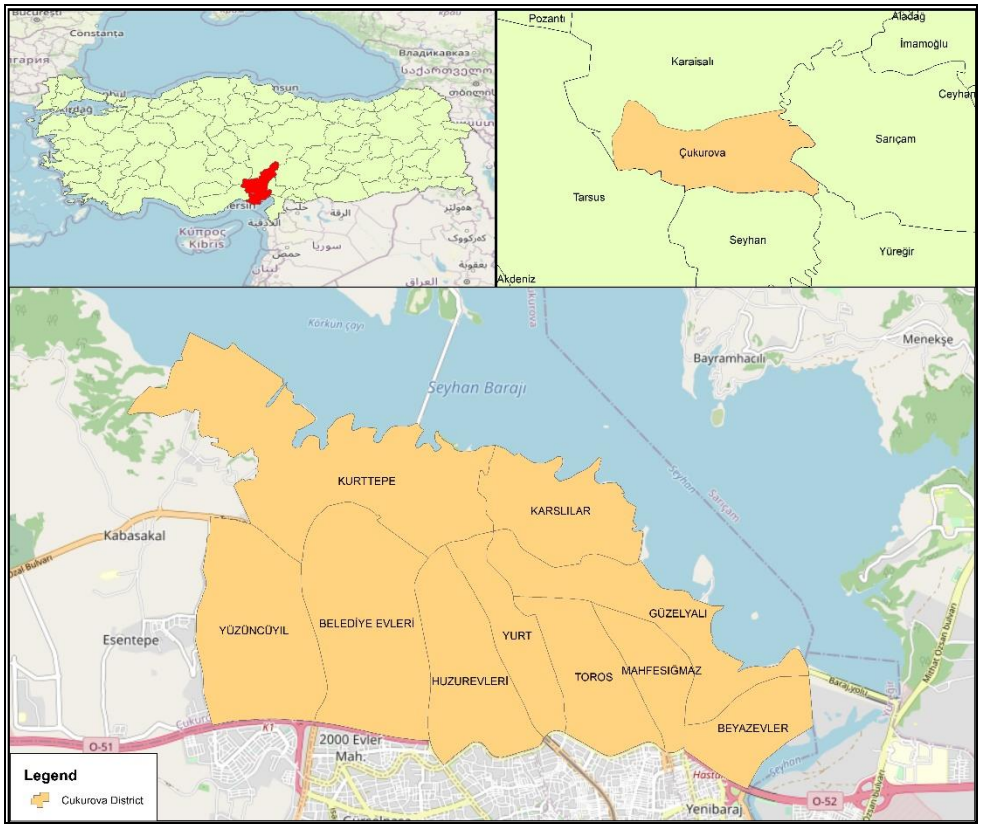

Figure 1: Location Map of Study Area

In the study, 1/5000 scaled digital Master Plan and True orthophoto images from the General Directorate of Geographical Information Systems of the Ministry of Environment and Urbanization were used as materials to examine the current active green areas of Cukurova district of Adana province in terms of their distribution and accessibility in the city. Fieldwork was carried out in the study area, observations and examinations were made, and various maps were produced using the relevant resources (book, article, report, thesis, etc.), TURKSTAT data, Rural services land inventory. To identify and plan active green areas; Map bases were prepared with ArcGIS 10.7 software to use 1/5000 digital Master Plan and True orthophoto images to evaluate the current active green texture. Active green area maps per capita were prepared for 10 neighborhoods (Table 1) in the Adana Cukurova district, showing the current active green space situation. The active green space maps per capita and showing the green space status prepared for each neighborhood were compared in terms of the standards and planning criteria used in previous studies. Taking into account the total area and population density of the Adana Cukurova district, maps were produced by analyzing the density and accessibility of active green areas using spatial analysis methods

Table 1: 10 Neighborhoods

Neighborhoods
Kurttepe
Karslılar
Yüzüncüyıl
Belediye Evleri
Huzurevleri

Yurt
Toros
Güzelyalı
Mahfesığmaz
Beyazevler

Results and Discusions

Distribution and Density of the Population

Cities are places where large masses of population gather. In urban settlements, the urban spatial distribution of the population is not homogeneous, but heterogeneous [37]. Although the Cukurova district was not a densely populated settlement before 2000, a significant population increase has been observed especially in the last 20 years. Parallel to this population increase, the area where the city expanded towards the north, northeast, and west, and as a result, the number of neighborhoods and population density of the neighborhoods increased [38].

There are 10 neighborhoods within the boundaries of the study area. There are differences in the population amounts of Cukurova district neighborhoods. The neighborhood with the least population is Karslılar District with a population of 4831, while the most populated neighborhood is Nursing Homes with a population of 62460. The area covered by the first established and determined according to the socio-economic conditions of that day was shaped according to the conditions of that day and this situation continues. However, most of the home-type houses in these neighborhoods have turned into shops and stores in the past historical processes. However, with the urban transformation, some house-type residences turned into multi-story buildings and the population density increased in those neighborhoods [38].

When the population numbers of Cukurova neighborhoods are examined, it is seen that two of the most populous neighborhoods were established on the edge of the Seyhan dam lake and they are scattered around. The areas of these areas are large and the number of building floors in most areas is low. For example; Karslılar, Kurttepe, and Beyazevler are the districts. The most populous ones are Nursing Homes, Toros, Municipalities, Yurt, and Güzelyalı neighborhoods. (Figure 2).

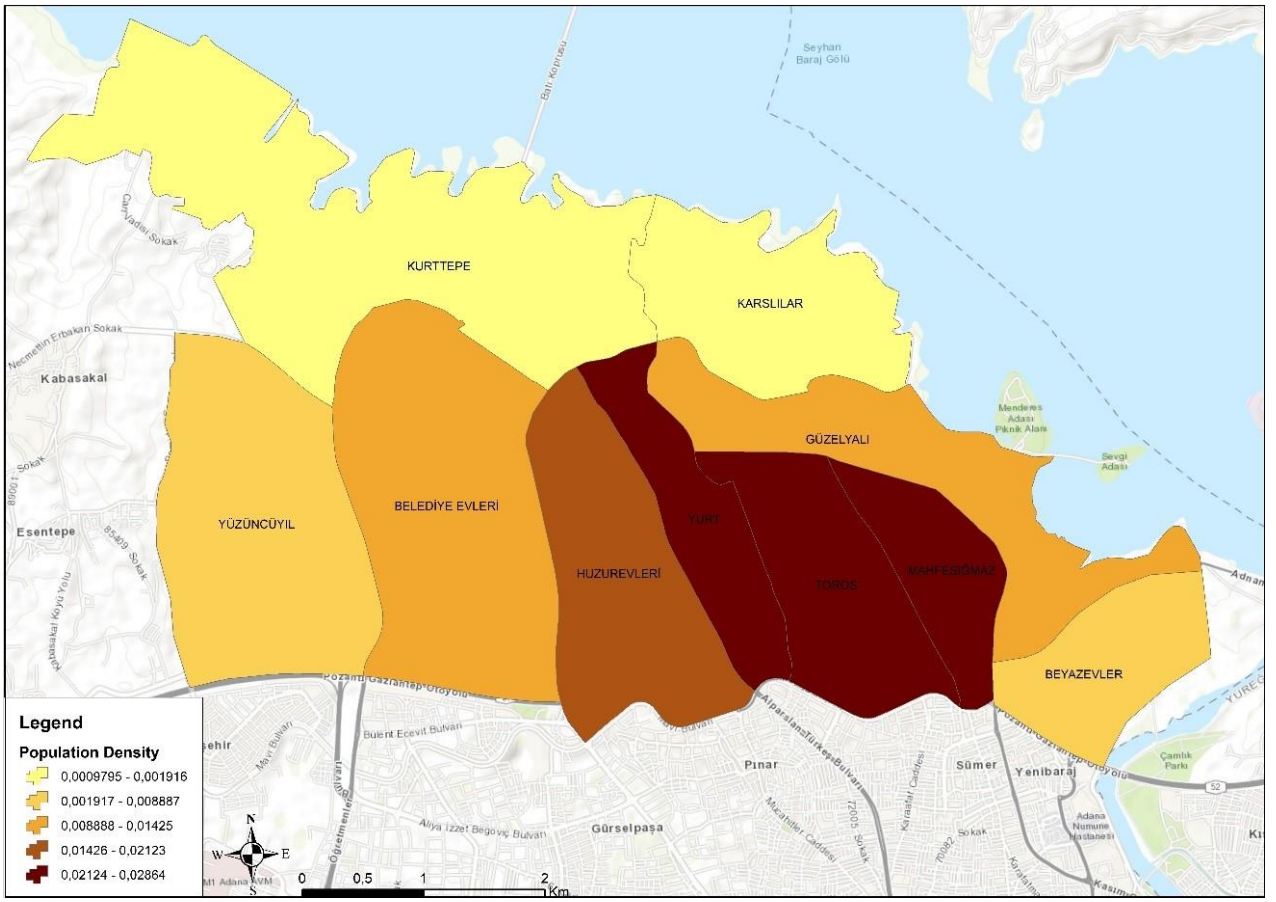

Figure 2: Population Density Map of Cukurova District

Green Areas: Areas covered with plants are called green areas. Recreation areas, picnic and resting places, park forests of various features, national parks, groves of large and small tree communities, and city parks, which are large in and around the city, and trees in clusters, groups, or rows of trees and ornamental shrubs. , roads, playgrounds, pools, etc. with flowers, grass areas, and compatible with them. Various types of garden areas including artificial facilities such as all are included in the concept of green areas [39].

Green areas that allow recreation can be classified according to their location in the city or their relationship with the city and their structural status. Green areas in the city are easy-to-access areas that can be used all day within a 5-15 minute walk. Neighborhood parks, children's gardens, sports and playgrounds, home gardens can be counted among these. Green areas in the city are areas that are mostly visited daily or used on weekends. It is among the regional parks and coastal parks [39].

The depressing effects of the monotonous life caused by the housing, population, and traffic density in Cukurova on the mental and physical structures of the people in the city make the people living in the city feel the necessity to participate in renewal and recreational activities [40-41]. However, when compared to western and developed country cities in terms of the number of active green areas found in the city and considering the minimum value (10 m²) of active green areas per person specified in the zoning plan regulation, it is very low in Cukurova district. As a result of the calculation made taking into account the amount of active green space available in Cukurova and the urban population of 2019, the active green area rate per person was determined as 2.53 m².

There are some active green areas in all of the sites in the study area. Kurttepe neighborhood has the least active green area with 3550.59 m² and the amount of green area per person is 0.54 m². With an area of 221 894.4 m², the neighborhood with the greenest areas is Belediye Evleri and its population is 57188 and the green area per person is 3.88 m². Although

Belediye Evleri quarter has the greenest areas, it is not the neighborhood with the highest green area per person. This is because its population is very large. Karslılar is the quarter with the highest green area per capita at 4.45 m² and 16.93 m². (Figure 3).

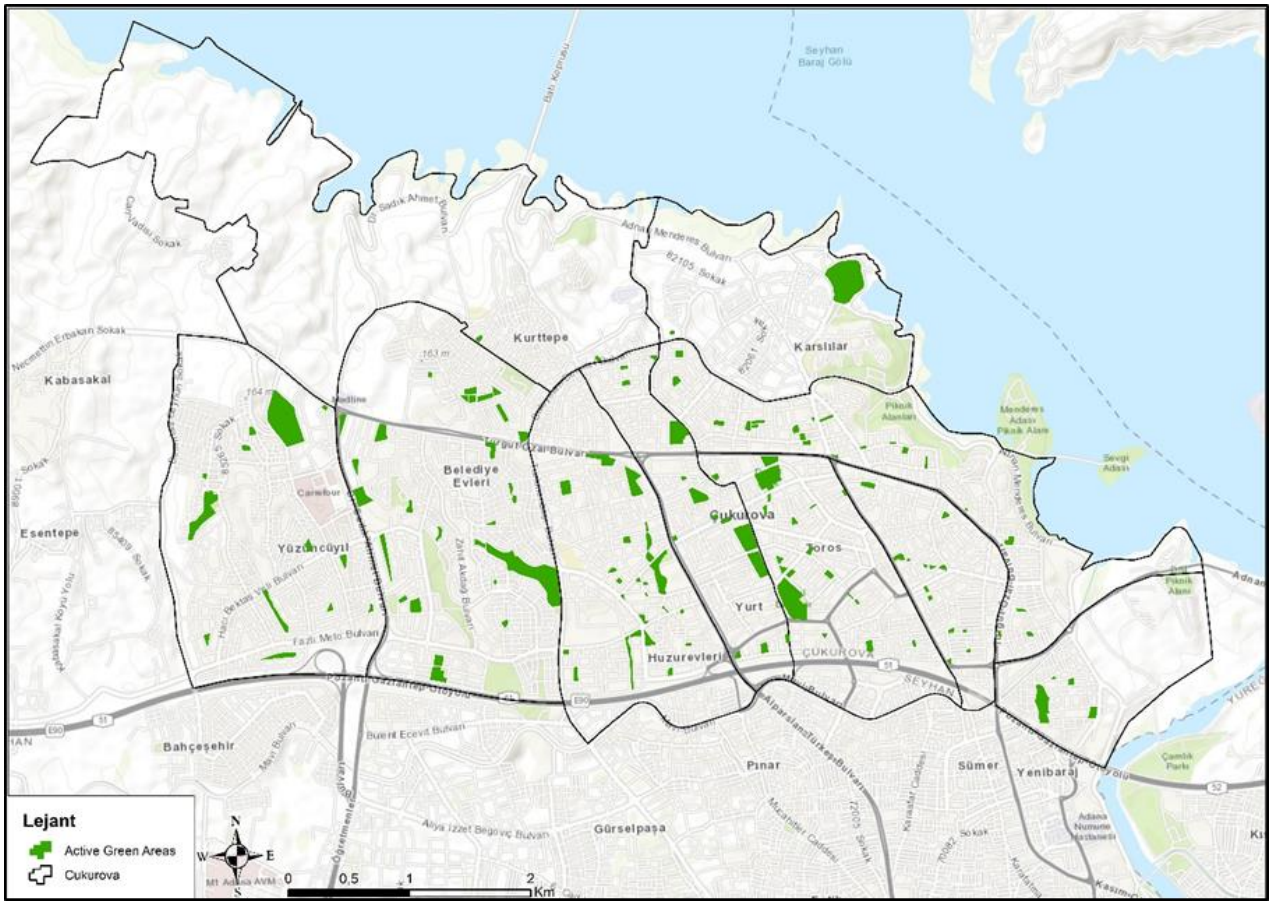

Figure 3: Distribution of Green Areas in Çukurova District

When we examine the green areas at the neighborhood level, neighborhood parks, which are one of the smallest green areas open to the public in urban areas, are mostly green areas that are used daily. The impact area of the neighborhood parks, which should be at least 8 decades in the area, does not exceed 800 m [42]. In addition to resting, sitting, and watching the scenery in the green area of the neighborhood park, table, and floor games such as mini chess, table tennis, in the appropriate places of the green area, these activities are function areas that encourage the public to the recreation culture. Facilities such as toilets, teahouses, and buffets should be included in the parks, and services that meet the eating and drinking needs of visitors [42,43]. In the neighborhood parks in the Cukurova district, there are generally children's playgrounds, sitting benches, and outdoor sports equipment. Also, in most of these parks, there are areas to meet the eating, drinking, and toilet needs of the people, recreational vehicles, and cafeterias that will attract visitors. When we examine the active green areas of the Cukurova district in terms of accessibility indicators, it is seen that there is a balanced distribution within the city. While the green areas in the Cukurova district are spread throughout the district except for the north-northeast, it draws attention that the periphery of the city is lacking in terms of accessibility. In the Cukurova district, Nursing Homes are located at a distance of 0-500 meters from the Municipal Houses Quarters in terms of accessibility. (Figure 4). Neighborhoods such as Kurttepe, Karslılar, and Beyazevler lack accessibility.

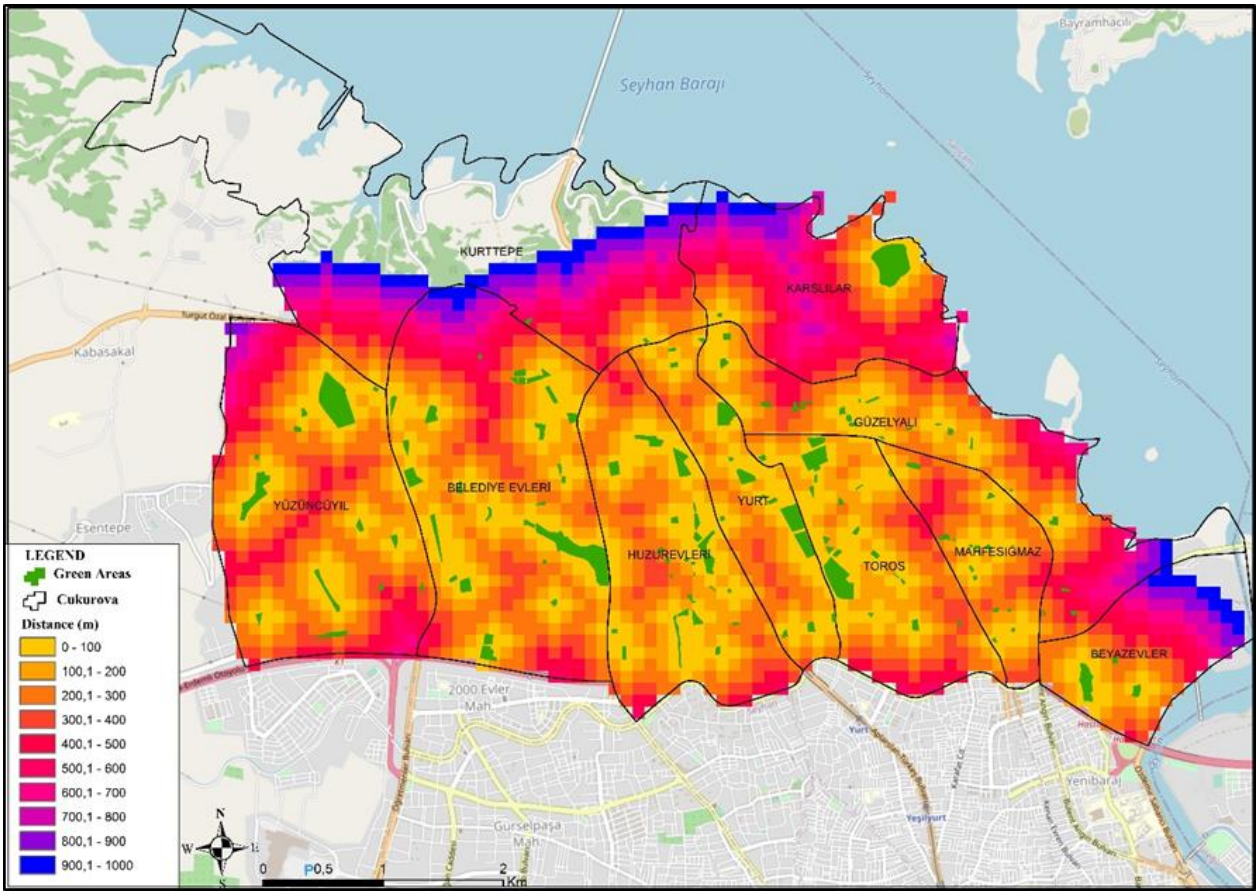

Figure 4: Accessibility of Green Areas in Cukurova District

When looking at the active green area density in the Cukurova district, the areas shown in dark green are the areas with the most active green areas. Especially in the area where the neighborhoods in the periphery of the district are located, the active green space density is very low. Looking at the densely populated neighborhoods, all of the neighborhood areas are concentrated in certain areas. These neighborhoods are Dormitory, Nursing Homes, Municipality Houses, and Yüzüncüyıl neighborhoods. The concentration of densities in certain regions leads to a deficiency in terms of competence and accessibility.

Green Area Inventory of Neighborhoods

Green area inventories in the neighborhoods are considered as active green areas under the title of green areas in the Cukurova Zoning plan. Evaluations made in 10 neighborhoods within the boundaries of the Cukurova district were made taking into account the norms that should be at the city scale.

Kurttepe Neighborhood: It is located in the northwest of the city, Karslılar neighborhood in the east, Belediye Evleri neighborhood in the south, Huzurevleri in the south and Yüzüncüyıl neighborhood in the southwest, Güzelyalı neighborhood in the southeast. In Kurttepe neighborhood, the population is 6,530, 666,502.65 m², and the active green area is 3550.58 m² compared to 2019. The active green area of 0.54 m² per person in the Kurttepe neighborhood is far below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Karslılar Neighborhood: Karslılar district is located in the northeast of the city, Kurttepe neighborhood in the west, Güzelyalı district in the south, and Yurt neighborhood in the southwest. In the Karslılar neighborhood, the population is 4831, the neighborhood area is 2520967.99 m² and the active green area is 81817.45 m² compared to 2019. The presence of active green areas of 16.93 m² per person in the Karslılar neighborhood is above the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Yüzüncüyıl Neighborhood: Yüzüncüyıl district is located in the west of the city, Belediye Evleri quarter in the east, and Kurttepe district in the northeast. In the Yüzüncüyıl neighborhood, the population is 36037, the neighborhood area is 4054833.998 square meters and the active green area is 160474.86 square meters compared to 2019. The active green area per person falls to 4.45 m², in this case, it is below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Belediye Evleri Neighborhood: The Belediye Evleri neighborhood is located in the center of the city, Yüzüncüyıl neighborhood to the west, Huzurevleri neighborhood to the west, and Kurttepe neighborhood to the north. In the Municipal Houses neighborhood, the population is 57188, the neighborhood area is 4646716.817 m² and the active green area is 221 894.49 m² compared to 2019. The active green area per person falls to 3.88 m², in this case, it is below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Huzurevleri Neighborhood: Huzurevleri district is located in the center of the city, Yurt neighborhood in the east, Belediye Evleri quarter in the west, and Kurttepe district in the north. The population of the nursing homes is 62460, the neighborhood area is 2942079.94 m2 and the active green area is 115062.16 m2 compared to 2019. The active green area per person falls 1.84 m², in this case, it is below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Yurt Neighborhood: is located in the center of the city, Toros neighborhood in the east, Huzurevleri district in the west, Güzelyalı, and Karslılar in the northwest. The population of the dormitory district is 45876, the neighborhood is 1601802,446 m² and the amount of active green areas is 105474.15 m² compared to 2019. The presence of active green areas of 2.29 m² per person in the dormitory neighborhood is below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Toros Neighborhood: Toros district is located in the east of the city, Mahfesığmaz neighborhood in the east, Yurt neighborhoods in the west, and Güzelyalı district in the north. The population of the Toros neighborhood is 61851, the neighborhood area is 2275011.51 m² and the active green area is 124218.160 m² compared to 2019. The presence of active green areas of 2 m² per person in the Toros neighborhood is below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Güzelyalı Neighborhood: Güzelyalı district is located in the east of the city, Karslılar neighborhood in the north, Mahfesığmaz, Toros in the west, Beyazevler neighborhood in the south of Yurt districts. The population of Güzelyalı district is 41527, the area of the neighborhood is 2913674.104 m² and the amount of active green area is 68258.158 m² compared to 2019. The presence of active green areas of 1.64 m² per person in the Güzelyalı neighborhood is far below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Mahfesığmaz District: The Mahfesığmaz neighborhood is located in the east of the city, Güzelyalı district is in the east, and Toros district is in the west. In the Mahfesığmaz neighborhood, the population is 34901, the neighborhood area is 1300559.45 m² and the active green area is 22616.44 m² compared to 2019. The presence of active green areas of 2 m² per person in the Mahfesığmaz neighborhood is below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Beyazevler Neighborhood: is located in the southeast of the city, in the northwest is Güzelyalı district. In Beyazevler Neighborhood, the population is 9487, the neighborhood area is 162 1902.87 m2 and the active green area is 35161.59 m2 compared to 2019. The presence of active green areas of 3.70 m² per person in the Beyazevler neighborhood is below the 10 m² / person norm recommended by the Ministry of Environment and Urbanization on an urban scale.

Table 2. Showing of the active green area per person of the neighborhoods

Neighborhood	Area m²	Total Population	Green Area m²	Green Area Per Person m²
Kurttepe	6666502,65	6530	3550,58	0,54
Karslılar	2520967,99	4831	81817,45	16,93
Yüzüncüyıl	4054833,998	36037	160474,86	4,45
Belediye Evleri	4646716,817	57188	221894,49	3,88

Huzurevleri	2942079,94	62460	115062,16	1,84
Yurt	1601802,446	45876	105474,15	2,29
Toros	2275011,51	61851	124218,160	2
Güzelyalı	2913674,104	41527	68258,158	1,64
Mahfesığmaz	1300559,45	34901	22616,44	2
Beyazevler	1621902,87	9487	35161,59	3,70
Total	**30544051,801**	**360688**	**912808,975**	**2,53**

Conclusions

Within the scope of this research, the Cukurova District; urban green areas, population density, and accessibility of the city were examined in terms of active green areas. According to the study, the spatial distribution, density, and adequacy of green areas were determined by calculating the amount of active green areas per capita in 10 neighborhoods that make up the city and discussed in terms of green space adequacy for the future. When the working area is examined as active green areas; As data of 2019, the active green area per person in Cukurova District is 2.53 m². According to the Zoning Law, the amount of green space in urban areas is 10 m² [44]. The total green area of Cukurova Active is 7.47 m².

10 neighborhoods in the study area were examined one by one and the area, population, active green area, and the number of green areas per person was determined. Accordingly, Kurttepe, Güzelyalı, Huzurevleri neighborhoods have been identified as places with the least active green space. It is known that city centers are the busiest and most active places in the city and these neighborhoods are located in the center of the Cukurova district. For this reason, green areas should be built in these neighborhoods urgently. When we look at the Karsılar neighborhood a little outside the district, the amount of active green areas (16.93 m²) is above 10 m², which is the measure of the zoning law.

Considering that the active green areas in the city are places to escape from the dense concrete structures of the city and the excess population and traffic situations, the excessive and dense structures of the district and the scarcity of green areas have negative effects on people. For this reason, we need to transform these areas into green areas by preserving existing green areas and realizing projects that revise the gaps in urban open and collapse areas. When urban active green areas are examined in the Cukurova district; It is seen that it is not in integrity within the areas of use and within the district, and it is insufficient when considering the ratio of the green area to the population.

Researches show that the insufficient amount of active green areas in the Cukurova District is not sufficient to explain the green area problem. If public areas in the city are used for different purposes, it is recommended that these areas be transformed into active green areas. Considering the active green areas in the Cukurova district, the active green areas should be distributed proportionally based on the neighborhoods and the quality of the existing green areas should be increased and put back into use. Applied in developed world cities in recent years; To take short breathing in the intense work tempo, rest and also to meet the children's need for play, their average size is 500 m² and the impact area is 500 m radius [45]. Another suggestion can be to meet the recreational needs of city residents by building Pocket Parks. By increasing the number of active green areas available; Neighborhood parks, pocket parks, neighborhood parks, and city parks are active green areas recommended for the Cukurova district.

Competing Interest / Conflict of Interest

The authors declare that they no conflict of interest. The none of the authors have any competing interests in the manuscript.

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Use of Geosynthetics in Road Construction

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ABSTRACT

Road and railway stabilization is the use of geosynthetic reinforcing elements to strengthen the ground in order to work on very soft and weak ground in the construction of asphalted or unpaved vehicle roads and rail systems. The geosynthetics increase the performance and design life of highways and railway construction structures in applications such as geogrids, roads, railways, airports and other earthworks with poor ground strength. Geosynthetics offer a much higher value than traditional road construction products and the fast, simple installation process greatly reduces the construction process. On highways, geosynthetics are placed on the weak base floor before the geosynthetic granular substrate is placed. Geosynthetics protect the structural integrity of the slab and prevent the granular sub-base material from slipping into the weak substrate. The use of geosynthetics extends the maintenance requirement of the flooring that is built on a weak floor.

Anahtar Kelimeler:
Asfalt,
Geosentetik,
Yol İnşaatı,
Demiryolu Stabilizasyonu.

ÖZ

Karayolu ve demiryolu stabilizasyonu, asfaltlı veya asfaltsız araç yollarının ve raylı sistemlerin yapımında çok yumuşak, zayıf zeminde çalışmak ve zemini güçlendirmek için geosentetik takviye elemanlarının kullanılmasıdır. Geosentetikler, geogridler, yollar, demiryolları, havaalanları ve zemin dayanımı zayıf olan diğer toprak işleri gibi uygulamalarda otoyolların ve demiryolu inşaat yapılarının performansını ve tasarım ömrünü artırır. Geosentetikler, geleneksel yol yapım ürünlerinden çok daha yüksek bir değer sunar ve hızlı, basit kurulum süreci ile inşaat sürecini büyük ölçüde azaltır. Karayollarında, geosentetik granüler alt tabaka yerleştirilmeden önce zayıf taban zemine geosentetikler yerleştirilir. Geosentetikler, levhanın yapısal bütünlüğünü korur ve granüler alt taban malzemesinin zayıf alt tabakaya kaymasını önler. Geosentetik kullanımı, zayıf bir zemin üzerine inşa edilen döşemenin bakım ihtiyacını artırır.

1. Introduction

Geosynthetic materials are widely used in many civil engineering fields, especially geotechnical engineering. Synthetic fiber, which is the raw material of geotextile, was produced from PVC (polyvinyl chloride) in the beginning of 1900s and since the mid-1960s, non-woven fabrics were manufactured as fabrication. The first known geosynthetic material application was synthetic woven fabrics (geotextiles) used in Florida USA for the control of coastal erosion in 1958 and it is seen that this geotextile material application still continues its duty [1].

In the following years, the usage of geosynthetics has increased rapidly in other fields of civil engineering such as geotechnics with the expansion of the usage area of geotextile products with different functions and the creation of geomembrane, geogrid and geocomposite products [2].

The ability of these polymer-based products to be produced by adapting them according to their needs, their lightweight structures with ease of transportation and being easy-to-use materials compared to other building materials play an important role in the expansion of their usage areas [3].

According to the definition of ASTM, Geosynthetics are polymeric planar products that are used in conjunction with a soil, rock, soil or other Geotechnical engineering material as part of a construction project, structure or system. Although the first known application of geosynthetic materials in the field of civil engineering has been seen in the field of geotechnical engineering with the application of soil improvement with geotextile material, its usage has become widespread due to different manufacturing types and application possibilities and it is used in almost all fields of civil engineering today [4].

According to production types; geosynthetics, including geotextiles, geogrids, geomembranes, geonets, geocomposites, and geosynthetic clay coatings and some other products are included with conventional materials known in applications [5].

2. Geosynthetics

Geosynthetic materials are used in civil engineering projects for many purposes including separation, drainage, strengthening and filtering. In order to replace these materials with alternative materials, gaining advantages in terms of material quality control, manufacturing quality control, cost advantages, technical superiority, shortening of construction time, material development, material availability and environmental sensitivity play an important role [6,7].

Table 1. Functions of geosynthetic materials (Hayden and friends, 1999)

Function	Geotextile	Geogrid	Geomembrane	Geocomposite
Filtering	√			√
Drainage	√			√
Separation	√			
Strengthening	√	√		
Insulation	√		√	

ASTM defines a geotextile as a permeable textile product used as a part of a construction project, structure or system in combination with soil, rock, soil or other Geotechnical engineering material [8].

Geotextile materials are mainly made of polyester (PES), polypropylene (PP) or polyethylene (PE-HD). It is found in the form of felt mats, either as geocafes or as combined materials. Felt materials are obtained by mechanical, thermal or chemical stabilization of superficially superimposed fibers or endless fibers.

• Mechanically reinforced matting mats are obtained by needling method. In this method, the eared needles are immersed in the fiber mat to be compressed and withdrawn again, thereby ensuring that the fiber systems are wound together. The mechanically reinforced felt-like material becomes soft, easy to shape and is bulky [9,10].

• The thermally stabilized felt material is usually bonded by heating under pressure. The fibers have a low melting sheath and a fusion occurs at the overlapping points.

• Chemically stiffening felt material is obtained by wetting with a bonding material which hardens by heat treatment. A solid bond occurs where the fibers come into contact with each other. Therefore, the chemically hardened material becomes very hard.

This felt-like material (geotextile) is water permeable and generally has the ability to stretch. The tissue consists of fibers arranged perpendicular to each other. They are separated from each other by the type and type of fibers [11].

Medium, bad and especially very bad infrastructures can be improved with Geotextile application. Geotextiles are permeable geosynthetics containing synthetic polypropylene or polyester fibers with a thickness of 0.4-3 mm and a weight of 70-350 gr. Geosynthetics are studied in two different classes according to their structure; [12,13]

• Woven Geotextile, perpendicular to the fiber layer

• Nonwoven geotextile materials with isotropic behavior where fibers are randomly distributed. These flexible geosynthetic materials with high deformation properties,

• Separating the layers of granular material,

• Strengthening the ground by increasing the contact surface on the ground with insufficient mechanical strength,

• Filter with small cavity structure,

• Water permeable structure is used to provide drainage [14].

3. Functions of Geosynthetics

Geotextiles are widely used in many fields of the construction sector with their hollow, partially durable structure and easy to use functionalities [15].

When designing the geotextiles in construction structures, six functions of geotextiles are taken into consideration. Geosynthetics with raw cavity structure; They are used with separation, filtering, drainage, protection and strengthening functions, and they are also used with insulation function by saturating the hollow structure.

Separation function: When the geotextile is placed on the interface of fine-grained ground and coarse ground, it acts as a separation. Thus, it prevents the mixture of materials to be formed due to dynamic or static load coming from the superstructure. As a result of their continuity, flexibility, deformability, permeability and high tensile strength, geotextiles distinguish between two floors with different geotechnical properties without interfering with the natural circulation of water [16,17].

In addition to these functions, when geotextile materials are used for separation purposes; [18]

• Increases the service life and carrying capacity of the roads as it prevents the movement of fine-grained soils under dynamic loads and allows the drainage of excess water,

• Ensures continuity even in weather conditions where construction can stop, as it prevents mixing of quality material and fine-grained ground,

• Using less aggregate in the filling and infrastructure works of road and railway constructions and providing better compaction,

It provides many functions by itself by performing its functions [19].

Filtration function: The geotextile acts as a filter, allowing water to pass through, but still holds the smallest grain diameter floor and does not allow it to drift. Geotextile is placed against water flow. It is desirable that the geotextile to be used in filtration work should have suitable maximum pore opening, sufficient water permeability, less impact from compression and high porosity [20].

After the placement of the geotextile, some fine-grained soil is carried along with the water in the soil. This material carried in the first stage must pass through Geotextile material. Thus, a layer is formed against the geotextile without fine-grained material. This naturally acts as a screened filter layer to prevent the movement of small particles towards the Geotextile. If these fine grains are retained within the Geotextile, a less permeable layer is formed and the flow of water is prevented. In order not to interfere with the flow of water and to prevent the formation of pore pressure, the permeability of the geotextile should be at least the permeability of the ground. Considering the risk of clogging and the compression of the geotextile into an impermeable structure, the safety factor is taken as 10 or 100 in the construction of important dam structures [21].

Drainage function: The geotextile transports liquid or gas along its plane to the desired outlet. During this transmission, the liquid or gas is collected in the Geotextile and transferred in its own plane. Geotextiles are more permeable than ground. Especially when they are porous and sufficient slope is achieved, water flow can be

provided in their planes. Therefore, it is useful to use in constructions such as tunnels, vertical drains, reservoir pavements and foundation walls where water must be drained [22].

Geotextile materials to be used for drainage should have high permeability, high resistance against pressure and good filter properties in their plane.

Strengthening function: It is the spreading of point loads over a wide area evenly and strengthening the floor mass by resisting the tensile forces formed.

Unlike floors, Geotextile materials have tensile strength. By joining the soil structure, they increase the tensile strength and deformation ability before breaking and provide strengthening of the soil. Thanks to reinforcement, significant material savings can be achieved by reducing or eliminating the need for aggregate material to be used for reinforcement in road constructions on soft floors [23].

Protection function: Geotextile materials protect the desired material by spreading it over a larger area by reducing the deformation and stress by placing it around the ground layer or the structural element or contact surface where it is required. For example; The geotextile material placed between the asphalt pavement and the old road pavement or between the geomembrane and the concrete surface for which waterproofing is required, protects the materials between which it is placed against deformation such as puncture and tearing.

Insulation function: The geotextile material is saturated with bitumen or plastic insulating materials to form an impermeable layer to provide a structure that will act as a kind of geomembrane. Geotextile materials are used with insulation function, especially by laying on the old road pavement on the roads to be renewed. The geotextile to be used with the insulation function must be capable of retaining a sufficient amount of bitumen in order to achieve an impermeable structure [24].

4. Usage areas of Geosynthetics

Geotextile materials have a wide range of applications. However, if the main titles are to be examined, geotextile materials are used on the basis of separation, filtering, drainage, strengthening, protection and insulation functions [25].

The main task of geotextile materials is to help reduce stresses and deformations, and to increase the bearing capacity and prolong the life of the added layers. Geo synthetic material is used between the existing floor and platform or frost protection layer. It is placed on the compacted platform and covered with a protective material. Geotextile material is used to prevent irregular settlements by regularly distributing both static and dynamic effects to the ground in highways and railways. In this case, geotextile materials are under the influence of both hydraulic and mechanical formations and should also prevent the pumping of fine materials into coarser top sheets [26].

Geotextile materials are thermally bonded or pinned felt mats or cages made of non-decaying synthetic material fibers. The lower the bearing capacity of the floor, the more heavy the felt must be used. The thermally stabilized geotextiles have a weight of about 100-200 g/m^2 and the needled ones weigh about twice that. The application of geotextile materials can be done mechanically during platform correction. In this way, since no additional work is required for the application of geotextile material, initial construction costs are very low, after the application will reduce the maintenance and renewal costs in the region and frost damage is seen as an economic advantage [27].

5. Geosynthetics in road construction

Geosynthetics have an assortment of employments from disintegration control to bank fortification to improved subsurface seepage. One of the most widely recognized uses, in any case, is in road construction, especially impermanent roads, for example, construction roads, get to roads and woods ways. These are the advantages of utilizing geosynthetics for these applications. Geotextile to the road infrastructure in Figure 1 thanks to the separation function when applied the layers are prevented from mixing with each other [28].

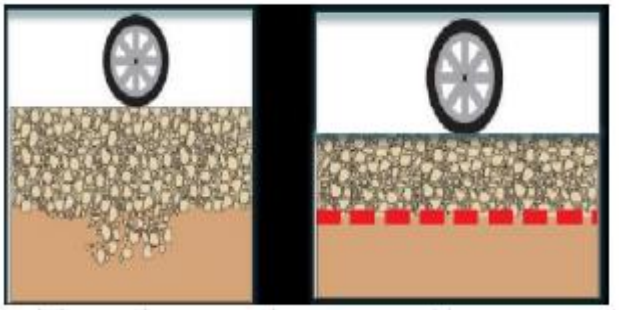

Figure 1. Geosynthetics in road construction

Bearing limit:

For building the two roads and parking garages, it's significant subgrade is steady with adequate bearing limit. By utilizing geogrids between the subsoil and base course, bearing limit is expanded. The interlocking of the spread soil with the geogrid gives level power move, which serves to expand bearing limit and, by and large, take into consideration base course thickness to be decreased. This strategy additionally makes costly soil trade superfluous [29].

Rutting:

One of the essential concerns when building unpaved roads on delicate subsoil is rutting and between blending of spread material into the subsoil. By improving burden circulation, geogrids serve to limit both rutting and soil intermixing. A particular task's necessities will direct the determinations of the geogrid required [30].

Power extension:

Low extension qualities of a geogrid are required for a fruitful fortification application. In numerous tasks, power assimilation at stretching requires an item with between 2-percent and 5-percent limit. For all the more requesting applications, items with up to 8-percent extension at break are accessible [31].

Establishment power:

At long last, it's essential to consider a geogrid's protection from establishment loads. High unique anxieties can negatively affect support while introducing and compacting spread soils and base course materials. To withstand this pressure, a geogrid ought to have thick, solid support bars [32].

Utilizing geosynthetics gives a more financially perceptive and productive technique than numerous options in an assortment of utilizations. To find out additional, or to discover the geosynthetics required for your next undertaking, come see us at Maxwell Supply of Tulsa.

6. Conclusion

Geosynthetic materials, which started to be used in the field of geotechnical engineering with the fabrication of geotextile materials in the 1960s, are now widely used in many fields of civil engineering, including road structures. In road engineering, geosynthetic materials are involved in forming drainage structures, separating different layers, preventing irregular settlements, providing waterproofing, protection of products providing waterproofing and strengthening of road infrastructure and superstructure layers.

As in the world, the use of geotextile and geomembrane materials in road engineering is widely seen in our country and different applications are frequently encountered according to the functions of these materials. However, as it can be seen in the researches, although it has been seen that there are many applications around the world to improve the road line stabilization by using geogrid material and to decrease the ballast and sub-ballast layer thicknesses, there is no known application in this regard in our country yet.

Competing Interest / Conflict of Interest

The author declare that they have no conflict of interests.

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