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EDITORS

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PREFACE

From the past to the present, natural ecosystems are constantly changing and have been negatively affected as a result of the intense relationship and interaction of people with nature. Various negative impacts are increasing, especially in water security, food production, settlements, and infrastructure.

In this context, climate change, food production, environmental problems, unhealthy urbanization, and the destruction of natural ecosystems are the biggest global problems nowadays.

Although mankind has reached the level of a Super Smart Society (Society 5.0) with technology, knowledge, and digitalization, “Environmental Problems” (*For example, unhealthy urbanization and settlements, loss of biological diversity, negative effects of climate change, destruction of natural areas, inappropriate land use, environmental pollution, waste, and residues,* etc.) is constantly increasing.

For this reason, instead of a human and economy-oriented approach, solutions should be produced with an interdisciplinary common mind and ecological awareness level for the solution and improvement of multifaceted problems.

In this context, it is of great importance to developing interdisciplinary/multiple cooperation and joint studies under the roof of “ARCHITECTURAL SCIENCES” rather than a single architecture in spatial planning/design/conservation/repair/management processes.

“ARCHITECTURAL SCIENCE” is defined as a holistic organization that includes the planning, design, management, repair, and protection of natural and cultural spaces (building environment) within the framework of principles, (e.g.functional, aesthetic, ecological, artistic, social, scientific, cultural, technological and economic, etc.) from the single object and building scale to basin and country scale.

In this context, the ***"Journal of Architectural Sciences and Applications"*** **(JASA)** was established in 2016 for cooperation,

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knowledge production, and sharing at the international level. (JASA link: https://dergipark.org.tr/en/pub/mbud).

As JASA's Journal Editors, scientific journals and scientific books are published to develop inter and multi-disciplinary cooperation and joint studies. In addition, international scientific symposiums are also organized.

In line with the mission of JASA, This Book, which includes 16 academic studies under the title of “***Architectural Sciences and Urban Agriculture*****”**, has been published.

In This Book, the theme of urban agriculture, which is seen as an important opportunity for food supply and safety in cities, is discussed, and different approaches to the urban area and surrounding agricultural areas are presented. Thus, in 16 different Book Chapters, current issues and problems have been examined from the perspective of urban agriculture and suggestions have been made.

We would like to thank especially the valuable authors who contributed to the book, all the referees for their support and contribution, and IKSAD Publishing House for their support during the printing process.

We hope it will be beneficial to our country and all stakeholders.

Best regards…

“Urban Agriculture is the City's Insurance for the Future of Food Supply and Security”.

EDITORS

Dr. Hüseyin Berk TÜRKER
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Comprehensive Review on Urban Agriculture

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1. Introduction

Developing countries, as well as developed countries, entered a period of rapid economic growth In the 1950s and 1960s. Despite positive developments in the field of economic growth, it has led to a re-evaluation of the development process from the end of the 1960s since the developing countries could not solve the problems of poverty, unemployment, meeting basic needs, income distribution, and regional imbalance (Kaypak, 2012; Cengiz, 2013). Thus, urban development has begun to be seen not only as a process of economic but also as a process of change in the social and institutional structure. In addition, the world population has been increasing since 1960. The world population were 7.7 billion in 2019. Population projections show that the global population will reach 8.5 billion in 2030 and 9.7 billion in 2050. In 2018, more than half of the world's population (55.3%) lives in cities (United Nations, 2019). It is expected that this rate will exceed 60% in 2030 and the population of many cities will exceed 30 million (United Nations, 2018). Rapid population growth is unsustainable for cities and causes more problematic urban areas (Çorbacı & Ekren, 2021; Cengiz & Özdemir, 2021). Population growth has an impact on infrastructure, ecological, society, and economy in urban areas (Bettencourt et al., 2007; Rosser, 1980; Marshall, 2007; Gezer & Gül, 2009; Cengiz et al., 2014a; Gül et al., 2021; Tuğluer & Ekren, 2022).

There are many strategies and concepts for urban sustainability. The most prominent of these concepts recently is urban agriculture. Urban agriculture is a crucial tool for decision-makers to create more sustainable and greener cities with its multifunctional contributions to urban systems.

This paper aims to describe (1) the definition, (2) history, (3) typology (4) benefits, (5) obstacles and risks of urban agriculture. We conducted a comprehensive review on urban agriculture.

2.Definition of Urban Agriculture

Urban agriculture is the cultivation of food products and all related activities in and around urban areas (Van Veenhuizen & Danso, 2007). It is a sector that encompasses all activities in and around urban areas, from the production to marketing of food and related non-food products to meet the daily needs of urban residents by using and recycling urban waste and natural resources (Smit et al., 1996). Urban agriculture is an industry that focuses on the use and recycling of resources and the production, distribution, and marketing of food and related non-food products in and around the city (Mougeot, 2000). Urban agriculture includes related agricultural activities such as packaging and marketing, as well as production, and it uses potential resources of the city for the urban residents. Also, it affects the socio-economic dynamics of the city (Orsini et al., 2013).

Urban agriculture is an alternative food system and an industry related to the production, processing, and marketing of all types of food and related non-food products, and it can be practiced using different methods in various places from micro to macro scale in and around the settlements (village, town, province, district, metropolitan, megacity) and it contributes to the ecological, economic, social and healthy systems of the city and aims at sustainable resource management (Cengiz et al., 2014b; Türker et al., 2021).

Urban agriculture is the agricultural enterprise in the city (Brown & Jameton, 2000) and it is constantly interacting with rural agriculture, urban land management, urban survival strategies, urban food security, sustainable urban development, and urban food supply systems (Mougeot, 2000). Urban agriculture is an alternative food system that is an integral element of rural agriculture.

Mougeot (2000) explained that the most significant difference between urban agriculture and rural agriculture is the integration of urban agriculture with the ecological and economic systems of the city and defined the basic building blocks of urban agriculture as follows:

- Type of economic activity
- Food / related non-food product categories
- Location
- Type of field
- Destination of the product
- Scale of production

These six blocks clearly show the difference between urban agriculture and rural agriculture.

Type of economic activity: Urban agriculture is not just a system focused on food production. It covers agricultural activities related to the distribution and marketing of food and related non-food product categories.

Food / related non-food product categories: Smit et al. (1996) classified urban agriculture products into 5 categories as horticultural products, aquaculture, livestock products, agroforestry products and other related products.

• **Horticultural products; vegetables, fruits, compost, etc.**

• **Aquaculture;** fish and aquaculture, algae, etc.

• **Livestock products;** milk, eggs, meat, manure, leather, hides, etc.

•**Agroforestry products;** Firewood, fruit, nuts, etc., compost, building materials

• **Other products:** flowers, potted plants, medicinal and aromatic plants, pesticides, etc.

Products such as silk and tobacco (Mougeot, 2000), mushroom and yeast production, beekeeping products, field crops, other ornamental plants, and related inputs (seeds, etc.) are also products of urban agriculture.

Location:

İntra-urban agriculture: Practicing urban agriculture activities at small and large scales within the city (continuous urban fabric).

Peri-urban agriculture: Practicing urban agriculture activities at small and large scales in the peri-urban area (Discontinuous urban fabric). Peri-urban areas are located in the transition zone between urban and rural areas and can easily change for various reasons (Douglas, 2012) (Fig 1). Mougeot (2000) stated that it is problematic to define the boundaries of peri-urban agriculture areas because they tend to vary in larger dimensions than intra-urban agriculture.

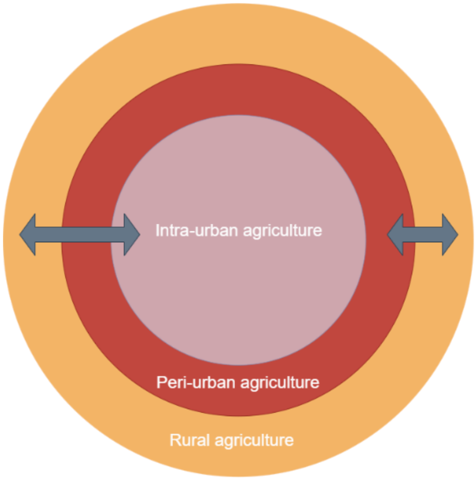

Figure 1. Location of intra-urban agriculture, peri-urban agriculture and rural agriculture

Type of field: Urban agriculture can be practiced in different areas in the city such as ponds, streams, lagoons, wetlands, home gardens, parks, roofs, containers, greenhouses, open areas, slopes, green belts, urban forests, and many urban environments (Smit et al., 1996).

Destination of the product: Urban agriculture mainly has two purposes, consumption and commercial, and the main target of the product is households and producers (Mougeot, 2000).

The scale of production: Urban agriculture is practiced from the micro to national and international levels (Rasouli, 2012).

3.The History and Current Situation of Urban Agriculture

The history of urban agriculture dates back to approximately 3500 BC (ASLA, 2020). Akyol (2011) divided the historical development of urban agriculture into six periods. These periods are:

- Pre-industrial

- Industrial revolution
- World War I
- World War II
- Post-war period
- Sustainability

Today, rapid technological change has had a significant impact on urban agriculture. In recent years, the controlled-environment agriculture (CEA) for commercial purposes has become widespread in cities (Despommier, 2013). Innovative urban agriculture approaches such as indoor vertical farming have shown significant improvement, especially since 2010 (Armanda et al., 2019). Indoor vertical farming provides maximum efficiency per unit area compared to traditional agriculture. However, the establishment costs and energy costs of indoor farming are quite high.

4. Typology of Urban Agriculture

Hodgson et al. (2011) classified urban agriculture typologies into 3 main categories; commercial, non-commercial, and hybrid. De Vries & Fleuren (2015) classified urban agriculture typologies according to product type, and production area. Roemers (2014) classified urban agriculture systems by considering their physical characteristics, social and actor, production characteristics, and potential sustainability features. Association for Vertical Farming (2020) has divided urban agriculture typologies into categories of type of organization, size of organization, integration, location, sunlight exposure, environment, and cultivation purpose (Table 1). Game & Primus (2015) categorized urban agriculture into two main typologies; controlled-environment agriculture (CEA) and uncontrolled-enviroment agriculture.

Table 1. Typology of urban agriculture

Hodgson et al. (2011)		**De Vries and Fleuren (2015)**		**Roemers (2014)**	**The Association for Vertical Farming (2020)**	
Commercial	Market farm	**Private**	Productive houses (2-20 m2)	Private gardens	**Organization type**	Cultivation
	Urban farm		Productive roofs (20-50 m2)	School/Corporate gardens		Technology
	Peri-urban farm		Productive roofs (Aquaponic systems) (20-50 m2)	Guerrilla garden		Institution
Non-commercial	Private gardens		Kitchen gardens (50-300 m2)	Community garden		Consultancy
	Community garden	**Common**	Allotment gardens (5000-20.000 m2)	Commercial agriculture in open field	The organization size	Start-up
	Institutional gardens,		Community gardens - Open field 400-10,000 m2)	Controlled-enviroment agriculture for commercial purposes in open field		Small-Medium enterprise
	Demonstration gardens		Community gardens – greenhouse (200-5000 m2)	Commercial roof farming		Large enterprise
	Edible gardens	**Public**	Edible green gardens (400-10,000 m2)	Non-commercial roof farming	Integration	Holistic
	Guerrilla gardening,	**Professional**	Roof gardens (Aquaponic systems) (500-1500 m2)	Non-commercial controlled-enviroment agriculture for indoors		Retrofitted
	Hobby beekeeping		Professional horticulture, open field (5000-40.000 m2)	Controlled-enviroment agriculture for commercial purposes indoors		Converted
	Hobby poultry breeding		Professional horticulture, greenhouse (5000-40.000 m2)		**Place**	Rooftop

Hybrid	Professional hydroponic systems (1.500-10.000 m2)		Interior
	Urban farm (300.000-800.000 m2)		Facade
	Green infrastructure farm (300,000-1,200,000 m2)		Underground
			On Ground
		Sunlight exposure	Exposed (Open area with 100% sun exposure)
			Enclosed (Semi-open area)
			Closed (Completely closed area)
		Growing environment	Aeroponic
			Aquaponic
			Hydroponic
			Planter
			Containers
			Extensive
			Intensive
		Purpose	Grow to share
			Grow to teach
			Grow to prepare
			Grow to retail
			Grow to wholesale
			Grow to clean
			Grow to heal
			Grow to develop

Based on the typology classifications in the literature, the main and sub-typologies, their purposes and scales for urban agriculture are classified in Table 2.

Table 2. Main typology and sub-typology of urban agriculture

Main Typology	Sub-Typology	Purpose	Scale
Private garden		Non-commercial	Micro
Community garden	School gardens, Institutional gardens, Demonstration gardens, Hobby gardens, Association/Organization gardens	Non-commercial	Micro
Edible garden		Commercial ve non-commercial	Micro - Macro
Guerrilla garden		Non-commercial	Micro
Market garden		Commercial	Micro-Macro
Urban farm		Commercial	Macro
Z-farming (Thomaier vd., 2015)	Roof farming, roof farming (greenhouse), indoor farming, building facades (Thomaier et al., 2015)	Commercial and non-commercial	Micro-Macro

5. Benefits of Urban Agriculture

Urban agriculture has four main benefits to the urban system. The benefits of urban agriculture are shown in Figure 2.

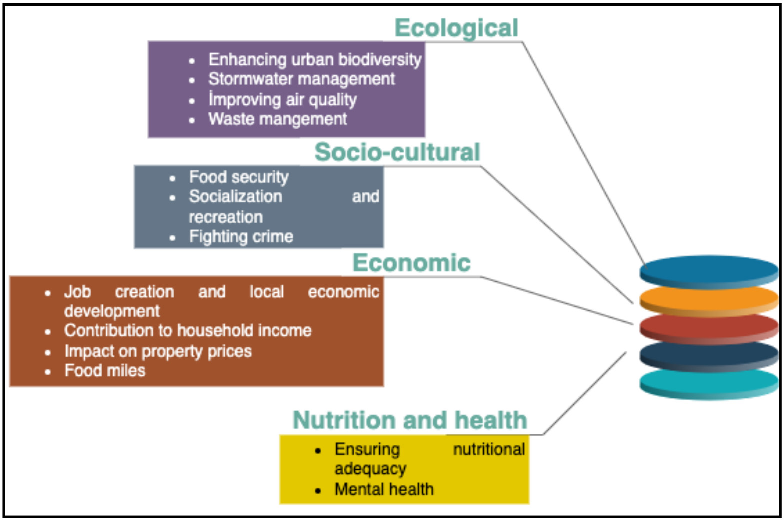

Figure 2. The benefits of urban agriculture

5.1.Ecological

5.1.1.Enhancing urban biodiversity

Biodiversity is one of the ecosystem services provided by urban agriculture areas (Doherty, 2015). Urban agriculture increases urban biodiversity and contributes positively to the ecosystem (Lin et al., 2015).

Biodiversity can sometimes be greater in urban areas than in rural areas. Deelstra & Girardet (2000) found that the amount of honey collected in the urban area is higher than in the rural area due to the high diversity of plants in the city. In another study, 54 bee species were observed in a community garden in New York City (Matteson et al., 2008). Forman and Godron (1986) were stated that urban agriculture increases biodiversity due to its contribution to the city's green space system (Doherty, 2015).

5.1.2. Stormwater management

In the natural environment, rainwater returns to the atmosphere in various ways. However, due to impervious surfaces in urban areas, it affects significantly to the amount of runoff and the quality of water (Butler et al., 2018). Urban agriculture areas built on previous surfaces play an active role in stormwater management. A study has revealed that transforming vacant land into urban agriculture areas can reduce stormwater runoff by about 85% (Hankard et al., 2016). Urban agriculture areas are an efficient solution for urban water management (Deelstra & Girardet, 2000).

5.1.3.Improving air quality

Urban agricultural areas have positive effects on climate (Metin & Çağlak, 2021). Urban agriculture areas increase humidity, reduce temperature, trap dust and gases, alleviate the effect of wind and improve the urban climate in cities (Deelstra & Girardet, 2000).

5.1.4. Waste management

Urban agriculture is one of the most important solution for waste management in urban areas. It recycles waste materials and uses them to grow agricultural products (Amirtahmasebi, 2008). In many countries in Asia, Africa, and northwest Europe, farm animals are fed leftover foods (Deelstra & Girardet, 2000).

5.1.5. Socio-cultural

Urban agriculture has several social benefits (Pearson & Hodgkin, 2010) such as social development, urban transformation, reducing discrimination, fighting crime and economic benefits (Viljoen et al., 2012).

5.1.6. Food security

Urban agriculture is an alternative to food security for urban households (Mougeot, 2000) and contributes to local and national food systems (Smit et al., 2001). Studies show that urban agriculture improves the food security of poor households (Armar Klemesu, 2000).

5.1.7. Socialization and recreation

Urban agriculture ensures the development of more active societies by providing socialization, which is one of the most crucial needs of human beings. Urban agriculture is not only an agricultural activity but also a social and recreational activity for urban resident.

5.1.8. Fighting crime

Hynes (1996) stated that urban agriculture in the USA provides rehabilitation within the scope of combating drugs in areas with high crime rates (Viljoen et al., 2012).

5.2. Economic

The most important economic functions of urban agriculture are; employment, income generation, business development, contribution to the national agricultural sector and the city's food system, and the economics of land use (Smit et al., 1996). In the literature, within the scope of the economic perspective of urban agriculture, it is mentioned that it provides new job opportunities, creates new markets for farmers, saves food and local governments, and increases property values (Golden, 2013).

5.2.1. Job creation and local economic development

Urban agriculture provides urban employment. It creates an opportunity to earn income, especially for unskilled young people, housewives, and the older adults (Smit et al., 1996). 2300 jobs were provided, 1000 new jobs were created, 2600 businesses were supported and millions of dollars worth of food were produced in 5 years in the projects financed by USDA (Kobayashi et al., 2010). In 2008, approximately $4.9 million worth of food was produced from community and guerrilla gardens in Philadelphia (Vitiello & Nairn, 2009).

5.2.2. Contribution to household income

Urban agriculture can strengthen women and allow households to live more economically. It can affect income contribution, especially for the low-income group (Bryld, 2003). Urban agriculture improves household food expenditures (Ackerman et al., 2014). In Sofia, the capital city of Bulgaria, 28% of households earned income from urban agriculture (Nugent, 2000).

5.2.3.Impact on property prices

Community gardens impact property prices in the neighborhood. According to a study, property prices in the neighborhood increased by 9.4% in 5 years. (Voicu & Been, 2008).

5.2.4. Food miles

"Food miles" refers to the journey of food from the field to the table. Urban agriculture activities shorten the distance of the food miles. Because of its proximity to markets, urban agriculture products reach the consumer in a shorter time and by traveling less. Reducing the food miles results in energy efficiency and savings.

5.3. Nutrition and Health

5.3.1. Ensuring nutritional adequacy

Hunger in the world is increasing day by day. Chronic food poverty has increased by approximately 17 million between 2016 and 2017 (FAO, 2018). Urban agriculture is a significant tool for curing chronic food poverty and solving nutritional problems. It is an alternative source for ensuring the nutritional adequacy of urban societies.

5.3.2. Mental health

Studies show that green areas have a positive effect on mental health. Urban agricultural areas, which provide an opportunity to contact with nature, contribute positively to the psychological health of people (Metin & Gül, 2022). In addition, it is effective on bioclimatic comfort conditions, which have an effect on people psychological health (Metin, 2022). In a study conducted in a hospital in Pennsylvania, it was observed that patient rooms with green views such as trees had less depression. In addition, gardening has therapeutic effects (Smit et al., 2001). The use of agricultural activities for mental health problems and learning difficulties is becoming widespread (Sempik et al., 2005).

6. Obstacles and Risks of Urban Agriculture

Smit et al. (2001) examined the problems related to urban agriculture in 4 parts; health and hygiene problems, negative effects on the environment, inefficiency, and aesthetic problems. Urban agriculture problems can be classified into three categories; regulatory, economic, and technical. Local problems of urban agriculture are vandalism, theft, resource problems, and lack of money and knowledge (Viljoen et al., 2012). Kaufman & Bailkey (2000) divided the problems of urban agriculture into 4 classes; site-related issues, government-related issues, management issues, and perceptual issues (Table 3).

Table 3. Obstacles of urban agriculture (Kaufman & Bailkey, 2000)

Site-related issues	Government-related issues	Management issues	Perceptual issues
Land use	Local government barriers	Lack of financial resources	
Site contamination	Government barriers	Experienced personnel problem	
Vandalism and security		Lack of time	
		Small scale projects	
		Settled in scattered areas	
		Conflicts between partners	
		Lack of successful business plan	
		High start-up costs	
		Failure to achieve project objectives	

Urban agriculture has potential risks. It pose threats to human health by affecting crops in various ways due to urban pollution (Vávra et al., 2014). Heavy metals were found in the leaves and roots of vegetables grown in hobby gardens close to industrial areas (Mikula & Indeka, 1997). In another study conducted in Sydney, it was found that 40% of the house gardens in Sydney had a soil Pb concentration of more than 300 mg/kg (Rouillon et al., 2017). The ratio of heavy metals accumulation in food products grown in the city is related to the location where it is grown. For example, heavy metals are higher in food products main roads. In addition, Pesticide misuse causes excess copper accumulation in some vegetables (Antisari et al., 2015).

7. Conclusion

A comprehensive literature review was conducted in this study. Urban development process play an important role in the human history (Tuğluer & Çakır, 2019; Tuğluer & Çakır, 2021). The rapid population growth in the urban development process negatively affected sustainable urban development. Urban agriculture provides an significant tool to decision-makers for sustainable urban development which contributes to urban systems and city dweller in many ways. Urban agriculture has many contributions to the city's ecological, economic, social, and health systems. However, urban agriculture is not a miraculous system as mentioned in the literature. It's just a tool. How this tool will be use and how useful it can be is in the hands of decision-makers. If there is no appropriate urban agriculture planning approach and policy, urban agriculture can do more harm than good. Therefore, the integration of urban agriculture into urban planning should be a holistic and sustainable approach.

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Author Contribution and Conflict of Interest Disclosure Information

All authors contributed equally to the article. There is no conflict of interest.

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Urban Agroforestry Systems in Urban Agriculture

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1. Introduction

According to the United Nations, the world's population is expected to grow from 7.7 billion currently to 9.7 billion in 2050. In this context, food production will need to be increased by more than 60% to meet food demand by 2050 (FAO, 2022).

According to the results experienced today (for example, the continuous increase in the world's population, the spatial and numerical increase of the cities as a result of rapid urbanization, the decrease in agricultural areas, the decrease in soil and water quality, the possible difficulties of climate change, the food supply problems experienced during the pandemic process, etc.) are envisaged as one of the biggest challenges. In particular, the fact that 80% of the world's food will be consumed in cities in 2050 has raised the issue of how cities will be fed as urgent action. Çakır (2021) stated that the continuation of this rapid increase in global population growth will harm ecological systems and natural resources.

In this context, factors such as climate change, depletion of natural resources, dependence on fossil fuels and pesticides, migration flows, volatile markets, and increasing wealth inequality could exacerbate rapid urbanization and a deepening food crisis (Borelli, et al., 2017; Türker et al., 2021).

Today, the phenomenon and perception of the city have also undergone a significant change. While the concept of the city was defined as a living space that does not include agricultural and animal activities in the past, the concept of a sustainable and ecological city that combines city life with agricultural activities is gaining more importance today. In this context, the concept of a sustainable city should have the following features;

- The city should not compromise its ability to meet urban people's current and future demands and needs.
- It should be self-sufficient.
- Environmental, social, and economic effects should be taken into account.
- It should be in harmony with nature.
- The governance organization should include principles such as healthy, livable, ecological, participatory, holistic, flexible, transparent, fair, and equal.

Due to current problems (such as inequality, poverty, and malnutrition in urban areas, increase in diseases, adverse climate change effects, unsustainable land use practices in the past and present, etc.), crop and animal production or cultivation methods in urban areas and new paradigms in food resource management are discussed.

Critical actions have been proposed by FAO to transform urban food systems (FAO, 2021).

1. Very broad participatory, coherent, holistic food policies and governance should be developed.
2. Local food investments and supply chain capacity should be increased and supported.

3. The infrastructure of local and small businesses should be developed and supported by accessible and inclusive financial systems.
4. Urban food systems should be integrated with urban planning and urban design.
5. Climate change adaptation strategies should be developed and put into action.
6. Public food purchases should be strengthened and the local economy should be revived.
7. Data collection, management and sharing for urban food systems should be provided.
8. Infrastructure and technological investments should be made for food value chain efficiency and safety.
9. Sustainable urban agriculture should be promoted for healthy and natural nutrition. The income of local producers should be increased.

Today, urban agriculture emerges as a guiding force that will enable the reinvention of food policies in cities, which are increasingly facing challenges such as food supply, production, cultivation, marketing and supply, cost, etc.

Urban agriculture is a popular phenomenon and people's awareness about it is increasing day by day (Türker, 2021a) and it is one of the sustainable urban development strategies (Türker & Anaç, 2022). Urban agriculture is a valuable driver of innovation. While urban agriculture cannot feed all cities (potential yields are very low and limited to certain types of food), it is recognized as a strategy that can help create resilient urban food systems that enable organic connectivity between cities and agriculture. In addition, urban agriculture plays a vital role in climate change mitigation and adaptation, disaster risk management, and increasing The climate resilience of vulnerable residents.

Agroforestry (AF) has an important place in sustainable urban agriculture practices. AF has the potential to utilize the ecological functions of trees and agricultural products, reduce the environmental footprint of agriculture, increase local food production, and contribute to local livelihoods (FAO, 2022).

In this context, Agroforestry Systems (AFS) are important strategic actions to improve urban food systems and practices, food security and nutritional status, protect and exploit natural capital, increase the sustainability and resilience of urban areas, and contribute to fair/healthy/affordable urban food systems (Clark & Nicholas 2014).

Urban Agroforestry (AFS) covers a variety of traditional and traditional farming, such as the cultivation of trees and agricultural products (fruit plants, medicinal aromatic plants, vegetables, grains, forage crops, fuel crops, etc.) and livestock (including fisheries) in and around a residential area. Modern production systems as well as related input sourcing, processing, and marketing activities. UAF is a dynamic, ecologically based, natural land use system that diversifies and sustains production to increase environmental, social, economic, and benefits for the land of all sizes (Mougeot, 2000; FAO, 2022).

Agroforestry can also improve the quality and availability of water, reduce the contribution and vulnerability of agriculture to climate change, increase and diversify producers' incomes, provide access to more nutritious food, and provide jobs for women and youth, among other services (FAO, 2022). Agroforestry is a very complex subject. For centuries, agroforestry has been skillfully practiced around the world, especially in tropical countries. Recently, it has been recognized that agroforestry science is a harmonious blend of both the biophysical and social sciences (Nair, 1993).

In this study, the concept of Urban Agroforestry, its importance, benefits, types, and information on Urban Agroforestry Systems (UAFS) planning were examined within the scope of urban agriculture.

2.1. Urban Agriculture (UA) and Peri-Urban Agriculture (UPUA)

Urban Agriculture (UA) can be defined simply as the cultivation of food in cities. Türker & Akten (2020) defines urban agriculture as a productive and sustainable land use. Urban and peri-urban agriculture has long been recognized as potential food security and income strategy (Zezza & Tasciotti, 2010; De Zeeuw et al., 2011; FAO, 2014; Porter et al., 2014). According to the Urban Agriculture and Food Security Resource Centers (RUAF) Foundation, the most striking feature that distinguishes urban agriculture from rural agriculture is its integration and interaction with the urban economic and ecological system. This interaction enables the use of urban residents as workers, the use of typical urban resources (such as organic wastes as compost and urban wastewater for irrigation), their direct connection with urban consumers, and their direct impact on the urban ecosystem (positive and negative), and the integration of rural migrants into this system. (RUAF, 2022).

Urban agriculture has been defined as '...an industry that produces, processes and markets food and fuel, largely in response to the daily demand of consumers within a town, city or metropolis, on land and water dispersed throughout the urban and peri-urban area, applying intensive production methods, using and reusing natural resources and urban wastes, to yield a diversity of crops and livestock"(UNDP, 1996).

Urban agriculture can be summarized by many definitions as follows; Urban Agriculture is the practice of cultivating, processing, and distributing food and other products in and around cities; it can be accompanied by a variety of complementary activities in its pre- and post-production phases, and it serves a variety of social, environmental, economic, nutritional, and recreational needs (Urban Agriculture Working Group, 2013).

While urban agriculture offers numerous benefits and opportunities, it also has risks to urban ecosystems such as soil pollution, fertilizer quality, water scarcity and security. Detailed studies are needed for the challenges of urban agriculture (Wortman & Lovell, 2013; Cohen et al., 2012; Türker, 2021b).

Urban and urban environmental agriculture (UPA) includes products from crop and livestock farming, fisheries and forestry, and ecosystem services in and around the city (FAO, 1999). Urban and peri-urban agricultural activities can be applied in different areas (e.g. vacant lots, home gardens, edges, containers, balconies, roofs, fish ponds, schoolyards, open spaces, road lanes, Along railroads, under power lines, riverbanks, rivers, common lands for community-based gardening) (FAO, 2001).

Table 1. Differences between "urban" and "peri-urban" (FAO, 2001 p.14)

Characteristics of "Urban" and "Urban Agriculture"	Characteristics of "Peri-Urban" and "Peri-Urban Agriculture"
• Attitudes differ between urban and peri-urban dwellers • Different kinds of people, often women • Different activities, often small-scale subsistence • Concept of "urban" varies a lot cross-nationally • UA is a part-time job • UA technology is different from PUA due to smaller plot sizes and different motivations for agriculture • Knowledge of urban farmers is different from urbanized • More infrastructure/ construction • More services (banks, schools, medical centers, etc.) • Different lands than in peri-urban areas, smaller areas cultivated, more subsistence production • Lower availability of natural resources. • Differences in policies/incentives/disincentives, institutional responsibilities (urban) • Easy access to markets • Poor air quality • High cost of labor and land • Primarily subsistence production • Management strategies different from PUA, mostly small-scale agriculture • Small-scale, scattered, and low-value crops produced in cities • Practiced by poor urban dwellers for subsistence	• Peri-urban production is economically dependent on the city • Lower population density than urban • More land/space available • PU area has more natural resources • PUA is a full-time job • PUA technology is different from UA, due to larger plot sizes and more commercialized agriculture • Land under threat of urbanization • Less infrastructure/construction • Fewer services (banks, schools, medical centers, etc.) • Different land use than in urban areas larger areas cultivated • Higher availability of natural resources • Differences in policies/incentives/disincentives • Less access to markets. • Better air quality • Lower cost of labor and land • Primarily market-oriented production • Management strategies different from UA, medium to large scale agriculture • Intensive, market-oriented, high-value crops • Practiced by groups and individuals with ready access to capital markets • UPA can become UA with accelerating urbanization

• UA can never become UPA again, but expand when zones of "urban blight" evolve

Urban agriculture has many components (e.g. Raw material supply, production techniques, ownership status, site typology, field size, employment, product production and cultivation, waste and residue management, recycling, promotion and advertising, sales and marketing, product handling, storage and packaging management). It has been developed using many sources and is given in Figure 1. (Mougeot, 2000).

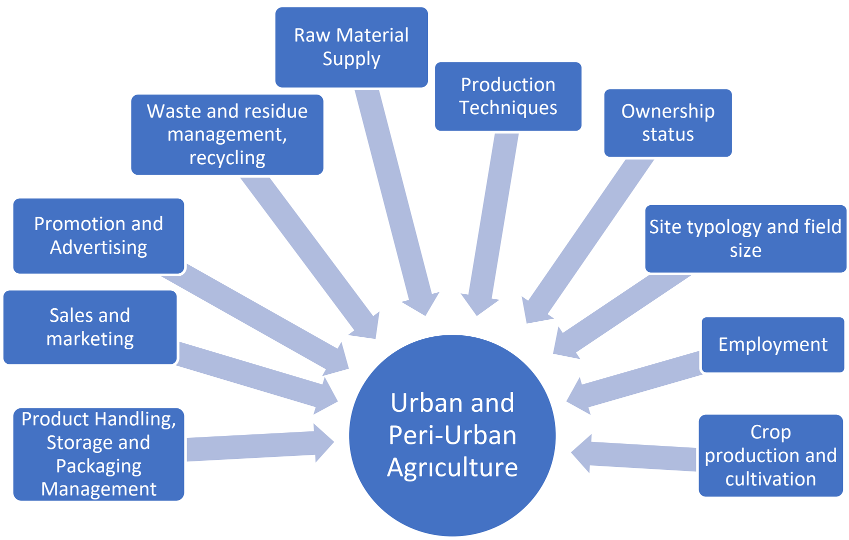


Figure 1. Basic components of urban agriculture

2.2. Typology of Urban Agriculture

The spatial typologies of Urban Agriculture are used to program and design local agricultural production in and around the city. The typologies are directly related to residential gardens, estates, public urban open spaces, and green infrastructure (Vries & Fleuren, 2015). Urban Agriculture typologies can be applied differently in many countries. The generally accepted Urban Agriculture typologies are given in Table 2.

Table 2. Spatial typology of urban agriculture with average surface and type of produce (Vries &Fleuren, 2015).

Type of Urban Agriculture	Organization	Approximate Production Area Per Unit	Main Crops and Animal Produce
Productive house (indoor) Private	Private	2 to 20 m^2 per house	mostly vegetables, herbs, and fruits
Productive roof (flat) Private	Private	20 to 50 m^2 per house	mostly vegetables, herbs, and fruits
Productive roof (flat), aquaponics	Private	20 to 50 m^2 per house	vegetables and fish
Kitchen gardens	Private	50 to 300 m^2 per house	potatoes, vegetables, herbs, and fruits
Allotment gardens	Private	complex 5,000 to 20,000 m^2	potatoes, vegetables, herbs, and fruits
Community gardens, open field	Collective	400 to 10,000 m^2	potatoes, vegetables, herbs, and fruits
Community gardens, glass house	Collective	200 to 5,000 m^2	vegetables, herbs, and fruits
Edible green amenities	Public	400 to 10,000 m^2	fruits and nuts
Roof gardens aquaponics	Professional	500 to 1,500 m^2	vegetables and fish
Professional horticulture, open field	Professional	5,000 to 40,000 m^2	potatoes, vegetables, herbs, and fruits
Professional horticulture, glass house	Professional	5,000 to 10,000 m^2	vegetables, herbs, and fruits
Professional hydroponics	Professional	1,500 to 10,000 m^2	vegetables, herbs, fruits, and fish
Urban farm	Professional	300,000 to 800,000 m^2	combination of meat, potatoes, vegetables
Green infrastructure farm	Professional	300,000 to 1,200,000 m^2	combination of meat, wheat, vegetables

2.3. Benefits of Urban and Peri-Urban Agriculture:

Urban agriculture areas are edible urban green areas that provide important ecological, economic, socio-cultural and health services to the city, and these areas offer alternative land use for planners and decision makers (Türker & Akten, 2021). Urban agriculture has many benefits and can be summarized as follows; It ensures the continuity of safe and healthy local food production, it allows the cultivation of organic and natural products, it offers seasonal fresh produce, it reduces the costs of production processes such as local material sourcing, transportation, storage, marketing, it provides habitat for wild species, it reduces urban heat island and reduces carbon emissions, it brings vacant lands to production economy, it provides recognition of various plant species, it increases information sharing and awareness about crop cultivation, it provides basic education about agriculture to children and young people, it provides integration with the soil, it provides affordable products, it creates the spirit of solidarity, it develops neighborhood culture and neighborhood relations, it provides physical, intellectual and mental contribution in terms of individual and public health, it creates a social gathering area, it brings different generations together, it increases the sense of belonging with various activities, it builds social capital and encourages community participation, etc. (Table 3).

Table 3. The benefits of Urban Agriculture (Urban Agriculture Working Group, 2013)

Benefits of Urban Agriculture	Community Engagement and Inclusiveness	Social Enterprise & Community Economic Development	Food Insecurity	Health	Ecology	Education & Skill-building
Productivity	√creates productive and inclusive spaces	√contributes to job creation	√addresses poverty by reducing hunger	√increases amount of green space	√retains and filters tormwater	√builds community organizing skills
	√Engages the unemployed and underemployed	√provides strong return on investment	√fosters an understanding of agriculture	√produces healthy fresh food	√lessens burden on municipal sewer system	√builds knowledge of farming practices
	√Promotes a culture of volunteerism	√makes vacant property valuable	√empowers those with a lack of food	√encourages healthy eating	√contributes to a healthy ecosystem	√provides student volunteer opportunities
	√strengthens community relationships	√provides income for producers	√improves food access in food deserts	√relieves stress	√encourages efficient use of resources	√builds project management skills
Resilience	√builds organizational capacity	√removes or protects against blight	√increases citizen control over food consumption	√provides local access to fresh, healthy food resources	√reduces reliance on non-renewable	√builds communication skills
	√people work together to overcome barriers	√an alternative use of urban public space	√increases preparedness times of crisis	√improves for diet	√increases biodiversity	√encourages shared knowledge in communities
	√builds pride in the environment	√increases the number and quality of green spaces	√reduces food spoilage and waste	√encourages physical activity	√reduces urban carbon dioxide levels	√fosters and understanding of healthy foods
Conservation	√increases the accessibility of green spaces	√improves housing values and property tax base	√uses food resources efficiently	√contributes to life-long health and well-being	√reduces waste production	√builds communication skills
		√	√	√	√contributes to ecosystem diversity	√inspires knowledge on food preparation
	√encourages the growth of ethno-cultural crops	√provides new products to retailers and restaurateurs	√fills food system gaps	√therapeutic use in addiction treatment programs	√green roofs reduce the heating and cooling burden of interior spaces	√engages people of all ages in learning and teaching
Innovation	√fosters cooperation and neighborhood stewardship	√reduces the need for municipal maintenance and policing	√makes fresh and healthy food affordable	√new ways of growing traditional and heirloom	√fosters technological advances in farming	√enhances job-readiness
	√engages the young and old alike	√encourages entrepreneurialism	√encourages forward-thinking	√encourages trying new foods	√provides opportunities for experimentation	√teaching aid for math and science

3.3. Urban and Peri-Urban Agroforestry

According to the United States Department of Agriculture (USDA), agroforestry is the mixing of crop and animal production systems of trees and shrubs to create environmental, economic, and social benefits. Agroforestry aims to conserve forest resources, benefit from ecosystem services where trees can contribute to agriculture, and balance the role of agroforestry in diversifying agricultural products and market diversity.

Agroforestry promotes biodiversity and produces many ecosystem services by integrating trees and shrubs, agricultural crops and/or livestock on the same land. This is not a new application; on the contrary, food, fodder, fiber and fuel have been widely produced by mixing trees and crops throughout human history. The promotion and development of agroforestry for food production can help reduce problems such as climate change, environmental degradation and biodiversity loss (Agroforestry Network, 2020) (Figure 2).

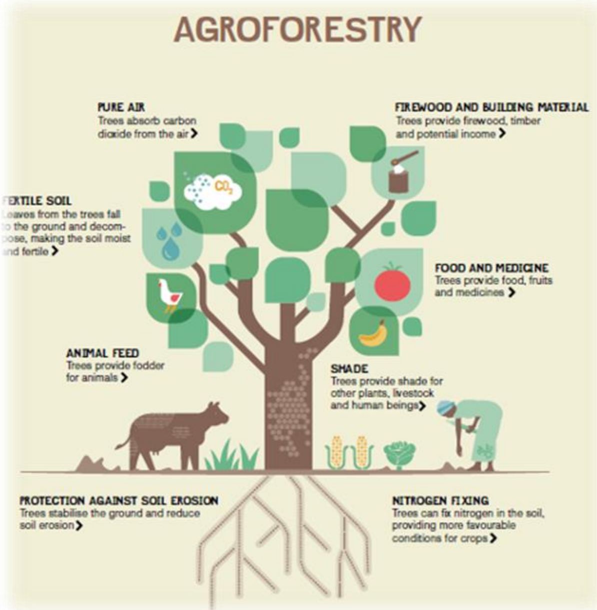


Figure 2. The benefits of agroforestry (Agroforestry Network, 2020)

Urban Agroforestry could serve as a progressive form of urban agriculture if the productive woody species are better integrated with others (Lovell, 2020).

Urban planning is a process for society that promotes sustainability, multifunctionality and resilience. Tree and shrub species are preferred because of their perennial and long-lived characteristics, their large volume compared to other plants, their natural strong "sense of place", their permanent characteristics, etc. The integration of urban agroforestry into city parks and other public spaces secures production and maintenance activities over the long term. Urban agroforestry (UAF) systems with productive trees and shrubs have the potential to overcome many obstacles (McLain, et al., 2012; Lovell et al., 2017).

Agroforestry is a very complex subject; actually, it's a mix of many topics. Agroforestry is a harmonious blend of both the biophysical and social sciences. For centuries, agroforestry has been skillfully practiced around the world, especially in the developing countries of the tropics (Nair, 1993).

International Institutions like the United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD), and the Food and Agriculture Organization (FAO) encourage farmers to practice agroforestry as part of their transition to sustainable agriculture of the future that will provide for their families and growing global population (Slavikova, 2019).

Agroforestry is a concept formed by combining the disciplines of Agriculture (agriculture) and Forestry (forestry) (Gül, et al., 2011). Different definitions are made by some researchers on Agroforestry (AF) (Table 4).

Table 4. Defines of AF

Literature	Defines of AF
Lundgren & Raintree (1982)	Agroforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as crops and/or animals, in some form of spatial arrangement or temporal sequence. In agroforestry systems, there are both ecological and economical interactions between the different components.
Nair (1993)	Agroforestry systems are complex system in ecological (structural and functional) and economic dimensions that includes two or more plant (or plant and animal) species, at least one of which is perennial woody, always with two or more outputs and a system cycle.
Şefik (1995)	It is a planned and continuous form of land use that increases the living standard of the people by getting the highest efficiency by using agriculture, forestry, and animal husbandry together or separately for a certain purpose(s) on a piece of land.
Rietveld (1995)	It is a combination and sustainable land use system made by deliberately integrating agriculture and forest technologies in order to achieve profitability, efficiency and diversity.
Tolunay, Gül & Bilgin (1997)	Agroforestry is an intermediate production technique that emerged due to the specific parts of agriculture" and "forestry" production techniques and the bottlenecks they create in meeting the basic needs of rural people. It is a land use system or practice in which forestry, agricultural and animal production are carried out together in the same area of production and management unit, taking into account ecological and economic relations.
Türker (1989)	Agroforestry is a land use system in which perennial wood products are used in a planned manner on the same land with annual agricultural products and/or animals to obtain the maximum output in a continuous time.
Xu, Mercado, He & Dawson, (2013)	Agroforestry is the combination of agriculture and forestry; rather than treating these as separate options for land use, it brings both together, recognizing and promoting tree use on farms. Agroforestry is the integration of trees into agricultural systems to increase productivity, profitability, diversity, and ecosystem sustainability.
Leakey (1996).	Agroforestry has been defined as a dynamic ecologically based natural resources management system that, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased social, economic, and environmental benefits for land users at all levels.
Alao & Shuaibu (2013).	Agroforestry generally refers to the land used system or farming system in which trees or shrubs are grown in association with crops, pastures, or livestock and in which there is ecological and economic interaction between the trees and other components. Agroforestry practice is a distinctive arrangement of components in spatial and time. It is characterized by the environment, plant species, and arrangement, management, social and economic functions.

Otegbeye (2002).	Agroforestry is a land use option where trees provide both crops and ecosystem services.
FAO, 2022	Agroforestry systems include both traditional and modern land-use systems where trees are managed together with crops and/or animal production systems in agricultural settings. They are dynamic, ecologically based, natural resource management systems that diversify and sustain production in order to increase social, economic and environmental benefits for land users at all scales.

Agroforestry has two main features; (Lundgren, 1982).

- Woody perennials are deliberately grown on the same unit of land in a mix or sequence with crops and/or animals.
- There is an ecologically and/or economically significant interaction (positive and/or negative) between the woody and non-woody components of the system.

The main ideas of urban agroforestry from various definitions are; (Tolunay et al., 1997; Ellis et al., 2005; Gül, et al., 2011).

- It is a different land use system in which various production systems such as agriculture, forestry, horticulture, fruit growing, and animal husbandry are combined and applied.
- It is always aimed to obtain two or more products.
- It produces trees, agricultural products, and animals as a whole, to increase productivity and reduce production risks on certain land.
- Agricultural forestry practices have much more product variety than monoculture. Production is spread over a longer period. A more regular income is obtained throughout the year.
- If forest trees are grown together with agricultural products, all plants get the opportunity to use more sunlight, soil moisture,

and nutrients in the soil than monoculture. Because in this system, forest trees, agricultural products, and animals generally use different parts of the biosphere.

The main criteria in the evaluation of UAF are a-Productivity, b-Sustainability, c-Adaptability, and d-Acceptability (Nair, 1993).

3.3.1. Benefits of Urban Agroforestry Systems (UAFS)

The benefits of urban agroforestry systems have been developed using different sources. Young, 1986; Kang et al., 1990; Crane, 1992, Nair, 1993; Sefik, 1995, Peters, 2000; Ayan, et al. 2001; Ellis, 2004; Gül, et al., 2011; FAO, 2022).

a. **Environmental Benefits;**

- It offers versatile benefits from the soil,
- It contributes to the improvement and development of soil quality, chemical, physical and biological properties,
- It increases soil nutrient levels,
- It reduces water and wind erosion, protects the topsoil,
- It prevents floods and floods and increases the life of dams
- It reduces the need to cut forest trees by obtaining wood products from farm production. It reduces the rate of deforestation.
- Rehabilitates lands that have been deforested or destroyed due to improper land use,
- It protects existing forests and prevents desertification,

- It improves the micro-climate against climate change, reduces and directs air temperature and wind speed, balances humidity, increases the amount of oxygen, holds and stores carbon, etc.
- It reduces, alleviates, and contributes to the adaptation of the losses that will occur from climatic changes.
- Vegetable residues obtained from agro-forestry systems allow their use as fuel.
- Agroforestry helps protect or increase yields in the face of climate change by providing shade and a cooler environment for sensitive crops or animals.
- It reduces losses from insect disasters and price fluctuations,
- It reduces the need for commercial fertilizers to increase soil nutrients.
- It ensures effective use of water consumption.
- It contributes to water quality.
- It increases visual landscape quality and attractiveness.

b. Social Benefits:

- Agroforestry can improve gender equality.
- It helps develop local producer communities and cultures.
- It contributes to cultural diversity
- It ensures the food safety and continuity of the producers,
- It provides social solidarity between producers and stakeholders.
- It provides opportunities for women and young entrepreneurs in terms of employment and income.

- Women and youth can play an important role in increasing agricultural production.
- Managers and Professionals work with local producers and communities, respecting local beliefs and culture. It also ensures the long-term sustainability of traditional systems.
- It protects local plant species and production techniques.
- It ensures the preservation and continuity of agricultural heritage.
- It ensures regular and diverse livelihoods and the protection of local producer communities.
- It increases the sense of belonging with the use of species that have spiritual value for people.

c. Economic Benefits:

- It increases food and nutrition security
- It reduces the risk due to two or more product types
- It reduces the risk of product loss.
- Compared to monoculture agriculture, it provides product diversification and production all year long.
- It increases the total production amount and quality.
- It produces reserve capital,
- It provides employment opportunities and increases household income.
- It reduces total facility and maintenance costs,
- It increases the land value,
- It improves urban trade.

- It reduces or stabilizes agricultural production prices
- It increases the total gross product and contributes to the national economy,
- Food-producing trees (fruits, nuts, leaves, etc.) provide easily accessible and nutritious food for urban people.
- The trees and plants grown on farms are used for important medicinal and naturopathic purposes that help improve people's health.
- Cut trees or their leftovers can be used as wood energy for cooking and/or heating.
- Leaves and other parts of trees are a source of fodder for livestock
- It reduces agricultural inputs and thus production costs

3.3.2. Some difficulties or limiting factors of UAFS

Some difficulties or limiting factors of UAFS are; (Nair,1993; Acar, et al., 2002).

- It creates competition between annual and perennial plants
- Time is needed the product to be repeated,
- It may create additional maintenance and protection costs,
- It creates the risk of damage to other plants in the mixture during tillage and harvest,
- It can inhibit the development of the other plant using the enzymes secreted from the roots of some of the plants grown in combination (Allelopathy).
- AFS applications may pose an alternative habitat risk for pests
- Soil cultivation (cultivation) costs may increase,

- Financial support may not be continuous,
- Courses-education and promotion expenditures may increase.
- Marketing risk of products may be encountered
- Transfer costs may arise
- Research costs may increase to develop technological bases.
- Return on investment may be delayed after installation.
- Overdependence on traditional farming methods and insufficient knowledge of sustainable approaches can lead to the indifference of politicians or administrators.
- Long-term use of privately owned land can limit investment.
- There may be bureaucratic obstacles in AF practices due to deficiencies in the legislation.
- There may be a risk of a lack of coordination between sectors.
- There may be political conflicts between sectors in land use.

3.3.3. The main purpose of UAFS

The main purpose of UAFS is**;**

It is to optimize the interactions between various products and services to provide higher, longer-term production than other forms of land use under current ecological, technological and socio-economic conditions (Geray & Görcelioğlu, 1983).

Short-term goals,

- To implement agroforestry techniques in the people's lands and to provide the necessary products
- Meet the food supply and other plant and animal needs of the population
- Increase agricultural product options

- Increasing the producer's livelihood options and raising their standard of living
- To bring the producer and the consumer directly together,

As a long-term goal;

- To improve green space/agriculture/forest relations with the public
- To raise awareness of nature and environmental protection,
- Protecting soil and water resources
- Reducing the pressure on agriculture and forest areas,
- Increasing urban aesthetics
- To ensure the continuity of the urban identity and character.

3.3.4. Classification of agroforestry systems:

UAFS are generally divided into 3 basic groups (Nair, 1993; Tolunay et al., 1997; Gül, et al., 2011; FAO, 2022) (Figure 5).

1-Agrisilvicultural (Trees+bushes+agricultural crops) are a combination of crops and trees, such as a street or home gardens. Examples; Improved fallow culture or rotational culture system, Alley cropping, Multi-layer tree garden, Multi-purpose trees, Home gardens, Plantation crop combination, Block plantation, fuelwood production, Windbreaks, shelterbelts, and live hedges, and Trees in Soil conservation and reclamation).

2-Silvopastoral systems (Trees+herbaceous plants): Combines forestry and grazing of domesticated animals on pastures, pastures, or farms Protein bank, Fences of fodder plants, Trees on the pasture, Animals and plants integrated training.

3-Agrosilvopastoral systems (Trees+shrubs+agricultural products+herbaceous plants): Integrated production of herbaceous and woody plants (Plantation crop combination), Multipurpose woody hedges, and Mixed cultures within the framework of residential areas.

In addition, different subsystems have been created within these systems; It is grouped as Silvifishery Systems (wood+fishing mix), Agrosilvofishery Systems (wood+agricultural products+fishing), Silvomedical Systems (wood+medical products), Grosilvomedical Systems (wood+agricultural products+medical products) (Zou & Sanford, 1990).

Today, UAFS applications are generally classified into 5 different types: alley cropping, forest farming, riparian forest, buffers, a combination of trees and fodder plants (silvopasture), and windbreaks/shelterbelts (Sanchez, 1995; Association for Temperate Agroforestry, 1997; Williams et al., 1997).

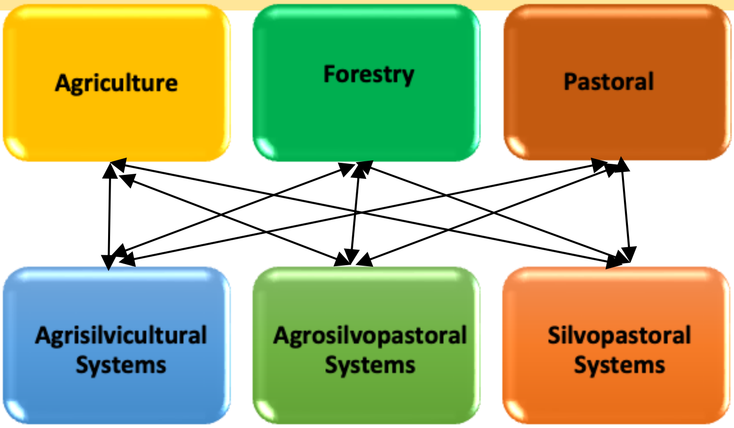


Figure 3. Basic types of UAFS

3.3.5. Used methods for UAFS applications:

Plants to be grown in agroforestry; The quality of the soil is determined by considering the climate, topography, altitude, and socio-economic factors. Applications of agroforestry systems can be classified into two separate groups (Figure 1). This classification has been developed using different sources. (Turna 1992; Şefik, 1995; Dosskey, et al., 1997; Gül, et al., 2011).

(1)- Crop Rotation System: It includes the use of annual agricultural plants in succession with trees over time. It is based on the temporary arrangement of products. There are two types of rotation systems in this type of classification.

a-Shifting cultivation; is a very old method. It is the method of growing fast-growing trees within a period of 8-10 years after 2-3 years of cultivation period of agricultural plants and continuing them alternately.

b-Taungya (Shamba) System: There are two forms of application. 1. For the first three years, trees and agricultural products are grown in the same area. Then, from 3 to 11 years, the trees are left to grow and when the trees reach the cutting age, they are cut and continued in the same way. In the second application, agricultural products are grown in the first 3 years. Then, between 3-6 years, trees and agricultural products are grown in a mixed manner. For 6-14 years, only trees are grown and continued alternately.

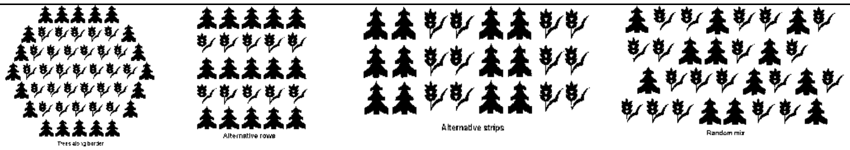
(2)- Nested Culture System: Trees and herbaceous plants are grown at the same time, but in a way that provides mutual support rather than competition. These products are grown in such a way that they do not compete with each other, on the contrary, they support each other. Thus, the yield per hectare every year is even higher. This system has 3 subsystems (Figure 4).

a-Tree Planting Along the Border: The borders of the area are the planting of trees in one or more rows. It arises from their cultivation from the edge of the fields as a windscreen, hedge, and boundary marker. In this way; On the same site, it performs complementary services such as food supply, firewood production, feed production for farm animals, green manure production as organic fertilizer, and protection-improvement of the field.

b-Changing Rows and Strips Alley-Hedgerows Culture: It is the plant of other shrubs and herbaceous plants in the rows and strip spaces of trees that are established in rows and strips at different distances. It is especially predictable in the stabilization of sloping lands. The strip consists of two or more rows, while the row is in a single row. This system is found to be more effective in terms of erosion control and sloping land improvement if applied along the grade curves or against the slope. If we explain the system, in the row method, trees are grown in one row and agricultural products are grown in the other, and this is followed. In the lane system, trees are grown in 2 or more rows, and agricultural products are grown in 2 or more rows after that, and this is followed and the field is completed.

c-Random Mixture: It is the mixing of trees and agricultural products. There is no special and limiting situation in the structure of the product composition. Plants coexist in places suitable for their ecology.

Figure 4. Subsystems of Nested Culture System



Planting Along the Border	Changing Alternative Rows	Changing Alternative strips	Random mix

3.3.6. Agroforestry systems widely used according to different land types:

In Humid Low Altitude Lands: Shifting cultivation, Home gardens, Multilayer tree gardens, Plantation crop combinations, Multi-layer tree garden, Intercropping systems, Taungya System, Inter-row culture or road afforestation (Alley farming).

In Semi-Arid Low Altitude Lands: Combination of wood and fodder crops (Silvopastoral systems), Windbreaks, protection strips and fences (Windbreaks/shelterbelts), Multipurpose trees for fuel and fodder (Multipurpose trees for fuel/fodder), Farm or residential Multipurpose trees on farmlands.

On Sloping and Mountainous Lands; It is a combination of soil protecting or improving shrubs or woody plants, Silvopastoral combinations with trees, and plantation crop systems.

3.3.7. Planning & design phases of UAFS

Planning & Design Phases for Applications of agroforestry systems are;

- Planning team is formed,
- A holistic land inventory (land conditions, demands and needs of land owners, capacity of the land, limiting factors, etc.) is prepared,
- UAFS model(s) suitable for purposes and terrain are determined.
- Objectives are set for the model/models to be implemented,
- Plant species suitable for the model are selected,
- Plant patterns or combinations suitable for the purposes and the model are created and projected at the planning/design scale,

- Environmental impacts (in positive and negative scales) are estimated, feasibility is prepared regarding the cost of application to the land (such as seedling material, labor, irrigation, fertilization), market conditions, limiting factors and benefits.
- Rules and recommendations regarding implementation and monitoring are put forward. In particular, measurable indicators and target levels are determined to test the achievement of objectives.
- Revision is made with feedback.

4. Conclusion and Suggestions

Today, issues of food supply, safety, production, processing, transportation, distribution, consumption, loss, and waste have become unprecedentedly important for everyone. In particular, climate and environmental changes, the COVID-19 pandemic, and related quarantines have further increased the importance of the food system.

Rapid urbanization brings local policies and approaches towards the urban food system to the fore, given the links with the built environment, consumption, and nature. Cities provide an opportunity to rethink the management of food systems.

The IPCC's AR5 (IPCC, 2013) predicts losses in food production and productive arable land in many regions due to climate change. Cities and urban people, which are dependent on plant and animal production in rural areas, will be affected significantly. Within the scope of climate change adaptation options, it includes support for the development of alternative food sources, including agricultural production, open green spaces, green roofs, local markets, developed social (food) safety nets, and inland aquaculture in and around the city (ICLEI, 2014).

It took important decisions during the 26th United Nations Climate Change Conference (COP 26), which took place on 31 October-12 November 2021 in Glasgow, Scotland. One of the key decisions is "Making infrastructure and agriculture more resilient, enabling and promoting to prevent loss of residential areas and livelihoods" (Gül, Dinç & Gül, 2021).

Today, it has been stated by the IUCN that nature-based solutions should refer to 7 basic SOCIAL CHALLENGES to turn them into action. These; climate change adaptation and mitigation, disaster risk reduction, ecosystem degradation and loss of biodiversity, human health, socio-economic development, food security, and water security (Gül, et al., 2021).

AFS can perhaps be considered as one of the nature-based solutions. Because it meets the social challenges effectively and efficiently. AFS is purposeful and should be planned and supervised. For this reason, AFSs find the combination of ecological, technological, economic, and socio-political conditions and possibilities in private, public, and marginal lands and ensure their use in the most appropriate way for the benefit of society.

AFS always has two or more products. It is expected to have efficient power within the purposeful period and continuity is essential. The simplest AFS should be more complex, ecological (structural and functional), and economical than a monoculture system. It improves the structural and functional properties of the growing environment. It is aimed to meet the needs of the local people. It is expected that the existing product variety will be increased. It increases the income level and living standard of the local people. Conservation of existing natural resources and reduction of destruction are among the main objectives (Gül, et al., 2011).

Agroforestry has become increasingly common as a useful land use practice. The term agroforestry emerged in the late 1970s, reflecting a significant change in agricultural development (FAO, 2022).

Tropical regions are the regions where agroforestry production techniques were first developed and most widely used in the world. Agroforestry production techniques developed in tropical regions are very difficult to adapt to Turkey due to the different ecological characteristics between tropical regions and Turkey in terms of habitat. Although the difference in ecological conditions is effective, some agroforestry techniques (especially shifting cultivation and Taungya) due to the characteristics of Turkey may have functions that increase deforestation and environmental degradation, therefore their applications should be avoided. Despite this, it is understood from the traditional practices in rural areas that some agroforestry techniques developed in tropical regions are compatible with the conditions of Turkey (Tolunay, et al., 1997).

Although AFS practices in our country are an important tool that ensures efficiency, profitability, and sustainability of natural resources, it is seen that not enough attention is given. AFS systems are suitable for all types of terrain. AFS has two-sided benefits, one to protect and develop the existing area in terms of land use, and the other to maximize crop production (Acar, et al., 2002).

There are suitable areas of use for AFS applications in rural and urban areas in Turkey, and it is possible to provide multi-faceted benefits with the appropriate methods to be selected. For example, in rural areas; Home gardens, school gardens, farm gardens, village common areas, dry or partially irrigated agricultural areas, sloping areas, salty lands, and transition zones (buffer zone) between forest village settlements and forest lands are suitable for AFSapplications.

In urban areas, it can be applied in residential and collective housing gardens, organized industrial areas, urban forests, hobby gardens, agricultural areas in the city, road refuges and green belt areas, etc. The important issue here is to determine which method will be used in which area and to create an appropriate plant pattern (Gül & Özgüner, 2007).

Recognizing the contribution of urban and peri-urban agriculture and agroforestry to climate change mitigation and adaptation has brought its integration into urban planning, land use policies, and strategies.

The success of urban farming practices depends on various factors (climate, weather conditions, light, insects, land and other growing areas, land tenure, healthy and clean soil or another growing environment, water, labor, operating funds, financial and technical support, and agricultural knowledge) and skills, processing, and transport infrastructure, distribution channels, consumer demand, available markets) (Tixier & Bon; 2006).

The risks that may be encountered in UPUAF applications are as follows:

- The products to be grown may be affected by the adverse conditions of the city and turn into unhealthy food.
- There may be risks to the protection of property in the application areas.
- As a result of activities open to the public, there may be safety hazards for food and equipment.
- It may lead to disagreements among the stakeholders regarding the use of the land.
- Potential soil pollutants (such as Lead (Pb), Arsenic (As), Mercury (Hg), Cadmium (Cd), and polycyclic aromatic hydrocarbons (PAHs)) in urban soils may pose risks to crops. (Wortman & Lovell, 2013).

AFS systems have become popular not only in rural areas but also in urban areas. Suggestions for urban agroforestry systems in our country;

- Agroforestry is an approach that integrates more than one natural component and brings together traditional and modern. For this reason, coordination and communication of different disciplines (agricultural engineers, landscape planners, forest engineers, economists, soil analysts, veterinarians, etc.) are mandatory.
- Relevant stakeholders should act together to know and explain agroforestry systems and to develop and disseminate suitable models or methods for our country.
- Cooperation and coordination between stakeholders and sectors should be ensured.

- UA and UAFS policies should be included in urban planning and design.
- Areas for application areas and typologies should be proposed.
- Planners and local governments; access to work areas, land use rights and policies, and financial and technical support opportunities.
- To increase agricultural knowledge and skills by relevant and authorized stakeholders, necessary training programs should be organized in areas such as production, processing, distribution, and transportation infrastructure.
- To promote agroforestry in national policy frameworks and increase its impact, awareness of relevant stakeholders should be increased.
- Dissemination of urban agriculture and agroforestry primarily depends on the initiative and support of public institutions and local government authorities, companies, entrepreneurs, NGOs, and local producers. At the same time, urban producers should be educated to increase consumer awareness of these new production methods and create quality supply chains.
- Limitations and difficulties in current legislation should be removed and improved. Land use policies for AFS of urban lands should be developed and their security should be ensured.
- A comprehensive development planning framework that supports urban agriculture should be established.
- UAFS approaches in each city may vary depending on the city's character, morphology, socio-economic structure, ecosystem

character, manager, decision maker and stakeholder vision, locations, and relationships. Therefore, UAFS applications may be different for each city. Planning and management policies for public and private spaces should be established according to these conditions.

- Applicable and sustainable projects (planning & design) should be given priority in UAFS studies.
- The most suitable UAFS methods should be determined according to the ecological and social-economic conditions of the land.
- A plant pattern or combination suitable for the method should be created.
- The commercial marketing possibilities of the selected woody and herbaceous plants should be investigated. Especially plants with economic value should be preferred.
- Individual characteristics (habitus, life span, growth rate, competitiveness, adaptability, ecological demands, endurance level, etc.), environmental services and functions, economic returns, and marketing opportunities for plant species (especially trees or shrubs) selection for UAFS models. It is obligatory to know and take into account the intervention and management measures to be made in practice.
- Branding and marketing of local food products obtained through agroforestry should be encouraged.
- Local markets should be created and accessibility should be ensured.

- Incentive finance mechanisms should be developed.
- Producers should ensure the highest level of participation.
- Experts should be trained for UA and UAFS at the city level.
- Stakeholder information should be developed.
- Limitations and possibilities for UAFS should be determined.
- An effective and competent governance organization should be established.

For “**Sustainable Life**” and “**Nature-Based Solutions**”, the creation and implementation of rational and most appropriate use options of lands should be the main target.

Thanks and Information Note

The article complies with national and international research and publication ethics.

Author Contribution and Conflict of Interest Disclosure Information

All authors contributed equally to the article. There is no conflict of interest.

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Dimensions and Relations of Urban Agriculture

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1. Introduction

The United Nations announced in its 2019 report that the population of the earth was 7.7 billion in 2019, and in the same report, it was predicted that this figure would reach 8.5 billion in 2030, 9.7 billion in 2050 and 10.9 billion in 2100. According to the 2018 United Nations World Cities data document, cities cottage approximately 55.3% of the world's population, with this figure expected to rise to 60% by 2030 (Nations, 2019). By 2025, urban areas will homes two-thirds of the population of the world (Orsini et al., 2013; Haberman et al., 2014) and this will consequently increase the significance of the food system for urban residents (MacRae et al., 2010; Haberman et al., 2014). The gradual increase in the rate of population in cities in the world has caused the rapid and uneven growth of cities, while on the other hand, it has led to a decrease in people's connection with nature. In addition, the decrease in agricultural lands in cities due to urbanization has brought problems such as food insecurity and poverty the surface.

As a result of the recent COVID-19 pandemic, the world has lately seen a worldwide significant rise in inflation as well as the high cost of living, and also disruptions to supply chains that have seriously affected urban economies' recovery (UN-Habitat, 2022). Again, the problem of food access in cities has been highlighted by the long checkout lines in stores that occurred during the curfews caused by the world's COVID 19 pandemic. The devastation caused by the COVID-19 pandemic serves as a stark reminder that cities must plan for dynamic and unpredictable futures. The main message from the COVID-19 pandemic is that cities should invest in planning and preparation such as economic, social, ecologic, and institutional resilience to react to a wide variety of shocks, including emergency plans that address the most vulnerable populations (UN-Habitat, 2022).

Urban agriculture's potential to respond to pressing, global problems like as food security and climate change increasing urbanization and social inequalities is key. Urban agriculture must be rethought about how we will reimagine our sprawling cities and how these urban centers will interact with agriculture, food production and their environment (EFUA, 2020).

This chapter aims to shed new light on what urban agriculture means and its necessity in a rapidly changing and urbanizing world.

More than ever, it emphasizes urban agriculture's potential contribution to food problems in countries and the significant role it performs in shaping the food problem. It draws attention to the relationship between urban growth and urban agriculture and reconsiders urban agriculture with its dimensions and definitions.

Urban Agriculture and Peri Urban Agriculture: A Concept and Theoretic Framework

Agricultural production within and around urban centers has existed since recorded history began. However, as an expression and concept, "Urban Agriculture" has only recently gained popularity, peaking in the 1990s. Although there is no globally accepted urban and peri-urban agriculture description (UPA), it has been used differently as more than one term by a number of researchers in numerous articles. Therefore, “Urban Agriculture” occasionally includes urban areas and sometimes not urban areas. Some use the term 'urban' whereas other utilize the term 'inner city'. In this study, it will be expressed as “urban and peri-urban agriculture” (FAO, 2022).

According to Mougeot (2000), urban agriculture (UA) either takes place in a town, city or metropolis (inner city) or on the edge of the city (urban) and begins to grow, process and develop, producing a wide variety of agricultural products (food and non-food) scatter. It also repurposes food and non-food objects, resources, and services found in and around cities.

"An sector in a town, city, or metropolis that tends to produce, practices, and markets food, fuel, and other products on privately or publicly owned land areas, bodies of water, and other locations in the city and its fringes, primarily to meet the daily needs of its inhabitants.” Urban agriculture usually includes focused production method, commonly utilizing and recycling resources and urban end up wasting, to generate a variety of land-, clean water, and air-based plant life, thereby enhancing the environment, one's own food production, one's household's standard of living, and the economic well-being of one's community (Smit et al., 1996; UNDP, 1996).

Urban agriculture is a specific kind of land use that lends itself to teaching and offers numerous opportunities for hands-on learning about anything from soil quality to water quality to plant names (Balmer et al., 2005).

According to (Türker & Anaç, 2022), urban agriculture is a productive land model ranging from improving urban poverty and urban food security to waste management, ensuring biodiversity and providing job opportunities.

As it can be understood from definitions, although small changes have been observed in the definition of urban agriculture over the years.

In summary, urban agriculture encompasses agricultural activities in and around the city, it can meet the food needs of city residents, it can provide economic support to the city's low-income groups, and it can ensure.

1.1. Why is the importance of urban agriculture?

For centuries, urban agriculture has served as the primary function of ensuring food safety around the world (Lovell, 2010) and recently there has been increased research and interest in urban agriculture (Türker & Anaç, 2022).

UA is a source of production in urban food production and is one of several food security options; similarly, efficient use of open spaces is one of several tools for the treatment and/or urban recovery of urban alike both solid and liquid waste, savings or earnings and job creation, and more effective management of freshwater resources (Mougeot, 2000). In urban agriculture; community gardens, farms, agricultural parks, rooftop farms, vertical farms, and private gardens in urban areas are all included in urban agriculture.

The benefits of urban agriculture included the richer and more nutritious diet for city dwellers as well as a focus on helping the poor and disadvantaged in developing nations (Zezza & Tasciotti, 2010).

There are many potential advantages to urban agriculture, including increased food security and resilience, community and economic development, environmental quality improvements, and partially meeting food demand (Saha & Eckelman, 2017).

2. Dimensions of Urban and Peri-Urban Agriculture

Urban agriculture has unavoidable advantages for towns and cities around the world, and interest in urban agriculture, especially among academics (Langemeyer et al., 2021). Urban agriculture is multidimensional and urban agriculture has many contributions to the city in ecological, economic, social and visual dimensions.

Exists (Türker & Akten, 2022).

Urban agriculture has a wide range of potential benefits, including the growth of local communities and economies, environment protection improvements, and the capacity to partially meet food requirements, potentially enhancing food resilience and security (Saha & Eckelman, 2017).

However, despite this interest, the area devoted to urban agriculture is declining (Bren d’Amour et al., 2017; García-Nieto et al., 2018; Langemeyer et al., 2021).

The unexpected Covid-19 pandemic has revealed the need for cities to question food resilience and the potential of cities for self-sufficiency through urban agriculture (Zhou, 2020).

According to the statement made by the Thomson Reuters Foundation, the restrictions imposed due to the coronavirus epidemic all over the world have caused damage to the agriculture and food supply chains. After the COVID-19 pandemic set all the alarms, people emptied their grocery shelves and in some cities the food supply was severely frowned upon (Zhou, 2020). It has been revealed that the whole world acted with fear and panic during the pandemic and the concerns about food security.

Food queues, empty market shelves, purchased seeds during the COVID-19 bans have shown that we need to draw attention to the necessity of urban agriculture all over the world. It has also made city planners, engineers, governments, decision support mechanisms, municipalities rethink how land is used in cities.

The advantages and dimensions of urban agriculture involve; contributing to food production, decrease food transport length (shortening supply chains), carbon storage, minimizing the urban heat island effect, aesthetics building communities, create more employment opportunities, boost community land values, supplying environment for wildlife, and conserve biodiversity.

In particular, it can be started by focusing on the dimensions of urban agriculture, which has many dimensions (Figure 1).

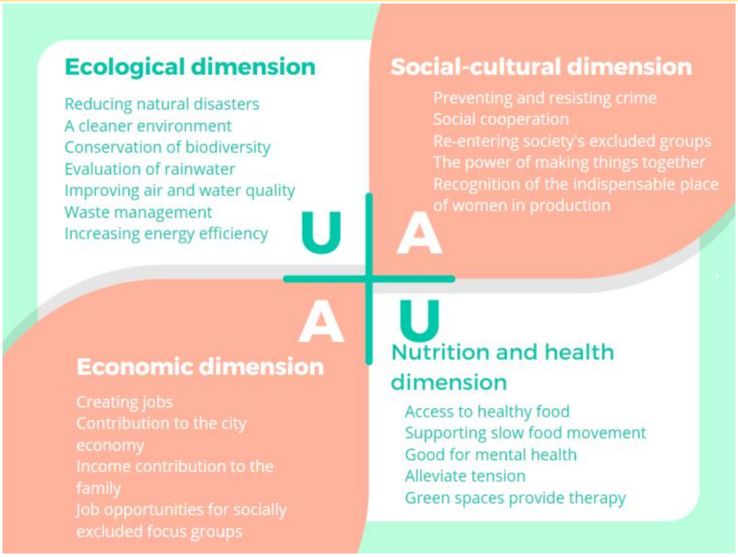

Figure 1. Dimensions of Urban Agriculture

2.1. Ecological dimension

Locally, urban agriculture can benefit the environment by enhancing urban air quality, lessening urban heat islands, and decrease water contamination issues caused by rain water. (Kaufman & Bailkey, 2000; Rene Van Veenhuizen, 2006).

The destruction of natural vegetation in cities by infrastructure elements such as buildings and pavements cause different climatic characteristics according to the environment and affects the formation of heat island in urban areas. Green roofs are extremely important in metropolitan areas where open green areas are gradually decreasing in order to avoid long-term heat storage of large non-reflective surfaces, known as urban heat islands, and to raise temperature values in the city center (Byrne & Sipe, 2010).

Green roofs (Figure 2), according to Lee, offer numerous benefits to the city, which include diminished urban heat island effect and energy usage, improved air quality, sustainable rainwater management, biodiversity by creating habitat for living things, and beautification. Summarized that the implementation of green roofs in Toronto will bring significant economic benefits to the city, particularly in storm water management and urban heat island reduction (Lee, 2017).

Figure 2. Example green rooftop farm (Anonymous a, 2022)

Vertical gardens have numerous aesthetic, economic, physiological, and environmental advantages. Here are a few examples: Absorbing and dispersing city noise, lowering the heat island effect, increasing biodiversity, and absorbing air pollutants (Anonymous b, 2022).

Furthermore, according to World Health Organization (WHO), people require 10 to 15 m^2 of green space per person, which must be distributed "according to the building density, the population density in a specific area, and this equates to at least 22 m^2 of green space for each four-story building with two houses on each floor.

Vertical farming and roof top farming contribute to the assertion that skyscrapers and tower blocks, particularly in metropolitan areas, should be surrounded by forests.

Vertical gardens are both top-notch on the playground. They can be viewed as a natural tapestry on a building top (Anonymous c, 2022).

2.2. Social-Cultural dimension

According to Veen et al. (2016), non-commercial gardens are controlled communally to cultivate crops, fruits and veggies and/or blossom for individual usages, so although entrepreneurship greenery are small-scale commercial garden initiatives. Furthermore, social cohesion, chat interface and helping one another were stated to be common in community gardens (Veen et al., 2016).

Furthermore, urban agricultural activities provide fruitful green places (Figure 3) for individuals to gather and produce food at the parcel level. When these areas are combined, they create a system of versatile, fruitful characteristics that also provide people with lots of benefits in as well as food production (Balmer et al., 2005).

Figure 3. Social aspect of community gardens

UA appears to respond well to conventional child rearing and household duties roles for women (Mougeot, 2000), creating employment especially for women, seniors and youth, and taking on the role of revitalizing the entire neighborhood. Because urban agriculture allows women to supplement their food supply while remaining close to home. Most female urban producers are more likely than men to engage in self-sufficiency (Maxwell, 1995; Hovorka et al., 2009). UA is especially important for women who care for and/or support extended families (Maxwell, 1995). Evidence suggests that UA can give women more authority over domestic resources, budgeting, outcome, and benefits (Moustier, 1999).

Through community gardens, urban agriculture can enhance both health and environmental issues by building connections among various ethnicities and different ages, rising community involvement, and human engagement (Hodgson et al., 2011; Veen, 2015).

As Brooklyn Grange (Figure 4), a rooftop farm, has illustrated, this is about much more than just growing food to sell. The broadening of its products and services, which range from sunset yoga and meditation to farm meals, ceremonies, and special events, has enhanced its social-cultural significance (Veen, 2015).

Figure 4. Brooklyn Grange Rooftop Farm

2.3. Economic dimension

It is crucial to thoroughly assess and promote UA's contribution to and effect on the wellbeing of particular rural and urban communities.

Urban agriculture is critical for improving the food security of poor urban households and in-vehicle effluent treatment and recovery is undoubtedly an indicator of UA's completed and cost-effective production (Mougeot, 2000).

The utilization of vacant and idle lands for urban agriculture, as well as the utilization of degraded land, can raise house prices in the surrounding area (René Van Veenhuizen & Danso, 2007; Pearson et al., 2010). Urban agriculture can also reduce the amount of energy used in food transportation by reducing the number of kilometers food must travel from farm to table. Food travels approximately 1,300 miles (2,080 km) from farm to table; this figure could be reduced to 30 miles (49 km) if some foods are produced more locally (Peters et al., 2009).

2.4. Nutrition and Health dimension

Plants lessen the physical symptoms of stress, according to a study by Professor Virginia Lohr of Washington State University. According to Dr. Lohr's research, employees who worked in an atmosphere containing plants were 12% more productive and less stressed than those who did not. There are many more studies that demonstrate how green environments enhance human wellbeing. Buildings that have and encourage access to plants have a larger favorable influence on human health than those that do not, according to Honeyman (1987). Green buildings have also been found to enhance post-operative recovery factor and aid in recovery (Anonymous b, 2022).

Agricultural activity can balance the decrease in physical activity that develops with aging, especially in women, and can reduce health problems (clinical depression, obesity, some cancers) with activity (Miles, 2007; Pearson et al., 2010).

Furthermore, the cultivation of food and gardening restores people's connection to the land and nature, as well as reduces people's stress, feelings of hopelessness, and nervousness helps some groups maintain a healthy diet (Mitchell & Popham, 2007; Kortright & Wakefield, 2011).

The UA effectively contributes in a variety of ways to reduce food insecurity, is critical for improving the food security of poor urban households (Mougeot, 2000). Urban agriculture can have a positive view on household food security for access to the world and food-related transportation (Zezza & Tasciotti, 2010). For example city gardens in Havana, Cuba, and in residential areas like Detroit, for example, have gradually improved the food quality and quantity accessible to producers' households and neighborhoods, improving household financial well-being (Peters et al., 2009; Keskin & Yıldırım, 2019).

3. Urban Agriculture Interactions in Urbanization

There are many different dimensions to consider when evaluating urban agriculture activities. In this regard, the phenomenon of urban agriculture should be tried to address within a spatial framework.

While agriculture is seen as the primary sector in rural areas, it has evolved into a variety of spaces that interact with urban activities in the 21st-century urbanization dynamics. Furthermore, urban growth in developing countries can significantly raise both the number of impoverished residents and the threat to food and nutrition security. This is because urban residents spend 30% more on food than people living in rural areas, and urban poor people are spending 60-80% of their earnings on food (Hubbard & Onumah, 2001; Matuschke, 2009; Indraprahasta, 2013). Recent economic and food security problems have fueled a growing urban food production movement (Lovell, 2010).

It is time to design and strengthen urban areas for urban food production, transforming agriculture from a traditional understanding of agriculture into smaller, more local agricultural pursuits and integrating with city life, where mechanization and agricultural chemicals are heavily used (Menteş, 2019). At this point, we are confronted with the need for urban agriculture in order to develop sustainable urban life in the future. However, one of the major constraints to urban agriculture applications is a lack of space in urban areas for growing food (Deelstra & Girardet, 2000). Despite the fact that agriculture was restricted to cities, cities began to grow in a variety of ways, including population growth, urbanization, and industrialization faced with continued urban growth, residential development on farmland, particularly in peri-urban areas, has placed enormous strain on already scarce farmland resources (Yang & Li, 2000; Skinner et al., 2001). Although peri-urban areas are subject to urban pressures as well as socioeconomic and land use changes, all of which threaten the farm's economic foundation, multifunctional agricultural development provides an approach that strengthens and modernizes peri-urban agriculture (Zasada, 2011). Agriculture in peri-urban areas contributes to the long-term development of those areas by limiting urban sprawl, providing natural ecosystems, enabling social inclusion, and consolidating food security in local communities (Biasi et al., 2015; Opitz et al., 2016; Duvernoy et al., 2018). Urban agriculture and peri-urban planning can help to control uncontrolled urban sprawl by creating a productive greenbelt around the city, organizing producers, and implementing sound planning (Lima et al., 2000). Furthermore, if this unity in urban agriculture and peri-urban areas is spatially determined in environmental plans, it can become a very effective concept for smarter growth of rapidly sprawling cities. New policies in urbanization are unavoidable, and they should be integrated into the mainstream of urban agriculture. In this regard, Smart Growth development should be promoted as a preferred alternative in many planning circles as a means of achieving sustainable urbanization.

4. Conclusion and Suggestions

According to De Bon et al. (2010), food accessibility and food safety would be one of the most important problems that we will face in the near future, in today's conditions where natural resources are rapidly consumed, destroyed and the concept of sustainability is important, and we are experiencing this in 2022. The idea of urban agriculture has entered our lives as a result of this situation, which is extremely dangerous for humanity. Therefore, the terms "urban agriculture" and "peri-urban agriculture" must be comprehended.

Urban agriculture is a reaction to crises, hunger, poverty and unemployment in the cities. It should not remain a silent reaction and should make its footsteps heard in all cities of the World.

Using urban planning to fuel innovative strategies against food poverty would lead to an updated spatial planning strategy that takes advantage of new prospects for creating food systems that are more resilient and would succeed where its predecessors failed. The need to consider urban agriculture has highlighted the importance of addressing issues related to urbanization.

This study emphasizes the importance of understanding urban agriculture benefits and urbanization together in order to envision future sustainable smart growth strategies.

Smart growth policies to be developed, planning decisions, and urban agriculture practices will be encouraged urban agriculture that will help to solve certain urban problems.

As a result, in order to ensure sustainable development in urban areas, both national and international studies should be carried out, urban agriculture should be integrated into urban planning and urban policy making processes, regulation for urban agriculture should be announced.

In this way, urban agriculture can truly be the keystone that aids in the reorganization of urban areas, as well as a new and more sustainable urban arrangement to foster the evolution of urban sustainability.

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All authors contributed equally to the article.

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Urban Agriculture within the Scope of Food Security, Food Safety and Resilience to Climate Change

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1. Introduction

The rate of urbanisation has started to increase rapidly parallel to the industrialisation throughout the world. While 30% of the world's population lived in cities in 1950, this rate increased to 55% in 2018 and is now expected to reach 68% by 2050 (United Nations, 2019). Increasing population densities and building volumes in urban areas are gradually reducing people's connections with nature. In particular, the concentration of grey infrastructure (roads, water, electricity, sewerage, etc.) instead of open and green areas in the cities leads to the damaging of the elements and processes of natural areas, distancing people from agricultural production and increasing food security concerns due to reduced agricultural areas.

The fact that the world's population is gradually increasing while agricultural areas are decreasing has led to the discussion of problems related to food supply and this issue has been brought to the global agenda. According to a study conducted by the United Nations Population Fund - UNFPA (2007), since more than half of the global population is now located in urban areas, food consumption is increasingly moving away from production centres and thus requiring longer transport and distribution networks for food supply. As people have to supply their daily food needs from long distances, they only can access to products that have lost their freshness or nutritional values. Long distance food supply from the producer to the consumer causes greenhouse gas emissions during ransport. The greater the distance food travels between farm and plate, the greater becomes the adverse environmental impact (Kemp et al., 2010). Therefore, it can be argued that the distance between food sources and people is one of the key concern for sustainable cities.

The most effective way to reduce the distance to food is to support food production within urban and peri-urban zones, in other words, is urban agriculture. In this context, one of the best practices was realised in Turkey in the early 20th century. Atatürk Forest Farm (AOÇ) serves as a model for urban agriculture in the world. It was established in 1925 in the centre of the capital city, of Ankara (Figure 1) upon the directives and special interest of Mustafa Kemal Atatürk, the founder of the Republic of Turkey and extended to the size of 55,000 decares (Kimyon & Serter, 2015). Looking at the history of urban planning throughout the world, it is possible to state that AOÇ is the first project to integrate agricultural production and research with citizen's recreational requirements in large cities. This place is the outcome of an idea far beyond its time. AOÇ was created in the city of Ankara many years before the world started to discuss on urban agriculture, and long before the beginning of landscape-based agropark/farmpark practices that are becoming more and more common in the world today and designed under the knowledge and coordination of landscape architects. As stated in the letter written by Atatürk to the Prime Ministry when he donated his farms to his nation, which is accepted as a testament, the founding objectives of AOÇ are given below (Açıksöz, 2001; Aydoğan, 2012);

- Acquiring theoretical and practical experiences in the fields of agriculture and agronomy,
- Expanding the field of work to produce all kinds of products grown under the country’s climate and engaging in all kinds of agricultural practises; establishing numerous factories and workshops, whether large or small; using all agricultural machinery in a proper and useful manner and creating facilities to repair all of them and to remanufacture a substantial part of them,
- Ensuring the adaptability and efficiency of domestic and foreign animal breeds with rehabilitation efforts conducted thereon,
- Establishing co-operatives or similar organisations to work together with surrounding villages in a productive manner,
- Maintaining continuous and close relations with domestic and foreign markets and adjusting operations and productions according to their demands,
- Improving and designing the land, enhancing the environment, creating healthy and beautiful places for the public to visit, enjoy and rest,
- Acting as a pioneer and a pillar for the favourable selection and development of the measures taken and to be taken by the State to improve agricultural methods, to increase production and to develop villages.

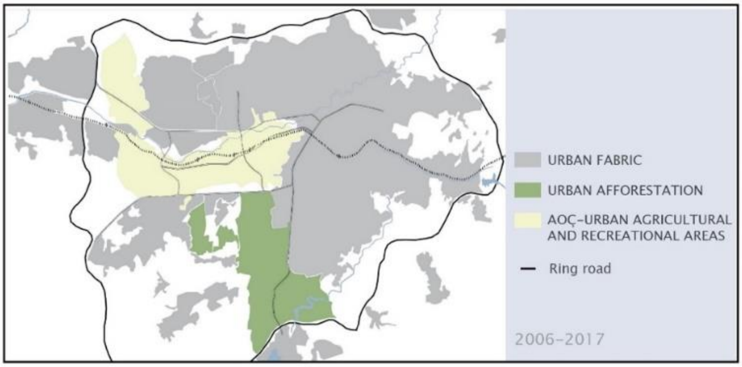

Figure 1. Urban agriculture and recreation area in Ankara city center, Atatürk Forest Farm (adapted from Aycı, 2020).

AOÇ, 1930 (Koç University Digital Collection, 2022).

AOÇ, 1930 (Koç University Digital Collection, 2022).

AOÇ Agriculture and Recreation Areas, 1935 (SALT Archive, 2022).

Figure 2. Photographs depicting the years of establishment of AOÇ

Mougeot (2000) defines urban agriculture as "a system that aims to cultivate, process and distribute a variety of food or plants within or on the periphery of a city by utilising human, material and service resources to a large extent and reintroducing these resources to the urban area". The Food and Agriculture Organisation of the United Nations (FAO) on the other hand defines urban agriculture as "agricultural activities carried out in and around the city by using resources such as energy, soil and water to meet the needs of the urban population" (FAO, 1999). Table 1 presents the main objectives, processes and products of urban agriculture below.

Table 1. Main Objectives, Processes and Products of Urban Agriculture (Baumgartner & Belevi, 2001)

MAIN OBJECTIVES	Food Safety
	Food Security
	Reducing Poverty and Hunger
	Public Health
	Sustainable Resource Management
PROCESSES	Agricultural Practices
	Soil Quality Management
	Water Management
	Public Health Management
	Urban Policy and Planning
PRODUCTS	Food
	Economy
	Health

Since the Industrial Revolution, irregular migration movements in the West have led to unplanned growth from rural to urban areas, which has put pressure on fertile agricultural areas on flat and nearly flat slopes that are very suitable for construction. Meanwhile, new urbanisation trends emerged in different parts of the world. One of these is the "Garden City" model developed by Ebenezer Horward in 1892 based on the advantages created by the city and the countryside together. After this first initiative, encouraging agriculture within the city itself, Le Corbousier proposed the idea of the "Functional City" in the 20th century, suggesting that the areas around the city should be utilised as agricultural production units (Kanbak, 2018). By early 20th century, food supply problems were experienced in countries due to the world wars when urban agriculture came out as a solution. Following the World Wars, on the other hand, the agricultural areas continued to be under the pressure of rapid and irregular urbanisation and this started to pose a serious challenge towards food security. But, fortunately, urban agriculture has the potential to be a solution to this threat by partially or fully meeting the food needs of urbanites. Urban agriculture is becoming increasingly important today as one of the effective tools against social, economic and ecological problems (Kayasü & Durmaz, 2021; Tandoğan & Özdamar, 2022). The benefits of urban agriculture are given in Table 2.

Table 2. Benefits of Urban Agriculture (Deelstra & Girardet, 2000; Pearson et. al., 2010; Van Tuijl et. al., 2018)

Ecological Dimension	Economic Dimension
• Urban agriculture increases biodiversity, • Contributes to rainwater management. • Provides wastewater management by utilising rainwater for farmlands. • Enhances urban climate by reducing temperature, retaining dust and gases, and mitigating the impact of wind. • The distance travelled by food is reduced, so that food reaches the consumer's table faster and with less fossil fuel consumption.	• Provides savings for local governments. • Contributes to employment and household income. • Contributes to the city economy. • Mitigates households' food expenditures. • Contributes to national food systems by providing an important alternative to food security for urban households.
Socio-Cultural Dimension	**Health Dimension**
• Urban agriculture provides opportunities for many physical activities, • Encourages active societies by providing socialisation, which is among the most important needs of human beings. • Creates a recreation environment where social cohesion and sharing is provided. • Provides the opportunity for the community to engage in agricultural activities.	• Urban agriculture provides a solution to nutritional problems that lead to obesity. • Provides a healing effect on mental health • Encourages the use of agricultural activities in the treatment of mental health problems.

An important outcome of urban landscape planning is the design of an open and green space system. Urban Agriculture constitutes a significant element of this open and green areas system. The types of urban agricultural may vary according to their functional characteristics. Food supply gardens, hobby gardens, vertical gardens, agricultural education gardens, therapy gardens, neighbourhood agricultural gardens, squatter agricultural gardens, urban farms, agroparks and agricultural heritage gardens can be cited as examples of different urban agricultural areas. Among these, the vertical farm concept represents a new development within the scope of urban agriculture. In North Chungcheong, South Korea, vegetables and strawberries are grown in a 600 m abandoned highway tunnel passage. This place is known as a vertical farm with LED lighting. It is predicted that in the 21st century, vertical farming will increase in controlled atmospheres in and around megacities. Currently, apart from South Korea, Japan, Singapore, Chicago, in USA and Vancouver in, Canada are some of the places where vertical farms are developing rapidly (Despommier, 2013).

2. Urban Food Security

The concept of food security emerged during the global food crisis in 1970. The World Food Summit is organised in 1974 with the impact of the crisis and defined food security as "having access to basic food resources on earth at all times and at an adequate level in order to ensure the regular distribution of food consumption, as well as compensating for fluctuations likely to arise in production and price". The Food and Agriculture Organisation (FAO) has defined food security as "ensuring that all people have both physical and economic access at all times to the basic foodstuffs they need, taking into account factors affecting the production and purchase of food by countries or individuals" (FAO, 1984). In its publication titled "The State of Food Insecurity in the

World", FAO defined food security as "the ability of all people to have physical, social and economic access at all times to sufficient, safe and nutritious food to meet their dietary needs and preferences for a healthy and active life" (FAO, 2015). Food security has the following four aspects listed below and all those aspects must be considered together in order to ensure food security (Kıymaz & Şahinöz, 2010; Keskin & Demirbaş, 2012; Niyaz & İnan, 2016; Dağdur, 2017):

- Availability of food: One of the most important factors for ensuring food security is the availability of sufficient food. This means the availability of food at a level that is sufficient to meet the nutritional needs of people.
- Accessibility of food: Sufficiency in terms of quantity does not mean that food security is ensured. People should have economic and physical access to food.
- Utilization of food (Benefitability): Food can be consumed only after the peoples have accessed food. The usability of food means the use of safe food in sufficient quantities per person and in accordance with basic nutritional needs (healthy and balanced).
- Stability (Determination): This means that the first three parameters are maintained in a stable manner. Even in extraordinary situations (such as climatic events, wars, economic crises and natural disasters), the food needs of people should always be met without any disturbances.

- The increase in demand for food and the instability in agricultural production lead to higher food prices and increased concerns about the availability of food, which is the first condition for food security.

A balanced and varied supply of foods is another important aspect of food security. People who eat a single type of food at every meal are not considered to be secure in terms of food (Koç & Uzmay, 2015). Also, household income and food prices are other factors affecting food security. The increase in the proportion of the population starving as a result of the decrease in food consumption due to the increase in food prices is referred to as the " global food crisis". It is projected that the number of people affected by hunger in the world will exceed 840 million. (9.8 % of the population) by 2030 (FAO, 2020). On the other hand, it is estimated that approximately two-thirds of the world's population, which will reach 9.5 billion in 2050, will live in cities (United Nations, 2014). Therefore, it is possible to mention that while the need for food is increasing, the problems related to food security may grow in the context of rapid agricultural production (Wiskerke, 2015). Urban agriculture is an important issue addressed by many disciplines in many countries as a solution to the mentioned problem (Pölling et al, 2016).

Changing climatic conditions, natural disasters, poverty, insufficient agricultural development, decreasing water resources, globalisation, decreasing income, increasing unemployment and rising sea levels are among the factors that are among the factors that are likely to threaten food security (Turan, 2012). Climate change is a major stress factor that is experienced over longer time periods and through changes in the frequency and intensity of extreme weather events. Unfortunately, agricultural production is vulnerable to long-term stresses such as climate change as it depends on complex ecological, economic and social processes (Thompson & Scoones, 2009). Of course, climate change will have several impacts on food security (Connolly-Boutin & Smit, 2016). If necessary measures are not taken in this regard, the changing climate may magnify the existing problem in countries and regions experiencing high levels of food insecurity. The State of Food Security and Nutrition in the World 2018 Report states that the main driving force behind the increase in the number of people suffering from hunger worldwide to 690 million in 2017, with an increase of 17 million, is the changing climate conditions.

The urbanisation pattern based only on structures and buildings like a cancerous cell, and also the production methods used in industrial agriculture are among the causes of food insecurity and ecological problems. The residues formed by the increasing use of chemical products in agriculture pollute groundwater and soil, causing environmental problems and triggering an ecological crisis. The use of sustainable good agricultural practices is important to ensure food security. The misuse of agricultural lands with the increase in industrialisation in developing countries is another factor that poses a major risk in terms of food security (Eraktan & Yelen, 2012). In order to ensure sustainable agriculture, the misuse of agricultural land should be avoided as soon as possible.

3. Urban Food Safety

An integral part of food security; food safety is defined as compliance with the necessary rules and taking precautions during the production, processing, storage and distribution of food in order to ensure healthy and flawless food production (TGDF, 2011). Food safety is a concept that includes the realisation of all processes related to food supply from production to consumption without harming people's health and nature and ensuring controls at all necessary stages during the production of food (Bıyıklı, 2011). People have always been confused about the concepts of food safety and food security and they are generally used interchangeably. While food security refers to the provision of sustainability in access to safe and healthy food, which also includes the concept of food safety, food safety refers to the measures taken to protect people's health in the process from production to consumption. Both of these concepts are extremely important in terms of providing the food that consumers need by ensuring the necessary conditions for the environment and human health during production (Niyaz & İnan, 2016).

During the period demoninated as "green revolution" after the Second World War, more water and chemicals were used to increase the yield per unit area. Highly used chemical products have led to adverse effects on plant health, significant decrease in biodiversity and pollution of soil and water resources. In her famous book "Silent Spring", Rachel Carson

(1962) proved how minute amount of pesticide enters the food chain and appears in the building blocks of penguins many kilometres away from their source. The increasing use of chemicals in agricultural production to increase yields jeopardises food safety in all aspects. In this sense, today, the need for control in the food production network is an important public health and environmental management issue. Considering the population growth to be experienced, it is necessary to increase food production in line with the principles required for food safety, and to change food consumption and waste behaviours in parallel.

The main causes of food security and safety challenges may be listed as climate change and low agricultural yields, fluctuations in supply, increases in prices, inconsistent policies, changing consumption habits of the society, low income level, population growth and inadequacy of control practices (Erkmen, 2010; Kıymaz & Şahinöz, 2010; Eştürk, 2013). In 2019, nearly 750 million people (or about one in ten people in the world) were exposed to severe food insecurity (FAO, 2020). If measures are not taken globally to ensure food security, it will become very difficult to access sufficient, healthy and safe food in the near future and various diseases and hunger phenomenon will begin to spread rapidly throughout the world (Koca & Somuncu, 2021). For this reason, measures to be taken with various global co-operations constitute a necessity in terms of ensuring food security and safety. Sustainable urban agriculture practices may contribute to food security by supporting rural food production and the protection of natural resources.

4. The Role of Urban Agriculture in Combating Climate Change

Climate-related disasters can be seen as the main challenges that cities face nowadays (Lwasa et al., 2013). The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report states that many climate change risks are concentrated in urban areas and that these impacts are increasing. Climate change-related problems lead to a decrease in food supply to cities and an increase in food prices (Lwasa & Dubbeling, 2015). The industrial food system, designed to provide high yields and relatively cheaper food, poses risks to public health. At the same time, problems arising from the mode of production, transport and distribution cause damage to nature and ecosystems.

Urban agriculture is an important element of the urban open and green space system that helps to adapt to climate change and improve the urban environment by mitigating its impacts. Urban gardens, agricultural lands, street trees, orchard, parks and forests reduce solar radiation, increase evaporation and thus reduce temperature (Simon, 2012). Urban agriculture can reduce the daily flow of food into cities and negative impacts on air quality, and can be used as an important tool to increase urban resilience by saving fossil fuel resources. By increasing local food production and reducing dependence on food imports, more resilient cities can be created (FAO, 2008).

The dominant form of urbanisation in the world based on, grey infrastructure (road network, impermeable structures etc.) causes degradation of natural landscapes and stimulates climate change. Urban agriculture is potentially an effective tool in combating climate change by reducinng the effects of urban heat islands and flood risks (Tidball & Krasny, 2007; Dubbeling, 2013; Mancebo, 2018). Also, urban agriculture may also mitigate the flood risk of urban areas by reducing stormwater runoff and creating an environment for excess water to be stored and infiltrated into other open and green areas.

Instead of growing food in remote areas and spending large amounts of resources on transport, growing food in the city may offer numerous benefits. In this way; greenhouse gas emissions and energy use are reduced as food is produced close to the city. Energy consumption is significantly reduced by reducing transport, cooling, storage load and with less packaging. Reuse of composted organic wastes to be disposed of in landfills will contribute to the reduction of methane and other greenhouse gas emissions in the landfills. Reuse of urban wastewater in urban agriculture has the potential to release freshwater for higher value uses and reduce emissions from wastewater treatment (Lwasa & Dubbeling, 2015).

The UN 2030 Agenda for Sustainable Development emphasises the need to "make cities and human settlements resilient, inclusive, safe and sustainable". UN member States have set a total of 17 targets to tackle inequality and injustice, end poverty and overcome climate change by 2030. This list includes sustainable agriculture goals that will help combat climate change and its impacts, such as reducing poverty, supporting sustainable agriculture, ensuring food security, and ensuring sustainable consumption and production. Consequently, building resilience in a city requires an integrated and landscape-based approach that addresses mitigation (e.g. strategies to reduce greenhouse gas emissions), adaptation (e.g. reducing vulnerability to climate change) and development (e.g. poverty reduction, income generation and food security). It is possible to fulfil these criteria in agricultural activities to be carried out in and around the city (Dubbeling, 2014). The extent to which urban agriculture can mitigate climate change, contribute to adaptation and increase the resilience of the city depends on the level of urban development, the state of infrastructure and the degree of integration of urban agriculture into urban policies.

5. Conclusion

The history of urban agricultural areas dates back to the 1500s and especially to the post-industrial years (Akyol, 2011). As the rate of urbanisation has increased over time, food production areas have started to remain far away from the whole urban core. Therefore, the authorities came with the idea that it would be in the interest of people and nature to design new strategies to ensure regular food supply and to plan food production areas close to the main consumption centres. It is not always necessary to allocate large areas for urban agriculture which is considered, as a component of the urban open green space system. It is possible to perform urban agriculture by using open spaces, parks, hospital and school gardens, roofs, etc. even in the most dense areas of cities. Supporting open and green areas with urban gardens for agricultural purposes will also contribute to the concept of "green city".

In addition, during the Covid-19 pandemic, which has affected the whole world since the end of 2019, urban residents have started to grow edible plants in pots in open areas like balconies and terraces of their buildings. The need for open and green areas, including urban agricultural areas, has been better understood due to the disruptions in the food supply chain during this period.

The world has recently been facing sudden climatic incidents caused by global climate change. One of the reasons for sudden and variable downpours and temperature increases is the replacement of green areas with concrete surfaces and/or the lack of open and green areas. These changing climatic conditions have not only caused losses in agricultural production, but also adversely affected food supply and this situation has started to become chronic problem. There is a growing need for sustainable solutions for food, waste, energy and water management within the scope of climate change adaptation. In this context, since the reuse of organic wastes will play an important role in reducing the carbon footprint and improving the urban climate, it is possible to consider urban agriculture as one of the solutions for climate change adaptation in today's world (De Zeeuw et al., 2011). In the face of global issues such as tackling climate change, the need for more equitable economic models and addressing health concerns, urban agriculture has moved from the periphery to the centre of public discussions (Bohn & Viljoen, 2011).

Since urban agriculture provides multiple ecosystem services and increases global sustainability, it needs to be analysed in terms of multifunctionality, resilience and sustainability, then evaluated through a holistic perspective. The functions of urban agriculture in combating climate change are summarised below:

- By producing fresh food in the centre or periphery of cities, food transport distances will be reduced, thereby lowering greenhouse gas emissions and energy use, while at the same time reducing pressure on the food supply chain,
- It will support cities in improving their microclimates,
- It will prevent the transformation of open lands at risk of urbanisation into concrete surfaces and increase urban biodiversity and improve vegetation cover,
- Urban agricultural areas, together with all elements of the open and green space systems, will contribute to groundwater recharge and runoff control,
- Water resources will be used in a balanced way in agricultural production by using wastewater cleaned under appropriate conditions through green infrastructure elements,
- Composting of organic wastes in urban agricultural areas and green areas will reduce waste costs.

Making use of urban agriculture for food security and healthy environments in urban planning will definitely contribute to the creation of resilient cities that challenge potential threats from urbanisation trends, climate change, natural disasters and population growth. It is possible that urban agriculture practices may produce positive results in terms of economic efficiency, ecological sensitivity, social integration between urban and rural areas, and assurance in food production and access to food. A crop production in harmony with climate, ecological conditions and natural vegetation is, of course, a desirable agroecological approach. On the other hand, even if practised agroecologically, agriculture is a form of intervention in the landscape/nature as by humans. It should not be forgotten that natural areas and organically developed cultural landscapes have a structural and functional character that is dynamic in time and space. Functional features that include ecological and cultural processes, and structural features that can be perceived/distinguished by human beings and create identity/character are the mechanisms that shape the landscape in question. Therefore, within the scope of a sustainable spatial development, it is inevitable that urban agriculture practices should be based on the mentioned mechanisms, as in any human activity. Defined as landscape-based urban agriculture or more inclusively landscape-based urbanism, this approach is actually a spatial practise guided by landscape planning and design. The products of urban landscape planning and design reveal the urban open and green space system and its elements from upper scale to lower scale in an integrated manner. In this context, urban agricultural areas can be considered as integrated elements of an open and green urban space system. Therefore, the appropriate foundation will be provided to access the benefits of urban agriculture described within the scope of this study or to eliminate the challenges thereof.

As a final remark, when the existing definitions of urban agriculture investigated in this paper are approached critically, it is possible to say that their scope does not include the citizens of the city. The exclusion of urban dwellers from food production processes is, in fact, a continuation of the deficiency of conventional agriculture in this regard. The problems rural-urban dissociation of existing policies or land planning and management approaches are not resolved. However, urban agriculture is a potential tool for rural-urban cohesion by building up a better role assignments and collaboration between these two related with food production process.

Thanks and Information Note

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Urban Agriculture as a Tool for Urban Resilience and Sustainability

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1. Introduction

Today, urban areas that host the majority of the world's population are trying to survive under many risks such as poverty, water scarcity, terrorism, natural disasters, epidemics and food insecurity. These risks are expected to increase and worsen due to climate change, population growth and continued rapid urbanization. However, cities' dependence on global resources increasingly weakens their defense against shocks that could disrupt existing supply systems. Especially after the Covid-19 pandemic, which affected almost every country, the fragility of cities has become more obvious (Gulyas & Edmondson, 2021). Therefore, determining strategies to better prepare cities for future crises has become one of the most discussed topics.

The global Covid-19 pandemic has brought back the level of food sovereignty in urban areas. Considering the ever-increasing global population and planetary urbanization processes, it is not a utopian perspective to expect the dimensions of food security problems in future cities to change. Today, the change in people's (food) consumption habits and the difficulty of accessing food are among the leading problems in our world. According to the projection of the United Nations, the world population is expected to reach approximately 10 billion in 2050. It is estimated that almost all of this population increase, which is 34 percent more than today, will occur in developing countries and the urban population will increase to 70 percent (UN, 2017). If this prediction is correct for the world population, it is expected that the income levels will also change in the form of today's multiples and in the same direction, the consumption habits will also change. This means that food production will increase by 70 percent to feed the larger, more urban and wealthier population (FAO, 2009). In other words, it will make it difficult for food systems to feed the population. For this, it is necessary to determine and implement policies and effective safety net programs to combat poverty, especially in rural areas.

The World Resources Institute (WRI) report titled “Creating a Sustainable Food Future” prepared in 2019 defines three areas that the global food system is facing; “food deficit, land use and greenhouse gas reduction deficit”. To fix these gaps, the report proposes a menu of options that could enable the world to achieve a sustainable food future by meeting growing food demands. Recommendations are to prevent deforestation, reforest or reinstate abandoned and barren lands to help stabilize the climate, promote economic development and reduce poverty (Searchinger et al., 2019).

This study is based on the recognition that, in the face of a rapidly increasing global population, urban agriculture deserves strong consideration in the planning of strategies such as urban resilience and global sustainability used to close these gaps.

In this context, the study argues that urban agriculture, which has multiple functions for cities and urban residents, can help both in ensuring global sustainability and in building urban resilience. In the study, the effect of urban agriculture on resilience and urban sustainability, and thus on the functionality of the urban system, will be discussed as a whole.

2.Urban Agriculture

Urban agriculture[1], which is defined by Bailkey and Nasr (2000) as "the cultivation, processing and distribution of food and other products through intensive plant cultivation and animal husbandry in and around cities", is "agricultural activities primarily carried out within the city limits" (Koç, 2003). The UPA definition, which covers the forms of "subsistence production and processing, from household level to commercialized agriculture" (Van Veenhuizen & Danso, 2007) differs according to its content. Therefore, there is variation among its definitions.

It has been defined by Smit et al, as "the cultivation of plants, trees, and livestock, including related input, processing, and marketing activities and services" (1996). It can be applied in different urban spaces such as field lands, vacant public lands, gardens, roofs, balconies and cellars. UPA differs in scale and location, mostly focusing on perishable and high value crops that can be grown indoors. The orientation and scale of the UPA varies. It ranges from the purely subsistence and recreational oriented micro-scale, to the small-scale semi-commercial gardeners, to the medium-sized animal breeders or to the large-scale commercial enterprises (De Zeeuw et al.,

[1] The UN Food and Agriculture Organization introduced the Urban and Urban Environment (agriculture in the areas surrounding the provinces) with the abbreviation UPA (Nugent, 2000). The same abbreviation for urban agriculture is used in the study.

2011). Taking many different forms around the world, depending on climate, current technologies, and cultural preferences, they have been shaped as home gardens in developing country cities to provide food to urban residents (East & Dawes, 2009).

Urban agriculture, which has a long history, manifests itself in Europe during the Middle Ages as kitchen gardens where vegetables, fruits, medicinal herbs and cut flowers are grown. The 16th century city of “Machu Picchu”, where terraces and irrigation infrastructures, waste, microclimate control and management systems for food storage were established to support food production in the city, can be given as an example to the large scale of UPA (Smit, 2002 as cited in Lowell, 2010).

Many cities that have recognized the extensive benefits of UPA have developed policy strategies and made adjustments in their legislation to support food production within city limits, taking into account the social functions it provides. Countries in developing regions such as Sub-Saharan Africa, Latin America and Southeast Asia can be given as examples with the plans they have developed regarding UPA. (Mougeot, 2005; Redwood, 2009). In these regions, generally by providing food for consumption, reducing food-related costs (Parrot et al., 2009), diversifying activities to generate income (Foeken & Owuor, 2008), and empowering women (Kumar & Nair, 2004; Madaleno, 2000) focuses on improving the livelihoods of the urban poor. In Montreal, Canada, a UPA system of 97 community gardens has been installed on 8,200 individual plots. It is thought that these community gardens contribute to the increase of socialization and technical knowledge and the empowerment of individuals (Reid, 2009). In Shanghai, China, which is considered the city created by UPA, many fertile lands are held for food cultivation (Girardet, 2005). The activities of UPA in the city provide 60% of the vegetables and 90% of the eggs consumed by the residents (Bhatt, 2009). There are more than 1,200 garden plots in the Barcelona Metropolitan Region, covering 0.65% of the total land area. Although the majority of these plots are illegally occupied, for gardeners, the home supplies a large percentage of their vegetable needs. In the Netherlands, there are 250,000 community and dedicated gardens on 4,000 hectares of land, and in Amsterdam alone 350 hectares are reserved for urban gardens (Domene & Sauri, 2007).

The most impressive example of UPA in recent years has been seen in Havana, Cuba, after the collapse of the Soviet Union, which ended large-scale trade between countries (Viljoen & Bohn, 2009).

Cuba, which only grows products such as sugar and tobacco, has created an urban gardening revolution in lands that have become unproductive due to years of monocultural agriculture and not having sufficient information about growing agriculturally diverse products. From 1997 to 2003, Havana experienced an average annual growth of 38% in UPA, resulting in a 13-fold increase in vegetable production. Most of the production is carried out on “organoponicos”, raised beds with a mixture of soil and organic matter that can be built on almost any plot. Today, most of the available land has been converted to urban agriculture within the borders of Havana (including urban environments and nearby rural areas), totaling more than 35,000 hectares (Koont, 2009). Clearly, urban agriculture remains an extensive and important activity in regions around the world.

3. Urban Agriculture and Resilience

Resilience theory emphasizes that diversity is important first. (Berkes & Folke, 1998). The term resilience, which is generally defined as "the ability of a system to absorb all kinds of shocks and the capacity to adapt to changing conditions without losing any of its basic functions" (Meerow et al., 2016), has been coined as a response to the global crises in recent years. First, building resilience requires an integrated approach. The resilience discussions, especially on cities, refer to the fact that urban areas are complex, dynamic and socio-ecological systems. Urban resilience is a multidimensional concept that includes various systems and actors (Sharifi & Yamagata, 2014). It is recommended that resilient cities be resourceful, flexible, redundant, robust and integrated. Resilient cities describe cities that can withstand and recover from a variety of ailments, especially those caused by climate change and socio-economic crises (Gulyas & Edmondson, 2021).

Food insecurity, malnutrition and urban poverty are causes and consequences of each other, so they go hand in hand (Mougeot, 2005). The fact that the conditions in urban areas are better than in rural areas cause this situation to be generally ignored (FAO, 2004). The food system primarily serves to meet the basic needs of people. However, it is the main determinant of the health and well-being of the society against malnutrition that causes deaths (FAO; IFAD; UNICEF; WFP and WHO, 2020). Therefore, securing access to adequate nutritious food for the urban population is an essential part of resilience (Baudoin & Drescher, 2008). Many developed cities today are highly dependent on globalized resources, which are vulnerable to environmental, economic, social and geopolitical stresses (FAO, 2020). Disruptions in food supply and rising food prices seriously affect consumers in urban areas, especially the urban poor. Increasing local production and developing shorter supply chains are ways to reduce the likelihood of disruption to the food supply. In addition, developing circular systems and diversifying resources, increasing backup capacity, can help reduce dependency on certain resources. Thus, it can improve the ability of food systems to respond to and adapt to shocks (Dubbelin et al., 2019).

There is growing evidence that UPA can increase the resilience of the city due to a number of social and ecological benefits, including increasing the resilience of food systems, mostly fruit and vegetables (FAO, 2020). UPA (Webb, 2011), which is thought to have a limited quantitative share for food supply, plays an important role in regaining agricultural knowledge and building psychological and social resilience in times of crisis. Barthel et al. (2014) suggest that “urban gardens act as pockets of socio-ecological memory for the preservation of local ecological knowledge”. Thus, food resistance increases and cities are protected from the food crisis. Research has shown that interest in UPA in developed northern cities during times of crisis is often driven by “the motivation of citizens and larger urban movements to counter global dependencies, take control of food production capacities, and drive local networks towards social change and resilience.” (Camps-Calvet et al., 2015; Kirkpatrick & Davison, 2018). For example, II. During World War II, the United Arab Emirates played a critical role in improving food security and raising public morale (Lang and McKee, 2018) in Europe and North America. In the ten-year civil war that started in 1992 in Sierra Leone, the food supply necessary to feed its 1 million population was largely provided by the UPA[2] (De Zeeuw et al., 2011). The global financial and food crisis in 2008 is one of the examples of urban food resilience on a global scale (Rosset, 2008). The economic crisis in 2008 caused global food prices to double around the world. The rise in food prices has been met with social movements and protests in some countries and cities (for example, Portau-Prince in Haiti, Ouhigouya in Burkina Faso, and Mahalla El-Kobra in Egypt) (Baker, 2008). However, some urban areas (for example, the metropolitan area of the Ganges-Brahmaputra Delta, including Dhaka in Bangladesh and Kolkata in India) were much less affected by such social movements due to UPA production systems (Barthel et al., 2019).

UPA plays an important role as a survival strategy not only in times of crisis, but also in terms of increasing food security of the urban poor

[2] For detailed information, see: Larbi, T., Cofie, O. (2007). Exploratory study report on UPA in Freetown, Sierra Leone .RUAF Project Report. Accra.

and refugees, who are the most vulnerable segments of the urban society, as well as providing healthy nutrition.Less seasonal than rural agriculture, UPA can be a guarantee of food security due to a steady supply of food (De Bon et al., 2009). It plays an important role, especially in areas where access to affordable and nutritious food is limited. In order to create resilient and sustainable cities, the resilience targets of the cities must be compatible with the global sustainability targets.

4. Urban Agriculture and Sustainability

The fact that economic and technological developments do not always go in parallel with social and environmental developments has brought the concept of sustainability to the agenda. The adaptation of the concept to cities has been realized in a more recent period. It is not possible to find a single common definition developed on the sustainable city. However, based on the definition of the concept of sustainability, it can be said that a city model that can harmonize economic, social and ecological areas with each other positively (or at least in a way that does not harm each other) is sustainable .Such an approach can cover many issues, from the use of renewable energy to solid waste management, from the nature of urban production to the socialization of income, or from a democratic governance system to the protection and development of the city periphery and green areas.

As the urban population grows, it becomes more difficult to provide affordable services, infrastructure and food supplies to urban residents, leading to economic and social inequalities. With the continuous growth of cities, the multifunctional role of UPA is gaining importance, especially in regions with high food insecurity. Knowing the functions of UPA is important to understand its relationship with sustainability. The integration of environmental, economic and social urban systems provides opportunities for sustainability. Being a part of the food system, opening up agricultural areas for the urban poor, ensuring food security and creating employment can be seen as parts of integration. The concept of urban sustainability was first introduced at the Habitat II conference held in 1996 by UN-HABITAT, a United Nations Program for the creation of sustainable human settlements and adequate housing for all. In Habitat II, where the development of sustainable human settlements was introduced to the urbanizing world, it was stated that achieving sustainable land use is necessary to provide food, water and energy for many living systems and human activities (UN-Habitat II, 1996). In the context of Habitat II, attention was drawn to urban agriculture, especially in the discourse on providing sustainable land use areas.

> *"(h) Develop and support the implementation of improved land-management practices that deal comprehensively with competing urban land requirements for housing, industry, commerce, infrastructure, transport, green spaces and forested areas, taking into account the need for spaces for everyday activities - for playgrounds, parks, sports and recreation areas and areas suitable for gardening and urban agriculture;* (Habitat, 1996)."

Habitat II proposes that urban agriculture aims at food security and food self-sufficiency, as well as social objectives such as providing recreational spaces for citizens. In fact, urban agriculture is still not seen as a main goal for cities, but is touted as a means of achieving sustainable urban land use. However, this also shows that urban agriculture has become an important component to ensure sustainability in cities.

Habitat III, held in 2016, 20 years after Habitat II, is considered the first conference to directly support the UPA concept. UPA, which was included in the "Planning and Managing Urban Spatial Development" section of the conference output "New Urban Agenda", was discussed in the context of its contribution to sustainability and food security;

> *"…We will also support urban agriculture and farming, as well as responsible, local and sustainable consumption and production, and social interactions, through enabling and accessible networks of local markets and commerce as an option for contributing to sustainability and food security."* (Habitat III, 2016)

One of the key features of the UPA is its multifunctionality, defined as the diversified economic, social and environmental roles assigned to it by society.

4.1. Urban Agriculture and Sustainable Development

At the Sustainable Development Conference held in Rio in 2012 by the United Nations, action packages were developed on many areas that could affect the quality of life to varying degrees.

The 17 sustainable development goals presented by the United Nations aim to increase the quality of life all over the world, as well as care about the development differences between settlements. For this reason, the presented targets have been elaborated from basic needs such as access to food and clean water resources and security, to sustainable communities and cities through developed and sustainable production and consumption relations over issues such as combating poverty and quality education. UPA contributes directly or indirectly to the realization of some of the Sustainable Development Goals (SDGs).

One of the goals to which the UPA directly contributes is goal 1(SDG1) (UN,2015), which aims to end all forms of poverty everywhere, titled “End Poverty”.UPA contributes to the livelihoods of the poor. At the same time, it increases social inclusion by reducing poverty and integrating disadvantaged groups of society into urban networks (Van Veenhuizen, 2006).Examples of these groups are the poor, the disabled, the elderly, immigrants and women. Therefore, growing food for the city is considered as one of the strategies used to reduce inequalities among city residents.

Another of the sustainable development goals to which UPA contributes is action 2 (SDG2) called “End Hunger”. This goal expresses the aim of ending hunger on earth, achieving food security and good nutrition, and supporting sustainable agriculture (UN,2015). According to the World Food Safety and Nutrition Report prepared under the leadership of the United Nations Food and Agriculture Organization, the number of people affected by hunger in the world has increased to 828 million by 2021 (FAO, IFAD, UNICEF, WFP and WHO, 2022). Today, the concept of “hunger” has turned into a phenomenon of “food insecurity”. It is especially important in cities where job opportunities are insufficient or the labor market is highly competitive. Rather than a primary source of income, employment in urban agriculture is often an additional lucrative activity that is expected to improve a household's financial situation. However, it is an important element of a survival and risk-sharing strategy that can secure family income during the crisis (De Bon et al., 2009). It can also encourage the development of micro-enterprises engaged in urban agriculture, input production (seed, fertilizer), food processing and packaging, transportation, marketing and retail and market sales, due to the diversity of actors involved.

He emphasized the importance of agriculture and sustainable cities in target 11 (SDG.11), which aims to make cities and settlements inclusive, safe, strong and sustainable (UN,2015). Accordingly, it should be aimed to develop inclusive and sustainable urbanization for participatory, integrated and sustainable human settlement planning and management in all countries. The road to sustainable cities includes a multifaceted approach that strengthens social capital, creates innovative agricultural technologies, and allows the participation of public and private sector partners.

UPA's innovative methods such as community and roof gardens, greenhouses, indoor and vertical farms can help ensure sustainable cities. Although UPA methods are not sufficient to feed large cities, research shows that urban farming techniques can produce enough vegetables for one person's daily consumption using very little of the urban land (De bon et al., 2009).The most important benefits of urban agriculture center around its ability to increase social capital and civic engagement in low-income communities.The sharing of knowledge and cultural values and skills gained through gardening serves as a social bridge that helps preserve food-related traditions. These benefits are particularly important in developing countries where agriculture is a large part of the culture.

5.Conclusion

Urban growth dynamics has led to the emergence of important problems related to food production, processing, transportation and consumption. In the face of global imperatives such as climate change mitigation, fairer economic models and food insecurity, the UPA has moved from an issue at the edge of public discourse to one at its center over the past few years. As an integral part of the urban system, urban agriculture performs important functions from the perspective of farmers on the one hand and residents on the other. In this study, the importance of UPA in providing urban resilience and sustainability has been tried to be discussed. UPA plays an important role in responding to the various challenges that developing countries face in building more resilient cities. It has often evolved as a necessary option to improve food security and support the livelihoods of urban residents.

Urban Agriculture contributes to the low carbon economy by transporting the food to be consumed at the city level with lower fuel amounts due to the short distance. It therefore has the capacity to increase the sustainability and resilience of urban communities. In addition, environmental understanding strategies that can increase the sense of belonging in cities, transfer agricultural knowledge, and implement participatory processes that will have an impact on citizenship and democratic levels can help. It can be conceptualized as an important driver of sustainability and resilience for urban communities, which can exist at multiple scales through the various functions of urban agriculture. Urban Agriculture has the potential to improve inclusiveness, improve food security, increase income and promote informal ways of communication among urban residents. Urban Agriculture contributes significantly to the functioning of urban ecosystems and thus to the quality of life of urban communities and contributes to reducing the overall impact of urban settlements.

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Community Gardens

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1. Introduction

Urban agriculture has been highlighted in recent years (Türker & Anaç, 2022). Urban agriculture brings together urban and agricultural concepts (2021a). Urban agriculture is the whole of the cultivation of food products and related activities in and around the city (Van Veenhuizen & Danso, 2007). It is a food system that provides solutions and improvements for the problems of urban areas (Türker & Akten, 2020). Orsini et al. (2013) urban agriculture; It is a system that can be affected by various factors, produces for the people of the city by using the potential resources of the city, is effective on the socio-economic dynamics of the city, and covers related activities such as packaging and marketing as well as agricultural production. Urban agriculture is an alternative food system that provides important services and contributions to the city in terms of ecological, economic, social, cultural and health aspects within the boundaries of its urban area (Türker, 2021b) and it is a productive land use (Türker & Akten, 2021). Based on the typology classifications in the literature, the main typologies for urban agriculture;

- Residential gardens
- Community gardens
- Edible gardens
- Guerrilla gardens
- Market gardens
- Urban farms
- Z-farms (Thomaier et al., 2015).

In this book chapter, the concept of community gardens, which is one of the main typologies of urban agriculture, its benefits and criteria are explained with examples

2. The Concept of Community Gardens

Community gardens; Gardens where agricultural activities are carried out individually or shared in public or private spaces of different sizes for various purposes by a community (Türker, 2020; Thomaier et al., 2015). Community gardens, which are diversified with a wide range of different experiences according to individual, collective, local, urban, regional and aesthetic dimensions, affect local culture and values in terms of being a conceptually democratic space and provide both a direct participation environment and an open space use with visual value and social interaction (Francis, 1989). The community garden is defined as a model that symbolizes the gathering of people in the process of searching and defining meaning through the environment. When people participate directly in the environment, take responsibility for the design, construction, management of this environment or support the continuity of the gardens; it is stated that a sustainable process that creates a more effective and deep meaning than a professional design process can be achieved. When the concept of garden becomes a public space, it is built on a distinct meaning for everyone, whether or not the user of the garden. It becomes original as a part of the daily life of a neighborhood or city (Lofland, 1989). In many countries, community gardens, in both urban and rural settings, are diversifying to meet local needs (Ferris, 2001). There are those that can provide cheap and accessible food for the local community, as well as community gardens where only open space and greenery is a priority.

Community gardens, which came to the fore due to the uncontrolled expansion of cities, urban density and urban land scarcity, are becoming an international phenomenon; It is seen as a way that offers a wide range of effects in terms of enabling recreational and social activities as well as the development of local food resources (Durmaz, 2013). Community gardens, which started to be defined as “Community Gardens”, emerged in the early 1970s with the process of creating gardens in many empty and unused areas by their own initiatives, by coming together for the purposes of food production and neighborhood beautification by those living in socially excluded and idle areas (Smith & Kurtz, 2003). There are different practices in each country in terms of land use. For example, community gardens in America and Europe are similar to "victory gardens" used to provide food in times of war or economic crisis. Small areas where food is grown in North America, large “greening” projects implemented to protect natural areas stand out as different community gardening practices such as small street pots on the corners of city streets. In England and Europe, the prominent model is "lease/share gardens" (allotment gardens) (Durmaz, 2013).

At the Nottingham Conference held in 2000, community gardens that were categorized by evaluating the practices found and functioning in most cities in the world; were taken up as shared gardens for recreational purposes, children's and school gardens, entrepreneurship gardens, working and teaching purposes/crime-repelling gardens, healing and therapeutic/silent gardens, pocket gardens, ecological restoration gardens/parks, informative/promotional gardens. It should be taken into account that the practices and approaches in these categories are not completely independent from each other and that community gardens can host more than one function and activity in the defined categories.

2.1. Recreational shared gardens

Gardens in this category are generally developed in neighborhoods with gardenless dwellings and no recreational open spaces. These gardens, which have soil beds created for growing vegetables and flowers, picnic and dining stove areas and common shade areas, are usually fenced areas with a lockable door.

Figure 1. Shared gardens created with different initiatives and concepts (Url-1,2)

In the USA, the New York City Council has ensured the development of many community gardens in idle or empty areas detached from the city. These gardens, which are formed with a community-based movement and formation, contribute to the development and beautification of the urban space, as well as their social and environmental benefits (Figure 1, Figure 2).

Figure 2. Gardens established in idle and empty spaces in the cities of New York and Chicago (Url-3, 4)

2.2. Children and school gardens

These are the gardens that have been exhorted by the regional education institutions in California by transforming school grounds and courtyards into gardens as part of the "A Garden in Every School" project. The community garden of Le Conte Elementary School implemented in Berkeley is an important example of these gardens. Various activities are organized in which students participate together with their families, and a wide range of horticultural activities integrated with the scientific education program are carried out.

Another example is the conversion of the courtyard of Martin Luther King High School Preparatory School, also in Berkeley, into an edible garden concept (Figure 3) (Durmaz, 2013).

Figure 3. Martin Luther King School, "Edible Schoolyard" applications (Url-5)

As part of the activities carried out at Le Conte Primary School, foods that can be used in the school's kitchen can be grown. A vacant lot has been transformed into a productive and beautiful garden, especially with its creation and maintenance by students (Figure 4).

Figure 4. Gardening activities at Le Conte Primary School (Url-6)

2.3. Entrepreneurship gardens

Community gardens, which are created to improve the social exclusion and poverty that occur mostly in disadvantaged neighborhoods, are diversified according to the needs. Berkeley Youth Alternatives Garden provides relaxation and recreation opportunities for children and entrepreneurship opportunities for young people from low-income families (Figure 5).

The organic products produced are sold to local businesses and the Berkeley Farmers Market. This process serves the dual purpose of both providing job training and providing income to participating youth (Lawson, 2005).

Figure 5. Berkeley Youth Alternatives Garden) (Url-7,8)

2.4. Gardens for study and teaching /crime deflector gardens

Community gardens come to the fore in creating alternatives necessary for solving the problems of young people with drug addiction and criminal tendencies in cities, and structuring their attention and actions in a shaping and remedial way. The Strong Roots Gardens in Oakland and Berkeley are important examples in this regard and were created by activists working at the neighborhood scale (Figure 6).

Figure 6. The Strong Roots Gardens (Url-9)

Another example of these community gardens that work towards providing job training to socially excluded youth and helping them earn an income to ensure equal opportunity is the St.Mary Youth Farm. Here, it is ensured that young people gain responsibility and sensitivity towards the environment and receive environmental training on the protection and regulation of the natural environment. It offers experience in cheap food production with the job training and opportunities it provides to the youth coming from the surrounding neighborhoods (Ferris, 2001).

2.5. Healing and therapeutic/silent gardens

These gardens, which are stated to be diversified with many examples, especially in San Francisco, are formed especially around hospitals and health centers. The garden, which was created at the San

Francisco Hospital under the name of Comfort Garden, was organized to commemorate the people who gave their years to the hospital (Figure 7).

Figure 7. Comfort Garden located in the garden of San Francisco Hospital (Url-10)

One of the gardeners working in the Urban Parks and Recreation Department, who also designed and planted the garden, provided the production of vegetables and medicinal plants here, and opened them to the use of patients and hospital staff. Studies have been carried out to provide food to patients. Therefore, the hospital garden was spontaneously transformed into a community garden and was created with this community-based movement (Cooper-Marcus, Barnes, 1995).

2.6. Pocket Parks

Pocket parks are small-scale open spaces, usually smaller than 1000 m², and can be an area where the citizens sometimes have lunch, read a book, get together or play games in the built environment. This unique garden approach can be on vacant lots, between building blocks, on an abandoned or modified axis, on a forgotten or unused parcel or residual area (Temizel & Erdoğan, 2022). Paley Park in Manhattan, the first pocket park application in the world, was financed by William Paley, the former head of CBS (Columbia Broadcasting System) (Figure 8).

Figure 8: Paley Park, New York (Url-11)

The Halcyon Commons neighborhood garden, on the other hand, was created with the cooperation of residents and the city planning department, by transforming what used to be a parking lot into a park area (Figure 9).

Figure 9. Halcyon Commons Neighborhood Garden (Url-12,13)

2.7. Gardens/parks for ecological restoration

An example of gardens for ecological restoration is Strawberry Creek Park in Berkeley. The creek has been partially restored in its natural state by volunteers and scientific experts from East Bay Conservation Crops. It is a good example of an exemplary stream restoration and provides a model that can be adapted elsewhere (Durmaz, 2013) (Figure 10).

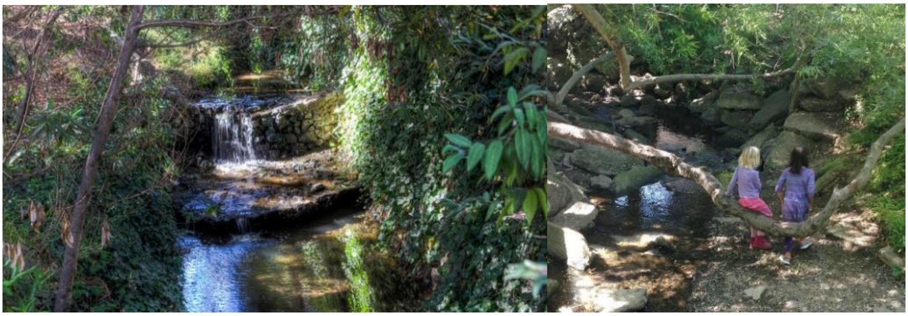

Figure 10. Strawberry Creek Park (Url-14, 15)

2.8. Informative/promotional gardens

An example of a good garden that was originally devoted to public education is Garden for the Environment in San Francisco. The function of the garden is to teach the citizens of fertilization, organic farming and water conservation. This garden is operated by SLUG (San Francisco League of Urban Gardeners) (Durmaz, 2013) (Figure 11).

Figure 11. Garden for the Environment, San Francisco (Url-16)

Arlanza Community Garden project, located in Riverside, California, stands out as an important example of gardens in this category. Under the leadership of young leaders who volunteered within the scope of CLP (Child Leader Project), it was desired to create a garden that would have positive effects on the environment for the inhabitants of Arlanza.

Figure 12. Arlanza Community Garden formation and campaign processes (Url-17)

In the summer of 2011, CLP youth attended a week-long training organized by Growcology (a non-governmental organization where volunteers participate in environmental activities). Thereupon, several activities were organized within the scope of CLP in order to raise awareness of the people living there and to include them in the garden. Arlanza Community Gardens project is being implemented with the strategic partnership of Growcology, Riverside Park Department of Urban Renewal and CLP young leaders (Figure 12)

3. The Benefits of Community Gardens

- Increase the amount of Local food, decreases food miles,
- Contribute green areas in city,
- Nature conservation, wildlife preservation,
- Give education about nature, and growing vegetables,
- Social inclusion, creating a sense of stewardship among neighbors,
- Improve environmental and public health,

- Host sport activities (Akyol, 2011).

4. Community Garden Criteria

- The garden area should include separate parcels of allotment gardens up to 10 ha area,
- The water and electricity resources should be accessible,
- The gardens should be designed for a community use not only a family or individual use,
- Cautions should be taken for car entrance to the garden if permitted,
- The pedestrian circulation should be suitable and the hard landscape materials should match with the garden design. Natural material should be preferred,
- A tampon zone should be applied around the garden,
- A clear lightning plan should be applied through the garden,
- A storage for equipments, and a composting area is necessary (Akyol, 2011).

5. Conclusion and Suggestions

Community gardens can also be found in areas belonging to local governments, schools, universities, associations and foundations or mass housing. The land for a community garden can be held collectively or individually. Some gardens grow collectively, may consist of plots where everyone works together or are also divided in a common area, and each section may be managed by a different group or family. Lands can be owned by trusted local governments or non-profit associations, and those who want to use the garden can use these areas in return for a lease agreement. Another method emerges as clearing vacant, unused lands and turning them into productive gardens. This method is a very common practice especially in American community gardening (Saylor, 2005).

There are many duties and responsibilities in a community garden, such as providing care, arranging roads, increasing financial resources, organizing events, and creating educational opportunities. For these responsibilities, which vary according to the concept of the community garden, the dues to be collected from the members and gardeners are provided by organizations or volunteering methods.

There is no standard land size in community gardens. People from all walks of life can take an active part in these gardens. Only a few people or hundreds of people can be actively involved in the garden, and different organizational models can be used in gardens. In the gardens created by an initiative by the community, the leaders are elected democratically, while in the initiatives of associations or municipalities, authorized persons or groups take responsibility (Lawson, 2005). The management process and land organization vary according to the people and groups who take care of the garden and their purposes. While some only grow flowers, others can work as a commune and share the produce, on the other hand, garden areas can be created that are accessible, applicable and aiming to increase diversity with raised soil applications. It is suggested that all types of community gardens should serve as a compromise between people, the urban environment and the concepts of sustainability (Okvat, Zautra, 2011). Communities that transform the vacant lands into arable land in the regions they live in create an area for themselves where they can connect with nature, while they can produce projects where they can give the products they have obtained to the people in need around them, or they can develop alternative learning methods through which they provide the necessary knowledge transfer for the maintenance of the garden community. In order to ensure sustainable society development, it is important for people to create and implement activities that can improve themselves by creating public spaces in the city. Community gardens, which stand out as one of the tools of this process, offer direct and healthy open public space interactions.

Considering that the basic element of planning is people, it is understood that the public spaces that people use and share in the city are important for the existence of a healthy social structure in the city.

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The article complies with national and international research and publication ethics.

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General Principles of Hobby Gardening

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1. Introduction

Population growth and climate changes in the world affect agriculture negatively and cause food crises. In addition to food problems, the increasing urban population also creates many socio-cultural, ecological and economic problems. Urban agriculture is an important productive land use for the solution of urban and food problems, combining the concepts of city and agriculture (Türker & Akten, 2020; Türker et al., 2021).

Urban agriculture is one of the popular sustainable concepts that has come to the fore in the world and in Turkey recently (Türker, 2021a). Urban agriculture is an alternative sustainable food system for urban areas (Türker, 2021b). Although its history goes back 3500 years, it has become popular recently (Türker & Akten, 2021). In recent years, urban agriculture strategies have gained importance in the context of sustainable urban development (Türker & Anaç, 2022). There are hobbies that people do outside of their work, and most importantly, they rest while they are trying and hobby gardening is one of them. Hobby gardening can be done not only in the garden but also on the balcony of your home. Within the scope of hobby gardening; Fields such as vegetable and fruit gardening, succulent and bulbous plants, and rock gardening are examined. Especially in recent years, everyone who wants to get rid of city life has turned to nature. Interest in hobby gardening has also increased in Turkey. In today's world, such gardens are increasing day by day in line with the demands of people. The first practical example of hobby gardens was implemented by the public in Ankara. However, all public and private sector entrepreneurs can also create hobby gardens. Land can be rented or purchased for the implementation of the project. First of all suitable fertile land is required according to the situation of the region. If the lands in the hands of the public are taken into account, special provincial administrations, municipalities, district governorships, universities, and relevant ministries can easily establish and rent these gardens. Thus, both idle lands are evaluated and additional income can be obtained. In addition, private entrepreneurs can set up hobby gardens in the city or close to the city center, in easy-to-reach places. However, the income status of the region, land structure, demand situation, etc. should be well- researched. Because the entrepreneur will do this business for profit, he should pay attention to the fact that the land is suitable for a hobby garden and that there is sufficient customer potential in the selection of the land. The best time to start hobby gardening is in the spring, when the soil starts to revive. Since there will be a revival in gardens, flowers and plants with the increase in temperature, maintenance processes come to the fore in many areas from irrigation to pruning, from feeding to spraying. These are processes that are enjoyable, and require patience, but make people happy at the same time. If hobby vegetable farming is to be done for the first time, if he has no experience with soil and plant cultivation, he must first know vegetables. Because each species has its own climate, soil and cultivation characteristics. For this, it can be started by making small-scale cultivation in pots. The time required for each plant to germinate, form stem and leaves, bloom, produce fruit and seeds, climatic conditions and maintenance procedures vary. Therefore, it is necessary to be patient in order to get the reward for hard work. In the planning phase; choosing the right land, position of the sun, water source, quality soil, choosing the right species, date of frost days, fertilization, spraying etc.

2. Choosing The Garden Location

The area required for hobby gardening varies according to the species to be used. If a wide field of occupation is desired, hobby fruit growing can be done by growing different types of fruit. However, an area of at least 500 m^2 is required according to the desired species and number of varieties. If hobby vegetable growing is to be done, it is expected that the variety will increase as the products are consumed and when vegetables are started to be grown. For hobby vegetable growing, as with ornamental plants, the area can be set inside the house, in front of the windows, on the balcony or in the garden. Ecological and economic factors come to the fore, especially in the vegetable and fruit garden plant, which is likely to have a commercial aspect. Climatic characteristics of a region are; first and last frost dates, number of frost days, annual, monthly, and daily average temperatures, maximum and minimum temperatures, differences between day and night, lighting conditions, amount of precipitation and type of precipitation (snow, hail, rain, dew, etc.) distribution, relative and absolute humidity, wind direction and strength, cold or hot blast should be taken into consideration. As for economic factors are; ease of transportation (proximity to the road), proximity to the village in terms of finding experienced workers, operating modes for the industry and proximity to the packaging houses and cold storage are taken into account in order to ensure that the produced product reaches the market with the lowest loss.

3. Ecological Factors

Like all living things, the growth and development events that make up the life of plants are guided by genetic structure and environmental conditions. In any region, those who can adapt to the environment, that is, ecological conditions of the plants with different genetic structures, have the chance to survive. In other words, the diversity of crop production is largely determined by the climate and soil conditions that make up the environment (ecology). Climate is affected by water surfaces, wind direction and the level of CO_2 in the atmosphere. In general, the temperature range that plants need for the realization and development of basic physiological life events varies between 5-36°C. When the temperature of the water, which fills the cells and intercellular spaces in plants, falls to the freezing point or even close to it, damage resulting in death occurs. In fact, cold damage in plants begins when the temperature drops below the minimum growth level. In any ecology, if the air temperature frequently drops to 0oC or below after the start of flowering in the fruits and the beginning of the vines in the early spring period, it is not possible to carry out economic fruit growing and viticulture in that ecology. Damages are more severe in high temperature young plant periods. Fruit set at the time of flowering and fertilization adversely affects the ripening of the fruit in the period after fruit set. High temperatures during the ripening period, like low temperatures, cause the color of the fruit to become lighter, the taste to decrease, and the leaves to turn yellow and wilt in species whose leaves are consumed. Therefore, it negatively affects yield and quality.

All plants need light for the formation of enzymes and hormones that direct basic physiological events such as photosynthesis, respiration, assimilation and transpiration, and color pigments such as anthocyanin, especially chlorophyll. Due to the temperature and the light intensity being higher than what the plant prefers, it shortens shoot lengths, stunts annual plants, prevents the development of flower buds, hardens and pubescence on leaves, lightens the color of fruits and species whose leaves are consumed, and reduces quality. Low light intensity; It causes elongation, weakening and embrittlement of shoots, a decrease in leaf area due to decreased photosynthesis, regression of new shoot formation, yellowing of leaves, wilting and defoliation. Humidity has an effect on fruit and leaf quality. High air humidity causes the stomata to close, thus reducing sweating and consequently reducing growth and development. The lack of moisture in the soil causes a decrease in germination, a limitation of root development, and thus a decrease in the yield and quality of the plant. Excess moisture in the soil can cause the soil to become stuffy, decrease the nutrient uptake by the roots, and increase soil-borne diseases. In addition, it adversely affects pollination and fertilization in plants, and fungal diseases such as powdery mildew and mildew are more common. In horticultural cultivation, winds blowing at a speed of 2-5 m/s increase respiration and transpiration and increase photosynthesis. Therefore, they are useful as they accelerate growth and development. In addition, light winds have the effect of increasing pollination and thus fruit set in garden plants, most of which show cross pollination. Particularly hot winds blowing rapidly, increase transpiration excessively and cause deterioration of plant-water balance, resulting in retardation of development by taking photosynthesis, scorching in branches and leaves, and cracking in fruits. Another climatic factor is ground and soil requirements. Generally, the south and east directions, as they warm up earlier, provide early ripening of the product with early flowering and flowering. South direction should be chosen for earliness. More damage can be seen in the south direction from late spring frosts. However, the airflow conditions of the terrain affect the severity of this situation. Sunburns may occur on trees in the south direction. The northern direction delays flowering and is less damaged by late spring frosts. Provides protection from sunburn in places with high light intensity. The most essential factor for the life of the plant is the soil. The physical, chemical and biological structure of the soil is the event that shapes production.

Soils are divided into two mineral (stony and gravelly soils, sandy soils, clay soils, loamy soils) and organic (peat and fully fragmented soil). These are soils that consist of mineral substances and contain less than 10% organic matter:

a. **Stony and gravelly soils**: It contains 80% stone and gravel and 20% fine soil. It has low water holding capacity. If the deficiencies are completed in these nutrient-poor soils; horticultural crops such as apricots, pears, vines and cherries can be grown. If there is 50% soil in this soil type, it can be used in early tomato, cucumber, pepper and eggplant cultivation due to its rapid heating and good aeration.

b. Sandy soils: They are relatively infertile and very acidic soils with low water holding capacity. High proportions of sand provide quick drainage, aeration and rapid decomposition of organic matter. Sandy soils heat up quickly and cool off quickly. There are nutrient deficiencies, especially Ca and Mg. Frequently watering is necessary.

c.Loamy soils: These soils are used in agriculture. It is suitable for growing horticultural crops. Sandy-loam soils drain better, aeration is better. Berries, peaches, plums, nuts and all vegetables love loamy soils.

d. Clay soils: These are soils containing more than 50% clay. They consist of very small particles. It becomes a ball when squeezed by hand, it is sticky. Poor aeration in the spring, cold soils that cannot be heated because they do not have a porous structure. It dries slowly, and holds water, it is the soil that comes to the pan late. When wet processed, a plow base and a clod-like structure are formed. Vegetables that require plenty of nitrogen and water such as cabbage, leek, tomato and artichoke can be grown in clay soils and improved by mixing organic matter.

Organic soils: organic soils contain 20-80% organic matter. It is composed of partly or decomposed plant residues. Their color is between reddish brown and black and they continue to mature. They have high water holding capacity, good aeration and are rich in nitrogen. It is not used directly, it is mixed to improve the structures of other soils. It is well aerated and the amount of nitrogen is high. It is suitable for growing vegetables and ornamental plants. Onions, potatoes, carrots, zucchini, lettuce and all other vegetables grow well on such soils. It is used in pure or mixed form in seed germination, steel rooting and sapling production, and potted ornamental plant cultivation.

Soil depth is an important factor as the roots of horticultural plants, especially perennial ones, usually develop in the soil layer at a depth of 1-5 m. For this reason, it is desirable that the impermeable layers of the soil or the ground water level be below the root zone. Since the root depth is more shallow in vegetables (45-120 cm), soils with less depth may be sufficient. The aeration and temperature of the soil are very effective in the development of plant roots. In a well-aerated soil, 50% of the pores are filled with air. Oxygen facilitates the uptake of nutrients from the roots. Among the soil types, the best aerated are gravelly, sandy, and the worst aerated are loam and clay soils. Acidic soils are found in very rainy ecologies. Liming can be done to increase the pH in acidic soil. In order to reduce the high pH in alkaline soils, fertilization should be done with acidic fertilizers (ammonium sulfate and urea). Soil salinity is also an important issue for plant cultivation in every field. It is caused by Sodium (Na^+), Chlorine (Cl^-), Sulfate (SO_4-^{2}) and Carbonate ($CO_{3\text{-}2}$) ions in the soil. Salinization occurs due to excessive inorganic fertilization, irrigation with salty water, rapid evaporation in arid regions, transportation of salty groundwater to the upper layers of the soil, and poor drainage. Due to the excessive salt in the soil and the osmotic potential it creates, plants cannot take water from the soil and experience physiological drought. In addition, excessive sodium and chlorine ions entering the body have a toxic effect. As a result, yellowing and wilting, yield and quality losses occur in the plant. In order to avoid or prevent salt damage, it can be tried to be improved by making organic fertilization, and irrigation should be done only as much as necessary (such as drip irrigation). Washing the soil with plenty of water by opening drainage channels can also be a solution. However, the most effective and permanent method is to breed plant species and varieties with genetically high salt tolerance. Soil stress is another problem to be considered. Soil fatigue is defined as the slowdown in the development of some cultivated plants grown consecutively in the same soil or the decrease in soil fertility due to various reasons. It occurs in perennial garden plants that grow on the same soil for many years. Soil fatigue symptoms; vegetative growth decreases, internodes shorten, stem thickness decreases, and dwarfing begins. Rosette formation on the leaves and a decrease in root development. Even if cultural practices such as irrigation and fertilization are made, the symptoms do not disappear.

4. Propagation Methods

Propagation is the controlled (planned) production of plants in order to ensure continuity. The survival of cultivated plants is possible by propagating them under controlled conditions using appropriate techniques. Propagation patterns in plants are generally divided into two. These are;

1) Sexual reproduction (generative reproduction, seed reproduction)
2) Asexual propagation (vegetative propagation (or vegetative), propagation by grafting, cuttings, dips, rhizomes, bulbs, tubers, etc., apomictic seeds and tissue cultures)

Botanically speaking, a seed is a mature ovule containing the embryo formed without or as a result of fertilization. Propagation by seeds is the most important method that enables plants to reproduce in nature. This method is the most widely used propagation method for many cultivated plants. Propagation by seed is an effective and economical propagation method in many plant species. This method is also widely used in the reproduction of many garden plants, especially vegetables and ornamental plants.

Conditions necessary for germination to occur in a seed; the seed must be viable and the embryo capable of germinating. The conditions of the place where we sow and plant the seed must be suitable for germination. The structural conditions of the seed should be suitable for germination. External factors affecting the germination of the seed; water, temperature, oxygen and light. These cells, which absorb water and swell, will force the outer shell and gradually cause the shell to crack. Transporting the nutrients in the seed to the growth points is one of the most important tasks of water. All seeds need a certain temperature to absorb water and germinate. Seeds can generally germinate from 2-3 ^{0}C to 25-26 ^{0}C. Lower and higher temperatures will inhibit germination to some extent or stop it altogether. Since the seed is a living being, it needs oxygen like every living thing. When the seed enters the germination period, the respiratory rate of the embryo will increase, so the need for oxygen will increase. The internal factors affecting the germination of the seed are; seed coats, germination inhibitors, and the need for chilling. These seed coats, which appear as and outer shell and inner shell or hard shell and testa, delay or accelerate germination depending on their structure, that is, they do not hinder. Germination inhibitors can be found in the testa, embryo, endosperm, fruit pulp and fruit juice. The need for vernalization is met by planting the seeds in autumn or by keeping the seeds in a cold environment for a certain period of time. This vernalization period increases the growing power of the embryo.

Methods of encouraging and accelerating germination of seeds; mechanical method, chemical method, water immersion method, folding: in the crate, in the open, in concrete pads. In seeds that have a shell structure that prevents water intake and gas exchange with the mechanical method, the outermost hard shell is cracked or broken in this application. In the chemical method, seeds are treated with some caustic or destructive chemical substances (acids and bases such as H_2SO_4, HCl, KOH). With the effect of these chemical substances, the crusts will weaken to a certain extent and thus water intake, breathing conditions and swelling will be provided. In the water immersion method, the seeds are immersed in cold or hot water for a certain period of time in order to soften the hard shell of the seeds, to facilitate the water uptake of the embryo, and to wash the inhibitory substances in the seed to some extent. The process of keeping the seeds in a humid environment for a certain period of time in order to meet the vernalization needs of the seeds, wash the inhibitors in their structure, facilitate the water uptake of the embryo and increase the germination vigor is called stratification. Sand is generally used for folding. It can be used in sawdust or moss as a folding medium. We have three options for stratification: outside, within a container, and on concrete pads. The stratification time varies depending on the germination time of the seed to be folded, that is, the vernalization time of the seed at the stratification temperature. It is not possible to preserve the superior characteristics of some plants by propagating them with seeds. The majority of fruit species show high genetic expansion when propagated by seed due to cross fertilization and heterozygous genetic structures. Asexual propagation provides a faster development than seed reproduction. This is especially certain for plants with very small seeds, such as mint, strawberries and potatoes. In some conditions, vegetative propagation can be done at a cheaper cost than seed propagation.

Vegetative propagation methods:

1**. Grafting propagation**: Growing plants on the roots of another plant.

Purposes of grafting; reproduction of species that cannot be reproduced economically by other vegetative propagation methods, benefiting from the superior properties of rootstocks, benefiting from the positive effects of intermediate rootstocks, changing varieties, repairing damaged parts of trees, accelerating the growth of plants obtained as a result of breeding work, examining virus diseases. Grafting types are bud and scion grafts.

Table 1. Graftage options (Vegetative Propagation Techniques Perrenial Crop Support Series)

GRAFTAGE	BUDDING	T-Budding		Pomegranate and wooden fruit trees generally
		Inverted T-budding		
		Chip budding		
	GRAFTING	Whip grafting	Sample whip grafting	Pomegranate and wooden fruit trees generally
			English grafting	
		Cleft grafting	Top cleft grafting	
			Side cleft grafting	
		Bark grafting	Top bark grafting	
			Wedge grafting	
			Slipping grafting	
			Side bark grafting	
			Bridge grafting	
			Approach grafting	
		Green grafting	Cleft type gratfing	Gooseberry
			Whip type grafting	

Cutting propagation: It is to form roots and shoots in stem and branch parts and shoots of plants of different ages and characteristics. Advantages of cutting propagation; A large number of uniform new plants can be obtained in a narrow area with small pieces, it is a cheap, quick and simple method and there is no need for grafting, the problem of rootstock-scion incompatibility is eliminated, a garden is not established with different plants due to the negative aspects of the seedling rootstock, The plant grows on its own roots. Among the fruit species, fig, pomegranate, quince, tea, hazelnut, olive and mulberry, grape species and varieties, most of the berry fruits, most of the perennial ornamental plants such as rose, ligustrum, trees such as poplar, willow can be propagated by cuttings. When cuttings were taken, healthy, moderately vigorous and well-known mother plants should be used. Cuttings should not be taken from diseased, defoliated, damaged vines and trees. The internodes of the branches for which cuttings will be prepared should neither be too long nor too short, and steel should not be prepared from the excessively lignified bottom parts of the shoots and the excessively lignified ends of the voracious branches. The time of cutting is for deciduous plant species, wood cuttings are prepared during the winter rest period and leafy green cuttings are prepared from non-lignified shoots during the growing season.

Cutting types;

1- According to the organs taken:

* Stem cuttings

* Leaf cuttings (African violet, Begonia, Sansevieria)

* Leaf-bud cuttings (Strawberry, black raspberry, blackberry, lemon, tea)

* Root cuttings (red raspberry)

2- **According to the period in which they were taken:**

* Wooded

* Semi wooded

* Soft wooded

3- **According to the way they are prepared:**

* Simple

* Torn

* Hammer

Layering: Rooting a branch without leaving the mother plant is called layering. It is used in the propagation of black raspberries, hazelnut, vine (in areas without phylloxera), figs and quince, and vegetative apple rootstocks that are difficult to propagate by cuttings. Types of layering are; tip layering (purple and black raspberries, blackberries.), simple layering (roses, forsythia, rhododendron, honeysuckle, boxwood, azalea, and wax myrtle), mound layering **(Jasmine, Currant, Quince, Strawberry, Gooseberry, Cherry),** trench layering (Passion fruit, barbadine (granadilla), jasmine), air layering **(litchi, Pomegranate, Orange, Lemon, Lokat, Bougainvillea).**

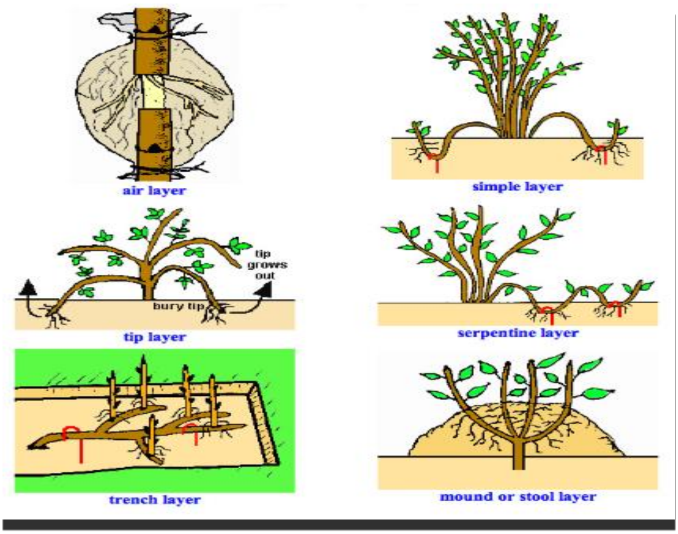

Figure 1. Types of layering (Anonymous, 2022) Access Address (20.07.2022).

The benefits of layering are; the submerged shoot or branch does not separate from the mother plant until it forms roots and shoots and becomes self-sufficient. Therefore, the flow of water and nutrients from the mother plant to the new plant continues. Layering methods are simple and can be applied easily. It is simple and economical. There are no rootstock and grafting problems. The disadvantages of immersion are that the submerged plant requires certain care. The coefficient of reproduction is lower.

Propagation by tuber, bulb, stem and root shoots (Plant Structures That Enable Natural Vegetative Propagation): They are biennial or perennial plants that have organs that can survive under the ground even though they dry out after completing their above-ground parts during the growing season.

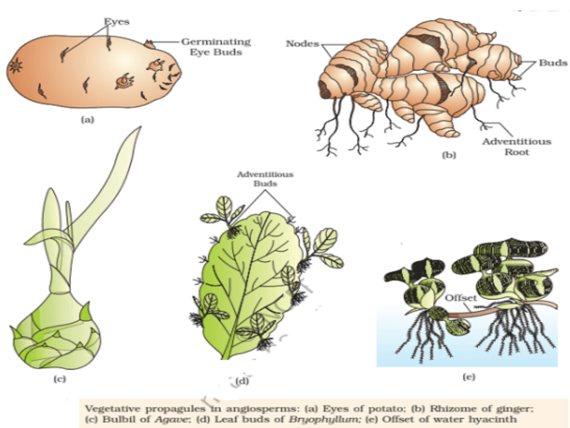

Figure 2. Plant Structures That Enable Natural Vegetative Propagation (Anonymous, 2022) Access Address (21.07.2022).

Runners: It is a specialized stem form that grows parallel to the soil surface, emerging from the axil of a leaf in the throat of plants with a rosette-shaped stem (Strawberry).

Rhizomes: It is a cylindrical, horizontal stem that grows underground. They always have knuckles and internodes at different intervals. The rhizome is typically the main axis of the plant, forming roots from the lower face and shoots towards the upper part of the soil (banana).

Offspring: In some plants, lateral shoots form from the side of the main stem. The formation of juvenile shallots at the bottom of onions is an example of the same phenomenon (Pineapple).

Tuber: The swollen root stems that occur in old plants and act as nutrient stores are called 'tubers'. These formations can also occur in areas where the trunk meets the soil (Olive).

Bulb: It is a specialized underground organ and a short stem covered with thick fleshy scales (Onion plant, tulip, lily, daffodil).

Corm: Although it is a storage organ formed by the swelling of the trunk by accumulating nutrients under the ground, it is not a true tuber (gladiolus, crocus).

Micropropagation: Small plant tissues are used as material. After the tissues are disinfected, they are planted in nutrient media prepared under sterile conditions. Developing plants are taken into pots and acclimatized to external conditions **(orchids, gladiolus, carnation, roses)**.

5. Maintenance Procedures

a. Tillage (deep, medium-deep, surface): The grower has to cultivate the soil in different ways, at different times and at different depths in order to improve the physical, chemical and biological structure of the soil and to keep it at the best level.

b. Sowing and planting: It is a different form of tillage. In some cases, direct sowing-planting can be done in the soil prepared for sowing and planting with medium deep and surface cultivation. In other cases, after that, the soil is processed once more and special planting-planting areas are prepared.

c. To do hoe: Grass hoe is applied in order to cut and remove the weeds that compete with the cultivated plants. Grass hoeing is done with hand hoes in small plots. In large areas, the crowbar pulled by a tractor between the rows is processed with a hoeing machine or surface plow, and the rows are processed with hand hoes. After heavy rains and irrigations, the hard layer formed on the soil surface is broken down. By deteriorating capillarity, water loss from the surface is prevented.

d. Irrigation: Irrigation time and the amount of water to be given in each irrigation vary depending on different factors. A number of factors such as the structure of the soil, the water demand of the plant, the development stage and root depth of the plant, air temperature and humidity, and wind affect this. The water to be used for irrigation should have certain properties. The first is the salinity of the water.

Ideally, the irrigation water temperature should be 1-2°C above the soil temperature during irrigation. For this, a water resting pool should be available in the enterprise. The water resting in the pool both approaches the ambient temperature and increases the amount of oxygen in it by being ventilated. The air and oxygen in the water are also important for the roots. Another feature sought in irrigation water is cleanliness. The water source should not be contaminated with industrial residues. It should not contain substances harmful to plants. In addition, city residues should not be mixed with irrigation water.

e. Fertilization: The basis of fertilization is the difference between the number of nutrients that plants will remove from the soil and the number of nutrients available in the soil, to give the soil or plants in different forms. In addition, it is also possible to fertilize in order to improve the physical and biological structure of the soil. In order to increase the organic matter of the soil, materials and methods such as barn manure, compost and green manuring are also used. Organic fertilizer applications should be done by sprinkling the fertilizer on the soil surface and then mixing it into the soil with a deep plowing of the soil in autumn. Thus, during the winter months and during the tillage in the spring, the fertilizer mixes into the soil in a homogeneous manner and is broken down. Chemical fertilizer applications can be made in different ways. Among them, scattering or mixing with the soil on rows, mixing with irrigation water and foliar application is the best.

f. Pruning: The purpose of pruning; is to provide the balance between the root and the trunk during planting, to give the trees the desired shape, to maintain the shape given in the trees that have been formed and yielded, and to balance the fruit yield and the formation of shoots in the trees. While pruning, care should be taken to give to shapes of the trees suitable for their natural growth, to cut less in strong growing trees or branches, to cut more in weakly growing ones, not to leave nails or knots in the pruned areas, and to cover the wounds with grafting paste or black paint. When compared to fruit growing and viticulture, finishing and pruning processes are not so important in vegetable growing. Pruning is only valid for some types of vegetables and is mostly seen as cultural treatment applied in the greenhouse. The shoots of the tomato stem from the leaf axils are cut off. This process is called "seating". In cucumber and melon, the lower leaf axils are taken, and the upper ones are taken from two nodes. Fruit formation from these nodes is not allowed. In all three species, after the plants reach the desired height, their growth ends are cut off and their growth is limited. This is also called "peaking" pruning. In the other pruning process, the lower leaf axils are taken, and the upper ones are taken from the two nodes. Fruit is allowed to form from these nodes. In all three species, after the plants reach the desired height, their growth ends are cut off and their growth is limited. This is also called apex pruning.

g. Disease and Pest Control: It covers mechanical, biological, chemical control and the use of resistant varieties.

Thanks and Information Note

The article complies with national and international research and publication ethics.

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Using Agroecology Principles in Urban Agriculture: Towards Sustainable Cities

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1. Introduction

Modern urbanization has tended to separate agriculture from the city. While theoretical definitions of the city remain hotly debated, and while it has become generally defined as an area characterized by population density (Tisdale, 1941) and a specialization in industrial and service functions, historically fields, cattle, fruits and vegetables were an integral part of city activities. Yet modernization has given increased the division of labor and space between rural and urban areas. This dichotomy was performative and production-oriented: the functions of both areas became separate, specialized and concentrated. Productivism from the 1940s onwards has forced this functional dichotomy regardless of the environmental and social consequences of the process. Urbanization in the modern sense has positioned agriculture as a rural activity principally servicing the needs of urban areas. This has been the most important trigger for intensive agricultural activities, aka the green revolution, to meet the needs of rapidly growing cities.

The dangerous environmental and social problems caused by production-oriented urbanization and intensive agricultural activities have reached dangerous dimensions and their global impacts have led to the necessity of intensive examination of ecological principles to ensure sustainability in these two areas. While urban ecology studies for cities have gained weight, the contributions of urban agriculture (UA) to urban ecology and ecosystem services have started to be understood. In rural areas, it is increasingly recognized that sustainability can be achieved by addressing agricultural activities in line with agroecological principles. Urban agroecology (UAE) has a potential to explore the ways to reinstate agriculture in urban life in a manner that bolsters the sustainability of city ecosystems, city social life and participative policy making by offering principles in order to contribute to making the existing UA into making it shape more sustainable, egalitarian, autonomous and less human and production centered cities. This chapter reviews the consequences of rapid urbanization and specialized agriculture and presenting agroecological principles to recreate a holistic agricultural approach adapted to urban ecosystems.

2. Rapid and Destructive Urban Growth

Urbanization can be said to have existed in history since the emergence of social and spatial organizations. However, cities have experienced unprecedented economic and demographic growth in the last 300 years. For the first time in history, urban population surpassed rural population in the world. By 2050, an estimated 68% of the total world population will live in cities (UN, 2022). With this growth momentum, cities are expanding into the natural and agricultural areas around them, while attracting an increasing number of rural dwellers. The term "urbanization" refers to both the increase in urban population and the transformation of rural land cover into urban land cover.

Urbanization is considered to be closely related to global environmental problems (climate change, air, water and soil pollution, reduction of biodiversity, disruption of biogeochemical cycles, etc.) (Gezer & Gül, 2009; Gómez-Villarino et al., 2021). Urban activities already account for more than 80 percent of the anthropogenic CO_2 emissions from manufacturing and industrial activities, as well as fossil fuel consumption for transportation and heating (Mills, 2007; Velasco & Roth, 2010; Weissert et al., 2014) produced globally each year (UNEP/UN-HABITAT, 2005) hence it is considered that the urban centers are triggering climate change (While & Whitehead, 2013) and the impacts of urbanization are spreading beyond their borders (Lippe et al., 2005). In addition, natural resources are increasingly being consumed to meet the demands of a growing urban population (Grimm et al., 2008).

Urbanization not only has global impacts, but also creates an ecosystem in itself as an area of urban land cover, close and tall buildings, impervious surfaces and artificial open spaces (Mills, 2007). The intensive use of fossil fuels in cities leads to environmental problems such as higher carbon dioxide levels, higher temperatures (urban heat island phenomenon), reduced infiltration, increased runoff, air, water, soil, noise and light pollution. These problems are exacerbated by population explosion, including migration, socio-cultural change and climate change (Singh, 2018).

Cities have negative impacts not only in terms of environmental problems but also in socio-cultural terms. Whether it is the city dweller or the rural population that provides inputs to feed the city dweller, they are constantly under the influence of various social pressures. Since Simmel (1950), the alienating effect of the city on urban people has been expressed by many sociologists and psychologists (Flanagan, 1993). In short, urban areas have become critical points of deterioration (Grimm et al., 2008; Sala et al., 2000).

Urbanization is at the heart of these problems, both causing and being affected by them. Another dimension of the urbanization is that this process has and is taking place at different speeds in different countries. Today, while developed countries have largely completed the urbanization process, developing countries are entering a period of rapid urbanization. This means that the effects of urbanization and the extent to which these effects affect cities vary depending on their economic, geographical, political and socio-cultural structures. However, the global nature of environmental problems and the similarity of the drivers of urbanization show that the need for sustainable cities is a great need and a common requirement for every city (UN, 2015).

When examining the effects of urbanization, it is important to take into account the unique multi-layered and multi-dimensional structure of each city. As mentioned earlier, the globalization of environmental problems does not mean that there is a solution that can be applied to every city in combating these problems. However, in line with the goal of achieving a sustainable city, specific solutions that address the unique structure of each city can be produced, provided that they comply with a holistic, sensitive, adaptable ecological principles that are not disregarding human factor.

3. The Complexity of Urban Ecosystems

An ecosystem is a unit consisting of living organisms and their physical environment with a regular cycle of matter between living and inanimate components, and with specific inputs and outputs (Odum & Barrett, 2005). While natural ecosystems are ecosystems that occur naturally and can survive without any human intervention, artificial ecosystems are ecosystems that are modified for a purpose or created to mimic the natural state. Artificial ecosystems require constant human intervention for their continuity. Cities are artificial ecosystems in which humans predominantly live (Steiner, 2011).

Urban ecosystems are characterized by the complexity and multifaceted interconnectedness of social and ecological components (Dooling, 2019). This is because as cities grow, the flow of energy and materials through them increases. This occurs through human socioeconomic activities to transform and transfer food, goods, energy and services (Decker et al., 2000). Urban ecology examines people in the city, nature within the city, and the interactions between humans and other living things and their environment.

Urban policies are now increasingly faced with the need to consider the conservation of semi-natural habitats on the one hand, and the enhancement of the services that vegetation provides to society on the other. However, before identifying the objectives of urban policies, it is essential to understand the functioning of the urban ecosystem (Potschin & Haines-Young, 2011).

Urban green spaces, which are considered as one of the research areas of urban ecology, have some benefits, also known as ecosystem services. Some of these benefits include reducing air pollution, improving the climate, reducing the urban heat island effect, providing aesthetic and urban identity value, and creating habitats for urban fauna. There are also studies showing that the presence of urban vegetation improves human health measured in various ways, including faster recovery from stress and disease, increased physical activity, cognitive function, emotional health, and other measures (Tzoulas et al., 2007; Lee & Maheswaran, 2011; Shanahan et al., 2015; Pataki 2015). UA plays a critical role in urban green space systems. Creating and protecting green spaces on the outskirts, on the other hand, is just as important as doing so within the city. Odum & Barrett (2005), characterize cities as parasites on natural areas and for a parasite to thrive, its host must be well and healthy (and for cities to be healthy and rich, natural ecosystems must be healthy and organized) (Haughton and Hunter 1994; Odum & Barrett, 2005). Future cities need to "embrace the ecosystem of the surrounding area, rather than retreating into their own shells and addressing primarily intra-urban concerns," (Lyle, 1993; Odum, 2005).

4. The Green Revolution and The Emergence of Agroecology

The green revolution is a process that started about 75 years ago, with a rapid increase in productivity due to the mechanization and intensive use of chemicals in agriculture (Mazoyer & Roudart, 2002). Following the green revolution, the production of cereal crops tripled, while areas under cultivation increased by only 30%. This happened all the world over, with few exceptions (John & Babu, 2021). Crop interventions to increase productivity have included selection of varieties for higher yield potential; wide adaptation to diverse environments; shorter growth period; superior grain quality; resistance to biotic stress, insects and pests; and resistance to abiotic stress, including drought and flooding (Khush, 2001). Practices such as chemical fertilizers and pesticides used for pest control, heavy mechanization, etc. have been implemented for productivity, which can lead to environmental damages such as acidification, nitrification, desertification, reduction of organic matter in the soil, soil contamination (e.g. with heavy metals and agrochemicals), soil compaction and erosion.

Public policies have promoted specialization in one type of production, led to the expansion of monoculture and homogenization of rural landscapes. Genetically uniform varieties of hybrids replaced genetically heterogeneous varieties. The most demanded kinds are chosen for mass production or the food sector, which reduces agricultural diversity (Buttel, 2006).

In socio-economic terms, this process has significantly reduced the need for agricultural labor in industrialized countries and directed economic activities towards the service sector and industry. These changes have led to large rural migrations and rapid increases in the urban population (Constantino-David, 2001). Another consequence of the green revolution is the loss of farmers' autonomy and the vertical division of labor in favor of multinational corporations. Ties of interdependence between farmers and these companies are emerging, and the share of income that farmers can earn from production is gradually decreasing (Conway & Barbie, 1988).

In poorer countries, there is much less chance of being able to compete with the globalization of the food market and lower transportation costs. There is a high productivity gap between subsistence farmers and intensive farmers (Mayozer & Roudart, 2002). Moreover, while many farmers in industrialized countries benefit from policies that support the export of their produce, less well-equipped farmers are unable to make a living from their work (Karabağ, 2021).

While the Green Revolution has greatly benefited industry and consumers, it has had poor economic consequences for the majority of farmers in the poorest countries and many farmers in rich countries. It has also brought significant public health problems and irreversible environmental damage. The Green Revolution is therefore not just about a few innovations in agricultural techniques. It is marked by the economic, social and cultural changes, dependencies and power relations that have emerged around the world since the second half of the 20th century (Fitzgerald-Moore & Parai, 1996).

The term agroecology was formed by the combination of the radicals "agro" (from the Latin *ager*, field), "eco" (from the Greek *oikos*, home or environment), and "logy" (from the Greek *logos*, speech, discourse and hence, science) (Özkaya & Özden, 2021).

Bensin used the term "agroecology" in 1928 to describe the application of ecological concepts to agriculture (Bensin, 1928; Wezel et al., 2009).

Over the years, studies have been carried out both directly using the term agroecology and not using the term but explicitly addressing agricultural practices in line with ecological principles (Wezel et al., 2009). In the process, the term has broadened in scope. Wezel et al. (2009) argue that agroecology consists of three interconnected and complementary approaches: "as a scientific discipline", "as a set of practices" and "as a movement".

There are researches belonging to the three types of agroecology in the literature. However, the meanings of agroecology have always been linked to cultural and socio-historical aspects, and while categorization is functional, the boundaries between meanings are blurred (Erwan et al., 2021). Rosset and Altieri (1997) stated that agroecology proposes a set of principles, not technical prescriptions; therefore, it is a process-based approach, not an input-based approach. It is important that this process is farmer-led and that farmers decide on research questions together with researchers and participate in the design, conduct and evaluation of field studies (Rosset & Altieri, 1997).

According to Rosset and Altieri (1997), agroecological principles are as follows:

1. Increase recycling of biomass
2. Strengthen the "immune system" of agricultural systems.
3. Provide optimal soil conditions for plant growth.
4. To minimize losses of energy, water, nutrients and genetic resources.
5. Diversify species and genetic resources in agroecosystems.
6. Promote key ecological processes and activities

Agroecology makes maximum use of nature's resources and minimal use of external inputs (fertilizers and pesticides, i.e. insecticides, fungicides and herbicides).

It supports biodiversity and requires the combination of diverse plants that are complementary in their agricultural function, the enhancement of organic matter (composting) and the combination of agriculture and animal husbandry. Agroecosystems are under pressure from changing climatic conditions, pests, diseases, globalization, technological interventions and other modern trends. To combat and adapt to these pressures, farmers have created biologically and genetically diverse small farms with their own local resilience mechanisms, guided by a complex understanding of nature (Altieri & Toledo, 2011).

Agroecological farmers promote and maintain a biodiversity by agro-silvo-pastoral associations, supporting soil cultivation and encouraging natural enemies of pests and using the organic waste as a resource for maintaining soil fertility and increasing its water retention capacity (Altieri & Toledo 2011). The recycling of organic matter and energy often makes it possible to avoid the use of chemical inputs.

According to Loreau et al. (2001), the greater the vegetative diversity of agroecosystems, the greater their resilience and adaptability to changing rainfall and temperature conditions.

Traditional agroecosystems are characterized by high levels of biodiversity, conservation of natural resources and a wide range of crops (Denevan 1995; Koohafkan & Altieri 2011; Rosset & Altieri, 2017). Agroecology sees these traditional ecosystems as an important model. It tries to create beneficial interactions between plant species through polyculture. This builds resilience to shocks (Lin, 2011).

Agroecology also has a strong social dimension. In Latin America, the increasing demand for biofuel crops such as sugar cane, corn, soybeans, palm oil, eucalyptus, etc. from China, Europe, the US and other countries, and the pressures of industrialization and globalization have led to the development of agroecology-based projects by NGOs and later farmers' organizations since the early 1980s, and a form of agroecological resistance in which issues such as food security and food sovereignty have come to the fore. In addition to the social benefits observed through the application of agroecology through family and community farming, agroecology movements also make social and political demands such as access to land, the role of production and access to markets. Many studies demonstrate the value of the agroecological approach in paving the way for sustainable food systems.

Urbanization increases the pressure on agricultural areas. The driving force of intensive agricultural activity is to obtain more yield per unit area. The increasing urban population relies heavily on continuous and sustained agricultural production. However, while the areas where agricultural activities take place are decreasing or fragmenting under the pressure of urbanization, they are also becoming poorer in terms of quality due to intensive use of chemicals.

The green revolution and mechanization in agriculture allowed vast areas to be cultivated and harvested in shorter periods of time. The damage caused to the ecosystem by this intensive mechanization, chemical drugs, fertilizers and genetic studies has been and continues to be examined in great detail in line with the ecological awakening. The point to note is the uniformity of all these methods. However, each ecosystem, whether artificial or natural, has a unique structure with its climate structure, soil characteristics, the living organisms in it and their interactions. This uniqueness, for example, answers the questions of why the same intensive agricultural practice is successful in some regions and unsuccessful in others, and why it causes more damage to the ecosystem in some regions than in others. This uniqueness is the most important perspective that agroecological principles bring to agricultural activities. In other words, the most important component of an agricultural landscape is the local people who know the plants, animals, climate, climate, soil, in short, every element of that landscape with the ancient knowledge carried for centuries. In a sense, local people are both a part of and the creator of that uniqueness. For this reason, approaches based on agronomical laws may be insufficient to develop original agroecological principles, as they inherently try to generalize.

5. Urban Agriculture is Multifunctional

Urban agriculture (UA) refers to agriculture practiced in urban areas or in the areas surrounding the city (Türker & Akten,2020). Urban agriculture is an alternative food system strategy for urban problems (Türker & Akten,2021;Türker & Anaç, 2022). It is an industry that includes food crops as well as non-food crops and livestock activities, and the people, materials, products and services required for agriculture (including production, sales, processing and marketing) (Mougeot, 2000). UA encompasses agricultural activities in places like schools, balconies, rooftop and community gardens, and orchards, which can use hydroponic, aquaponic, and aeroponic soilless farming techniques, vertical farming, and other indoor or controlled environment agriculture (CEA) systems. Although meeting food needs is thought to be the primary benefit of UA, it is actually a multifunctional activity. UA has functions that serve the three dimensions of sustainability (Elkington et al., 2007): environmental, social and economic. It benefits the environment as open-green spaces and promotes urban sustainability. It aids in pollution reduction (Gómez-Villarino et al., 2021), air and soil quality regulation, greenhouse gas storage, and flood and disease control (Camps-Calvet et al., 2016; Orsini et al. 2020). Furthermore, they promote biodiversity and provide habitat for urban fauna (Lin et al., 2015; Orsini et al., 2020).

Socio-cultural benefits include community health and nutrition promotion (Siegner, 2020), recreation, mental and physical health, tourism, and spiritual experiences (Camps-Calvet et al., 2016; Orsini et al., 2020). According to Milligan et al. (2004), UA can help older people overcome social isolation and contribute to the growth of social networks. It can also be used for science and educational purposes, such as teaching food literacy (Siegner, 2020; Türker, 2021a). The ability to serve as an open space in disaster situations is also a significant benefit for densely built cities.

Economically, it serves several purposes, including the establishment of subsistence gardens and the reduction of urban dwellers' reliance on supermarkets, the reduction of the city's reliance on external inputs, the reduction of costs through shorter supply chains (De Bon et al., 2010), and the provision of labor. With all of these mutually reinforcing and feeding functions, UA has emerged as a significant potential for feeding a growing population while increasing eco-sociological benefits (Türker, 2021b)

6. Agroecological Principles for Urban Agriculture

Urban agriculture has many functions. However, it also brings with it some risks. Ernwein (2018) argues that UA can contribute to reinforcing neoliberal forms of subjectification. In cities where urban land is highly valued (e.g. Istanbul), municipalities have limited space for UA. Since they cannot meet the demand, competition between users is likely to arise. This could lead to renting out these areas and the rents could increase, influenced by the competitive market. Such community gardens could become privileged spaces, i.e. subsistence gardening could become a hobby for the upper middle class.

Another risk is that UA may become dependent on external inputs (Rosset & Altieri, 1997), either because of limited space and harsh ecological conditions, or because of the need to constantly outsource seeds, fertilizers, etc. in line with the requirements of organic farming practices. A monocultural structure with the cultivation of a single type of crop may not be able to meet the potential ecosystem services of UA. Such situations also fail to support biodiversity. Besides, intensive use of pesticides against agricultural pests may cause soil and water pollution. UA has the potential to transform cities towards sustainability. However, to realize this potential, agroecological principles should be taken into account.

Urban agroecology (UAE) is an emerging concept that includes the science of ecologically sustainable food production as well as social-ecological and political dimensions (Altieri and Nichols 2019; Dehaene, Tornaghi, & Sage 2016; Tornaghi 2017). UAE increases food sovereignty in cities through easier access to healthy food (Kennard & Bamford, 2020). UAE has unique characteristics that need further study and action to create equitable, resilient and protected urban food systems (Tornaghi, 2017).

UA has great potential to provide ecosystem services under sustainable management based on agroecology and can be easily adapted to a wide range of conditions and characteristics due to its high socio-economic and technical flexibility (Gómez-Villarino et al., 2021).

Agroecology is not just an agricultural method, but a movement that explicitly addresses social, cultural and environmental justice, and UA practiced with agroecological principles can play an important role in improving the resilience and quality of life of cities in terms of urban sustainability (Gómez-Villarino et al., 2021). In other words, UAE should strengthen cities' immune systems, increase biological activity in urban soil, reduce inputs and resource losses, support biodiversity and improve ecosystem services.

7. Conclusion

As the world's population increasingly lives in cities, cities have to undergo an ecological and sociological transformation towards sustainability as producers of environmental problems and as ecosystems affected by them. In this process, UA has significant potential both environmentally, economically and socially, but to harness this potential, the principles of agroecology (Bezner Kerr et al., 2022), which transcend human and social values, demand equity and social justice in food systems, support the autonomy and well-being of food producers, promote meaningful and dignified forms of food systems work, and reshape ways of interacting with non-human species and ecosystems, must be used.

With the environmental dimension of agroecology, it will be possible to increase the efficiency of biological processes and enhance biological activities above and below the soil also in the urban environment (Altieri & Nicholls, 2019, Peroni et al., 2022), and biodiversity and habitats will be supported and ecosystem services will be enhanced.

The human and cultural dimensions of agroecology create potential for social-ecological innovations that can support sustainable transformations in cities (Hermann & Chuang 2018).

In addition to all these, the uniqueness approach brought by the agroecological approach encourages taking into account the ecology, history, socio-cultural structure and economy of each ecosystem, rather than a one-size-fits-all prescription. This will enable approaches that blend agroecological experiences in different countries with local knowledge and internal dynamics to realize their own practices on the basis of ecology, equity and social justice.

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All authors contributed equally to the article.

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Evaluation of Agroecology's Contributions to Sustainable Urban Planning

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1. Introduction

The world population is increasing day by day and this increase is frightening. Because population is one of the forces that change the balance of natural resources and life, causing many problems.

When the course of the world population is examined; It is seen that the figure, which was estimated to be approximately 2.6 billion in 1950, reached 6 billion in 1999 (UN, 2022), 7 billion in 2011 and 8 billion in 2022 (TUİK, 2022). With this change, it assumes that the population will be 8.6 billion in 2030, 9.8 billion in 2050 and 11.2 billion in 2100 (UN, 2022). These numbers and scenarios, "where will this population live (shelter)?" and "how will it be fed?" He turned his questions into the most important issues of the century.

The answer to the question of where this population will live was "in the cities". Population growth has been shown to be the most dominant determinant of urban land expansion from 1970 to 2014. (Seto and Reba, 2022). Today, about 56% of the world's population (4.4 billion) live in cities. The urban population is expected to double its current size by 2050, in other words about 7 out of 10 people will live in cities (World Bank, 2022a). Urban areas cover almost 0.5% of the land area (Seto et al., 2012). Urban areas around the world are spreading, on average, twice as fast as their populations (Angel et al., 2011; Shlomo et al., 2011). Based on the continuation of current trends in population density and a change in all areas with a high probability of urban expansion, scenarios assume that urban land cover will increase by 1.2 million km^2 by 2030. This figure is almost three times the situation in 2000 (Seto et al., 2011; Seto et al., 2012). Today, however, the "transformation of agricultural areas into urban areas" is the most obvious fact. This situation has been demonstrated by many studies (Aubry et al., 2012; Halim et al., 2013; Dadi et al., 2016; Tufa & Megento, 2017; Prasada & Masyhuri, 2019: Tufa & Megento, 2022). The loss of urban agriculture in urban land use planning is a global trend with only a few exceptions (Langemeyer et al., 2021).

According to the World Bank development indicators, 10.71% of the world is arable land for 2020. In addition, agricultural land in the world is 47388929 km² (36.46%). (Worl Bank, 2022b). However, between 2000 and 2019, agricultural land decreased by 127 million hectares. With population growth and returns, the cultivated area per capita decreased between 2000 and 2019, and the world average decreased by 17% to 0.20 hectares per capita. In addition, agricultural value increased by 73% between 2000 and 2019 (approximately $3.5 trillion). The number of people working in agriculture worldwide, including forestry and fisheries, decreased by 17 percent over the period 2000-2020 to 874 million in 2020 or 173 million from 2000 (FAO, 2021).

Urban land expansion is one of the most visible, irreversible and rapid types of land cover/land use change on the global biosphere in contemporary human history (Seto et al., 2011; Gao & O'Neil, 2020). This transformation causes dramatic environmental changes: land use and cover change, loss of farmland, climate change, habitat fragmentation, reduction of biodiversity, change in hydrosystems, change in biogeochemical cycles, etc. (Luck, 2007; Güneralp et al., 2015; Grimm et al., 2008; Seto et al., 2011; McDonald et al., 2020). This has shown that the cost of urban/modern life is not only the loss of agricultural areas, in other words, the loss of nutrition/food areas (Cengiz et al., 2019; Çoban et al., 2020; Karadağ et al., 2022a). However, "hunger", which is the basic human need, has clearly revealed the seriousness of the situation.

Today, 3.1 billion people (almost 40% of the world's population) cannot eat healthy. Hunger is affected as many as 828 million people in 2021. This number increased of about 46 million people since 2020 and 150 million since 2019. In just two years, acutely food insecure people grew from 135 million to 193 million. In addition, more than 80% of the extreme poor live in rural areas. Two-thirds of those experiencing acute food insecurity are rural food producers. Today, Covid 19 and the Russia-Ukraine war, affecting every stage of production and supply, have exacerbated global hunger. Because overcoming hunger, malnutrition and poverty, war, epidemic, etc. It is more difficult in situations where it is experienced and such crises have increased in recent years (FAO, 2022a). The solution, on the other hand, brought up the question of "what kind of agriculture solution can provide" due to unstoppable population growth and rapidly expanding cities. The answer is conventional farming, industrial farming, organic farming, good farming, agroecology, etc. has added many applications/approaches extending to our lives.

Considering that the city and agriculture are intertwined, the attitude in the sustainability approach regarding land use is important. The aim of the study, which developed from this idea, is to reveal the harmony and interaction between the approaches and principles developed on the basis of sustainability for urban and agricultural areas.

1.1.Sustainable City

The concept of sustainability was first included in the World Nature Charter document adopted by the World Union for Conservation of Nature (IUCN) in 1982. The concept of sustainable development was first defined in the Brundtland Report of the United Nations in 1987. The definition is made as “meeting the needs of today without risking the accumulation of the needs of the next generations”. In the said report, the concept of sustainability is; It has been discussed in the context of problems such as poverty and the domination of poverty on the environment, the negative effects of rapid population growth and population concentration on the quality of life, excessive consumption of environmental resources and urban growth and uncontrolled expansion of cities. The concept of sustainable development has turned into a value that has been used in all areas of life after the Brutland Report. Especially with the UN Environment and Development Conference held in 1992, sustainable development has become an important policy by the whole world (Kocaoğlu & Sert, 2018).

The basis of sustainable urbanization is the sustainable development approach. The concept of sustainable development was introduced for the first time at the 1972 Stockholm UN Conference on Human and Environment. Principle 15 of the declaration emphasizes that "planning should be applied to settlements and cities in order to prevent negative effects on the environment and to provide maximum social, economic and environmental benefits". In the 16th article of the declaration; Reference is made to the issue of creating settlements on the basis of environmental conditions. These two principle, by emphasizing healthy, planned, livable cities, expressed sustainable urbanization for the first time and put forward its basic principles. In the 1987 Bruntland report by the Brutland Commission, sustainable urbanization was also emphasized in the suggestions for solutions on the issues of fighting poverty, population growth rate, increasing the quality of life, and consumption of natural resources. In the "Supporting the Development of Sustainable Human Settlements" section of Agenda 21, which was adopted as a result of the Environment and Development Conference organized by the UN in 1992, it was aimed to improve the social, economic and environmental quality of human settlements. These provisions have also guided sustainable urbanization. These approaches are important in terms of bringing early sustainable urbanization to the agenda (Arar, 2022).

Thus, studies on sustainable cities have begun. For example, within the scope of the Congress of Local and Regional Authorities held in Strasbourg in 1992, the European Urban Charter, which consists of 13 topics and 68 principles, was adopted. For sustainable cities, the European Conference on Sustainable Cities and Towns held in Aalborg, Denmark on 27 May 1994 is very important. The conference enabled the determination of both the principles and implementation methods of sustainable urban development. It became one of the cornerstones of sustainable urbanization at United Nations Conference on Human Settlements: Habitat II (City Summit) organized by the UN in 1996. The aim of the conference is to ensure sustainable settlement for all (Karakurt Tosun, 2009).

The accumulation of international studies on sustainable cities has led to the definition of different sustainable urban criteria sets in the world (Tuğaç, 2018). Measuring the sustainability of cities today is very important (Demiroğlu et al., 2019). Urban sustainability indicators are important tools for evaluating the performance of cities. The criteria is environmental, economic and social indicators designed to detect progress towards achieving sustainability goals (Mega & Pedersan, 2012). Sustainable urban criteria function as road maps that allow cities to evaluate the diversity arising from their differing resources, different metabolic processes and population structures in rational policy development and decision-making processes in order to achieve urban sustainability. However, it is very important to determine the right criteria in this context. Many criteria have been developed to measure sustainability. The criteria include elements specific to the conditions of the country or the main issues focused on by the international organization that developed the approach system and are highlighted. Below are the most common uses (Tuğaç, 2018);

- Criteria sets set forth by international organizations: European Environment Agency Urban Metabolism Framework, EU Eco-City, European Commission Green Capital Award, European Commission Green Leaf Award, European Foundation Urban Sustainability Indicators, United Nations Guide to Urban Indicators, World Bank ECo2 Cities Initiative, OECD-Compact City, etc.
- National criteria sets set forth by countries: Urban Ecosystem Europe-UEE, City Blue Plan, Reference Framework for Sustainable Cities-RFSC, Criteria Set Approach for Sustainability, Citta Slow, etc.
- National criteria sets set forth by countries: China Urban Sustainability Index (China), ELITE Urban Criteria (China), STAR Community Rating System (USA) , etc.
- Sets of criteria established by other organizations: Siemens Green City Index, etc.

Sustainable cities are defined as settlements that consume natural resources less and try to make them renewable while realizing social and economic development (Öztürkoğlu et al., 2018).

1.2. Agroecology

Understanding how nature works and promoting nature-based agriculture in a rapidly changing world are critical to sustaining food systems in the face of worsening urban heat island effects and other climate variables. In this context, it is transformative agroecology that connects ecological networks, sustainable agriculture approaches and social movements through change-oriented research and action. (Cheng et al., 2022). The challenges faced by today's agriculture on the basis of sustainable living have increased the interest in agroecology (Wezel & Jauneau, 2011). Whereas agroecology 20. it has been one of the areas of scientific research since the beginning of the XIX century.

Agroecology has been one of the fields of scientific research since the beginning of the 20th century. Since the 1920s there have been scientific works referring to the application of ecological principles to agriculture (FAO, 2022b). When the scientific studies between 1928-2002 are examined, the definition of agro ecology, the establishment of the relationship between ecology and agronomy, the examination of product-agricultural activity-environment interaction, participatory approach, etc. based on many works (Francis et al., 2003). It has also been demonstrated in some works that agroecology provides political recognition and positive food and nutrition (Kerr et. al., 2021). In the studies carried out to date; “The need for holistic approaches to population, diet and food production” was emphasized (Tamburino et al., 2020). In fact, the 1960s was a time when interest in agroecology was encouraged for maximum efficiency (Egerer & Cohen, 2020). The 1970s-1980s were years when agroecology expanded as science/scientific research. The 1980s-1990s, on the other hand, were the times when agroecology came to the fore on the basis of sustainable living, the sustainability of agriculture was questioned, a tool of the green revolution and industrialized agriculture as an alternative. There are scientific works that brought the concept of biodiversity to life in 1990s agroecology. In these years, agroecology largely defined a system that started with field and land scales and integrated with ecosystem elements (Wezel & Jauneau, 2011; Gliessman, 2018; Egerer & Cohen, 2020; FAO, 2022b). In the late 1990s, agroecology was introduced as the ecology of the whole food system (Francis et al., 2003). The agroecosystem was no longer just a farm, it was a system in which all its components and participants were included in the food system. And since everyone ate, this system included the whole of humanity and even those who produce and consume. Thus, agroecology became a way to create relationship-based market systems that are equitable, fair, and accessible to all. Then it became the focus of politics (Gliessman, 2018).

Since the 1920s, scientists and researchers have used the term agroecology to refer to the application of ecological principles to agriculture (Gliessman, 2018; FAO, 2022b). But agroecology has many definitions. The most common of these definitions are given in this study. Altieri (1995) defined agroecology as the application of ecological concepts and principles to the design and management of sustainable agroecosystems. Altieri (1999) elaborated on this definition, defining it as "a discipline that provides basic ecological principles for studying, designing and managing agroecosystems that are productive and conserving natural resources, while at the same time being culturally sensitive, socially just and economically viable". In fact, it can be defined as an approach that integrates ideas and methods from various sub-fields rather than a specific discipline. Agroecology is a normative challenge to the way various disciplines approach agricultural problems. The roots; It extends to agricultural sciences, environmental movement, ecology, analysis of indigenous agro-ecosystems, and rural development studies. Francis et al., (2003) defined agroecology as the integrative study of the ecology of the entire food system, encompassing ecological, economic and social dimensions. This definition encourages the researcher, educator, and student to embrace the integrity and connectivity of systems. In addition, agroecology encourages a focus on solutions appropriate to the uniqueness, resources and constraints of each place. Therefore, it is a practical approach. The definition goes beyond production practices and immediate environmental impacts at the field and farm level. Organization for Economic Cooperation and Development-OECD (2003) defined agroecology as the study of the relationship between agricultural products and the environment. Agroecology

Europe (2015) considers agroecology as a whole as a science, a practice and a social movement. It emphasizes that it encompasses the entire food system, from soil to the organization of human societies. It is value-laden and based on fundamental principles. Agroecology recognizes that the whole is more than the sum of its parts and encourages participant interaction. According to Gliessman (2018), agroecology is the integration of research, education, action and change that brings sustainability to all parts of the food system. It is interdisciplinary as it values all kinds of knowledge and experience in food system change. It is participatory because it requires the participation of all stakeholders from farm to fork and everyone in between. It is action-oriented because they are alternative social structures to the economic and political power structures of the current industrial food system. The approach is based on ecological thinking that a holistic, systems-level understanding of food system sustainability is required.

The aim of agroecology is to guide a more equitable and sustainable food production system. It takes into account ecological conditions and social systems related to the landscape (Egerer & Cohen, 2020). Ecological conditions; energy flows, species interactions and material cycling, etc. It means. However, anything that can affect the agricultural process is also part of the process (Tomich, 2011). Peasant-based agroecological approaches are often developed and shared through extensive farmer-to-farmer social networks.

Agroecology also contributes to the process of "re-peasantization" in which smallholders return to the land, in contrast to the general trend of rural-to-urban migration. For peasant organizations, agroecology contributes to the struggle for autonomy over the land by reducing reliance on external inputs, credit and indebtedness. For them, agroecology; it is not only a scientific or technological project, but also a project of political resistance and survival (Altieri & Holt-Giménez, 2022).

Agroecology, as a science, prioritizes action research, being holistic and participatory, and interdisciplinary interaction. It is not normative. It does not provide any recipes or technical packages. It is based on local application of basic agroecological principles. Agroecology, as a science, prioritizes action research, being holistic and participatory, and interdisciplinary interaction. It is not normative. It does not provide any recipes or technical packages. It is based on local application of basic agroecological principles. As a practice, agroecology prioritizes the sustainable use of local renewable resources, the knowledge and priorities of local farmers, the smart use of biodiversity to provide ecosystem services and resilience, and solutions that contribute environmentally, economically and socially, from local to global. It also advocates smallholder and family farming, farmers and rural communities, food sovereignty, local and short food supply chains, diversity of indigenous seeds and breeds, healthy and quality food (FAO, 2022b). Political dimension of agroecology;

means challenging the root causes of the socio-environmental destruction of industrial agriculture (Altieri & Holt-Giménez, 2022). Agroecology is a way of creating relationship-based market systems that are equitable, fair and accessible to all (Gliessman, 2018).

The Food and Agriculture Organization of the United Nations (FAO) FAO: (1) improving efficiency in the use of resources; (2) conserving, protecting and enhancing natural ecosystems; (3) protecting and improving rural livelihoods, equity and social well-being; (4) enhancing resilience of people, communities and ecosystems; and (5) promoting good governance of both natural and human systems (FAO, 2014; Barrios et al., 2020). However, FAO has developed this vision (2015-2019) and endorsed the 10 essential elements of Agroecology framework. This framework was developed on the basis of the First International Symposium on Agroecology for Food Security and Nutrition, and calls made at regional meetings to strengthen the social and political aspects of agroecology. These elements; (1) Diversity, (2) Co-creation and sharing of knowledge, (3) Synergies, (4) Efficiency, (5) Recycling, (6) Resilience, (7) Human and social values, (8) Culture and food traditions, (9) Responsible governance, (10) Circular and solidarity economy. Culture and food traditions: by supporting healthy, diversified and culturally appropriate diets, agroecology contributes to food security and nutrition while maintaining the health of ecosystems (FAO, 2022c). These 10 key principles are a useful analytical tool and mental model to facilitate decision-making by practitioners and other stakeholders when planning, implementing, managing and evaluating agroecological transitions. It helps to frame agroecology in an inclusive way without privileging stakeholders or the region. Therefore, it facilitates the decision-making process at various levels and at various scales. It can also facilitate the identification of entry points for research, analysis and examination of possible theories of transformative change towards sustainable agriculture and food systems. The 10 Elements are interlinked and interdependent and represent a simplified, yet holistic, way to think about reality. Each element is essential, reflecting the holistic and integrated nature of agroecology (Barrios et al., 2020).

2. Materials and Method

The main material of the study is the 10 basic elements developed by FAO for the common vision of sustainable food and agriculture (Table 2.1) and the 5 criteria sets most widely used by the European Union (EU) for sustainable cities (Table 2.2). In the study, the criteria used in the European Union were chosen as the sustainable city criteria. Because Turkey is in the process of harmonization with the EU.

The research was carried out in four stages. In the first stage, the literature on agroecology and sustainable cities has been revealed. In the second stage, the basic elements of agroecology and the interaction points/subjects of the most widely used sustainable urban criteria in the European Union have been determined. In the third stage, for sustainable cities, the possible contributions of the issues at these interaction areas to the city were interpreted with a subjective approach. Finally stage, sustainable urban criteria and the strong and weak points of the agroecological approach were evaluated holistically on the basis of planning.

Table 2.1. FAO 10 essential elements of agroecology (Barrios et al., 2020; FAO, 2022).

Elements	Explanation
Diversity	Diversification is key to agroecological transitions. Because it ensure food security and nutrition while conserving, protecting and enhancing natural resources. The variety here has a fairly wide scope. It does not only refer to bio-ecological diversity. Information held by different actors within the agricultural system, different activities, different livelihood options, etc. also counts as diversity.
Co-creation and sharing of knowledge	With participatory processes, solving problems and adapting innovations to life are more successful. Agricultural activities are produced by people. Participation in agroecological processes is central to the decision-making process.
Synergies	Synergy is essential to support production and ecosystems by improving core functions. Building synergies enhances key functions across food systems, supporting production and multiple ecosystem services .
Efficiency	Agroecological practices aim to produce more by using less inputs and resources.
Recycling	Agroecology is agricultural production with lower economic and environmental costs. This also means more recycling.
Resilience	More resilience people, communities and ecosystems are key to a sustainable food and agriculture system.
Human and social values	Maintaining and improving rural livelihoods, equity and social well-being is essential to sustainable food and agricultural systems.
Culture and food traditions	by supporting healthy, diversified and culturally appropriate diets, agroecology contributes to food security and nutrition while maintaining the health of ecosystems.
Responsible governance	Sustainable food and agriculture requires responsible and effective governance mechanisms at different scales (from local to national to global)
Circular and solidarity economy	Agroecology aims at circular and solidarity economies that reconnect producers and consumers. These economies provide the social basis for sustainable development. It also offers innovative solutions for living within the confines of our planet.

Table 2.2. European Union (EU) criteria set

Measure Set	Criteria and explanations*
European Environment Agency (EEA) Urban Metabolism Framework	Evaluating the potential impact of urban planning alternatives on components of urban metabolism (such as energy, water, carbon and pollutant flows) can provide a quantitative estimate of their sustainability performance (González, et al., 2013). In this context, a criterion system based on the calculation of urban metabolism has been established by the EEA. With this criterion, it is evaluated whether the performance of the metabolic flow of the cities can be increased or not. It is a measurement set of 15 criteria developed on the basis of topics such as economy, transportation, production, land use, water use, waste-recycling, urban area-green space, unemployment, air quality (Tuğaç, 2018).
EU Eco-City	Eco-cities are settlements modeled on the self-sufficient, flexible structure and function of natural ecosystems (Akıncı and Pouya, 2019). They take full advantage of the benefits of ecological systems. It acts as a fundamental catalyst for urban change (Saad et al., 2017). It is a measurement set consisting of 6 criteria developed on the basis of urban structure, transportation, energy, economy and processes (Tuğaç, 2018).
European Commission (EC) Green Capital Award	The environmental sustainability of cities with a population of at least 100 000 is evaluated by the European Commission. Eco-city approach; It is a measurement set consisting of 12 criteria, in which environmental, social and economic dimensions are considered together (Tuğaç, 2018).
European Commission (EC)Green Leaf Award	Small cities with a population between 20000-100000 are evaluated. It is a measurement set of 6 criteria that evaluates issues such as climate change, energy, transportation, biodiversity, land use, environmental problems, and recycling (Tuğaç, 2018).
European Foundation Urban Sustainability Indicators	In this criterion system, certain sustainability practices are specific to a certain city (unique sustainability). It is a measurement set consisting of 16 criteria developed on the basis of issues such as climate change, environmental quality, transportation, energy, water production, security, justice and participation (Tuğaç, 2018).

**The criteria are given in Table 3.1 in the Findings section.*

3. Findings and Discussion

In this study, in which the basic elements of agroecology and sustainable urban principles are examined holistically, it has been determined that many criteria which is environmental quality, biodiversity, justice, economic approach, energy use, waste management interact and feed each other. Morever in the urban sustainability criteria; It has been observed that the principles on "guiding ecological approaches, synergy, creation-sharing of knowledge, ecosystem security, strengthening of cultural structure, participation and circular-solidarity economy" are lacking. Espacely, agricultural land-food supply issues were not mentioned at all. More environmental issues were mentioned. When the basic principles of agroecology are examined, it is seen that environmental quality and its determinants we are not discussed in detail, but are evaluated on the basis of efficiency and recycling. Principles on combating climate change have not been determined either. In addition, there are no principles on transportationenergy and security issues. Knowledge sharing, co-production, synergy, resilience, strengthening of values, governance and solidarity economy weren't emphasized either (Table 3.1).

When the interaction points of urban sustainability and agroecology are examined in the Table 3.1, the following situations have drawn attention.

- Urban sustainability has an approach that preserves biodiversity, and two of the criteria reviewed (EC Green Capital Award, EC Green Leaf Award) have this statement. It is structured on a foundation that preserves biodiversity in agroecology. Therefore, it contributes to urban sustainability.
- In three of the criteria (EEA Urban Metabolism Framework, EC Green Capital Award, EC Green Leaf Award), land use for sustainability is considered as a criterion. As Demiroğlu and Karadağ (2015) and Cengiz et al. (2017) stated, correct field/land use is the product of ecology-based approaches and agricultural areas should be determined in this way. Agroecological approaches are also an activity with ecological relations are produced with reference. For this reason, it also exhibits ecology-based approaches in site selection.
- Effective use of water resources is a important criterion in 4 of the criteria (EEA Urban Metabolism Framework, EC Green Capital Award, EC Green Leaf Award, European Foundation Urban Sustainability Indicators). Agroecology-based agricultural activities, on the other hand, aim at the efficient use of water resources. As Demiroğlu et al. (2016) and Demiroğlu et al. (2018) stated, water resources play a key role in ecology-based urban planning. Efficiency, which is one of the basic elements of agroecology, especially supports this criterion.

Table 3.1. Interaction areas of urban sustainability and agroecology

	Criteria for Sustainable city	Basic elements of agroecology									
		1	2	3	4	5	6	7	8	9	10
EEA Urban Metabolism Framework	Gross domestic product per capita	■		■	■	■	■				■
	Production efficiency - CO_2				■	■					
	Registered vehicles	■									
	Energy efficiency in transportation				■	■					
	Public transport network						■				
	Land use efficiency	■	■	■							
	Energy consumption efficiency				■						
	Water consumption efficiency				■	■					
	Waste intensity Recycling				■	■					
	Urban area amount										
	Access to green areas										
	Concentration - Pm10				■	■					
	Concentration - NO_2				■	■					
	Unemployment						■	■			■
EU Eco-City	Regional and urban context		■								
	Urban structure										
	Transport				■	■					■
	Energy and material flows	■									
	Social economy			■	■	■		■			■
	Processes	■	■	■			■	■		■	■
EC Green Capital Award	Climate change mitigation		■	■	■	■	■	■			■
	Adaptation to climate change	■	■	■	■	■	■	■			■
	Sustainable urban mobility									■	
	Sustainable land use				■			■			
	Nature and biodiversity	■			■	■	■		■		
	Air quality				■	■					
	Noise										
	Waste				■	■					
	Water				■	■					
	Green growth and eco-innovation	■	■		■	■					
	Energy performance				■	■					
	Governance		■					■		■	■

** These elements; (1) Diversity, (2) Co-creation and sharing of knowledge, (3) Synergies, (4) Efficiency, (5) Recycling, (6) Resilience, (7) Human and social values, (8) Culture and food traditions, (9) Responsible governance, (10) Circular and solidarity economy.*

Table 3.1. Continue

	Criteria for Sustainable city	Basic elements of agroecology									
		1	2	3	4	5	6	7	8	9	10
EC Green Leaf Award	Climate change-energy performance										
	Sustainable urban mobility										
	Nature, biodiversity and land use										
	Air quality and noise										
	Waste and circular economy										
	Water										
European Foundation Urban Sustainability Indicators	Global climate										
	Air quality										
	Acidification										
	Ecosystem poisoning										
	Urban mobility/clean transportation										
	Waste management Energy consumption										
	Water consumption										
	Disturbing factors										
	Social justice										
	Housing quality										
	Urban security										
	Economic sustainability of the city										
	Open-green spaces and historical heritage										
	Urban participation										
	Authentic sustainability										

- In three of the criteria (EC Green Capital Award, EC Green Leaf Award, European Foundation Urban Sustainability Indicators), combating climate change is accepted as a sustainable city criterion. At this point, agroecology supports sustainable cities with its many features (reducing input use, supporting recycling, etc.). Combating and adapting to climate change has a power that shapes the future of cities and life (Gül et al., 2021).
- In three of the criteria (EC Green Capital Award, EC Green Leaf Award, European Foundation Urban Sustainability Indicators), land

use for sustainability has been accepted as a criterion. According to Karadağ et al. (2019), Karakuş et al. (2019), Karakuş et al. (2020), Demiroğlu and Karadağ. (2021), Demiroğlu et al. (2021) and Karadağ and Demiroğlu (2022) stated, this struggle will be solved with an approach based on ecological systems. In fact, the guide of agroecology is ecological systems. In addition, there are criteria that express environmental quality (waste, noise, air-water-soil quality, etc.) in all of the criteria examined. Agroecological approaches share the same goal, especially with the elements of recycling and efficiency, and contribute to sustainability.

- The efficient use of energy has been accepted as a criterion in all of the criteria. Agroecological approaches aim at a production based on efficiency.
- Safety is an important issue in urban sustainability and this issue found in one of the criteria (European Foundation Urban Sustainability Indicators). The principles of agroecology, especially "improving human-social values, responsible governance, resilience", support security. In addition, the security system targeted with agroecology can be a guide for the whole city.
- In three of the criteria (EEA Urban Metabolism Framework, EU Eco-City, European Foundation Urban Sustainability Indicators); Criteria that are very important in defining sustainable cities such as economy and unemployment are included. The approach of agroecology to this issue is quite impressive. It offers new solutions

that directly connect the circular and solidarity economy, that is, the producer and the consumer. It offers solutions that will nurture the resilience and well-being of societies with food systems.

- In one of the examined criteria (European Foundation Urban Sustainability Indicators), justice and equality criteria are given. These criteria are important for sustainable cities. Agroecology is an egalitarian, fair and rights-protected system, and it expresses this in all its processes. It also supports this with participatory approaches. Participation is an important criterion for sustainable cities. It only mentioned this criteria in European Foundation Urban Sustainability.
- Urban areas are a system that cannot be separated from agricultural areas today. Sustainable city criteria do not include any criteria regarding this situation. However, urban food supply is one of the basic needs in urban sustainability. Today, wars and Covit-19 have shown the importance of food supply for city (Altieri & Nicholls, 2020; Langemeyera et al., 2021; Erişen, 2022; Rusciano & Gatto, 2022). For about the topic Vargas-Hernández (2021) stated sustainable urban food system based on agroecology; states that it is an alternative movement for the development of a fairer and healthier environment and that it is becoming increasingly widespread. Also, Gómez-Villarino et al. (2021) states that urban agriculture applied within the framework of agroecology principles offers impressive solutions for sustainable cities. The basic

elements of agroecology are a guide at this point. It is a guide for a sustainable city to meet its food-nutrition needs. Urban agriculture in addressing food insecurity and poverty has a key role (Musosa et al., 2022).

- The production, updating and sharing of knowledge is very important for sustainable cities (Demiroğlu & Karadağ, 2019). Agroecology has quite impressive approaches in this sense. However, no criteria related to this issue were found in the criteria examined.

4. Conclusion and Suggestions

Today's cities have been the center of combating especially climate change, population growth, unplanned urbanization and epidemics. City governments are looking for ways to reduce or alleviate these difficulties, vulnerabilities and risk. In this process for the city, "sustainable approaches" have been adopted as a principle at every stage of management, especially in planning. Natural resources, which are rapidly disappearing as a result of increasing population and growing cities, cause this approach to gain more importance day by day.

In this context, approaches including sustainability procedures that guide today's land uses are being developed. Agroecology, which is examined in the study, is a approach that will guide sustainability in agricultural areas both in the city and on the periphery of the city. Also agroecology; has principles that will contribute to the deficiencies and weaknesses in urban sustainability principles. Considering the intensive occupation of agricultural areas by cities, the holistic approach of these two concepts, agroecology-sustainable city-is impressive.

Principles of agroecology refer to agriculture guided with ecological principles, especially on the basis of participation, governance and justice. Urban sustainability, on the other hand, has principles developed on the basis of protecting environmental quality. In today's world, where the city and agriculture are intertwined, it is inevitable to consider both approaches as a whole. In this case, strengthening the urban ecology and participation emphasized in the agroecological approach and supporting the local people will contribute to the cities. Also, Altier et al. (2020) and Cheng et al. as stated in (2022); today's food supply is one of the issues shaping the future. For this reason, agriculture-food plays a key role in the planning of cities, which are today's living spaces. Therefore, sustainable cities should be built in a healthy structure that is self-sufficient in food and does not harm the environment.

Agroekoloji has a system to prevent the interruption of food sources. This system, on the basis of the balance of the living world (ecology), integrates the producer-consumer-produced into a fair and secure system. Conversion to agroecological approaches is difficult but not impossible. However, it is necessary to start this work on the basis of sustainable cities. At this point; As Türker (2021) and Türker & Akten

(2022) stated, "Work can be started in urban agricultural areas, which are the most valuable places of the city that can be turned into a food source.

Urban agricultural areas should be considered and protected as food production areas of the city, not just hobby gardens. This acceptance should be clearly emphasized on the basis of sustainable urban approaches. Also agricultural area; it should not be the first areas to be invaded in the expansion of the city. Today's wars and epidemics, in which food access is disrupted and we are witnessing, clearly demonstrate the importance of urban agriculture.

As a result, in order for the city to be sustainable, all the components that make up the city must have the same approach. Therefore, city and agriculture for sustainability; diversity, synergies, efficiency, waste-recycling, resilience, culture, culture and food traditions, co-creation and sharing of knowledge, human and social values, energy consumption, heavy metal concentration, transport, social economy, unemployment, climate change mitigation, noise, etc. should be evaluated on one scale on which the criteria are evaluated. It should be noted that; for sustainability, first of all, it is necessary to be a self-sufficient city (even country) in agriculture/food.

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The article complies with national and international research and publication ethics.

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All authors contributed equally to the article. There is no conflict of interest.

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Sustainable Ecological Fertilization Technique in Urban Agriculture

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1. Introduction

The plant production and cultivation sector is an increasingly developing sector that makes a significant contribution to the economy, and the development of new techniques and methods has become a priority (Şimşek & Gül, 2018). In today's conditions, the general purpose of the production methods in plant production is to obtain the highest quality material with the latest technical and economic methods. Fertilizer consumption for agricultural purposes in our country shows an increasing trend every year. Fertilizers can be of organic origin as well as inorganic origin. According to 2021 data, the amount of chemical fertilizer used in our country is approximately 6-6.5 million tons (Tarım Bakanlığı. 2021). Fertilization is not only giving plant nutrients to the environment but also increasing and raising the productivity status of the grown product material. In recent years, "organomineral fertilizers", which contain organic and mineral substances, are preferred to grow multiple crops, called intensive agriculture.

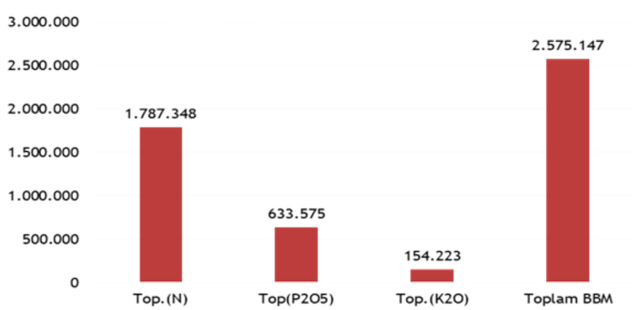

Figure 1. Fertilizer Consumption Amounts in Turkey in 2021 (Tarım Bakanlığı, 2021)

All kinds of commercial and non-commercial activities related to aquaculture constitute the total input costs. Therefore, it should be evaluated within the same framework. For example, all kinds of activities for the production of seedlings in the open field for industrial afforestation or the production of vegetables in a closed greenhouse environment are considered basic inputs. Because the main factor in plant production is the soil (growing environment). The processes from the seed stage to the sapling are the same. However, the demands and characteristics of the plant are other important factors in production, and there are different ecological demands according to the species/variety (Leventoğlu, 2022).

Soil fertility is the ability of the soil to provide essential plant nutrients in sufficient quantities and in suitable proportions to sustain plant growth. The general soil factors affecting soil fertility are as follows; soil water, soil texture, soil air, soil temperature, soil reaction, soil organic matter, soil biological properties, plant nutrient amounts and ratios, soil-plant water relations, colloidal properties of soil, cation and anion exchange in soil and soil salinity, etc. (Url, 1). The nitrogen, phosphorus, and potassium demands of plants are generally higher than the soil concentrations of these elements. For this reason, exogenous fertilization is required to provide the absolutely necessary plant nutrients for plants (Çakır, 2020).

Among these factors, the organic matter ratio of the soil is very important. It has indispensable importance on the fertility of the soil, both because of its positive effect on the physical, chemical, and biological properties of the soil and because it is a source of nutrients, especially nitrogen (Jat & Ahlawat, 2006; Alam et al., 2007; Ali et al., 2007; Sşngh et al., 2008; Rangarajan et al., 2008).

In our country, as a result of poor soils or loss of them by erosion, soil fertility increases through fertilization or frequent irrigation, and in this case, soil productivity decreases gradually as the salt content in the soil increases (Acar et al., 2002).

1.1. Fertilizer Definition and Classification

Fertilizer is a substance obtained both naturally and artificially with organic and/or inorganic components that enable plants to grow and increase their yield. In other words, fertilizers are divided into 2 groups natural (organic) and inorganic (commercial or artificial). They contain organic materials such as natural fertilizers, animal feces, and various plant residues. The plant nutrient content of natural fertilizers is less than artificial fertilizers, but it is very important in terms of improving the physical structure of the soil and water retention. The most important natural fertilizers; are barnyard manure, compost, and green manure (Karaöz, 1992). Dönmez & Çakır (2016) stated that while straw, sawdust, woodchip, leaf, animal fertilizer, and compost usage as organic mulch is very common in our country, usage of bark is very common in Europe and America.

According to Alagöz, Öztürken &Yılmaz (2006), in their study in Antalya, Aksu region, they investigated the effects of three different origin organic materials on soil properties. The materials used were selected as chicken manure, garbage compost, and leonardite. As a result, they determined that the regular and effective use of organic material is effective in raising and improving the physical and chemical properties of the soil.

It has been emphasized in all the scientific studies and literature that the fertilization process is very important for the grown product material. The basis of success in fertilization is to understand the fertilization processes well, analyze them well, use the proper methods, and follow the basic rules.

In this study, suggestions were made on fertilization techniques as a result of work experience, observations, and examinations of fertilization processes in plant production.

1.2. Fertilization in Sustainable Ecological Agriculture

Ecological agriculture is all kinds of agricultural activities carried out by preserving soil parent material, water resources, and climatic inputs to grow healthy products. Fertilization methods have special importance in ecological agriculture. Because in sustainable agriculture, protecting the soil's parent material and transferring its functionality from generation to generation can be realized with organic fertilization and methods. For this purpose, it can be provided with organic-based materials that will support or even replace the inorganic structure as much as possible to preserve the natural balance (Leventoğlu, 2022).

1.3. Rules to Be Followed in Fertilization in Sustainable Ecological Agriculture

Soils of Turkey and natural nursery lands are generally poor in terms of organic matter. This is a situation that directly affects productivity. To increase the productivity of organic matter-poor soils, it is essential to enrich soils in terms of organic matter (OGM, 1986).

For purposeful fertilization;

- All kinds of needs of the grown product (soil, fertilizer, pesticide, and climatic requirements) should be determined correctly and feeding should be done.
- Synthetic-origin fertilizers and inorganic products that will damage the soil parent material during the feeding phase of the grown product, affect the texture and structure, and accumulate residues should be avoided as much as possible.
- Fertilizers consisting of organic products and products rich in plant nutrients should be preferred.

According to Akgül (1985), it was emphasized that compost, green manure, and other organic fertilizers should be preferred instead of artificial fertilizers unless it is mandatory, and it was stated that the use of compost made from various organic residues increases productivity in nurseries. Animal manure is the fertilizer that provides the best nutrient for soil structure and texture. If it is applied to the soil suitably, it is preferred over commercial fertilizers in terms of better nutrient content and economy. When animal manure is given to the soil; It enriches the soil in terms of nitrogen, phosphorus, potassium, and sulfur and increases the water-holding capacity of the soil (Kaçar & Katkat, 2009). Feeding should be done as a result of the analysis of the growing medium (soil parent material) by adhering to scientific methods and methods. To determine the amount of fertilizer to be used during production; First of all, it is necessary to analyze the soil in which it will be grown (Güçdemir, 2006). Appropriate dosage, appropriate time, and correct fertilization methods should be preferred in fertilization. It has been revealed that seedlings fed with fertilization at the right time and with appropriate dosages gain appropriate morphological and physiological characteristics (Özdemir, 1971; Tacenur & Efeoğlu, 1979). To the regulations published in the Official Gazette No. 22145 in 1994, the principles of fertilization method regarding ecological agriculture should be followed.

2. Material and Method

Fertilization practices and activities of 60 farmer producers and 25 agricultural enterprises (small, medium, and large enterprises) located in the same location in 6 geographical regions in our country (Mediterranean Region, Aegean Region, Marmara Region, Central Anatolia Region, Black Sea Region and Southeastern Anatolia Region) have been observed and examined. Thus, it was determined whether it was made by current production techniques, interpreted and suggestions were made.

The activities of the producers and enterprises engaged in aquaculture according to the regional product pattern are given below.

- Mediterranean Region: Greenhouse (Vegetables and Fruit), Fruit (Citrus and Other), Open Field (Cool climate cereals, corn, cotton, greenhouse, etc.)
- Aegean Region: Greenhouse (Vegetables and Fruit), Fruit (Citrus, Olive, and other), Open Field (Cool climate cereals, corn, tobacco, greenhouse, etc.)
- Marmara Region: Fruit growing (Peach, olive, pome fruits, nuts, etc.), Open Field (Cool climate cereals, corn, sunflower, fruit growing, greenhouse)
- Central Anatolia Region: Fruit Growing (Apple, stone fruits, and others), Open Field (Vegetables, cool climate cereals, corn, sunflower, beet, potato, and greenhouse)
- Black Sea Region: Fruit growing (Hazelnut, kiwi, apple, pome fruits, and others), Open Field (Vegetables, cool climate cereals, corn, greenhouse)
- Southeastern Anatolia Region: Fruit growing (Pistachio, olive, etc.), Open Field (Vegetables, cool climate cereals, corn, cotton greenhouse),

Fertilization activities on the specified products formed the basis of this study.

3. Findings and Discussion

67-70% of our country's soil has an alkaline structure. In short, it can be thought that these soils are sick due to the structure and chemical structure they contain. Therefore, when unconscious feeding and fertilization activities are added to the work, in a very short time, production will be impossible in the soil.

One of the most sensitive issues of sustainable ecological agriculture is fertilization. To minimize this danger, especially for the lands of our country, it is necessary to take the necessary measures in the production plans.

Table 1. The amount of pure substance and Bbm consumed in our country (Tarım Bakanlığı, 2022).

Years	Total consumption	Total(N)	Total(P2O5)	Total(K2O)	Total(plant nutrient)
2017	6,332,872	1,764,638	754,759	124,945	2,644,333
2018	5,411,881	1,527,588	521,058	115,512	2,164,158
2019	6,087,714	1,682,549	667,367	116,501	2,466,416
2020	7,143,144	2,052,685	763,639	114,565	2,930,889
2021	6,480,101	1,787,348	633,575	154,223	2,575,147

Table 2. Macro-micro element values and texture of the sampled soils

Regions	N(%)	P(ppm)	K(ppm)	Mg(ppm)	Ca(ppm)	S(ppm)	Fe(ppm)	Zn(ppm)	Cu(ppm)	Mn(ppm	Na(ppm)	cation exchange capacity(me/100g)
Black Sea	0,08--0,28	6,07--45,4	76--343	298--2008	974--6464	1,33--40,6	9,41--32,4	0,96--4,95	2,35--11,6	5,78--35,47	15--439	20,86--49,44
Central Anatolia	0,1--0,38	9,27--209	140--2085	712--1545	2697--7298	5,4--7	4,04--31,25	0,74--8,63	2,23--12,47	4,69--18,59	21--890	28,23--70,82
Marmara	0,08--0,37	10,8--186	106--435	392--1186	681--6059	3,86--70,8	10,28--34,27	0,41--8,41	0,78--11,94	5,34--28,22	25--178	22,2--49,51
Aegean region	0,1--0,17	10,1--177	76--827	352--828	537--5487	6,46--96,7	11,16--26,99	1,09--7,39	2,76--9,74	10,5--26,41	11--97	14,16--39,76
Mediterrenian	0,09--0,15	7,29--53,2	94--661	440--2003	3165--6434	3,26--47,6	4,97--24,96	0,48--5,65	1,28--19,44	1,95--16,11	11--178	26,92--57,64
Southeast region	0,12--0,16	117--120	288--627	608--732	3400--3463	18,5--88,3	7,69--16,1	2,13--8,79	4,58--4,67	8,8--15,64	34--261	36,03--37,65

Table 3. Average texture values of the sampled soils

Regions	pH	organic matter(%)	EC(mS/cm)	lime(%)	sand(%)	clay(%)	dust(%)	field capacity	fading point	suitable humidity(%)
Black Sea	5,53-8,89	1,2-4,47	0,03-0,45	0,05-8,11	14,2-65,8	19,9-43,8	14,3-48,9	18,11-37,19	7,67--21,69	6,89-15,5
Central Anatolia	7,84-8,89	1,56-6,49	0,12-0,43	3,38-27,5	6,68-56,4	18,8-67,4	21-39,4	14,79--38,03	8,04--25,23	6,75--16,3
Marmara	7,69-8,42	0,96-10,4	0,04-0,29	0,05-10,6	28-77,6	12,3-47,4	20,2-51,7	13,91--33,91	7,67--22,66	6,24--16,81
Aegean region	7,34-8,73	0,86-2,57	0,06-0,83	0,04-9,77	27,7-56,5	18,3-34,7	22-38,9	16,88--30,82	5,44--15,03	11,09--15,84
Mediterrenian	8,23-8,86	1,43-3,15	0,12-0,27	8,85-80,4	16,2-66,6	19,2-48,9	10,2-45,3	17,62--38,02	8,51--25,11	6,05--14,93
Southeast region	7,65-8,23	1,48-2,76	0,25-0,4	6,8-9,71	36-41,9	23,2-29,4	28,7-40,8	19,12--21,72	11,38--11,95	7,74--9,77

According to the texture values of the soil analysis results taken in the sample areas in the study, it was observed that the amount used in the fertilization and plant nutrition activities of the producers and the majority of the enterprises were not appropriate according to the result values of the fertilizer and bbm applications.

It has been observed that the traditionalist understanding of methods and practices, which are frequently encountered in agricultural activities in our country, continues. Therefore, instead of wrong practices in traditional agriculture, it has become necessary to use products that will increase the organic structure of the soil and accelerate and expand these practices (Table 1-2-3).

Except for a part of the Black Sea lands, the vast majority of all our regions are included in this alkaline soil structure group. According to the structure and texture data of the soil samples taken from different regional locations, it has clayey-clay loam soil types that are poor in organic matter, contain a high amount of unsuitable lime, and especially have a high pH. In this context, the use of fertilizers that promote alkaline structure further encourages alkaline structure. Sustainable ecological fertilization in urban agriculture may be insufficient for commercial purposes and expectations. The amount of inorganic fertilizer to be used in soils rich in organic matter will be low at that rate.

However, an issue that should not be forgotten is that organic matter improves the soil, improves it, and corrects the structure. Organic matter is not fertilizer. During the production phase, the organic matter ratio in the soil is not sufficient and plant nutrition is needed. In particular, organomineral fertilizers, which contain both organic and inorganic structures, are much more preferred today. As a result of the use of these fertilizers, it will both increase the organic structure and provide the inorganic materials to be given to the soil in the amount needed.

3.1. Comparison Of Sustainable Agricultural Practices With Western Countries

When we look at the average of the last 10 years in our country, the amount of commercial fertilizer use has increased from 5 million tons to 7 million tons. Considering the amounts used by the European and American manufacturers, it can be thought that these usage amounts should be even higher. However, the amount of fertilizer used in Europe is 2.5-3 times higher per decare used in our country. This means that approximately 15-18 million tons of fertilizer are used in a European country with an equal amount of agricultural land. However, when examined, the yield per decare of our country's land is so low that it cannot be compared with some European countries' soils. However, it should not be thought that the reason for the high yield in Europe and America is due to the use of more fertilizers.

Although the amount of unconsciously used fertilizer in our country is less than in western countries, it is observed that our soils are heavier in texture, poor in organic matter, and have a barren structure. It has been determined that manure is mixed with drinking water and there are residues (residues) in many produced products. In this sense, many fresh vegetables and fruits that we export are returned by the countries to which they are exported, due to the high amount of residues in the products (Table 4).

Table 4. Turkey and World BBM Consumption Amounts (Tarım Bakanlığı, 2022).

2021	**Amount of Plant Nutrients Consumed (million tons)**
Turkey (Türkiye)	2.65
World (Dünya)	310
Rate (Oran)	% 0,85

3.2. Discovery and Use of Our Own Natural Resources in Sustainable Ecological Agriculture

There are some soil improvement methods and concepts that 70% of our producers do not know, especially in coastal areas and places where vegetable and fruit cultivation is done. Domestic producers buy from foreign-origin product groups that are sold at astronomical prices to gain efficiency, accelerate the activation of the soil, increase the amount of organic matter in the soil, dissolve the bound compounds that do not work and lock the soil. These products, which can be included in the organic structure, should be extracted as Gidya, and Humic-Fulvic acids, which have rich deposits in our country, and it should be made mandatory for our producers to use them.

3.3. The Importance of Water in Sustainable Ecological Fertilization

It is a cycle that can be realized with water that the fertilizers, which consist entirely of salt, can dissolve in the soil and be taken up by the roots. Sowing and planting are carried out by local farmers with a traditional approach and irrigation water is consumed unconsciously and brutally. Although irrigation unions and public institutions are trying to take precautions in this sense. However, the need for water in soils poor in organic matter with low productivity is higher than in rich soils.

The products obtained from our resources, which are rich in organic matter, will increase the water-holding capacity as well as improve the soil. In this way, the indiscriminate waste of our water resources will be prevented and it will make a serious contribution to our economy.

4. Conclusion and Suggestions

The basic approach in plant production, after determining which nutrients the product to be produced needs according to the results of soil and leaf analysis, the type of fertilizer suitable for soil and climate characteristics and the amount of fertilizer to be applied should be determined. Considering the chemical properties of the fertilizers to be applied, it should be decided how in which dose and when to apply. In determining the fertilization method, besides the fertility of the soil, the plant production system and irrigation method are also important.

Fertilizer is an indispensable commodity in agricultural activities. All kinds of agricultural products grown need macro and microelements and must be met with fertilization. However, fertilizer is consumed and used unconsciously in our country. Due to the general structure of the lands in our country, production continues with traditional knowledge. Although there are many scientific studies on this subject, difficulties and mistakes continue, especially due to insufficient awareness of producers and traditional habits. However, positive results cannot be obtained because the monitoring and control processes for fertilization activities are not carried out effectively. Thus, producers increase their input costs by using more commercial fertilizers of foreign origin as a result of unconsciously consumed fertilization activities. It is accepted that unhealthy and inefficient agricultural product activities in our country have reached a dangerous and anxious level in terms of human health, the country's economy, and food safety.

Implementing and disseminating agroforestry systems in urban and rural areas, which provide versatile utilization of the land to improve and develop the chemical, physical and biological properties of the soil, may play an important role in increasing the organic matter ratio of the soil (Gül et al., 2011)

95% of the chemical fertilizers brought from abroad and sold at high prices can be produced with our natural resources and brought to the agricultural sector. Humic-Fulvic acid-containing macro-micro-element products sold under many organic headings can be produced in our natural mines, with preparations to be created in laboratory environments of raw materials to be obtained from coal enterprises. These products can be supplied by manufacturers at more affordable costs. In sustainable ecological agricultural activities, the first goal should be to turn to organic fertilizers that will not harm the environment and natural resources as much as possible.

Thanks and Information Note

The article complies with national and international research and publication ethics.

Author Contribution and Conflict of Interest Disclosure Information

All authors contributed equally to the article. There is no conflict of interest.

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Control of Plant Disease in Home Vegetable Gardens

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1. Introduction

Today, global agriculture is threatened by rapidly increasing population, global climate change, deterioration of land existence and integrity, biodiversity loss, and food insecurity. In addition the impact of urbanization on agricultural dynamics cause many food problems (Türker & Akten, 2020). The world population is expected to reach approximately 9.6 billion by 2050. For this reason, food production and stocks must be constantly increased in order to meet the nutritional needs of the increasing world population. With the increasing population, the need for food is increasing day by day. Therefore, it is estimated that global food production should increase by 70% for the average daily calorie needs of the world population in 2050.

Food insecurity has substantially increased in urban areas as a result of the recent COVID-19 epidemic, disruptions in the food supply chain, the hardship of physical and economic barriers limiting food supply, a lack of labor, and an increase in food waste. Therefore, there was a need to move towards more flexible farming systems, reduce food waste and strengthen local food production. Urban agriculture has a wide range of economic activities from production to marketing and distribution. Urban agriculture is one of the popular sustainable green strategies in the world and in Turkey recently (Türker, 2021a). Urban agriculture provides a tool for urban problems (Türker, 2021b). Urban agriculture helps cities become more sustainable places with its ecological, economic, social and health benefits (Türker &Akten, 2020). Urban agriculture is constantly in contact with the ecological, social, cultural and health systems of the city (Türker & Akten, 2021, Türker & Anaç, 2022).

Home gardening and urban farming practices have become important strategies for increasing availability at the home and community level. Farming in cities can take place in a variety of settings, including small areas near the home, local community gardens, indoor and roof gardens, and vertical farming. Home gardening has played an important role in improving food and nutritional security, especially during and after the COVID-19 pandemic. In addition, it has strengthened the ecosystem in many aspects such as plant biodiversity, microclimate, water flow, water quality, and human health.

In general, home gardening refers to the cultivation of a small area of land adjacent to the home or within walking distance. Home gardens can be defined as a mixed crop system that includes vegetables, fruit, field crops, spices, herbs, ornamental and medicinal plants, and livestock that can serve as an additional source of food and income.

According to Michelle & Hanstad (2004), there are feature of a home gardens;

1) are settled near the house;

2) plant diversity is high;

3) It is generally for the family's food needs, not for income;

4) are usually small areas and

5) is a production system that low-income families can also do

Important benefits of home gardening ;

- Enhanced food safety

- Increased amount of food and healthy diet with thanks to food diversity
- Income and rural employment rise as a result of seasonal and off-season production.
- Increased plant diversity, reduced risk;
- Environmental benefits involve recycling of water and waste nutrients, the control of shade, dust, and erosion, and the maintenance or development of local biodiversity.

Plants are described as diseased when their growth and development deviate from normal. Biotic agents and abiotic conditions can cause significant crop losses in home gardens. Many species of microorganisms cause the biotic agents such as bacteria, fungi, nematodes, viruses, viroids, phytoplasms, and parasitic weed seeds. In order for disease to occur, the pathogen must be in contact a susceptible host plant. Pathogens can be carried to plants alone or in combination in a variety of ways, including wind, water, insects, infested seeds, transplants, soil, animals and humans. In addition, the environmental conditions at the time the pathogen comes into contact with the plant must be suitable for the development of the pathogen. Plant diseases can have significant impact on production in our home gardens. When these diseases are not controlled, it causes significant product losses up to 70%. These diseases reduce crop production and the satisfaction that householders can receive from the garden. Disease-related losses can be reduced significantly by combining effective disease-prevention techniques. First and foremost, successful disease management begins with a correct diagnosis or the identification of the cause of the problem. In this study, is emphasised about the plants grown and plant diseases and the control of diseases in home gardens.

2. Vegetables Grown and Common Diseases in the Home Garden

The following Table 1 shows vegetables grown in home gardens and some of common diseases.

Table 1. Vegetables and common diseases

Family	Vegetable	Diseases
Alliaceae	Onions leeks Garlic shallots	anthracnose, Fusarium basal rot, leaf spots and blights (fungal), gray mold, powdery and downy mildew, rust, smut and white mold, bacterial blights, soft rot (bacterial), viruses
Solanaceae	tomato	damping off (Pre-emergence and post-emergence), *Fusarium* wilt, anthracnose, *Alternaria* stem canker, bacterial speck, bacterial spot, bacterial wilt, early blight and other leaf spots and blights, leaf mold, pith necrosis, tomato spotted wilt, tobacco mosaic, cucumber mosaic, tobacco streak and other viruses.
	potato	early blight, late blight, *Rhizoctonia*, scab, *Fusarium* and *Verticillium*, bacterial soft rot, potato leafroll, potato virus Y
	pepper	Anthracnose, *Phytophthora* blight (root and crown rot), bacterial spot, cucumber mosaic virüs, tobacco mosaic virus
	eggplant	Anthracnose, leaf blight (fungal), damping off (seed decay), *Verticillium* wilt, Phomopsis fruit rot
Cruciferae/Brassicaceae	broccoli, brussels sprouts	*Alternaria* leaf spot, Fusarium wilt, black rot and downy mildew, Black

	cabbage cauliflower collard kale kohlrabi mustard greens radish rutabaga turnip	leg (fungal), club rot, seed decay, wire stem, turnip mosaic virus
Cucurbitaceae	cucumber melon watermelon gourds pumpkin winter squash, summer squash	Angular leaf spot, anthracnose Fusarium wilt, downy mildew, bacterial wilt, gummy stem blight, Phytophthora blight and fruit rot, powdery mildew, Alternaria leaf blight and cucumber mosaic, watermelon mosaic, squash mosaic virus
Fabaceae	beans peas	Anthracnose, bacterial blights, gray mold, leaf spots and blights (fungal), powdery mildew, rust, white mold and viruses
Asteraceae	lettuce	anthracnose, bacterial spot, downy and powdery mildew
Malvaceae	okra	Fusarium wilt, powdery mildew
Chenopodiaceae	spinach	downy mildew and white rust
Poaceae	corn (sweet)	seed decay, leaf blights (fungal), Maize dwarf mosaic virus, rust

3. Control of Plant Diseases in Home Gardens

3.1. Cultural control

Cultural controls are measures that are not suitable for plant pathogens, but are taken for the purpose of growing the plant healthy. These measures are based on 3 main points.

- Growing healthy plants
- Removing suitable environment for disease agents
- Preventing the spread of disease agents

This control method includes all processes related to plant cultivating that may affect the formation of diseases in plants. It is the use of agricultural procedures such as sowing, planting, fertilization, irrigation, tillage, pruning, and harvesting in such a way that disease development is reduced or eliminated. Disease formation can be prevented by adjusting the sowing or planting time forward or backward considering the biology of the disease agent. Suitable irrigation ensures that the plant is healthy and increases its resistance to diseases. Inadequate or excessive irrigation makes the plant susceptible to pathogens. Excessive irrigation can cause oxygen lack of to the roots, rotting of the roots of the plant and the emergence of some diseases, causing the death of the plant. Soil-borne fungal diseases such as seed decay, damping-off, root/crown rot and wilt are more likely to occur in extremely wet soils. Overwatering should be avoided because leaf spot diseases develop rapidly when leaves are wet. With the drip irrigation method, a good irrigation can be done without wetting the leaves. In this method, water moves slowly over time at the base of the plant or just below the soil surface. When fertilizing consciously are applyed, they help plants to be healthy and productive. The lack of macro and micro nutrients in the soil causes some problems in plants. Plants are more susceptible to diseases. Therefore, fertilizing improve the physical and chemical structure of the soil and increase the resistance of the plant. In addition, excessive or one way application of fertilizing increases the susceptibility to plant diseases. When compost, farm manure and green manure are applied to the soil, the organic matter amount, productivity, air capacity, water holding capacity and microorganism activities of the soil increase.

Site selection

The garden area where the most suitable and favorable conditions should be selected for the plants. The climate and soil characteristics of the place where the plant is grown are the most important factors for the healthy development of the plant. The healthy development of the plant increases resistance against diseases. When choosing a garden area, heavy soils should not be preferred with high water holding capacity. A well-drained area should be chosen to prevent damping-off and other problems in gardens. In particular, excessive soil moisture increases root and crown diseases such as damping, crown and root caused by soil-borne fungal pathogens. Surface water should be well drained throughout the garden. After rains, surface water should leak through the soil or be removed by drainage. When soil moisture around a plant is high, it will increase the likelihood of leaf and stem diseases. Therefore, plants should be planted on a raised bed (6 to 8 inches) to remove excess moisture from the plant root zone. For example, many types of vegetables need full sunlight for high yields. Therefore, it reduces the incidence of most leaf diseases.

Disease-resistant cultivars

The use of disease-resistant vegetable varieties at the beginning of cultivation should be quite preliminary in disease control. Significant advances have been made in developing vegetable crop varieties resistant to some of the more serious pathogens.

In many cases, using resistant varieties is the only effective method of controlling certain diseases, primarily in gardens where the pathogens have been established in the soil. The source of the seed may be important in identifying which pathogens the seed maintains.

Sanitation

Pathogens that cause the disease are usually carried over to the next year in the debris of the harvest left over from the previous summer. Diseased plants in the summer, they must necessarily be removed from the garden and burned. Diseased plant debris left in the garden cause the disease to spread to healthy plants. In the fall, the wastes plant remaining in the garden before plowing the garden should be raked and burned. Leaving diseased plants in the garden, especially rotting vegetables, is dangerous in the spread of the disease. Weeds must be eradicated because they serve as a host for pathogens, particularly insects that transmit viruses and other pathogens. Disinfection of tools and equipment will also help to avoid the spread of pathogen. Proper soil preparation, fertilization, and watering, as well as early detection and removal of infected plants, are all sanitation practices.

Crop rotation

Disease control in home vegetable gardening should begin long before seeds and seedlings are placed in the soil. By keeping records of the plant species grown a year ago in the garden, an effective crop rotation can be achieved against diseases caused by soil-borne pathogens.

Most vegetables are susceptible to many diseases. Crop rotation is critical for reducing losses from vegetable diseases. Continuous cultivating of cultivated plants from the same plant family in the same place causes increasing of pathogens. Plants from the same or neighboring families should not be planted in the same place every year during the rotation.

Examples of some plants from the same family are follows:

- Brassicaceae family: broccoli, Brussels sprouts, cabbage, cauliflower, Chinese cabbage, mustard greens, kohlrabi, radish, rutabaga and turnip
- Cucurbitacae family: cucumber, cantaloupe, gourds, muskmelon, pumpkin, squash and watermelon
- Solanaceae family: eggplant, pepper, potato and tomato
- Chenopodiaceae family: table beet and spinach
- Fabaceae family: beans and peas
- Apiaceae family: carrot, celery and parsnip
- Alliaceae family: chive, garlic, leek, onion and shallot
- Asteraceae family: lettuce
- Poaceae family: corn
- Malvaceae family: okra

Solarization

Solarization is a method that uses the heat energy of the sun to sterilize the soil. Soil solarization is a non-chemical method of removing soil-borne plant diseases in the garden. Solarization uses sunlight to heat the soil, causing physical, chemical, and biological changes. The method is most effective during mid- and late-summer, when high air temperatures incorporate with intense sunlight. After solarization treatment, high temperature and toxic products kill or suppress plant pathogens and weed seeds. Beneficial organisms are less damaged by solarization than by fumigation. Solarization is known to increase the amount of nutrients released from organic materials present in the soil. In the solarization process, the soil is first processed in the hottest months of the year, cleaned of clods and weeds, and then watered to activate the microorganisms in the soil. Then, the top of the soil is covered with a transparent polyethylene cover that is resistant to ultraviolet rays (harmful rays of the sun). In this manner, it is exposed to sunlight for 30-45 days. The soil is constantly moistened with periodic irrigation. Wet soil carries heat better than dry soil, permitting heat to penetrate deep into the soil and kill pathogens in the rhizosphere. Soil temperatures need to be above 100 F for 4-6 weeks to minimize soil-borne diseases. There should be no spaces between the cover and the soil surface. With this method, soil-borne pathogens, weed seeds, nematodes and harmful insects are destroyed up to 10-15 cm depth of the soil. It is a very effective and economical method.

3.2. Physical control

Physical controls mainly include mechanical and thermal methods.

Mechanical methods

Mechanical methods include the actions made to remove the disease agent or to prevent its formation. This method includes activities such as burning disease-infected plants or specific parts of plants or weeds, flooding, uprooting, plucking, and cutting. One of the points to be considered in mechanical methods is cutting diseased plant parts before sporulation of the pathogen. In addition, in order to remove the diseased part, the disease part should be cut down to the healthy part, then either burned or buried very deeply.

Thermal methods

Temperature application (high or low), dry air, radiation application and usage of electromagnetic waves are all thermal techniques commonly in the physical control against plant diseases. These techniques are used to eliminate disease agents or to reduce their population. Thermal methods are used for soil sterilization, disinfection of reproductive organs, purification of plants from fungi, bacteria and viruses, and prevention of diseases before storage. In this method, soil sterilization is done with hot water or steam in greenhouses and seedbeds. In this application, the pathogens in the soil are destroyed by keeping the soil at a certain temperature (at least for 30 minutes 70-82 °C). Production materials (seeds, seedlings, cuttings, tubers, bulbs, rhizomes) contaminated with many bacterial, fungal and some viral pathogens can be cleaned with the application of hot air and hot water. The application of hot water is based on the elimination of pathogens in and on it without harming the vitality of the seed and other plant parts. Hot air applications are more effective especially against viruses because it can be applied at higher temperatures and longer than hot water applications.

3.3. Biological control

Biological control is the practise of removing the disease agent and suppressing diseases by using live materials.

The advantages of biological control are as follows:

- It does not harm the natural balance.
- It has no negative effects on the environment and human health.
- It is cheaper than other methods of control.
- Natural enemies are protected.
- There is the possibility of constantly protecting plants.

3.4. Chemical control

Every year, plant diseases caused by fungus, bacteria, and viruses cause severity problems on vegetable gardens. Many methods of control can be mentioned to suppress diseases. In some cases, disease occurs in the garden despite all the practices used against diseases. Chemical control is applied to protect the plant from the pathogen or to treat the infected plant. However, in this control, it is expected to protect human and plant health, not damage living organisms in nature, maintain natural balance, and increase the quantity and quality of the product. Chemical control is the most used method due to its positive results in a short time compared to other methods, the need for less labor in practice and its ease of application. All alternative control measures should be used before deciding on chemical control. Chemical methods should be used as less as possible in the control of diseases. In some cases, chemical control is the only effective way to control some diseases. Safe fungicides, bactericides, fumigants recommended by provincial and district directorates of agriculture, research institutes, universities and agriculture consultants should be used. The uncontrolled use of pesticides harms the soil, environment and human health and adversely affects the country's economy. The most commonly used pesticides against pathogens are fungicides. Fungicides can act as preventative, eradicant or curative and systemic according to their mode of action. Protective fungicides are used before infection and to prevent the pathogen from entering the host and infection. Therefore, it should be applied to plants before the disease starts. When spraying, care should be taken to apply pesticides so that the plant surface is completely covered. Eradicant fungicides are also known as curative that kill or prevent the growth of the pathogen in the plant where it is applied. Generally systemic fungicides are eradicants, but some protective fungicides also have eradicants. Systemic fungicides are absorbed and transported by the plant and can cure most diseases. Antibiotics, fungicides, bordeaux mixture and some copper preparations are effective in bacterial diseases. However, antibiotics are not used much because they are not economical. There is no pesticide used against viral diseases.

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Weed Control Methods in Urban Agriculture

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1. Introduction

The world's population is expected to reach 11 billion by 2050, at an increasing rate. In terms of developing countries, including Turkey, the period from the second half of the twentieth century to the present can be described as one of rapid urbanization. Due to this accelerated urbanization, cities today house about half of the world's population. The increase in the urban population creates significant pressure on agricultural areas or destroys existing agricultural areas. This is also crucial for "food security" and "access to food," which may become issues as a result of future demand growth (Yenigül, 2016). Sustainable agriculture alternatives have been introduced to ensure the need for food for the growing population in cities, and urban agriculture has been recognized as one of these alternatives (Türker & Anaç, 2022). Urban agriculture provides a wide range of alternative activity areas that can be used to develop a food production model that is environmentally friendly. Agriculture, which has been a part of human society for roughly 15,000 years and supplies the foods needed to sustain humans, is a field that grows as a result of environmental factors. When it comes to agriculture and food; economic development, poverty reduction, food security, and environmental sustainability also come to mind. Sustainable food and agricultural production cannot be achieved with a decrease in seafood, shrinking forests, expanding deserts, rising carbon dioxide and heat levels, eroding areas, declining water indicators, destruction of grasslands, rising seas, drying rivers, and extinct species (Kurt, 2004).

Agriculture, which has been a part of human society for roughly 15,000 years and supplies the nutrients needed to sustain humans, is a field that grows as a result of environmental factors. When it comes to agriculture and food; economic development, poverty reduction, food security, and environmental sustainability also come to mind (Lal, 2020). The idea of "Sustainability" has grown in significance as an essential component of the solution to the issues of environmental degradation that are progressing and the depletion of natural resources in cities. A sustainable city contains the essential elements of a strong economy, a wholesome and progressive society, and a clean, sustainable environment. It is characterized as a living environment that improves the quality of life of its inhabitants. Urban agriculture is a dynamic process that can exhibit various agricultural activities and many functions together. Türker (2021a) defines urban agriculture as a combination of urban and agricultural concepts. Urban agriculture is an alternative food system (Türker, 2021b). Urban agriculture is one of the most crucial strategies for ensuring sustainable urban development. Urban agriculture, which makes cities greener, also helps with economic growth, poverty reduction, food security, the productive reuse of municipal waste and wastewater, biodiversity preservation, and fostering a connection between urban dwellers and nature (Türker & Akten, 2021). Urban agriculture brings a sustainable and green character to the cities with its productive function in the urban landscape (Türker & Akten, 2020). Urban agriculture has started to gain recognition as one of the crucial components of sustainable development, particularly since the 2000s. Today, urban agriculture is practiced in most parts of the world with different techniques and participants. Insufficient food supply is a significant issue given the world population's rapid growth. For this reason, it is necessary to increase the production and efficiency of foodstuffs and to take measures to prevent food loss or to increase agricultural productivity, it has become necessary to manage diseases, pests, and weeds that cause significant losses in agricultural products.

Around the world, urban agriculture has been growing, particularly in declining cities were more unoccupied land has created farming opportunities. Additionally, there has been an increase in interest in sustainable farming as more people choose to eat organic and locally sourced food. Urban agriculture faces the same problems with weed species and weed management as rural agriculture, though. Research on weed species and weed control options in urban agriculture is limited.

Controlling weeds that are growing next to rivers, in wetlands, on roadside berms, on hilly terrain, or in reserves and bush remnants can be extremely challenging for territorial authorities in densely populated urban areas for a variety of reasons. One of the most significant variables affecting agricultural production worldwide is the presence of diseases, pests, and weeds. This could be up to 100% more product losses if there are no control methods against plant protection factors. Despite the world's rapid population growth, a lack of production areas and even a decrease in arable land in many settlements will cause food supply problems in the coming years. Considering that the ratio of people living in rural areas to the total population is constantly decreasing, it becomes a necessity to need more products from the unit area by spending less labor. As a result of the increase in income levels due to increasing urbanization; It is seen that people's demands for agricultural products are constantly increasing and their needs are diversifying every year. Also, urban agriculture comes to the fore in meeting these needs. The increase in the total population and its needs and the diversification of demands increase the need for agricultural products day by day. As a result, sustainable agricultural practices are critical. To increase the yield and quality of agricultural products, modern agricultural techniques and inputs should be used appropriately. Almost everywhere, including roads, pavements, parks, playgrounds, landscaping areas, turf areas, hobby gardens, and orchards, weeds are a problem. Weed species and their population densities; the agricultural system applied, including especially the climate and soil characteristics, ecological conditions, cultivated plants, soil cultivation, fertilization, irrigation, herbicide use, crop rotation, etc. varies depending on the factor (Önen et al., 2018; Köktaş & Öğüt Yavuz, 2020). Weeds that significantly damage both urban areas and urban agriculture will be highlighted in this part, and general control strategies will be covered.

2. Weeds and Their Effects

Weeds are defined as plants that spread rapidly and grow in undesirable places, compete with desired plants, and are considered troublesome or problematic. Weeds are plants that are harmful to desirable ecosystems, crops, people, and animals (WSSA, 2022; EWRS, 2022; Uygur, 2022). Weeds compete with cultivated plants for ground, light, water, and nutrients in agricultural ecosystems, causing significant yield losses on the one hand, and inhomogeneous growth and maturation in cultivated plants on the other. They cause significant yield losses by living as semi/full parasites on cultivated plants. Weeds lower the quality of items made from plants, animals, and cultivated land. They also raise the cost of farming output. They can disrupt irrigation systems, dams, lakes, ponds, and pools. By easily igniting the above-ground organs that dry in forests, industrial regions, railroads, and highways, they can start fires. They, on the other hand, harm the development of cultivated plants due to their allelopathic properties and host a variety of other plant protection factors (disease agents and pests) or vectors. Furthermore, apart from agricultural areas; forests, wetlands, aquatic environments, steppes, etc. they also cause problems in areas such as pastures, dams, residential areas, industry, and transportation facilities, which are under the control of natural ecosystems and people. Weeds may also poison people and animals, which could result in eventual death (Önen, 2021). Weeds are generally undesirable plants as they adversely affect human activities. Weed control is necessary not only because of the agricultural damage they cause but also because of its ability to adapt to adverse conditions over time. Despite all the developments in the control of weeds today, weeds still; cause serious ecological, economic, health, and social losses in many different natural/agricultural ecosystems around the world. The number of weed species adapted to agricultural ecosystems with intensive tillage, as well as the problems associated with them, is growing by the day due to yield losses and control costs. The number of the most significant weeds that cause significant problems around the world and must be controlled in the production process in terms of ecological, economic, and health concerns has been stated to be around 1,600 species (Randall 2012). Sixty-eight percent of the 200 species of the most significant weeds in the world are from twelve plant families (Holm, 1978). The most significant factor restricting production, particularly in organic agriculture, is cited by producers as weeds. Weed species with similar characteristics should be classified in terms of determining, planning, and implementing control strategies for effective weed control. Weeds can be categorized in many different ways based on their traits (taxonomic, morphological, physiological, genetic, etc.), life cycles, number of cotyledon leaves, stem structures, the plant communities they form, patterns of damage, habitats (living environments), cultivated plants, the vegetation period, based on place of occurrence (croplands, pasture lands, waste places, playgrounds, road-sides) and origins (geographical regions of origin).

3. Weed Control Methods

To successfully control weeds, it is crucial to make a proper diagnosis of the weed. To control weeds, many techniques are utilized (Mainardis et al., 2020). There are numerous techniques used to control weeds. The choice of the control approach is influenced by elements from the biology and ecology of the weed. To identify the key factors that can aid in the management to control accordingly, it is required to examine the biology and ecology of the weed (Güncan, 2010). The most significant factor when selecting a strategy of control is that the weed species that is the problem should be correctly diagnosed, in which the growth stage and crop/area have done control are known. While a single method is sufficient in any weed control, it may not be in others. Weeds are controlled using a variety of techniques, including cultural, physical, mechanical, biological, and chemical ones. However, it can be divided into chemical control methods and non-chemical alternatives. Every weed control method has advantages and disadvantages. While mechanical methods were frequently employed to control weeds in the past when labor was still inexpensive, today generally prefer chemical methods instead due to their ease of use, effectiveness, rising labor prices, and difficulty finding workers when needed. Simple techniques like hand weeding or hoeing can eliminate some weeds, but others required specific measures to be effectively controlled. Conscious and effective agricultural control strategies must be implemented to safeguard both human health and the environment. A combination of these strategies frequently provides more efficient and cost-effective control than a single method. In terms of weed control, a single strategy is typically insufficient. By combining various methods, it is feasible to achieve effective control. Understanding weed biology and ecological needs are essential for controlling them. However, once these critical points have been identified, controlling weeds or planning control programs could be done (Özer et al., 2001).

3.1. Preventative weed control:

Any weed-management strategy that seeks to stop weeds from growing in cultivated crops, pastures, greenhouses or any place is referred to as preventative weed control. Keeping weeds off the field is the best way to against them. Field sanitation is done using procedures that prevent weeds from growing or spreading. The utilization of clean seeds (certified clean), clean tools, and clean equipment is the most crucial of these applications. Thus, new weed seeds are prevented from entering the field and weed density is reduced. Removing some weeds from ditches, field edges, and pits is the most important factor in stopping their spread. In terms of field cleaning, weeds should be eliminated from the field before they establish seeds.

a. Using certified weed-free seed: The supply and planting of clean seed constitutes the first stage of any effective weed management program. Because of the use of contaminated crop seeds, some weeds are more likely to spread from year to year.

b. Cleaning of tillage and harvesting equipment: The transfer of weed seeds and vegetative organs clinging to farm equipment from one place to another is an important factor in the spread of weeds.

c. Removing harvester waste out of the field: A significant number of weed seeds are present in harvester residues. Weed seeds that have not shed their seeds before harvesting are mixed with harvester residues. To avoid the shedding of weed seeds before harvest, the cultivated crops must be harvested as soon as possible.

d. Fermentation of manures: The majority of weed seeds that don't lose their viability are seriously affected by well-fermented manure.

e. Weed-free animal feed: It is critical to avoid feeding weed seed-containing materials (hay, grain, etc.) to farm animals.

Using weed-free gravel, sand, and soil is preferable, and weeds must never be allowed to grow along irrigation channels, fence lines, or cropland.

3.2. Cultural weed control:

To create favorable conditions for the crop, a variety of cultural activities including selection of variety, tillage, planting, fertilizer application, irrigation, etc., are used. While cultural approaches cannot eliminate weeds, they can help to reduce their population. Therefore, they ought to be utilized in conjunction with other strategies. Healthy plant cultivation boosts the cultivated crops' ability to compete with weeds. Some applications may be taken into consideration for this purpose. Thus, the culture increased competition with weeds in terms of the plant's light, water, and nutrient needs. A component of integrated weed management, which includes the coordinated application of cultural, manual, and/or mechanical control approaches, is cultural weed control. From the time of sowing, until the crop canopy closes, weeds must be controlled.

a. Selection of variety: The seeds of cultivars that will be planted must be adapted to the region, germinate uniformly, have high germination vigor, and be disease and pest-resistant.

b. Competitive cultivars: There are two approaches to guarantee a cultivated plant's success in the competition by providing it with the light, water, and nutrients it needs: product in the presence of weeds ability to maintain efficiency, and feature enough to suppress weeds. The cultivation of competitive varieties reduces the development of weeds, prevents weed invasion caused by interruption of weed seed production, and provides effective weed control. These cultivars should be tall, have early covering, a high shoot density, a large leaf area index and coverage area, and have high root biomass and root weight. Weed emergence time, weed density, and weed type are the three main factors influencing crop-weed competition. Weeds that appear concurrently with or before the cultivar will, of course, be more competitive than weeds that appear after the cultivar's development, as they dominate the land.

c. Field preparation: Weeds must be kept out of the field. Weeds should not be allowed to flower. This aids in the prevention of weed seed population growth.

d. Tillage: The depth of tillage, has a direct impact on weeds. Weed seed and vegetative organs in the soil are impacted as plowing depth increases, which reduces weed growth in the field. Since weed seeds cannot be buried deep or remain in the upper layer, they can easily germinate again in soils without surface tillage or cultivation. Another strategy to lower weed density is to tillage using a different technique each year.

e. Optimal plant population: Insufficient plant population causes weed infestation. To achieve a proper and uniform crop stand that can compete with weeds, it is crucial to follow procedures such as selecting the right seed, using the correct sowing technique, using a sufficient seed rate, etc. Due to better planting tools, the availability of high-quality seeds, and successful weed control initiatives, growers should be able to control their seeding rates with a high degree of precision today. The idea is that the more space the crop takes up in the rows, the fewer occupancy weeds have to invade. Weed suppression will be dependent on the distribution pattern of the canopy foliage and rooting system.

f. Crop rotation: Weeds, diseases, and pests become more dense and destructive in monoculture (Blackshaw et al., 2007). The best way to control pests through cultural measures is to differentiate between crops in the rotation (Francis & Clegg, 1990). Since weeds magnify in products that can grow and develop under the same conditions, the application of rotation helps to control weeds. The process of producing various crop plants on the same agricultural land at regular intervals, one after the other, is known as crop rotation. Crop rotation provides unsuitable conditions for a certain weed species, thus preventing the development and reproduction of that species. The soil becomes exhausted when crops are planted successive to one another, and weeds become more vigorous nearby. Crop rotation helps stop the spread and population increase of invasive weed species. Crop rotation decreases issues like weeds, insects, and diseases but also enhances soil fertility and structure, enhancing crop production and reducing the use of herbicides in weed control. Crop rotation is becoming an increasingly popular strategy for weed control, particularly in terms of sustainable agriculture. To control weeds, it is also a good alternative to use cover or suffocating plants in crop rotation. A good crop sequencing in rotation reduces weed density during germination and emergence of the crops, thus minimizing yield loss. In addition, it prevents the proliferation of weed species that are difficult to control in the long term.

g. Planting technique: Planting techniques that promote the growth of the cultivated plant but are unsuitable for weeds should be used, taking into account the climate-soil-culture plant.

h. Intercropping: The basic goal of co-planting is to increase the production of multiple products rather than just a single crop. The ecological variety on the land is increased via the "Intercropping" method, which is regarded as another cultural measure that increases the competition of the crops against weeds.

ı. Stale seedbed: If the seedbed preparation is delayed, some weed species develop and cover the field before planting the crops. By using this method, the crop can grow in a practically weed-free conditions.

i. Cover crops: Although cover crops are used to control weeds and keep the soil moist, they are not usually chosen since the chosen cover crops might compete with the primary crop. It is preferred to be utilized as crop rotation or green manure instead. Cover crops used as green manure are plants that are planted in the soil before the main crop and are used by mowing just before the main product is planted or mixed directly with the soil without mowing. It is a crucial procedure that supports the sustainability of the agricultural ecosystem. When grown as a cover crop alternately cultivated crops, some varieties (like wheat and rye) offer economic advantages. While nitrogen provides benefits such as satisfying the need, decreasing pesticide residues, preventing erosion, and lowering plant pests by attracting beneficial insects to the environment, cover crops improve the physical, chemical, and biological qualities of the soil. Leguminous plants and grass plants are the two main plant families that include cover crops. Among them, *Fagopyrum esculentum*, *Helianthus* spp., Brassica spp., and *Raphanus sativus* are the most well-known cover plants.

j. Drainage and irrigation: An effective method for preventing weed infestation in the field is through drainage and wise irrigation system selection. The use of flood and sprinkler irrigation enhances the weed population. Drip irrigation is hence efficient in terms of both water use and weed control.

3.3. Physical weed control

Since humans first started cultivating crops, mechanical or physical weed control methods have been used. One of the first weed management techniques remains valid today and is economically feasible: physical control approaches.

a. Hand weeding: It is most likely the earliest method of weed control, and it is still a useful and effective way to get rid of weeds in both cropped and uncropped areas. It's effective against annuals, biennials, and only the tops of perennials. Before the weeds produce seeds, hand weeding should be performed. In small agricultural areas, green areas (grass), areas with recent contamination, and situations where agricultural machinery cannot access, hand weeding is generally used.

b. Hoeing: For years, the hoe has been the best and most used weeding implement. Hoeing is a practical and efficient weed control technique used with crop species. In addition to weed control, it can also be used to maintain water in the soil and loosen the top layer of soil. It achieves well to control biennial and annual weeds. The efficacy is significantly lower because of that resprouting of perennials' underground plant parts. Before the weeds produce seeds, hoeing should be performed.

c. Digging: Digging is a very effective way to get rid of perennial weeds' subsurface portions that are responsible for spreading the weeds in the deeper soil layers.

d. Mowing: Mowing is generally done to prevent weeds from giving seeds, to reduce their competition with the cultivated plant, and to empty the underground organs of perennial weeds. The majority of the time, this method is used in nurseries, orchards, fodder crops, meadow and pasture areas, vacant lands, and row planting places. Mowing is done without weeds forming seeds. Repeated mowing not only stops perennial weeds from seeding but also reduces the materials stored in the underground organs.

e. Burning: Using fire or burning is frequently a cost-effective and useful way to control weeds. Depending on the crop and the area, burning may be used to control some weeds. It is used in conditions when cultivation and other conventional procedures are impractical. This technique is typically used to control weeds between rows of cultivated plants that are grown in rows. It may also be favored for weed management in irrigation channels, along the sides of roads and railroads, and on empty land. The burning process is carried out in different ways depending on the purpose and application area. It is used in several ways depending on the purpose and the application area, such as pre-harvest and post-harvest burning, non-selective burning of all plants on the soil surface, band burning or between rows, and selective burning of all plants on the soil surface.

f. Flooding: By flooding weeds at the beginning of their growth, this approach aims to break their connection to the atmosphere. Groundwater calcareous and non-saline soils provide effective weed control. Flooding usually succeeds if weeds are completely submerged for prolonged periods.

g. Electromagnetic rays: The techniques for controlling electromagnetic radiation, whose application has been studied recently against weeds, can be employed successfully in practice if the essential changes are implemented. These techniques will have the chance to be effectively employed in orchards, vineyards, and cultivated plants grown in rows, particularly in robotic systems where cutting-edge technologies are used to identify between weeds and cultivated plants with the use of sensors. These technologies limit the use of input and environmental harm by applying the chemical just where there are weeds rather than throughout the entire field (Kitiş & Avuşolu, 2014).

The rays, which are the subject of weed study, damage or inhibit the growth of weed seeds and weed plants, incurring. There are six different types of electromagnetic rays: microwave, UHF, infrared, ultraviolet, gamma rays, and laser. Some are used for weed control and some are still in the research phase.

h. Mulching: Since the soil surface is covered with light-proof material, even if the weed seeds germinate and come to the soil surface, they cannot continue their lives because they cannot photosynthesize. In this respect, mulching is one of the most successful weed control methods.

Although mulching often involves the use of black polyethylene coverings, both organic and inorganic materials can be utilized. There are several organic and inorganic materials that may be utilized, including pine shavings, pine chips, wheat straw, paper, wood shavings, plant stems, peat, shredded corn cobs, grass cuttings, perlite, oyster shell, nut shell, pumice, coarse sand, and bamboo. To control weeds by inhibiting light, these materials should be utilized at least 10 cm thick.

ı. Solarization: Solarization is the process of heating the surface soil with plastic covers laid on moist soil by taking advantage of the sun's rays. Solarization is applied in the summer when the sun's rays are highest, and it can be useful for controlling weeds that are problematic in the spring and fall. Some weed seeds lose their ability to germinate on the soil's surface. The effects of a high temperature might cause dormancy to be broken. These seeds produce seedlings, but extreme temperatures cause them to die. On annual weed species, it usually works. The sensitivity of the seeds to temperature is the basis of solarization application success. Weeds in cultivated crops can be effectively controlled by applying soil solarization before planting. Before planting spring-planted crops like tomatoes, peppers, zucchini, and cucumbers, solarization, which is performed in greenhouses or temperate tropical climates, can be used. Also before strawberry planting in the field, it can be used.

3.4. Biological weed control:

It is a method of controlling weeds by using their natural enemies. Agents including parasitic plants, bacteria, viruses, fungi, insects, birds, and fish are natural enemies.

3.5. Chemical weed control:

Chemical control becomes necessary when other control approaches are unable to achieve the desired results in the management of weeds. Herbicide usage has increased more than other weed-control methods. Herbicides are substances that can kill or slow the growth of weeds. Man has substantially increased his weeding effectiveness by integrating traditional weeding methods with herbicides.

3.6. Integrated Weed Control:

Applying a program (combination) of several agricultural techniques as well as cultural, mechanical, physical, and chemical weed control treatments is known as integrated weed control. As a result, any weed control method's dependence and risks are reduced. The goal of integrated weed management is to retain weed density at a manageable level and stop weed control from evolving into a more challenging form (in terms of species, variety, reproduction, and density). As a result, crop losses caused by weeds can be reduced while maintaining farm profitability. Weeds can become resistant to only one or two techniques of weed control over time. Weeds develop resistance to herbicides if they are exposed to the same active ingredient repeatedly over time. The weeds have a chance to adapt to such conditions when the same sort of crops are grown in the same area.

4. Conclusion and Suggestions

Urban agriculture improves biodiversity and air quality in cities, reduces waste generated by urban areas, and reduces the total environmental effect of food transportation and storage. Depending on the existing site features, urban agricultural activities can be conducted in a variety of locations, including community gardens, household gardens, parks, fruit trees planted along roadsides, green roofs, walls, and greenhouses. The principal advantages of urban agriculture are seen in the production of horticultural items. Urban horticulture is the most competitive branch of urban farming due to the high cost of urban land and the need for high water- and fertilizer-use efficiency. Weed control is an important component of urban agriculture. Weeds cause significant problems for agriculture because they compete with cultivated plants for resources like water, nutrients, and sunlight. As a result, crop yield and quality decrease. Additionally, allelopathic characteristics in over 240 weed species have been discovered (Colquhoun, 2006). Approximately 6700 weed species have been identified as a problem in global agriculture (Holm et al., 1979), with 76 of these species being the most problematic weeds (Holm et al., 1977). To develop an efficient integrated control system against weeds, it is crucial to carefully evaluate the interactions between cultivated plants and weeds. To keep weed infestations to a minimum so that crops may be produced commercially and other human activities can be carried out effectively practice weed management. Thus, weed management becomes a vital component of agriculture. Weed control is one of the most demanding agricultural activities, accounting for a large amount of agricultural output costs. There are multiple effective methods of nonchemical weed control in urban agriculture and the best method will depend on the weed species present, control cost, and efficacy. Without using herbicides, adequate weed management may be achieved with careful planning and the use of integrated techniques. Mulching, plant selection, planting design, and a variety of additional pre- and post-planting approaches, such as decreasing the soil nutrient status, steam thrower techniques, flame thrower techniques, and manual removal, have all been used as alternatives to herbicides. We can prefer non-chemical weed control techniques to maintain eco-friendly relationships while keeping weeds under control.

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Evaluation of Urban Agriculture in terms of Animal Production

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1. Introduction

The expansion of urban areas and the openness of surrounding rural areas to build up together with the migration from rural to urban areas caused a decline in agricultural areas. This situation creates the problem of food security and in terms of sustainability, agricultural activities were defined as urban activities and the concept of urban agriculture was revealed (Yenigül, 2016).

Urban agriculture does not have a universally clear definition; for ensuring vegetative and livestock products on private property or communal land, generally within urban areas; defined as a processing industry that produces food or fuel, reusing natural resources and urban waste, through the intensive application of factors of production (Yılmaz, 2015; Bins & Nel, 2019). Urban agriculture practices in the agricultural lands around the city prevent the use out of the purpose of these areas and bring the producer closer to the market as an alternative farming method (Bingöl, 2019). Integration of agriculture in the city plays a supportive role in local food systems and complements rural agriculture (Türker & Akten,2020). In addition, urban agriculture is a system that aims at sustainable resources and waste management (Türker & Anaç, 2022).

Types of urban agriculture have been grouped in different shapes in the literature. Smit et al. (1996) classified the products in urban agriculture gathered into five groups horticulture, water, livestock, agroforestry, and other products. Livestock products in this grouping include milk, eggs, meat, manure, leather, and hide products. On the other hand, Mbiba (2000) on the other hand, considers urban agriculture according to its location divided into three groups agriculture on the land, agriculture off-land, and environmental agriculture.

Urban agriculture has provided advantages in terms of the economy and environmentally. Urban agriculture, in terms of the economy, provides advantages such as reducing the maintenance cost of public spaces, increasing employment and income, effective valuation of resources and increasing property values, and reducing consumption costs of households. In terms of the environmentally, it is providing a positive effect by reducing its ecological footprint and thanks to the recycling of organic waste by providing sustainability (Rasouli, 2012; Graefe et al., 2019).

Increasing food demand in urban areas has led to increased investment and applications and has led to its becoming evident in urban residential areas (Popoola et al., 2020). Urban agriculture is particularly suited to perishable, diversified, labor-intensive, and high-income areas more suitable for special crops (Zeunert, 2018). However, the high consumer demand for these products and urban agricultural activities made this purpose attractive (Specht et al., 2016).

In recent years economics has been brought on issues in many developing countries for many reasons the as the oil crisis, wars, droughts, climate change, the rapidly growing world population, distorted industrialization, country policies, hitch in economic management, and inability on creating employment, etc. Depending on these reasons, the decrease in productivity in rural and urban areas, people began to experience a drop in their income and therefore problems in the balance of payments. This situation has caused the mobilization of regional and local dynamics; people to overcome both these economic problems and the anxiety of accessing safe food started to deal with agriculture in the urban area.

Traditionally, people of lower socioeconomic status have undertaken urban agriculture. However, recent research, shows that a large number of people are engaged in urban agriculture for different social, economic and cultural reasons.

This study, it is aimed to evaluate the place and importance of animal production in urban agriculture. This purpose, how animal production is grouped in urban agriculture, and it is focused on the types of animal production, legislative regulations on animal production and their environmental effects have been revealed. At the end of the research, it has been tried to bring solutions to the issue.

2. Grouped Animal Production Models in Urban Agriculture

Especially in developing countries, with the rapid increase in urbanization, economic development and income increase have occurred, leading to an increase in the demand for foods of animal origin (Hatab et al., 2019). As well as this demand income status, vary showing to depending on climatic conditions, available technologies, and cultural preferences (Artmann & Sartison, 2018).

Animal production, despite its unique problems, by offering opportunities has often been part of urban agriculture (Asma & Sarah, 2018). From a scientific point of view, because it has great potential for recycling nutrients and can be integrated with agricultural product growing systems, it has been an area of field of interest (Graefe et al., 2019). However urban areas are unnatural areas for animal production and the Concern that they will reduce the quality of life of individuals, has caused limited scientific research (Specht et al., 2016).

In the literature and legislative provisions on urban agriculture; animal production, are entered the scope of small-scale animal husbandry (poultry), beekeeping, and aquaculture (Sağlam, 2018). As potentially, categories of lands deemed suitable for urban agriculture and products produced according to production scale differ. The scale of production is micro; in small-scale urban agriculture and community garden categories poultry and beekeeping production activities are suggested; animal farm activity is recommended in large-scale urban agriculture with a macro production scale (Türker, 2020). Particularly, existing lands are rocky and where there is limited space for agricultural production urban livestock farming is more recommended (Popoola et al., 2020). In this way, animal production has entered the scope of environmental agriculture as a location, and out of urban spreading is taking place (Alğın, 2021).

3. Varieties of Animal Production in Urban Agriculture

Urban agriculture is made to integrate animal production; has advantages such as food security, earning economic income, and providing biodiversity (Whittinghill & Sarr, 2021). Animal production in urban agriculture; mainly in African and Asian countries, is mainly carried out as poultry farming (Kanbak, 2018). Urban green spaces and pollination required for honey production are important living areas that provide important resources (Sarı, 2021). Ponds in cities and reservoirs in parks are contributed to aquaculture and wide bodies of water help reduce the impact of global warming (Qui et al., 2013). It is observed that livestock farming, such as ovine and bigwig, remains outside the urban agriculture model (Specht et al., 2014).

If poultry farming activities are in urban agriculture, it is carried out as hobby poultry farming with markets and urban farms (Alğın, 2021). Poultry in urban agriculture is cheap and easily available being a source of protein, and increased energy in food production, because it reduces transportation costs and is easy to produce in small gardens on poultry farming, has recently started to become as well as widespread commercially (Kejela et al., 2019). Where production place is limited or restricted, to the extent allowed to the coop and provided that meets the requirements, spaces are maximized using vertical structures (Meenar et al., 2017; Uko, 2020). Such structures: such as the in bulk state of lands, the shrinking of the enterprises over time, adverse weather conditions, etc. There is ought to require to be no problems, in a short time the city dwellers also includes advantages such as reaching fresh and reliable food (Şahin & Kendirli, 2016).

Beekeeping activities in urban agriculture are carried out in markets and urban farms, for commercial purposes or as a hobby. Commercially agriculture or in non-agricultural areas such as parks, in unused openings such as roofs urban honey production activities are carried out (Alğın, 2021). Urban honey production, though beekeeping activities are discussed in public; especially residential beekeeping on including it has become an exponentially increasing activity due to the diversification of opportunities. Moreover, thanks to its pollinator feature in the backyard and urban farms in urban agriculture, contributes to the increase in productivity in production (Langelotto et al., 2018; Mengual et al., 2018). Despite urban beekeeping activities emerging as a hobby and industry, in addition to contributing to honey and agricultural production, it can also increase the environmental quality of the city (Kohsaka et al., 2017).

In urban agriculture, in aquaculture fish production is generally common. Thanks to their biological systems (hydroponic) living in urban agricultural farms, fish, and crop production are produced in the same environment, and soilless farming techniques circulating in a ring closed loop system of water and nutrients, are also widely used. The aquaponic farming system, which is at an advanced level of this, is being ensured the sustainability of this situation and becomes more efficient than a traditional hydroponic system (Şeker, 2021). Although fish production is a secondary product in these systems, it is been the main member of the system; the most commonly produced species are Trout *(Oncorhynchus mykiss)* and Freshwater Sea Bream *(Tilapia)*. (Bingöl, 2019). Soilless systems used in such urban farms are in general defined as controlled environment agriculture (Wadumestrige Dona et al., 2021).

In addition to animal production, in urban agriculture, fertilizer, an economic product, provide a significant advantage. Farm manure is the leading product; especially for the energy needed in vertical farms is one of the leading entries (Şahin ve Kendirli, 2016).

3.1. Legislation arrangements for animal husbandry in urban agriculture

Animal production in urban agriculture is an important subject topic of discussion from the past to the present. Historically, restrictions on the subject and policy gaps, in production activities problems and difficulties arise (Meenar et al., 2017). In particular, the legislative regulations on animal production, the fact that it is aimed at the development of rural areas has led to the fact that it is not associated with urban areas (Yenigül, 2016). However, in the animal husbandry field in urban agriculture; provided that the public control of the products and wastes that may occur in cities with the least discussions gradual transition opportunity has been provided (Brinkley & Vitiello, 2014). However, in some cities, legislative arrangements are not clear; even in some parts of the city observing changes in animal production are caused to affect the production options (Preiffer et al., 2014).

Although creating policies for urban agriculture may appear simple, due to the distribution of tasks between different public institutions, there are so many difficulties in implementing them. For this reason, despite the development of urban agricultural policies in the last 20 years, it is seen as a difficult area to define (Gaspard, 2021). Especially; intended for efficiency related to animal production in urban agriculture, stakeholder expectations should be met in the planning of policies and must be sensitive to local conditions (Asma & Sarah, 2018).

Urban agriculture, lack of animal husbandry in the model, and limiting agricultural production and protein sources, pose problems for farm sustainability and food security (Preiffer et al., 2014). For this reason, several policy, planning, and social initiatives are provided in some cities to encourage legislation to allow beekeeping and small-scale animal husbandry (Zeunert, 2018). However, in this legislation, for urban life, it is observed that the qualms on continue (Brinkley & Vitiello, 2014). In addition, in such cases, require permitting or neighbor approval, limitation of some animal species and determination of number quota, design of animal shelters, dimension, and their voltage requirements are expected to be provided (Meenar et al., 2017).

In addition to the advantages of animal husbandry activities in urban agriculture; there are also disadvantages, primarily in terms of health. For this reason, the oldest legislative regulations in urban agriculture, there were, foremost health-related issues, related to animal husbandry. (Gaspard, 2021). Animal wastes resulting from the production activities, antibiotics, and for reduce of the effects of agricultural pesticides, depending on the population density of the city and the type of animal brings limitations on the number of animals and production areas (Dölekoğlu & Gün, 2021). Also, in terms of ecologically, such as noise, bad smell, and discomfort, with legal regulations posing a danger to human health; the prohibition of animal husbandry and fattening, is one of the biggest obstacles to animal production in urban agriculture (Menteş & Aslan, 2021).

3.2. Environmental effects of animal production in urban agriculture

Temperature rises and excessive precipitation caused by climate change have increased diseases in plants and animals, reduced soil quality by reducing productivity, and led to a decrease in productivity in urban agriculture. Barely, to be able to adaptability of urban agriculture to climate change, transport distance of food, and reduction in carbon dioxide production, which causes greenhouse gases it has been observed that it has environmentally positive effects (Artmann & Sartison, 2018). Despite these positive effects, practices arising from the lack of knowledge and equipment on urban agriculture can cause negative impacts on the environmentally (Menteş & Aslan, 2021).

Although the use of chemical fertilizers is allowed to provide high yields and out-of-season crops, it has been observed that it harms the environment and human health (Sağlam, 2018). The use of animal manure instead of the use of chemical fertilizers provides a healthier but slower growth of the product (Turan, 2015). In animal production in urban agriculture, fertilizer resulting from most common carried out poultry farming have rich in elements. Even though suitable for crop production this fertilizer is rich in nitrates since it should be given to plants by burning not widely used (Yılmaz, 2015).

The use of chemical fertilizers in urban agriculture; the high use of agrochemicals and the discharge of waste waters resulting from these to open water sources cause public health and environmental concerns (Amadou et al., 2014). Also, it is aimed to protect public health by establishing epidemiological and microbiological standards so that wastewater can be used in urban agriculture (Yılmaz, 2015).

Urban agriculture, also, feeds the animals with organic household waste, which is an important factor in reducing environmental pollution (Graefe et al., 2019). In this situation, it is accepted that it plays an important role in the greening of cities and improving the climate; it is also accepted as one of the ways to adapt to climate change (Specht, 2014). Also, closed systems such as aquaponics in animal production in urban agriculture; through the use of pesticides, and organic and chemical fertilizers are prevented from leakage into the environment reducing pollution and providing on protected for biodiversity (Nkrumah, 2019). Reducing as well urban waste by turning it into fertilizer, are contributed to improving biodiversity and air quality (Dölekoglu & Gün, 2021). Despite these advantages provides of fertilizers and waste, it is observed that the requests and incentives are still limited for various reasons in developing countries (Tadesse et al., 2021).

4. Conclusion and Suggestions

Thanks to its advantages on the economic and environmental aspects of urban agriculture, applications began to spread; activities carried out as a hobby accelerated their transformation into commercial purposes. Economic growth and development in cities increased the demand for animal production; in poultry, honey, and aquaculture the importance of animal production in urban agriculture has started to increase.

From urban areas being unnatural areas for animal production to restrictions on animals in urban areas from human health and ecological point of view and determined policies have been the subject of discussion throughout history; this situation limits production and constitutes difficulties. To overcome these difficulties, information meetings should be held to increase animal production in urban agriculture within the framework of the legislation determined, and facilitation and incentives for market access should be provided. Also, for animal production activities in urban agriculture certain cities should be selected as a pilot region, it should be implemented without any restrictions and should be removed from the limitation of agriculture to the countryside. Despite the create on disadvantages of climate change, conscious execution of practices in urban agriculture contributed to its high adaptation to conditions. In agricultural activities use of animal manure; disposal of agricultural pesticides and wastes by standards, feeding organic waste with animals, and turning urban waste into compost constitute these conditions. Due to health and environmental concerns, demand for these applications is low; therefore, regional and local-based incentive practices should be provided, and notifications should be made on agricultural extension activities.

Thanks and Information Note

The article complies with national and international research and publication ethics.

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The Improper Use of Agricultural Landscape due to Urbanization: The Case of Çanakkale City

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1. Introduction

Today, as a result of rapid population growth and the urbanization, the natural balance of the landscape is first disrupted; then, its cultural structure is damaged; and thus, major changes occur on all landscapes over time (Demir & Demirel, 2016; Nayım & Uzun, 2018). Urbanization is permanently changing land uses all over the world (Ricketts & Imhoff, 2003). In particular, landscape patterns in cities and their immediate surroundings are greatly affected by anthropogenic changes in land cover during urbanization processes (Yeh & Huang, 2009). As a result of these changes in the landscape, agricultural landscapes are undoubtedly the most damaged landscapes (Brueckner, 2000; Brueckner, 2001). The transformation of agricultural landscapes in the urban immediate surroundings, also known as the urban periphery, is a global problem today and is unfortunately increasing dramatically on each passing day (Doygun, 2017).

The most common concept in the process of transformation and damage to agricultural landscapes is the improper use of land, especially, due to urbanization. As stated by Cengiz (2013), the improper use of land takes place on fertile agricultural lands, which are generally I. II. and III. class agricultural lands. These lands host all kinds of plants, are flat, have good drainage, have high soil depth and should never be used for non-agricultural purposes.

According to Kayıkçı (2005), the most important part of the soil as a natural resource that produces food and feeds all living creatures is agricultural land (Sezgin, 2010). Agricultural land subjected to improper use is not used in accordance with its potential and therefore cannot meet its main purpose of providing food.

In order for natural and cultural landscapes to meet the needs, they must first be protected and used in accordance with their potential in a planned manner (Aydoğdu et al., 2012; Mutoko et al., 2014). The conservation of natural and cultural landscapes depends on many ecological factors, but above all, on the use of land in accordance with nature. This approach basically involves dividing the country's land into "Land Use Capability Classes (LUCC)" in terms of its suitability for various uses (agriculture, forest, settlement, industry, etc.) (Kışlalıoğlu & Berkes, 2009). The use and development of agricultural landscapes in the context of land use capability classes is of utmost importance for the sustainability of agriculture.

Generally, land use transformations are primarily in the form of transformation of agricultural lands into urban areas due to the development of residential areas in the vicinity of agricultural areas. We can observe the physical examples of such transformations in our country (Doygun, 2017). Reflecting the effects of recent rapid urbanization on agricultural lands, Çanakkale city is one of these examples.

For the purpose, we first explain the concepts of agricultural landscape, its improper use and rapid urbanization as the primary reason for that, are explained. Then, the interaction of the characteristics of the LUCC, which prioritize the use of agricultural landscapes, with urbanization as the most important reason for the improper use of agricultural landscapes, is examined based on the conservation and sustainable use of agricultural landscapes.

1.1. Agricultural Landscape as a Subclass of Landscape

According to their cultural, biotic, and abiotic elements, landscapes are classified under two categories: natural and cultural landscapes. Cultural landscapes are further classified into rural and urban landscapes according to the characteristic differences they have (Gül, 2000; Demir, 2019; Korkut & Kiper, 2021). However, there is no clear distinction for the elements that still exist or change in the landscape in terms of temporal depth (Demir, 2019). For this reason, there may be different expressions and interpretations in the sub-headings of the main classifications. The following are the main classes of landscape and their related sub-headings (Figure 1).

The character of agricultural landscapes, as the examples of transition from natural to cultural landscape (Tırnakçı et al., 2018), the constituent of the cultural landscapes (Gülçin, 2019), and are also traditional cultural landscapes (Cullotta & Barbera, 2011), are mainly formed by natural landscape elements such as land structure, soil characteristics (land use capability classes, large soil groups, erosion, soil depth, etc.), topographical features, water and climate (Açıksöz & Tanrıvermiş, 2000; Gül, 2000; Korgavuş, 2012). Natural landscape elements also interact with the culture of the place in which they are located, and reveal agricultural landscapes in various forms (Gül, 2000; Erduran Nemutlu, 2017; Atik, 2019).

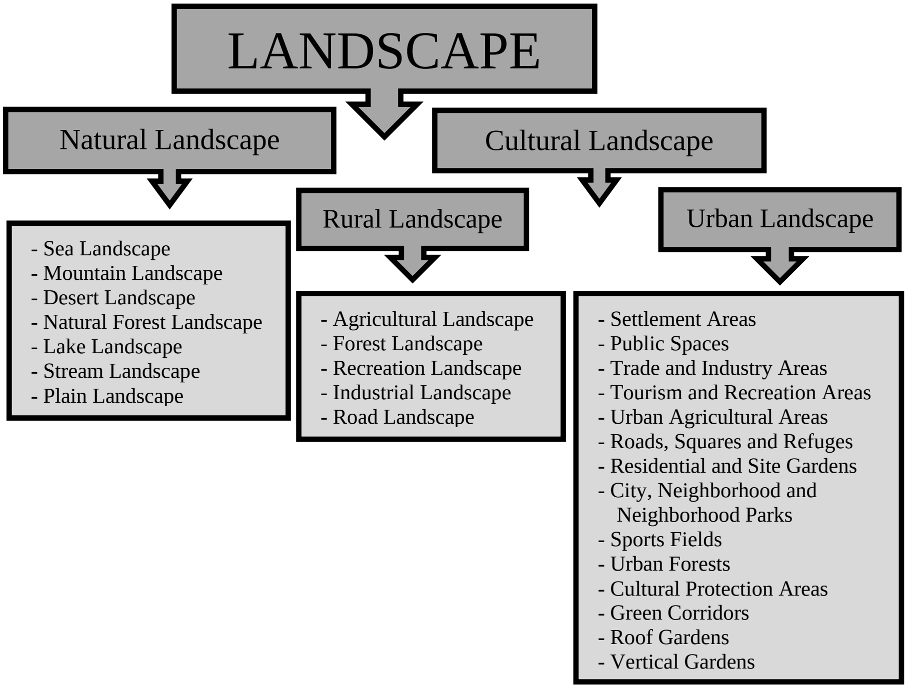

Figure 1. Landscape Classification (prepared by using Gül, 2000; Demir, 2019; Korkut & Kiper, 2021)

Most agricultural landscapes are a mosaic of farmers' fields, semi-natural habitats, human infrastructures (e.g. roads, dams, etc.) and rarely natural habitats (Açıksöz & Tanrıvermiş, 2000; Marshall, 2004; Chopin et al., 2019). On the other hand, agricultural landscapes represent the cultivation of agricultural products by people for economic purposes (Açıksöz & Tanrıvermiş, 2000; Tırnakçı et al., 2018). Agricultural landscapes have many ecological, economic and social impacts. They conserve the soil, create aesthetic appearance in the green texture, create wildlife habitat and contribute to tourism as well as agricultural product production (Bürgi, 2004; Lin et al., 2015;

Tırnakçı et al., 2018; Novikova et al., 2019; Türker, 2021a). As one of the most dominant landscapes in the terrestrial area, agricultural landscape contributes greatly to be prevented global climate change global biodiversity conservation while providing staple food crops (Liu et al., 2014; Chopin et al., 2019; Türker et al., 2021). In addition to all these, agricultural landscapes stand out as the most important solutions for sustainable development goals related to the environment and food security (DeClerck et al., 2016). Agricultural landscapes have been indispensable for the continuation, development and sustainable development of rural and urban areas thanks to their cultural, economic and ecological characteristics (Liu et al., 2014; Cengiz et al., 2014; Landis, 2017; Çolak & Memişoğlu, 2018; Tırnakçı et al., 2018; Gülçin, 2019). They can continue to exist as a resource value in line with the protection of the agricultural landscape characteristics of the region (Doğan & Erduran Nemutlu, 2018). Thus, it is extremely important to protect, develop and use agricultural landscapes in line with their purpose for the sustainability of agriculture (Demir et al., 2011; Gülçin, 2019; Akci et al., 2016; Türker, 2021b; Karadağ et al., 2022).

1.2. The Improper Use of Agricultural Landscape

In addition to human activities, land use/land cover on the earth changes rapidly due to natural disasters (Tağıl, 2006; Kizos et al., 2010; Kurtşan & Nurlu, 2020). Land use/land cover change is one of the fundamental problems of sustainable development today (Falcucci et al., 2007; Pelorosso et al., 2009). This largely human-induced change has a devastating impact on the landscape and today the greatest global transformation is under way in this fashion (Lambin et al., 2001; Pelorosso et al., 2009). Over the past 300 years, an estimated 30-50% of the world's land surface has been transformed by human actions (EEA, 2017; Dıkçınar Sel, 2021). The most striking of them belong to agricultural landscapes. Today, the most common concept in the transformation of agricultural landscapes is its "improper use".

Although it is a concept generally used for agricultural landscapes, Greene & Stager (2001), Livanis et al. (2006) and Kılıç (2010) state, the improper use of land, which causes large-scale loss of productive land, has been an important agenda item for all developing countries since the 1980s.

Today, the extremely limited availability of arable land and the increasing improper use of these lands have led to significant degradation and loss of agricultural land (Keleş & Hamamcı, 1993; Yalçıner Ercoşkun & Karaaslan, 2009). Food is one of the most important of vital needs. The need for human nutrition has continued to increase until today and will continue to do so in the future (Bayramoğlu, 2010). Therefore, agricultural lands should be protected and should never be used for other purposes (Akci et al., 2016). As Kılıç (2008) states, the general reasons that lead to the improper use of agricultural land are the reasons that can be encountered in every society today.

These are rapid and unhealthy urbanization, uncontrolled industrialization, tourism and infrastructure investments, unplanned use of land and legal and administrative problems (Ünal & Başkaya, 2000;

Yılmaz, 2001; Özbek & Öztaş, 2004; Karakayacı, 2010). All these reasons lead to a large proportion of agricultural landscapes to be improper used, especially in developing countries. Among these, the most common and destructive cause is rapid urbanization, the biggest problem in developing countries.

1.3. Rapid Urbanization

Throughout history, human settlements have mostly spread around fertile agricultural areas where food can be obtained (Yiğitbaşoğlu, 2000; Yılmaz, 2001). However, today, as the population of cities increases, it is observed that they develop on the agricultural areas in their immediate surroundings (Yılmaz, 2001; Doygun & Erdem, 2014). It is estimated that, in 2018, about 55.3% of the world's population lived in urban areas. And, by 2030, cities will house 60% of the world's population and one in three people will live in cities with at least half a million inhabitants (UN, 2018).

It is also estimated that by 2050, the proportion of people living in cities will increase to 88% in high-income countries; to 83% in upper-middle-income countries; to 59% in lower-middle-income countries; and to 50% in low-income countries (Figure 2) (UN, 2019).

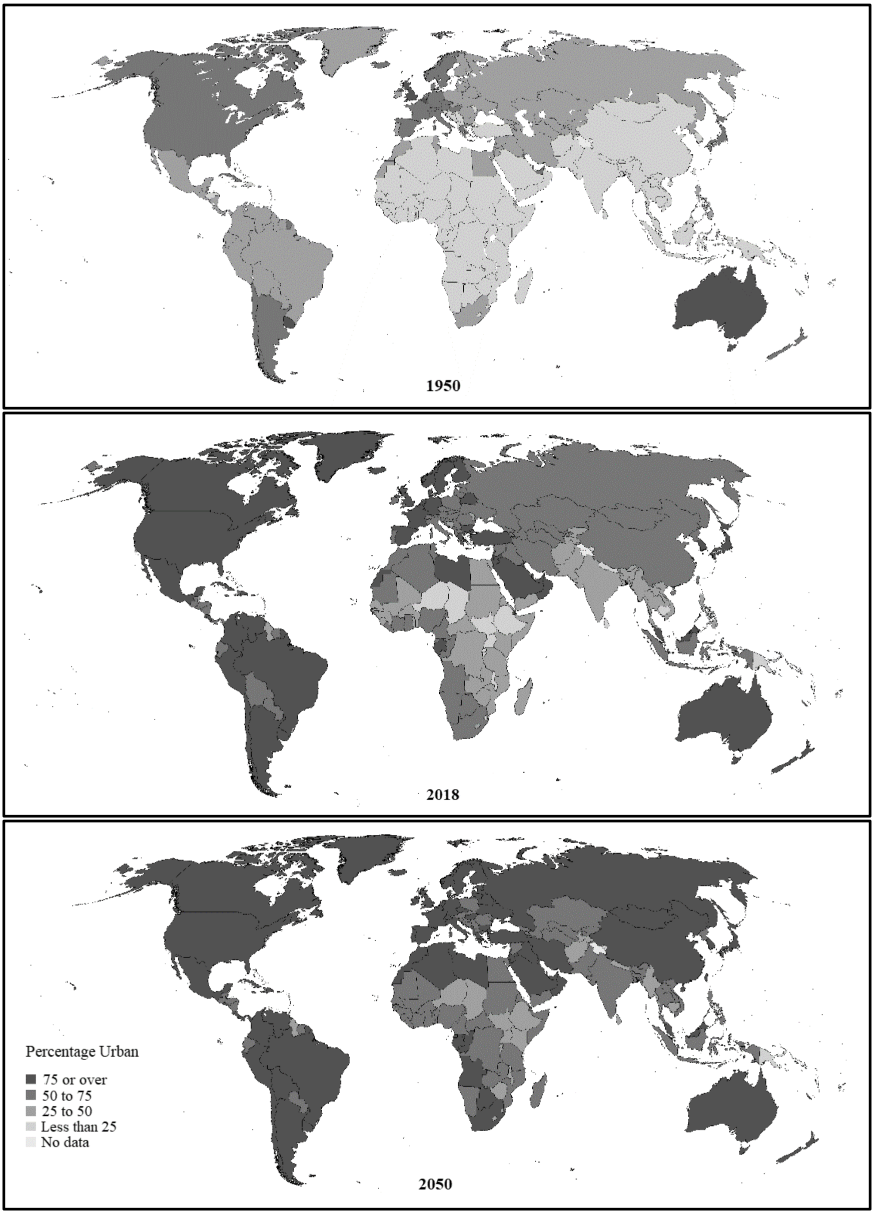

Figure 2. Percentage of Population Residing in Urban Areas, 1950, 2018 and 2050 (UN, 2019)

In the next two decades, most developing countries will be host more urban population than the rural areas. While the benefits of urbanization cannot be ignored, the pace and scale of this transformation will lead to many other problems (Montgomery et al., 2003). The first and most fundamental of these problems is the need for housing for the growing population.

Rapid population growth and the accompanying rapid urbanization naturally increase the need for new settlement areas; thus, the rate of construction is gradually increases (Tağıl, 2006; Sezgin, 2010; Sezgin & Varol, 2012). Various social, ecological and economic problems arise in cities as a result of this dire situation.

There are major changes in the number and quality of urban settlements, population size, number and share of urban dwellers, and land use (UN, 2019). Among these, the most dramatic and lasting change occurs in existing land uses.

Urban growth caused by rapid and unhealthy urbanization puts pressure on forests, water resources and areas surrounding urban areas. The most affected by this pressure is undoubtedly agricultural landscapes **(**Figure 3) (Akseki & Meşhur, 2013). As the basis of ecosystems such as soil, water, land, etc. on which food production depends, agricultural landscapes are under great pressure today due to global changes such as population growth (Chen, 2007; McKenzie & Williams, 2015; FAO, 2017; FAO, 2021) and rapid urbanization (Brueckner, 2000; Brueckner, 2001; Montgomery et al., 2003; Su et al., 2011; Rótolo et al., 2015).

Figure 3. Impact of Urbanization on Agricultural Areas (URL-1)

The transformation of agricultural areas into urban areas with rapid urbanization is a phenomenon observed all over the world as well as in Turkey (Çepel, 2008). However, while urbanization has a balanced development in developed countries, it causes the destruction or disappearance of fertile agricultural lands in the urban periphery in developing countries (Kara, 1988; Sezgin, 2010). By 2050, it is estimated that agriculture needs to produce almost 50% more food than in 2012 in order to meet global demand and move towards achieving "zero hunger" by 2030. The prime agricultural land that provides the resources for the purpose is unfortunately being rapidly lost due to urbanization (FAO, 2021). According to TURKSTAT data, agricultural areas in our country have decreased by 2904 ha in the last 10 years, which reflects a decrease from 40,967 ha to 38,063 ha as of 2021 (TURKSTAT, 2022).

Today, agricultural landscapes, which are among the most damaged land uses, are rapidly transformed into new settlement areas with a planning approach contrary to the ecological approach (Açıksöz et al., 2008; Türker & Akten, 2021). Urbanization keeps agricultural land under constant and severe pressure due to its demand for land. This shifts agricultural activities to lower-quality lands (Aksoy, 1997; Özbek & Öztaş, 2004). For, the high rent per unit area and low economic risk is an important advantage in developing countries. Another factor is that it does not make construction difficult so long as it is suitable for construction (Yılmaz, 2001).

In addition to all these, rapid urbanization leads to fragmentation of agricultural lands, and increase in land prices and taxes in urban areas. This situation is one of the biggest obstacles to the continuation of agricultural areas and agricultural production (Nas, 2016). In fact, it is the ability to use the land on which housing is built that matters rather than urban growth. There are residential areas on I., II. and III. class fertile agricultural lands, which are more suitable for agricultural activity in terms of land use capability. This poses a great problem in terms of agriculture today (Yılmaz, 2001). It is generally impossible to restore the lands used for non-agricultural purposes and opened for construction (Akci et al., 2016). Every decare of agricultural land lost is a significant loss for the ecosystem in the long term. For, the land is a natural resource that is necessary, valuable and limited to meet future nutritional needs (Aksoy, 1997). For this reason, agricultural soils should be used and protected in accordance with their potential in this age when the population is increasing rapidly and the need for nutrients is increasing (Akseki, 2011; Akseki & Meşhur, 2013).

2. Material and Method

2.1. Material

The boundaries of Çanakkale city center and the zoned area/settlement area in its immediate vicinity were chosen as the study area. Çanakkale city center and its immediate surroundings is located between 40º 03′ and 40º 18′ north latitudes and 26º 34′ and 26º 47′ east longitudes and covers an area of approximately 41.83 km² (Çanakkale Municipality, 2001a; Çanakkale Municipality, 2001b; Çanakkale Municipality, 2010; Kepez Municipality, 2010; Çanakkale Municipality, 2021; Kepez Municipality, 2021) (Figure 4). The focus of the study is the urban development/zoning plan periods. Therefore, all urban development/architecture periods of the city from past to present (Figure 5) define the boundaries of the study area.

The reason why Çanakkale city center and its immediate surroundings were chosen as the study area is its rapid growth in the direction of Dardanos and Güzelyalı in the south, Kepez Town in the east, and Karacaören and Işıklar in the north. However, these settlements mentioned can also be defined as urban periphery agricultural landscape character and agricultural land use is more intense. Therefore, the main concern of the study is the rapid urbanization and zoning of areas with prominent agricultural landscape character.

Figure 4. Geographical Location of the Study Area, Turkey - Çanakkale (based on Google Earth, 2021)

First of all, the urban development areas of Çanakkale city center and its immediate surroundings were analyzed by using the relevant literature (Uyanık, 2003; Çanakkale Municipality, 2004; Koç, 2006; Özel Cengiz, 2011; Çavuş & Başaran Uysal, 2018; Çanakkale Municipality, 2021; Kepez Municipality, 2021) and generally based on the zoning plan periods classified into eight periods **[a.** 1949 - 1963 (1st Period), **b.** 1963 - 1978 (2nd Period), **c.** 1978 - 1984 (3rd Period), **d.** 1984 - 1993 (4th Period), **e.** 1993 - 1995 (5th Period), **f.** 1995 - 2011 (6th Period), **g.** 2011 - 2016 (7th Period), **h.** 2016 - 2021 (8th Period)] (Figure 5).

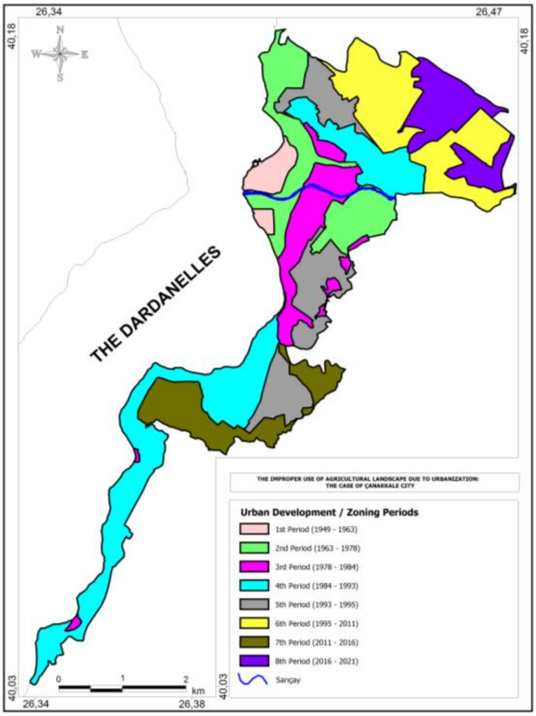

Figure 5. Urban Development/Zoning Periods for the Study Area (prepared with the help of Koç, 2006; Özel Cengiz, 2011; Çanakkale Municipality, 2021; Kepez Municipality, 2021)

Secondly, the Inventory of Land Resources and Soil for 1999, prepared by the Directorate General for Rural Services (KHGM, 'Köy Hizmetleri Genel Müdürlüğü' in Turkish) and the soil data obtained from the Directorate General for Agricultural Reform of the Ministry of Agriculture and Forestry (the Ministry of Agriculture and Forestry, 2019) were used as auxiliary material and basic base maps for the creation of the study area LUCC map (Figure 6); and digitized or reclassified in line with the purpose of the study.

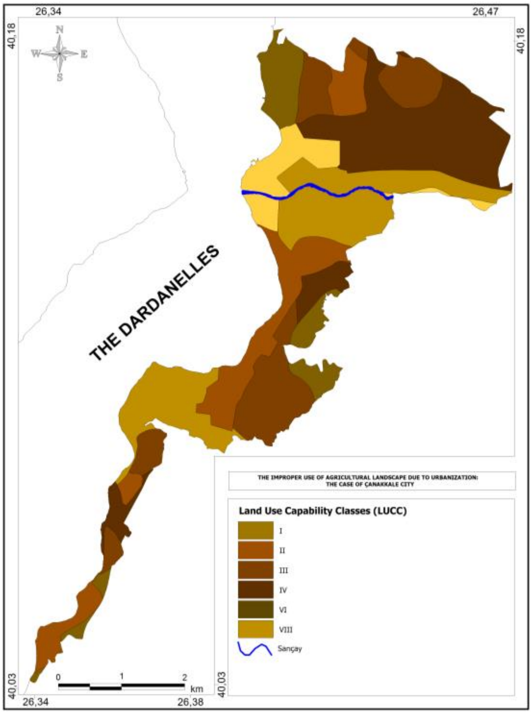

Figure 6. Study Area LUCC Map (prepared with the help of KHGM, 1999; the Ministry of Agriculture and Forestry, 2019).

In addition, the literature (theses, projects, articles, papers), notes taken during the fieldwork and photographs taken during the field survey were included in the study as other auxiliary materials.

2.1. Method

Overlay analysis was used as the method in the study. In this context, the Land Use Capability Class map, which determines agricultural landscape use, was analyzed with overlay analysis with the zoning/settlement boundary (eight periods) of Çanakkale city and its immediate surroundings. Then, the LUCC was queried within each urban development/zoning period. This way, it aimed to determine the interaction of LUCC, which is the most important soil feature in determining the use of agricultural landscapes, with urban development in the context of development periods.

In other words, the pressure of urbanization on agricultural landscapes was revealed. Within the framework of the study; MapInfo Professional 10.5 program, which is one of the Geographical Information Systems (GIS) software, was used to transfer raw data and maps to digital media after they were taken from the source, to create thematic maps, to relate them to each other and to interpret them.

3. Findings and Discussion

3.1. LUCC - Settlement (zoning periods) comparison

At this stage of the study, the loss of agricultural land within each urban development/zoning plan period was under scrutiny. In this context, firstly, the soil inventory map included in the "Land Asset" report of the Directorate General for Rural Services dated 1999 was digitized and reclassified. Secondly, the LUCC map, which prioritizes the use of agricultural landscapes, and the zoning/settlement boundaries created for the study area were subjected to overlay analysis and queried on an area basis using Map Info 10.5, a GIS software. In this respect, the relevant figures (Figure 7 - Figure 8 - Figure 9 - Figure 10) and Table 1 provide detailed information on which LUCC classes each zoning period has developed.

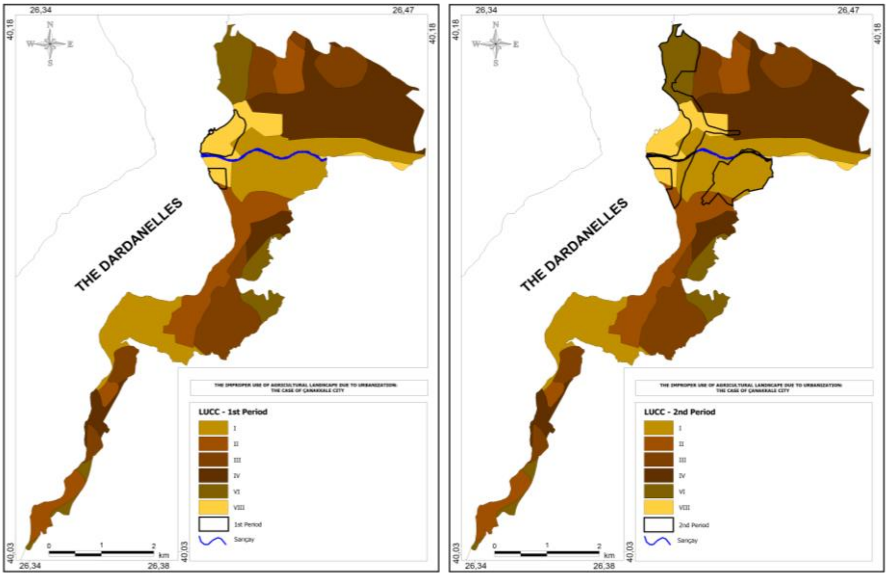

Figure 7. LUCC - Zoning Periods (1st and 2nd Period) Comparison

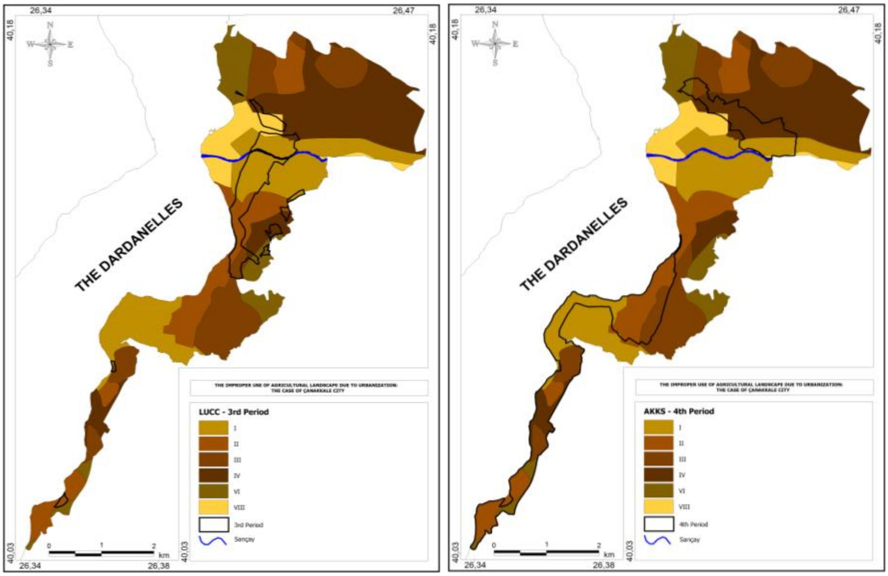

Figure 8. LUCC - Zoning Periods (3rd and 4th Period) Comparison

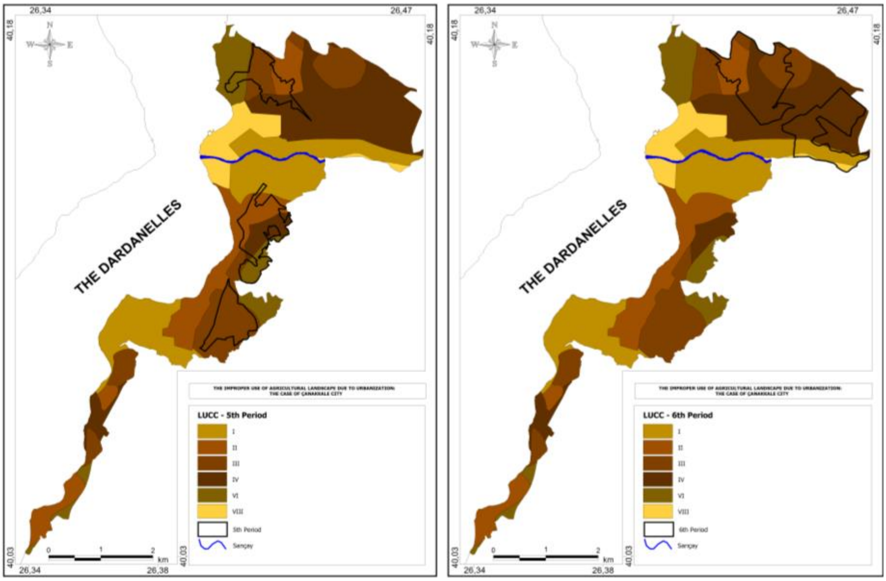

Figure 9. LUCC - Zoning Periods (5th and 6th Period) Comparison

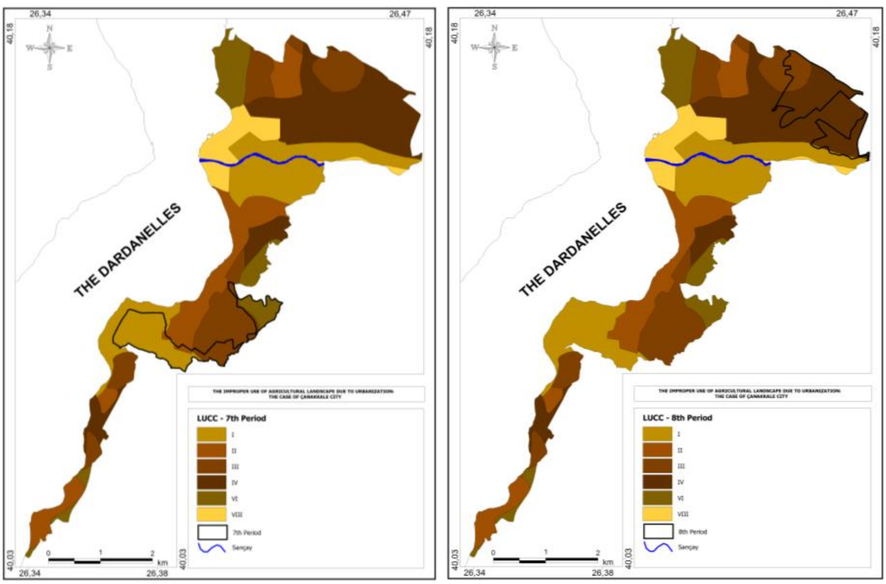

Figure 10. LUCC - Zoning Periods (7th and 8th Period) Comparison

The findings show that land classes that determine agricultural landscape use were generally not taken into consideration in these urban development periods. In particular, Class I lands, which represent very valuable agricultural land and should never be transferred to any other land use other than agriculture, was found to be transformed into urban areas with high rates as: 2nd Period (45.30%), 3rd Period (50.39%) and 7th Period (58.29%) (Table 1).

Table 1. LUCC - Urban Development Periods Comparison (m2 - %)

Feature	**Urban Development/Zoning Periods (m^2)**							
AKKS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
I. Class	0,04	2,60	1,94	2,33	0,04	0,83	2,25	0,06
II. Class	0,04	0,36	0,80	3,30	1,17	0,94	0,12	-
III. Class	-	0,05	0,31	2,03	2,52	1,10	0,76	0,73
IV. Class	-	0,10	0,35	2,31	1,11	3,85	-	3,00
VI. Class	-	1,58	0,10	0,54	0,81	-	0,73	-
VIII. Class	1,24	1,05	0,34	0,08	-	0,18	-	-
Total	**1,32**	**5,74**	**3,84**	**10,59**	**5,65**	**6,90**	**3,86**	**3,79**
Feature	**Urban Development/Zoning Periods (%)**							
AKKS	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
I. Class	3,03	45,30	50,39	22,00	0,71	12,03	58,29	1,58
II. Class	3,03	6,27	20,78	31,16	20,67	13,62	3,11	-
III. Class	-	0,87	8,05	19,17	44,52	15,94	19,69	19,26
IV. Class	-	1,74	9,09	21,81	19,61	55,80	-	79,16
VI. Class	-	27,53	2,60	5,10	14,34	-	18,91	-
VIII. Class	93,94	18,29	8,83	0,76	-	2,61	-	-
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

In addition, it is observed that class II, III and IV lands, which should be used primarily for agricultural purposes, were utilized for zoning in different urban development periods. It is noteworthy that following zoning features were conducted II. Class lands at 3rd Period (20.78%), 4th Period (31.16%) and 5th Period (20.67%); III. Class lands at 5th

Period (44.52%); IV. Class lands at 6th Period (55.80%) and 8th Period (79.16%).

Figure 11. Agricultural Landscapes Transformed into Residential Areas in and Around Çanakkale City Center (Original, 2022)

This result is a major indicator of the rapid depletion of the agricultural landscape, which is a buffer zone between the urban landscape and the natural landscape, as well as a place of food production in the urban space (Figure 11).

As Aksoy (1997) and Türker (2021b) state, while urban growth affects larger areas, some of these areas are directly related to the city. Nowadays, it does not have any beneficial effect for a farmer to continue agricultural production near an urban area.

Unless there is a vital necessity, the use of cultivable agricultural land for non-agricultural purposes is undoubtedly a great extravagance (Özbek & Öztaş, 2004). In the process of urban planning, perceiving the concept of "development" only as the zoning of new settlements has dire ecological consequences for cities (Erdem & Meşhur, 2005). Today, the amount of agricultural land per capita is rapidly decreasing all over the world due to rapid and unplanned urbanization (Akseki, 2011; Türker & Akten, 2020). The use of primary agricultural land for different sectors, especially housing, is one of the most important ecological consequences of rapid urbanization (Ünal & Başkaya, 2000). Due to the extraordinary events experienced today (global climate change, disasters, epidemics, etc.), it is not desirable for countries to become agriculturally dependent on foreign countries by reducing their self-supply potential (Doğan, 2007; Akseki & Meşhur, 2013). For this reason, a country with fertile agricultural areas should be able to ensure food security and protect, develop and evaluate its existing agricultural landscapes in the most accurate way in order to maintain economic development (Bayar, 2018; Gülçin, 2019). The increase in demand for food, especially with the increasing population, requires more rational use of the already limited amount of agricultural land (Karakayacı, 2010). While soil resources have the potential to meet the current agricultural needs (Bayar, 2018), not using the land in line with its capability/potential changes the use of soil and causes its rapid loss every year (Aydoğdu et al., 2009).

4. Conclusion and Suggestions

The fact that a large part of the world's population lives in cities and thus, the expansion of cities especially towards rural areas causes significant problems that cannot be ignored. As UNDP (2019) points out, rapidly depleted natural and cultural resources are one of the biggest problems threatening the world on a global scale.

Agricultural landscapes are one of the most important cultural resources that are rapidly destroyed today. This will be felt more intensely in the coming times. As stated by FAO (2017) and FAO (2021), it is predicted that agricultural landscapes will undergo a major change by the end of this century.

Changing dietary habits and meeting the growing demand for food are increasing the pressure on climate, water, soil and land resources (FAO, 2021). The sustainability of agricultural landscapes depends on natural conditions such as climate, water, soil, biodiversity, etc. (Munton, 2009; Primdahl et al., 2013). One of the most important of these conditions is land use capability classes that determine the capability of the land and its potential for land use.

The global Covid-19 pandemic has also reaffirmed the need for controlled use of scarce resources, as well as the importance of rural/agricultural areas in cities and urban periphery. Safe food supply is one of the most important needs, especially for cities, in pandemic conditions. This will only be possible if agricultural areas are protected, developed and sustainable in accordance with their current capabilities.

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Urban-Agricultural Conflict in Urban Areas in Türkiye

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1. Introduction

The growth of the world's urban population and widespread urbanization in the surrounding areas is one of the emerging phenomena of the twentieth century and has become the main subject of urban and regional academic studies in recent years (Dadashpoor & Ahani, 2019). The concept of urbanization has been defined in the report of the UN (2018) as a complex socio-economic process with numerous consequences in terms of different levels of society, environment and biodiversity (UN, 2018). Although urbanization is generally seen as a demographic and economic phenomenon, it is also a human-created ecological transformation process that significantly affects the functioning of local and global ecosystems (Huang et al., 2010). Urbanization is often characterized by an aggregation of the human population with an increase in per capita energy consumption and extensive modification of the landscape (Luck & Wu, 2002; Liu, 2009). When the above definitions of urbanization and other related studies (reports, articles, etc.) are examined, it is seen that urbanization is handled in different dimensions: While the first dimension is the population accumulation process in cities; (He et al., 2006; Song et al., 2012; Shahbaz vd., 2014; Wang et al., 2014); the other dimension is the physical expansion of urban areas (Satterthwaite, 2010; Seto et al., 2011; Chatterjee & Majumdar, 2021).

It is obvious that population has played a dominant role in the urbanization process since the beginning of civilization (Seto et al., 2011). Wei (2015) stated that the main reasons for the urbanization process are people's desire to benefit from opportunities such as better employment, education, food, entertainment etc. Due to these reasons, with the cities becoming centers of attraction, while 30% of the world's population lived in urban areas in 1950 (UN, 2018), this rate reached 57% in 2021 (World Bank, 2022).

Although it is stated in the "*UN-HABITAT World Cities Report*" that it is premature to predict whether the pandemic experience in 2020 will lead to permanent demographic changes, there is also an estimate that the world will become more urbanized in the next decade than today. It is predicted that 60.4% of people will live in urban areas by 2030, (UN-HABITAT, 2020) and 68% in 2050 (with the world population reaching 9.7 billion) (UN, 2019). It is also estimated that this rate will reach 82.4% in underdeveloped countries by 2050 (Hazell, 2019).

All these trends signal that the number of middle- and upper-income consumers with more dietary preferences, energy and greenhouse gas emission intensive (and often more land intensive) will continue to increase, and thus the proportion of the global population that does not produce food (Satterthwaite et al., 2010).

Another relevant issue is two important demographic changes: the decline in population growth rates and the aging of the population. According to Satterthwaite et al. (2010) aging populations in wealthier countries may produce more people who want to live in "rural" areas. This does not mean de-urbanization, but rather the urbanization of rural areas. These people will eventually cluster around city centers with improved medical and other services. (Satterthwaite et al., 2010).

Therefore, the other dimension of urbanization is the physical expansion of urban areas; that is urban sprawl. Between 1970 and 2000, the global urban land area increased by 58,000 km^2. The highest expansion rates occurred in North America, China, India and Africa (Seto et al., 2011). Between 1990 and 2015, while the urban population in developed countries increased 1.2 times, the urban land area increased 1.8 times (UN-HABITAT, 2020). By 2030, "built-up areas" are projected to triple around the world to 1.2 million km^2. (Seto et al., 2011).

Undoubtedly, the areas most affected by this population projection and physical expansion are agricultural areas (FAO, 2020). First of all, this uncontrolled land transformation caused the loss of fertile agricultural lands and a decrease in agricultural productivity. (Firman, 2000; Allen, 2003). Especially in countries where agriculture is the main economic activity and urban population growth is high (such as China, India, Turkey, the United States, and Vietnam), cropland loss is likely to be acute as residential areas are growing faster than the urban population. Such a trend has profound effects on cultivated land productivity and it is anticipated that the severity of these effects will intensify over time **(**Seto et al., 2011; Seto & Ramankutty, 2016).

Various studies have shown that the impact of urbanization on agricultural lands and practices goes far beyond loss of agricultural land and low yields. (Wu et al.,2011; Verhoeve et al., 2015). The general effects of urbanization on agricultural areas can be classified as direct effects (such as removal of existing vegetation and construction of urban infrastructure) and indirect effects (such as loss of habitat and thus loss of biodiversity, fragmentation and isolation of landscape, climate changes, air, water and soil pollution) (Grimm et al., 2008; Chatterjee & Majumdar, 2021).

On the basis of this literature, it is useful to examine the changes in agricultural areas in the world. Because, in the *"World Food and Agriculture - Statistical Yearbook"* 2021 report of FAO, it was stated that the global agricultural land decreased by 3% (with a decrease of 0.13 billion hectares) compared to 2000 and decreased to 4.8 billion hectares (ha) (FAO, 2021). In the same report, it is also stated that although there has been a decrease in agricultural lands since 2000, there has been a significant increase until the 1990s (with an average increase of 0.1 percent per year in the 1961-2019 period) (FAO, 2021). Although there has been little change in the regional distribution of global cultivated land area between 2000 and 2019, cultivated area per capita has decreased in all regions as population has increased faster than cultivated land area. The world average on the subject decreased by 17% in 2019 compared to 2000 and fell to 0.20 hectares per capita. While this decrease in question was seen the most in Africa (-26%, 0.21 hectares per capita), respectively; Africa (-18%, 0.36 hectares per capita), Asia (-15%, 0.13 hectares per capita), Europe (-8%, 0.39 hectares per capita), and Oceania (-7%, 0.79 hectares per capita) (FAO. 2021).

Also, Azadi et al. (2018) examining the effects of drought in the conversion of agricultural lands, it was reported that 12 million hectares of land (23 hectares/minute) where 20 million tons of grain could be grown every year, was lost, especially due to drought and desertification. In the same study, it was stated that during a five-year drought period (2000-2004) in Afghanistan, crop diversity decreased by 71% and productivity by more than 50% (Azadi et al., 2018).

The main subject of the study consists of 14 metropolitan cities selected as examples in Türkiye. Because the statistical data in the country showed that the trend of population and agricultural lands change, which is seen all over the world, is more severe in Türkiye. While the population has increased by 24.89% (TSI, 2021a) since the 2000s, when urbanization increased intensively in Türkiye, agricultural areas have decreased by 7.09% and cultivated areas by 10.35% (TSI, 2021b).

Additionally, the physical spread against agricultural lands in Turkey is more severe than in the world. Because Bayar (2018) examined the land cover change in Turkey between the years 2006-2012. In the study, it was stated that approximately 96.144 ha of agricultural land has been transformed into other land cover areas, primarily structural areas. In related studies, it has been stated that the most common misuse of agricultural lands in the country is urbanization, industry, tourism, mining and public investment areas (Topçu, 2012; Bayar, 2018).

Moreover, the urbanization rate in Türkiye is 93.18%, which is well above the World average (TUIK, 2021a). Actually, this ratio is not very realistic. It can be said that the reason why this rate is so high is the Whole City Law No. 6360 (No. 6360), which changed the balance between the rural population and the urban population in the country.

With the law, the legal personality of many villages and towns was abolished and these settlements became neighborhoods affiliated to metropolitan municipalities. With this law, the population requirement of 750,000 determined by the law no. 5216 for the provincial municipality was changed to the provincial population. In this context, 14 new metropolitan municipalities have been established in addition to the 16 metropolitan cities previously declared as metropolitan cities in the country. With this law, the metropolitan municipality borders in these provinces are regulated as provincial administrative borders (Official Gazette-OG,2012).

In this context, the aim of this study is to reveal the urban-agricultural conflict in the relevant metropolis (Aydın, Denizli, Balıkesir, Hatay, Malatya, Manisa, Kahramanmaraş, Mardin, Muğla, Tekirdağ, Trabzon, Şanlıurfa, Van and Ordu), declared as metropolitan cities with the law numbered 6360. In revealing the conflict, it is discussed that changes in agriculture and cultivated areas and transformations in land cover depending on the population variable in the relevant metropolises.

2. Material and Method

The main material of this study consists of 14 metropolitans (Aydın (M1), Denizli (M2), Balıkesir (M3), Hatay (M4), Malatya (M5), Manisa (M6), Kahramanmaraş (M7), Mardin (M8), Muğla (M9), Tekirdağ (M10), Trabzon (M11), Şanlıurfa (M12), Van (M13), Ordu (M14)) with high agricultural production potential in Türkiye, which were declared as metropolitan cities in 2012 and whose entire area was considered as urban in the legal sense. One of the reasons for the selection of these cities is that they were in the status of medium-sized cities in the country before 2012. Medium-sized cities play a crucial role in achieving sustainable development and improving food security and nutrition. Because these cities are key strategic areas for the sustainability of rural-urban regions with their proximity to rural areas and close interactions (FAO, 2019).

First of all, in order to draw the basic framework of the study, domestic and foreign articles on the subject were scanned from the "*Sciencedirect*" and "*Journal Park*" search engines by using the keywords of agricultural land use, agricultural land use change. Statistical databases of TSI were used to reveal the information on the population of the relevant metropolitan areas and their agricultural land use. Information on the land cover change of the provinces was obtained from the environmental status reports of the provinces.

A quantitative approach was adopted in the study. The indirect and citation research method of this approach was used. Statistical analysis was used as a research technique.

3. Findings

3.1. Urban-rural population and agricultural areas in Türkiye

It has been determined that the population of the country has increased by 24.89% in the last 21 years (2000-2021) in Türkiye. Today, approximately 85 million people live in the country. During these years, the rural population rate decreased from 35.10% to 6.82%, while the urban population rate reached 93.18% with an increase of 28.28%. (Table 1).

Table 1. Population, Urban-Rural Population Ratio in Türkiye (2000-2021) (TSI, 2022a)

		Urban Population		Rural Population	
Year	**Population**	**Number**	**Ratio (%)**	**Number**	**Ratio (%)**
2000	67.803.927	44.006.184	64,90	23.797.743	35,10
2007	70.586.256	49.747.859	70,48	20.838.397	29,52
2008	71.517.100	53.611.723	74,96	17.905.377	25,04
2009	72.561.312	54.807.219	75,53	17.754.093	24,47
2010	73.722.988	56.222.356	76,26	17.500.632	23,74
2011	74.724.269	57.385.706	76,80	17.338.563	23,20
2012	75.627.384	58.448.431	77,28	17.178.953	22,72
2013	76.667.864	70.034.413	91,35	6.633.451	8,65
2014	77.695.904	71.286.182	91,75	6.409.722	8,25
2015	78.741.053	72.523.134	92,10	6.217.919	7,90
2016	79.814.871	73.671.748	92,30	6.143.123	7,70
2017	80.810.525	74.761.132	92,51	6.049.393	7,49
2018	82.003.882	75.666.497	92,27	6.337.385	7,73
2019	83.154.997	77.151.280	92,78	6.003.717	7,22
2020	83.614.362	77.736.041	92,97	5.878.321	7,03
2021	84.680.273	78.908.631	93,18	5.771.642	6,82

With the increase in population in Türkiye, it has been determined that agricultural areas have decreased by 7.09% and cultivated areas by 10.35%. In addition, when the relevant chart is examined, it will be seen that the agricultural area per capita decreased from 0.604 ha to 0.450 hectares, and the cultivated area decreased from 0.264 ha to 0.190 ha. (Table 2). In the relevant years, the agricultural area per capita was 25.50%; cultivated areas decreased by 28.03%. The rates are much higher than the rates of change in the world (FAO, 2021).

Table 2. Total Agricultural Area and Per Capita Agricultural/Cultivated Area Ratios in Türkiye (2000-2021) (TSI, 2022b).

Year	Toplam tarım alanı (ha)	Kişi başına düşen tarım alanı (ha)	Ekili alan (ha)	Kişi başı düşen ekili alan (ha)
2001	40.967.000	0,604*	17.917.000	0,264*
2007	39.504.000	0,560	16.945.000	0,240
2008	39.122.000	0,547	16.460.000	0,230
2009	38.912.000	0,536	16.217.000	0,223
2010	39.011.000	0,529	16.333.000	0,222
2011	38.231.000	0,512	15.692.000	0,210
2012	38.399.000	0,508	15.463.000	0,204
2013	38.423.000	0,501	15.613.000	0,204
2014	38.558.000	0,496	15.782.000	0,203
2015	38.551.000	0,490	15.723.000	0,200
2016	38.328.000	0,480	15.575.000	0,195
2017	37.964.000	0,470	15.498.000	0,192
2018	37.797.000	0,461	15.421.000	0,188
2019	37.716.000	0,454	15.398.000	0,185
2020	37.762.000	0,452	15.628.000	0,187
2021	38.089.000	0,450	16.062.000	0,190
Değişim oranı (%)	-%7,09	-%25,50	-%10,35	-%28,03

*Since there is no population data for 2001, the data of 2000, which is the most recent year, were taken.

3.2. Population in the Metropolitans

In order to better reveal the rural-urban conflict in the metropolitan cities, which is the main subject of the study, it is useful to focus on the rural-urban population distribution before the law, without evaluating the current total population of the provinces. When the details of the population data of the relevant metropolitan cities before 2012 are examined, it will be understood that the difference between the rural-urban population is not much. Because the rural population ratios of 2007-2012 in all provinces are much higher than the rural population averages of Türkiye in the relevant years. (TURKSAT, 2022a). (Table 1-3; Figure 1)

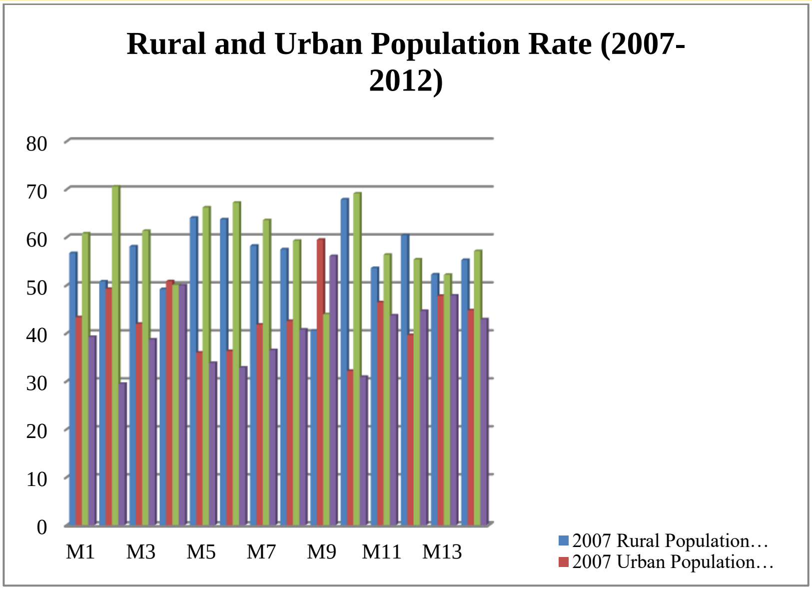

Figure 1. Urban-Rural Population Ratios of Relevant Metropolitans (2007-2012) (TSI, 2022a)

Table 3. Urban-Rural Population Ratios of Relevant Metropolitans (2007-2012)

Metropolitan	2007		2008		2009		2010		2011		2012	
	a*	b**	a*	b**	a*	b**	a*	b**	a*	b**	a*	b**
M1	56,68	43,32	57,66	42,34	58,61	41,39	59,46	40,54	60,05	39,95	60,79	39,21
M2	50,78	49,22	67,57	32,43	68,12	31,88	68,80	31,20	69,55	30,45	70,57	29,43
M3	58,07	41,93	58,59	41,41	59,53	40,47	60,31	39,69	60,75	39,25	61,32	38,68
M4	49,17	50,83	48,40	51,60	49,41	50,59	50,21	49,79	49,71	50,29	50,05	49,95
M5	64,06	35,94	67,11	32,89	63,55	36,45	64,83	35,17	65,78	34,22	66,21	33,79
M6	63,72	36,28	64,10	35,90	65,23	34,77	67,00	33,00	66,50	33,50	67,19	32,81
M7	58,22	41,78	58,14	41,86	58,36	41,64	60,95	39,05	62,30	37,70	63,54	36,46
M8	57,47	42,53	56,29	43,71	57,23	42,77	57,60	42,40	58,40	41,60	59,26	40,74
M9	40,53	59,47	41,59	58,41	42,34	57,66	42,82	57,18	43,24	56,76	43,93	56,07
M10	67,87	32,13	67,67	32,33	67,70	32,30	68,35	31,65	68,97	31,03	69,11	30,89
M11	53,56	46,44	52,18	47,82	53,34	46,66	54,43	45,57	55,65	44,35	56,32	43,68
M12	60,39	39,61	56,28	43,72	55,76	44,24	55,46	44,54	55,47	44,53	55,36	44,64
M13	52,23	47,77	51,22	48,78	51,60	48,40	52,12	47,88	51,51	48,49	52,16	47,84
M14	55,25	44,75	53,40	46,60	55,15	44,85	56,23	43,77	57,29	42,71	57,10	42,90

a*Urban Population Ratio (%) b** Rural Population Ratio (%)

Therefore, with the law, nearly 6 million people living in 14 cities, whose rural population and agricultural area are above the average of Türkiye and which were declared as metropolitans, gained urban status overnight. Agricultural area of 51.896.650 da is also included in the relevant metropolitan borders (Table 4).

Table 4. Total Agricultural Area and Rural Population of the Metropolitans (2012)

Metropolitan	Total Agricultural Area (da)	Rural Population Included in Urban Population (Number)
M1	3.631.819	394.695
M2	3.666.602	279.745
M3	4.421.426	448.988
M4	2.550.538	741.084
M5	2.947.333	257.573
M6	4.885.725	441.649
M7	3.225.058	387.585
M8	3.225.242	314.914
M9	2.366.492	477208
M10	3.229.299	263.272
M11	1.041.614	331.016
M12	10.719.605	786.620
M13	3.406.721	503.258
M14	2.579.176	318.076
TOTAL	**51.896.650**	**5.945.683**

When the total population data of the metropolitans covering the years 2000-2021 is examined, it has been determined that the population has increased in all provinces except Malatya (M5) and Ordu (M14). The province with the lowest population growth rate is Balıkesir (M3) (16.19%); with the highest number is Tekirdağ (M10) (78,55%).

Table 5. Population Change Rate (C.R) in the Metropolitans (%) (2000-2021)

Year	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14
2000	950.757	850 029	1.076.347	1 253 726	853 658	1 260 169	1 002 384	705 098	715.328	623.591	975.137	1.443.422	877.524	887.765
2007	946 971	907 325	1 118 313	1 386 224	722 065	1 319 920	1 004 414	745.778	766 156	728 396	740 569	1 523 099	979 671	715 409
2008	965 500	917 836	1 130 276	1 413 287	733 789	1 316 750	1 029 298	750.697	791 424	770 772	748 982	1 574 224	1 004 369	719 278
2009	979 155	926 362	1 140 085	1 448 418	736 884	1 331 957	1 037 491	737.852	802 381	783 310	765 127	1 613 737	1 022 310	723 507
2010	989 862	931 823	1 152 323	1 480 571	740 643	1 379 484	1 044 816	744.606	817 503	798 109	763 714	1 663 371	1 035 418	719 183
2011	999 163	942 278	1 154 314	1 474 223	757 930	1 340 074	1 054 210	764.033	838 324	829 873	757 353	1 716 254	1 022 532	714 390
2012	1 006 541	950 557	1 160 731	1 483 674	762 366	1 346 162	1 063 174	773.026	851 145	852 321	757 898	1 762 075	1 051 975	741 371
2013	1 020 957	963 464	1 162 761	1 503 066	762 538	1 359 463	1 075 706	779.738	866 665	874 475	758 237	1 801 980	1 070 113	731 452
2014	1 041 979	978 700	1 189 057	1 519 836	769 544	1 367 905	1 089 038	788.996	894 509	906 732	766 782	1 845 667	1 085 542	724 268
2015	1 053 506	993 442	1 186 688	1 533 507	772 904	1 380 366	1 096 610	796.591	908 877	937 910	768 417	1 892 320	1 096 397	728 949
2016	1 068 260	1 005 687	1 196 176	1 555 165	781 305	1 396 945	1 112 634	796.237	923 773	972 875	779 379	1 940 627	1 100 190	750 588
2017	1 080 839	1 018 735	1 204 824	1 575 226	786 676	1 413 041	1 127 623	809.719	938 751	1 005 463	786 326	1 985 753	1 106 891	742 341
2018	1 097 746	1 027 782	1 226 575	1 609 856	797 036	1 429 643	1 144 851	829 195	967 487	1 029 927	807 903	2 035 809	1 123 784	771 932
2019	1 110 972	1 037 208	1 228 620	1 628 894	800 165	1 440 611	1 154 102	838 778	983 142	1 055 412	808 974	2 073 614	1 136 757	754 198
2020	1 119 084	1 040 915	1 240 285	1 659 320	806 156	1 450 616	1 168 163	854 716	1 000 773	1 081 065	811 901	2 115 256	1 149 342	761 400
2021	1 134 031	1 051 056	1 250 610	1 670 712	808 692	1 456 626	1 171 298	862 757	1 021 141	1 113 400	816 684	2 143 020	1 141 015	760 872
C.R (%)	**19,28**	**23,65**	**16,19**	**33,26**	**-5,27**	**15,59**	**16,85**	**22,36**	**42,75**	**78,55**	**-16,25**	**48,47**	**30,03**	**-14,29**

The number of provinces with population growth above Türkiye's average is 5; these provinces are Hatay (M4); Mugla (M9); Tekirdag (M10); Şanlıurfa (M12) and Van (M13) (Table 5).

3.3. Agricultural lands in the Metropolitans

When the table regarding the total change in the agricultural areas of the provinces is examined, it will be seen that the agricultural areas have increased only in the provinces of Manisa (M6), Tekirdağ (M10) and Van (M13). In other provinces, this change progressed to the detriment of agricultural lands (Table 6). The highest increase was in Van with a rate of 22.38%; The highest decrease was found in Malatya with a rate of 24.77%. Except for Denizli (M2), Manisa (M6), Tekirdağ (M10), Van (M13), the reduction rate of agricultural lands in the other 10 provinces is above the Türkiye average (Table 6).

When the distribution created according to the product diversity of the provinces is examined, it will be seen that the cultivation areas of "Fruits, Beverage and Spice Plants" have increased in all provinces. Except for Mardin (M8) and Trabzon (M11) provinces, it has been determined that the areas where vegetables are grown have decreased in all metropolitan cities. It has been spesified that the production areas of cereals and other plant products, which are in the status of planted areas and are an important food supply of the country, have decreased (Except M10 and M13) (Table 6).

In fact, the rate of change of the areas where grains are planted is over 60% in the provinces of Trabzon (M11) and Ordu (M14) (Table 6).

Table 6. Agricultural Area Change of the Metropolitans (2004-2021) (TSI, 2022b)

	Rate of Change in Production Areas of Fruits, Beverage and Spice Plants (%)	Change Rate in Vegetable Production Areas (%)	Change Rate in Production Areas of Cereals and Other Herbal Products (%)	Total Change Rate in Agricultural Lands (%)
M1	1,02	-58,16	-13,26	-7,66
M2	32,39	-13,45	-17,53	-5,32
M3	5,77	-49,56	-17,95	-13,54
M4	47,79	-44,26	-40,25	-18,42
M5	29,12	-37,24	-37,49	-24,77
M6	70,54	-15,14	-23,58	5,15
M7	33,36	-25,43	-26,12	-19,89
M8	112,37	23,70	-17,10	-17,08
M9	21,62	-63,93	-39,21	-14,78
M10	25,84	-71,73	9,32	7,55
M11	21,48	4,33	-65,71	-7,20
M12	60,52	-44,49	-24,54	-12,72
M13	75,33	60,53	31,83	22,38
M14	5,15	-22,68	-62,93	-7,70

Agricultural area per capita and cultivated area per capita in these provinces -except for Van (M3)- have decreased over the years.The province with the highest rate of change in agricultural areas per capita is Muğla (M9) with a rate of -32.80%; the province with the lowest rate is Manisa (M6) with a rate of -7,34%. The number of metropolitans in which the rate of change in agricultural areas per capita is higher than the overall rate of change in Türkiye (-25.50%) is 4; these provinces are Hatay (M4); Malatya (M5); Muğla (M9) and Şanlıurfa (M12) (Table 7).

When the related table is examined, it will be seen that the rate of cultivated area per capita has decreased more than the relevant rates in agricultural areas. The province with the highest rate of change in cultivated areas per capita is Tekirdağ (M10) with a rate of 64.55%; the province with the lowest rate is Trabzon (M11) with 22.92% (Table 7). The rate of change in cultivated areas per capita in half of the metropolitans that are the subject of the research (7 provinces) is higher than the rate of change in Türkiye in general (-28.03%). These metropolitans are Aydın (M1); Hatay (M4); Malatya (M5); Mugla (M9); Tekirdag (M10); Şanlıurfa (M12) and Ordu (M14) (Table 7).

Table 7. Amount of Agricultural Area/Cultivated Area Per Capita in the Relevant Metropolitans and Their the Change Rate (%) (2007-2021)

Year	M1		M2		M3		M4		M5		M6		M7	
	a*	b**	a	b	a	b	a	b	a	b	a	b	a	b
2007	4,06	1,64	4,02	2,89	3,79	2,65	1,91	1,11	4,67	2,14	3,76	2,14	3,79	2,84
2008	3,93	1,63	3,91	2,77	3,76	2,62	1,89	1,11	4,44	1,95	3,77	2,10	3,56	2,69
2009	3,99	1,69	3,87	2,74	3,70	2,57	1,83	1,04	4,30	1,83	3,72	2,04	3,40	2,64
2010	3,79	1,52	3,94	2,79	3,55	2,35	1,84	1,07	4,31	1,79	3,50	1,85	3,43	2,67
2011	3,53	1,26	3,81	2,65	3,45	2,26	1,76	0,93	3,84	1,55	3,57	1,86	3,56	2,61
2012	3,61	1,32	3,86	2,63	3,81	2,61	1,72	0,88	3,87	1,56	3,63	1,92	3,03	2,04
2013	3,61	1,33	3,82	2,61	3,65	2,44	1,70	0,91	3,75	1,47	3,68	1,93	3,31	2,27
2014	3,55	1,35	3,75	2,60	3,54	2,33	1,65	0,88	3,77	1,49	3,61	1,87	3,36	2,18
2015	3,50	1,31	3,67	2,53	3,46	2,27	1,58	0,83	3,82	1,44	3,57	1,78	3,30	2,24
2016	3,42	1,26	3,57	2,39	3,45	2,26	1,57	0,82	3,67	1,41	3,53	1,73	3,10	2,12
2017	3,39	1,28	3,47	2,31	3,38	2,23	1,50	0,77	3,53	1,34	3,49	1,72	3,08	2,09
2018	3,25	1,18	3,46	2,30	3,21	2,07	1,42	0,69	3,49	1,36	3,45	1,65	3,14	2,07
2019	3,17	1,12	3,48	2,29	3,16	2,01	1,36	0,65	3,50	1,38	3,44	1,62	3,05	2,16
2020	3,16	1,12	3,51	2,26	3,15	2,02	1,37	0,63	3,48	1,40	3,50	1,61	3,08	2,19
2021	3,18	1,18	3,40	2,22	3,13	2,04	1,41	0,64	3,38	1,38	3,48	1,58	3,02	2,14
C.R (%)	**-21.69**	**-28.44**	**-15.34**	**-23.29**	**-17.57**	**-23.26**	**-26.11**	**-42.29**	**-27.79**	**-35.57**	**-7.34**	**-26.24**	**-20.32**	**-24.47**

3.4. Land use in the Metropolitans

In order to see the urban-agricultural conflict in the provinces more clearly, it will be useful to evaluate the land use changes over the years as well as interpreting the statistical data on the population and agricultural areas of the provinces (Republic of Türkiye Ministry of Environment, Urbanism and Climate Change, 2022). When the table in which the land use change results of the provinces are processed for the years 2000-2018 is examined, it will be seen that the proportion of artificial areas, including urban and industrial areas, has increased in all the metropolitans. The highest increase in artificial areas was detected in Hatay (M4) and Tekirdağ (M10) (Table 8).

The provinces where there is a decrease in agricultural areas in the provinces of Malatya (M5); Kahramanmaras (M7); Mugla (M9); Tekirdag (M10); Trabzon (M11); Şanlıurfa (M12). The metropolitan with the highest decrease is K.Maraş (M7). These results indicate the pressure on agricultural lands in the relevant provinces.

Although it has been determined that agricultural areas have increased in some provinces (Aydın (M1), Denizli (M2); Balıkesir (M3); Hatay (M4); Manisa (M6); Mardin (M8); Van (M13) and Ordu (M14)) It is observed that the area of *"Forest and Semi-Natural Areas"* has decreased in the provinces. This situation brings to mind the possibility of transforming forest and semi-natural areas into artificial areas in these provinces (Table 8) .

Table 8. Land Use Classification of the Metropolitans (2000-2018)

Metro	Ratio of Artificial Area (%)		Ratio of Agricultural Area (%)		Ratio of Forest and Semi-Natural Area (%)		Ratio of Wetland (%)		Ratio of Water Structures (%)	
	2000	2018	2000	2018	2000	2018	2000	2018	2000	2018
M1	2,79	3,19	46,53	48,32	49,56	46,81	0,04	0,07	1,08	1,61
M2	1,87	2,22	39,74	42,53	56,87	54,14	0,99	0,53	0,54	0,58
M3	1,94	2,70	45,12	47,11	51,46	48,58	0,17	0,17	1,21	1,44
M4	3,36	4,54	51,48	52,5	44,95	42,55	0,08	0,16	0,13	0,24
M5	0,62	0,95	36,69	35,81	61,28	61,79	0,02	0,02	1,37	1,43
M6	1,90	2,42	52,02	52,85	45,09	43,66	0,03	0,04	0,96	1,02
M7	0,85	1,59	42,72	35,60	55,47	61,68	0,07	0,06	0,89	1,07
M8	0,87	1,48	49,22	53,16	49,82	45,29	0	0,01	0,09	0,07
M9	2,12	2,46	23,46	22,55	73,12	73,39	0,37	0,33	0,94	1,27
M10	4,1	5,11	78,19	77,41	17,28	16,59	0,02	0,02	0,41	0,86
M11	0,65	1,24	46,42	40,69	52,41	57,85	0,0	0,0	0,52	0,21
M12	1,19	1,93	72,14	70,99	25,11	25,15	0	0,06	1,56	1,86
M13	0,68	1,09	23,35	28,11	64,84	59,86	0,91	0,78	10,23	10,17
M14	1,1	1,35	48,08	57,34	50,53	40,98	-	-	0,28	0,33

4. Conclusion, Discussion and Suggestions

In the study, a general evaluation was made on population growth, urban sprawl and agricultural areas in the World and Türkiye. Agricultural production areas and land cover change were examined depending on the population variable in 14 metropolitan cities, whose rural population and agricultural production potential are much higher than Türkiye's average and declared as metropolitan cities by Law No. 6360 (OG, 2012). and in this process, it has been determined that the rate of change in these provinces is above the Türkiye average. In the study, it has been clearly demonstrated that urban areas have developed against agricultural areas and other natural/semi-natural areas. This population projection indicates that the risk of conversion of agricultural lands around the relevant metropolitans to urban areas will increase.

Because in recent years, many researchers from around the World (Morello et al., 2000; Dewan& Yamaguchi, 2009; Primdahl et al., 2013; Duvernoy et al., 2018; Beckers et al., 2020; Dadashpoor & Salarian, 2020; Chakraborty et.al., 2021) and many researchers from Türkiye (Alphan, 2003; Ortaş et al., 2008; Sezgin ve Varol, 2012, Akseki ve Meşhur, 2013; Cengiz et al., 2014a; Uzun & Demir, 2016; Cengiz et al., 2017; Bayar, 2018; Çolak, 2018; Partiöç, 2018; Sönmez, 2018; Gülçin, 2019; Kurtşan & Nurlu, 2019; Karakuş et al., 2020) have revealed in their studies that agricultural areas have decreased and these areas have turned into more structural areas.

Considering that the agricultural areas lost with the effect of urbanization and industrialization may increase over time, it is highly likely that ecological, economic, social and cultural wear will occur in the country. At this point, it is obvious that it is necessary to develop multi-dimensional conservation principles and a holistic planning approach and policies for the protection of agricultural lands. In this context, it is very important to plan these areas and define legal instruments with a focus on protecting agricultural areas in Türkiye (Akseki & Meşhur, 2013; Karadağ et al., 2022).

However, there are gaps in a planning approach that considers agricultural landscapes at the ecosystem level holistically and ensures the balance between protection and using in the country (TMMOB, 2014; Karadağ et al., 2018; Demiroğlu et al., 2019; Türker, 2021; Karadağ&Demiroğlu, 2022). It is extremely important that the planning hierarchy in the country is set up correctly at the point of protecting natural resources, that land use plans are based on ecology/ecosystem, and that urbanization and agricultural policy objectives are established in a balanced and sustainable manner (Demiroğlu et al., 2014; Demiroğlu & Karadağ, 2015; Karadağ & Cengiz, 2018; Demiroğlu et al., 2019; Karadağ & Şenik, 2019; Karadağ et al, 2019; Karadağ et al., 2020). In this direction, it is important to develop policies that will ensure the participation of landscape planning in the planning hierarchy of the country. With the development of a spatial planning system that will guide the use of land within the framework of landscape planning, the urban-agricultural conflict will be minimized; In the long run, the severity of ecological, socio-economic and cultural problems will also decrease. (Yılmaz, 2010; Cengiz et al, 2017; Gülçin, 2019).

It is also extremely important to develop different coping strategies at local and national levels to review and synthesize the impact of urbanization on agricultural lands (Azadi et al. 2018). At this point, in addition to the preparation of use plans at different scales that will ensure the sustainable use of the lands, it will also be beneficial to establish a system to monitor these plans and to regularly monitor the changes in land use using up-to-date technology and methods (such as landscape metrics, land cover change, urban-spatial expansion indicator) (Aksoy ve Özsoy, 2013; Doygun, 2017; Anselm et al., 2018; Gülçin 2019; Salem et al., 2020; Dutta et al., 2020).

Because considering the important role on matters (food security, local livelihood, economic development, poverty reduction, etc.) played by agricultural lands;there is a clear need to understand the relationships between urban-agricultural land use change and how their interactions can be aggravated by each other (Azadi et al., 2018).

In general, there are great gaps in the legislation governing the use and protection of agricultural lands in the country (Aksoy & Özsoy, 2013; Ünal & Başkaya, 2000; Öztürk, 2004; Yörür, 2010; Cengiz et al., 2014b; Demiroğlu & Karadağ, 2022). For example; it has been stated in related studies that it is worrying that the expression of public interest in the legislation on the protection of agricultural lands (OG, 2005; OG,2017) in Türkiye is vague and quite comprehensive. In addition, it has been stated in the relevant legislation that reducing the use of agricultural lands to the governor's level may pave the way for the misuse of agricultural lands (Gün, 2006; Topçu, 2012; Gün, 2014; Bayar & Karabacak, 2017; Sönmez; 2018).

At this point, Karadağ et al. (2022) evaluated the relevant law and its regulation within the framework of the sustainability principles (*connection, natural resource planning, safe and sustainable food production, ıntegrity, ınterdisciplinary approach, participation*) determined for the protection and sustainable use of agricultural lands and they stated in their studies that Türkiye does not have sufficient sensitivity and awareness about the sustainable use and protection of agricultural lands.

It has also been emphasized in many studies that the negative effects of the law numbered 6360, which constitutes the main emphasis of the study, on the country's agricultural areas, agricultural production, rural population, agricultural economy, employment, and rural tourism activities are worrying. In related studies, it has been stated that the environmental, economic, social and cultural effects of the law on rural areas are worrisome (Gün, 2014; Demiroğlu et al., 2014; Üçer et al., 2014; Görür & Yörür, 2017; Demiroğlu et al., 2019; Demiroğlu & Karadağ, 2022).

As a result, sustainable-ecological-ecosystem-based urban-rural processes should be placed at the center of planning and national/local rural-urban policies at the point of protection and development of agricultural areas in the country. Protection and development of agricultural lands should be legally secured. Legal gaps on the subject should be eliminated.

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The article complies with national and international research and publication ethics.

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Gastronomy Tourism and Culinary Culture of Yalvaç (Isparta) Region

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1. Introduction

With the population growth in the world and our country, the urbanization process and its area are increasing very rapidly on horizontal and vertical scales. More homes, schools, commercial centers, and highways are being constructed to meet the needs of the population growth in the expanding cities. However, it is evident that human demands are growing and diversifying, which harms ecological systems and resources physically (Çakır, 2021). Today, it is a known fact that the world population is concentrated in urban areas and 75% of natural resources are consumed in cities. It is predicted that the negativities experienced on a global, regional and local scale will lead to global crises in energy, water, and health issues, especially in food. In this context, managers, politicians, and decision-makers have started to give priority to the development of green-blue infrastructure and nature-based solutions to increase the capacity of cities to adapt to climate change, resource consumption, and scarcity. For this purpose, urban agriculture, agrotourism, and gastronomy tourism applications are accepted as important solutions. Especially urban agriculture is a popular phenomenon (Türker, 2021a) Urban agriculture provides an important tool to improve the population growth in cities and therefore the more complex urban problems (Türker, 2021b). Urban agriculture is a landscape approach and has important contributions to the ecological, economic, social and health system of the city. Urban agriculture is an important form of land use, which contributes to the creation of healthy cities for future generations by creating a more ecological urban environment, thus contributing to sustainable urban development (Türker & Akten, 2020; Türker & Anaç, 2022). It offers solution strategies for the problems of urban areas (Türker & Akten, 2021).

The global epidemic, economic changes, problems in the food sector, etc. which have been experienced in the world and our country in recent years, have adversely affected rural areas as well as cities. For this reason, the sea, sand, sun triple tourism concept approach has begun to lose its appeal for consumer groups with high environmental awareness, who seek awareness and seek more natural products (Cömert & Özkaya, 2014). In the tourism sector, rural tourism, agrotourism, and gastronomy tourism have become important components of local development in terms of spreading tourism activities over 12 months to respond to the needs of the masses with changing expectations.

Contrary to monotonous mass tourism in the classical understanding of tourism, destination areas that offer a wide range of products such as natural values, local traditional architecture, archaeological and historical values, local cuisine, and traditions/customs are more preferred by domestic and foreign tourists.

Turkish gastronomy has its roots in Ottoman cuisine, a combination of the influences of Central Asian, Middle Eastern, and Balkan traditions It has then influenced other Mediterranean cuisines with which it shares today many ingredients and recipes. As in other areas, it also exhibits a vast array of regional and local variations (Surenkok et al., 2010).

Today, Turkish Cuisine has thousands of years of history and cultural heritage value. For this reason, it is of great importance to bring it into urban and rural tourism. Today, the reasons for the preservation and sustainability of cultural heritage assets are the desire to understand and keep alive the past, to create an organic bond with the past, to convey the existing heritage assets to future generations, to ensure the social, economic and ecological development of the region and society, to develop the tourism capacity of the region, etc. are listed as (Ekinci, 2009; Gül et al., 2019).

In this context, for the tourism masses seeking awareness; Local eating and drinking culture (gastronomy), which has become an attractive element, has become an important part of local or regional tourism. In the tourism sector, gastronomy activities are an important tool in the formation of a culturally competent environment.

Gastronomy plays an important role in the development of tourism, agrotourism, urban agriculture, and ecotourism activities. Agrotourism (agricultural tourism) is a type of tourism preferred by people who enjoy nature, know the value of nature, and are interested in cultural heritage and gastronomy.

Agrotourism is a modern and traditional alternative tourism type based on agriculture, which allows tourists to stay in farms or hostels and experience various agricultural activities intertwined with nature while providing economic vitality in the countryside and contributing to the development of the region (Durlu-Özkaya et al., 2012).

In this context, it requires tourism planning, design, and management by considering the natural and cultural tourism components of a region's gastronomy culture in a sustainable and integrated manner

Yalvaç's local cuisine has an important cultural heritage value with its diversity and richness of the eating and drinking culture, which is still maintained by preserving itself from the past to the present, and which includes different tastes and traditions. The diversity in Yalvaç's traditional culinary culture depends on many factors.

The Yalvaç, which is located in the Mediterranean Region, is bordered by the Central Anatolia and Aegean Regions and is influenced by the cuisine of these regions, and its unique rich food culture has emerged.

In this study, the traditional gastronomy culture of the Yalvaç district was evaluated in terms of gastronomy, and suggestions were made that it could be integrated with Yalvaç tourism planning.

2. Gastronomy Tourism

Food has always been an essential component of society and an essential motivation for most human activities (social eating, meetings, weddings, journeys, celebrations, etc. (Antonioli Corigliano & Baggio, 2003).

The types of food and drink consumed to ensure the continuation of life, and the way they are prepared is an application based on customs and traditions. For this reason, the eating habits of a society are called the food culture of that society (Arslan, 1997, 29).

The eating and drinking culture of a region is a culture that is shaped within the scope of the traditions and customs of the society in geographical areas and undergoes changes as a result of communication with different cultures around them (Akman & Mete, 1998).

Factors that influence gastronomic identity are religion, history, ethnic diversity, innovation, talents, traditions, beliefs, and applicable values or norms. These factors will affect the gastronomy sector such as basic ingredients, cooking methods, and taste and texture of food (Putra, 2019).

The food culture that the society has realized from the past to the present, together with the geographical conditions, is a part of the local identity. The word 'gastro' comes from the word 'gastros' which means stomach and 'gnomos' which means science and law in Greek. And culinary is defined as a country or a place where the origin of food is served or prepared (Kivela & Crotts, 2006; Güzel & Apaydın, 2016).

Concepts such as 'gastronomy tourism', 'culinary tourism', 'nutritional tourism', 'gourmet tourism', 'gastronomic tourism', and 'food tourism' are used to describe the use of food for tourism purposes (Doğdubay & Giritoğlu, 2008; Kivela & Crotts, 2006; Lin et al., 2011; Mc Krecher et al., 2008; Tikkanen, 2007; Horng & Tsai, 2008; Surenkok et al., 2010; Yüncü, 2010).

Gastronomy is defined in the dictionary as a fondness for food, an understanding of food, the science of food, and the art of good food. Gastronomy tourism is an important type of tourism that benefits from the attractiveness of the culinary culture (eating and drinking culture), which is one of the important components of cultural identity and contributes to sustainable economic development (Wolf, 2006, 21).

Gastronomy tourism is a tool that can be used as a supporting activity or main activity with the food and beverage culture in the destination area and create an economic impact (Quan & Wang, 2004).

Gastronomy tourism includes components such as the production, properties, microbiology, food preparation, cooking method, eating habits, historical and cultural elements of the food, the way it is served, and the place where the food is served (Gillespie, 2002; Çalışkan, 2013).

The main motivation factor of gastronomic tourism can be realized in the form of visiting producers, food festivals, restaurants, and special areas to taste a special type of food or see a meal being produced and to eat from the hands of a famous chef (Yüncü, 2010).

3. Material and Method

It is aimed to determine the local characteristics of the gastronomy culture, which is one of the traditional and rich cultural components of Yalvaç, and to evaluate it in terms of tourism. Subjects such as traditional production, processing, production, and consumption processes of the products have been researched and the results obtained have been evaluated.

3.1. History of Yalvac District

Yalvaç is located in the northeast of Isparta, on the southern skirts of the Sultan Mountains, and in the Mediterranean Region. Yalvaç is at an altitude of 1170 meters and covers an area of 1415 kilometers. Yalvaç is the largest district of Isparta province with a population of 60 thousand along with the surrounding villages, 20 thousand in the center.

It was established side by side with the ancient city of Antiokheia, which was one of the important centers of the ancient period in terms of history and was the capital of the region. The earliest findings regarding the history of Yalvaç begin with the Tokmacık region, where fossils of "Horse, Elephant, and Rhinoceros" lived 8 million years ago. Later, it continued with the Neolithic Period (6 Thousand B.C.) settlements in the vicinity. Antiokheia ancient city, BC. With the establishment of the city of Antiochos by I. Antiochos Soter in 275, it came to the stage of history. However, the fact that the findings of the Sanctuary of Men near the city reached the 4th century B.C. shows that there was also a classical period culture in the region. The city experienced its heyday under the rule of Rome, and intensive construction activities were observed. During the reign of Augustus (27th century B.C.- 14th century A.D.), 8 colonies were established in the Psidia Region, but only Antiochia was given the title of "COLONIA CAESAREIA", that is, the city of Caesar, due to its location (Yalvaç Belediyesi, 2021).

The city lived its second period in the Byzantine period. St. Paulus, who realized the importance of the city, came to Antioch three times between the 46th and 58th centuries AD, laying the foundations of Christianity and spreading it to the world from there. Especially with the liberation of Christianity at the beginning of the 4th century AD, it continued its importance as a religious center during the Byzantine period (Yalvaç Belediyesi, 2021)

The city, which was in ruins from the Arab raids and Crusader wars that started in the 8th century A.D., began to gradually withdraw from the stage of history. However, in 1176, after the Seljuk Sultan Kılıç Arslan II defeated the Byzantine army and after the Miryakefalon War, which was fought near Yalvaç, The Turks settled in the region and regained the cultural center feature of the city (Yalvaç Belediyesi, 2021).

Yalvaç conceptually means "prophet, messenger, envoy, and guide". In addition, it is the name of the Oghuz tribe who settled in Yalvaç. Yalvaç has carried the meaning of this name throughout history. Archaeological values, historical and traditional architectural examples, local dishes, local handicrafts, traditions, and customs, etc., constitute the basis of Yalvaç's cultural heritage. It is of great importance to carry all these values, which are the result of thousands of years of gains, to the future with the same gains, with the awareness of protection (Dedehayır, 2008).

3.2. Tangible and Intangible Cultural Values of Yalvaç District:

Today, tangible and intangible values of a region are accepted as cultural heritage values. Assets with heritage value; It is an integral component for present and future change and development, forming the basis of universal, national, regional, and local identities, describing and recording the historical development process, forming a common memory at the scale of space, time and culture (Gül et al., 2019).

The natural and cultural tangible values of the Yalvaç District have been examined under 5 headings, with the casting studies and some literature reviews in the Yalvaç Region. These values are given in the Tables in detail. These;

• Archaeological and geological values (Table 1).

• Religious and ethnic structure/object/events (Table 2).

• Historical values (Table 3).

• Traditional and special architectural structures and objects (Tablo 4).

• Natural and cultural spaces and green areas (Tablo 5).

Table 1. Archaeological and geological values of the Yalvaç Region

Archaeological and Geological Values	**Explanations**
Pisidia Antiokheia Ancient City: *(Pisidia Antiokheia Antik Kenti)*	It is the place where St. Paul gave the first sermon on Christianity in Anatolia and is an important center for faith tourism. It has an important place to be the capital of the Pisidia region during the Roman period. The city was built on an area of 46 hectares, all surrounded by walls. Regular excavations were started by the SDU Archeology Department in 2008. However, the main structures of the ancient city, of which 10% is above ground, include the West Gate, the two Main Streets on which the structures of the city are located, the Theatre, the Central Church, Tiberius Square, the Propylon, the Temple of Augustus, the Monumental Fountain, the Bath, the St. Paul's Church and Stadion (Yalvaç Belediyesi, 2021).
The Sanctuary of Men *(Men Kutsal Alanı)*	The Sanctuary of Men is approximately 5 km southeast of the ancient city of Antiokheia. It is at an altitude of about 1600 m. The Sanctuary of Men consists of a temple built in the name of Men, one of the mystical Gods of Anatolia, and buildings gathered around it in the Gemen Grove. The God of Men, especially in the inner-west regions of Anatolia, is a God who is the protector of poor, weak, sick people, and who distributes goodness and healing to people, and its roots reach back to the Mesopotamian period (4000 BC) (Yalvaç Belediyesi, 2021).
Limnia Island (Limnia Adası)	Gaziri Mevkii, located 25 km from Yalvaç, is an island in Hoyran Lake. Archaeological studies on the island have revealed that it was used as a residential area in the past. A temple thought to have been built in the name of Artemis and the remains of other structures connected to this temple were found on the island, which is about 3 km from the lakeside. However, a comprehensive study has not been carried out on the island and it has not been brought into tourism (Çolak, 2018).
Rock Tombs *(Kaya Mezarları)*	It is located on cliffs to the east of Hoyran Lake. It is thought that there are rock tombs peculiar to the nobles, facing the lake and toward the sunset (Yalvaç Belediyesi, 2021).
Mounds *(Höyükler)*	There are many mounds in the Yalvaç district (Akçasar Höyük, Dörtyol Mound, Ayvalı Mound, Camlica Mound, Kirkuyusu Mound, Kumdanli (Söğütdibi) Mound, Tokmacik Mound, Yarikkaya Mound, Sücüllü Mound, Kurusarı Mound, Yağcılar Höyük, Çamharman Mound, Çamharman Höyük, Tekirman Höyük, Tekirman Mound, Mound, Terziler Höyük, Altinoluk Höyük -Necropolis Area) (Url-24).

Tokmacik Fossil Site *(Tokmacık Fosil Alanı)*	It measures 100x150 m and is approximately 10 m high, just south of Tokmacik Village. It is on a south-sloping land. There are pottery samples from the Old Bronze Age to the Roman period in the mound (Url-24).
Aqueducts (*Su Kemerleri)*	It was built as a 10-kilometer-long waterway to meet the water needs of the Pisidia Antiokheia Ancient City in the Roman Period.

Table 2. Religious and ethnic structure objects and values of Yalvaç Region

Religious and Ethnic Structure Objects and Values	**Explanations**
Mosques *(Camiler)*	Devlethan Mosque (Ulu Mosque) (14th century) Hamidiye (New) Mosque (19th century), Leblebiciler Mosque.
St. Paul's Church (Great Basilica) *(St. Paulus Kilisesi (Büyük Bazilika)*	Today, Christians become "pilgrims" by walking the Ancient St. Paul's Road (approximately 500 km), which starts from Perge, 10 km east of Antalya, and extends to Yalvaç. Christians who reach Yalvaç complete their worship by reaching the Church of St. Paul in the ancient city of Pisidia Antiocheia, which is the largest building in the region (Kuter & Erdoğan, 2006).
Emir Ahmet (Sayyid Sultan Ahmet) Tomb *Emir Ahmet (Seyyid Sultan Ahmet) Türbesi*)	The tomb is located in the Yalvaç Bey (Demirciler) Bedesten in Çınaraltı, Pazar Yukarı Mahallesi. During the Seljuk Period, there was a large Madrasa named after the tomb. Emir Ahmet died in 1325 after educating many students here (Yalvaç Belediyesi, 2021).
Registered Cemetery of Muhammed İbrahim El-Yalvaci (İhbar Billezi) Efendi (Muhammed *İbrahim El-Yalvaci (İhbar Billezi) Efendi'ye ait Tescilli Mezarlık)*	This cemetery was registered as a monumental structure by the Antalya Cultural Heritage Preservation Regional Board in the cemetery south of the Hisarardı Village Mosque.
Kusku Dede Tomb (*Kuşku Dede Türbesi)*	The Tomb is located in the Kuşku Cemetery of the Leblebiciler District of Yalvaç. The Tomb has a hexagonal structure and its parts are covered with marble. There is a marble sarcophagus, carpet, and prayer rug inside the tomb.
Şeyh Mehmet Tomb *(Şeyh Mehmet Türbesi)*	The tomb is located in the Hüyüklü Town of Yalvaç. The tomb has a lead-domed structure and an open tomb.
Nohutlu Baba Tomb (Nohutlu Baba Türbesi)	The tomb is located under the poplar trees in Hisarardı Village of Yalvaç. The tomb, which has a wooden roof, is located in the garden.

Seyfettin Tomb *(Seyfettin Türbesi)*	The mausoleum is located in Körküler Village. The tomb, which was previously made of wood, was later converted to reinforced concrete and has a wooden roof.
Cem House (Cemevi)	The Cemhouse is located in the Körküler Village of Yalvaç. It has a reinforced concrete structure.
Sağır Dede (Sağrışık) Tomb *(Sağır Dede (Sağrışık) Türbesi)*	The tomb is located in Sağır Village of Yalvaç. The tomb has a triangular structure.
Şeyh Mehmet Tomb *(Şeyh Mehmet Türbesi)*	According to the narration of the people in Körküler Village, it is said that he was an Alevi Seyh. The location of the place declared as a mausoleum is the "Tekke Önü" location. Classical period architectural pieces were used as spolia in the place seen as a tomb (Url-24)
Kutlu Tomb *(Kutlu Türbe)*	The tomb is located in the Ayvalı Village of Yalvaç. It has a wooden roof and is made in a square shape. Their places are plastered with earth. Inside the tomb, there are two tombs, Sadık and Satı, which are covered with earth.
Gazi Dede Tomb *(Gazi Dede Türbesi)*	The location of the place declared as a mausoleum is "Gazi Dede Hill" location in Cetince Village. It looks like a tomb surrounded by reinforced concrete in a forested area.

Table 3. Historical values of the Yalvaç Region

Historical Values	**Explanations**
Ottoman Turkish Bath *(Osmanlı Hamamı)*	It is a bath reflecting Ottoman traditions during the Ottoman period and is not in use at the moment. Restoration work has been started within the scope of a prepared project but has not been completed yet (Yalvaç Belediyesi, 2021).
Çınaraltı Place *(Çınaraltı yeri)*	It is an area where the Monumental Sycamore tree is about 800 years old and where people sit. The old sycamore tree is 16 meters tall, the trunk circumference is 10.25 meters, the trunk chest diameter is 3.26 meters, and the branch length varies between 7.50 and 15.80 meters.

	The Sycamore Tree was registered as a Monumental Tree by the Antalya Conservation Board (dated 11 May 1992 and decision no 1401). The region where the plane tree is located; The nearby Madrasa, Hamam, and Devlethan Mosque are also important in terms of showing the settlement center and form of the Turks during the Seljuk Period. Today, Çınaraltı is one of the most preferred areas of people with its nine coffee houses lined up around it (Yalvaç Belediyesi, 2021).
The Square That Tells About Yalvaç *(Yalvaç Anlatan Meydan)*	The square is located in the city center, opposite the town hall. Symbolizing the rich history of Yalvaç, it overlaps with its name and provides the city to tell itself in the concept of a guide. When you enter the square, which is an open-air museum, through the covered and columned entrance on the north side, you come to the corridor with wide pillars arranged in the form of a circle and equally spaced on both sides. There are information boards on the pillars on both sides of the corridor, the upper part of which is open (Kılınç et al., 2019).
Arch Bridge *(Kemer Köprü)*	The bridge is in Hüyüklü Town and is connected by vertical and horizontal concrete beams to the right and left of its entrances. It has 3 eyes, two small and one large. The large arch in the middle is pointed and held higher than the others. Under his feet, the defects caused by the flood over time were consolidated later. There is an inscription on the east side of the bridge, just to the left of the large arch with the spire in the middle, to the south. (Yalvaç Belediyesi, 2020).
Old The Fountain (Eski Çeşme)	The fountain in Eyupler Village measures 102x240x270 cm. It is made of ancient architectural pieces, antique bricks, and collected hearth stones (limestone) using mortar between them, and the wooden gable roof is covered with tin. Except for the ancient pieces below, all the faces of the fountain, including the carved basin, are plastered. A two-stage pointed arch was made with plaster on the niche where the basins are located. In front of it, there is a concrete trough with a slight right-hand boat. Two prismatic antique architectural pieces (one of them an inscription) on the front façade were used as the column on which the arch was seated (Yalvaç Belediyesi, 2020).
Battle of Myriakephalon *(Miryakefalon Savaşı)*	The Battle of Miryakefalon, which was fought near Yalvaç, was fought in 1176 between the Seljuk Sultan Kılıç Arslan II (1155-1192) and the Byzantine Emperor Manuel Komninos I (1143-1180). If the 1071 Malazgirt Victory is a victory that opens the gates of Anatolia to the Turks, the 1176 Miryakefalon Victory is a victory in which Anatolia is registered as the Turkish homeland (Yalvaç Belediyesi, 2021).

Traditional Neighborhood Stone Kilns *(Geleneksel Mahalle Taş Fırınları)*	Since the years when the Turks came to Anatolia and settled down, the people of Yalvaç have been continuing their bread-making traditions. Making bread in neighborhood stone ovens is the product of important culture and tradition. Inside the building, which was built with thick walls using mudbrick, there is an elevation called Hanay with a wooden floor. Stone ovens for baking bread are usually located on these elevations just opposite the inn. The inside of the ovens is completely covered with stone, the heating process is done on one side of the oven, and bread is baked on the other side in the same environment (Yalvaç Belediyesi, 2021).

Table 4. Traditional and special architectural structures and objects of the Yalvaç Region

Traditional and special architectural structures and objects	**Explanations**
Yalvac Museum *(Yalvaç Müzesi)*	Continuing research in Pisidia Antiokheia, which became the focus of archaeological research for about 150 years, revealed the need to establish a museum in Yalvaç in the 1900s. The construction of the museum was started by the General Directorate of Antiquities and Museums in 1963 and the Yalvaç Museum was opened on September 9, 1966. The museum, which consists of a Prehistory gallery, a classical hall, a Yaletnographic hall, a colonnade exhibition, and a garden, is in the center of Yalvaç.
Former Leather Factory *(Eski Deri Fabrikası)*	Yalvaç Industry and Trade Incorporated Company, one of the first 125 companies established in 1924 during the Republican era, served in the leather sector. Today, the existing machines are exhibited in an open-air museum in a special area in front of the building as an indicator of the industrial conditions of that period.(Yalvaç Belediyesi, 2021).
Historical old Yalvaç Houses and Traditional Textured Streets	Traditional Yalvaç Houses are distinguished from other regions by their distinctive section naming, as well as reflecting the old Turkish house architecture. The basic part of the houses built with adobe and wood materials was built with stone material, including spolia blocks, up to the basement level. Its outer surface is plastered with mudbrick mortar and covered with a hipped tile roof. There are the following sections in the houses, where the entrance is generally provided by double-leaf wooden

(Tarihi Eski Yalvaç Evleri ve Geleneksel Dokulu Sokaklar)	doors: Hayat, Kiler, Ahır, Samanlık, Mutfak, Hanay, Köşk, Baş Oda, Eşik, Döner Oyma (Yalvaç Belediyesi, 2021).
Felt House *(Keçe Evi)*	Felt-making has an important place among the traditional handicrafts that have continued since the Turks came and settled in the region. Felts produced from completely natural materials, goat and sheep wool, and compression method without using sewing were used as carpets and rugs in old Yalvaç houses, and in daily life by shepherds for shutters and other purposes. The emotions and thoughts of the people of that period were also used in the motifs of various eye-catching colors on these products (Isparta Valiliği, 2010).
Tıraşzade Mansion (Municipal Culture House) *(Tıraşzade Konağı Belediye Kültür Evi)*	It is located on Kahveci Bekir Street in Kasyukari District. It is adjacent to the Kasyukari Neighborhood Masjid, which is located on the north side. It is also known as Traşzade Mansion (Yalvaç Belediyesi, 2020).
Hancı Eminoğlu Süleyman House (Yalvac Culture House) *(Hancı Eminoğlu Süleyman Yalvaç Kültür Evi))*	It is located on Namazgah Street in Görgü Orta District quarter of Yalvaç District. Its ownership belongs to the Provincial Legal Entity. It was registered by the Antalya Conservation Board (decision dated 07.08.2003 / 5987). House; It was built on a stone foundation as adobe and bağdadi on an area of 14 x 19 meters, in the plan type with an inner sofa, with 3 floors and a garden. It was covered with wooden hipped roof corrugated tiles (now similar modern tiles). It is a little flat because the barn and cellar are built on the ground floor. After the repair, this floor includes the guard room, kitchen, and heating room; Toilets were built under the western section. In the original house, lime whitewash was used on tow plaster inside and mud plaster was used on the outside (Yalvaç Belediyesi, 2020).
Mustafa Bilgin Art House *(Mustafa Bilgin Sanat Evi)*	It is located near the Keçe house in Görgü District. Mustafa Bilgin Women's Art House is a project planned by Yalvaç Municipality after the restoration of an old Yalvaç house. In these houses, it is aimed that courses such as ceramics, glass, and painting will be given to the women of the neighborhood, the products made by women will be exhibited and then sold, and thus women will participate in production (Yalvaç Belediyesi, 2020).

Table 5. Spatial values: (natural areas, open and green areas, recreation areas) of the Yalvaç Region

Spatial values: (natural areas, open and green areas, recreation areas)	Explanations
Hıdırlık *(Hıdırlık)*	The place where the traditional Hıdırellez of Yalvaç is celebrated is 1 km from the town center. away. There is a restaurant in the area surrounded by pine trees.
Hisarardı Village *(Hisarardı Köyü)*	The village is 3 km away from Yalvaç City Center. It has an important cultural tourism potential with its traditional civil architecture and natural and cultural values.
Hoyran Lake *(Hoyran Gölü)*	It is the name given to the Hoyran locality within the borders of Yalvaç of Eğirdir Lake. The area around the lake, which is 25 km away from the town center, has natural beauty and a public beach. In addition, the area is suitable for both highland tourism and caravan camping tourism.
Gemen Grove *(Gemen Korusu)*	Gemen Grove is 7 km from the town. It has an interesting beauty with its history and unique natural scenery (Durmuş, 2004:39).
Natural Caves (Doğal Mağaralar)	Akar-Donar Cave, Değirmen Önü Cave, and Bear İni Cave are registered caves. In addition, there are many caves to be explored within the borders of Yalvaç.

Intangible cultural heritage consists of traditions, customs, representations, expressions, knowledge, and skills that a community inherited from past generations and adopted and kept alive as part of traditional living culture. Yalvaç is very rich and diverse in terms of intangible cultural heritage (Table 6).

Table 6. Intangible Cultural Values of Yalvaç Region

Intangible Cultural Values of Yalvaç Region:	**Explanations**
Craft Traditions *(Geleneksel El Sanatları)*	The main Yalvaç handicrafts that have survived from the past to the present are as follows: Weaving Arts (Carpet, Rug, Haba, Sack), Felting, Knitting (Socks, Booties, small saddlebags, Gloves, Mushaf, Geri (Kıl Haba), Spinning (Hemp yarn), Turkish Motif Multiplier, Waist Bead, Ringing, etc.), Metal Art (hot smithing, coppersmithing, tinsmithing), Woodworking Art (miniature wooden carriage and oxcart manufacturing), Leather Arts, Saddlery, etc. Today, most handicrafts (weaving arts, copper making and tin making, saddlery, saddle making, etc.) are facing extinction
Local Clothing *(Yöresel Kıyafetler)*	Bindallı, Embroidered vest, Şalvar, Delme, Üç Etek, Uçlu Fes, Pontur (regional trousers worn by men).
Knowledge and Practices Related to Nature and the Universe *(Doğa ve Evrenle İlgili Bilgi ve Uygulamalar)*	Hıdrellez celebrations, Diş göllesi, Köstek kesme, Halk, Kırk basması, Alevi- Bektaşi Ritual, Semah, Sugözü Adak Festival, Yalvaç District traditional cuisine culture.
Oral Traditions and Lectures *(Sözlü Gelenekler ve Anlatımlar)*	Sunday Prayer, Marriage, Daughter tradition, Engagement, Henna Night, Wedding, Religious Holidays, Birth Customs, Circumcision Wedding, Local Folk Dances, Yalvaç Folk Songs, Local Children's Games, Room Burning, Straw Burning, etc.
Performing Arts *(Gösteri Sanatları)*	Village theatrical plays, folk dances, folk music, children's plays, etc.
Social Practices, Rituals and Feasts *(Toplumsal Uygulamalar, Ritüeller ve Şölenler)*	Hıdrellez festivals (Every year on May 6), Pisidia Antiokheia Culture, Tourism and Art festival (started in 1992 and is held every year), Sugözü Adak Festival, Özbayat Kelek Festival.

4.2. Traditional Culinary Culture of the Yalvaç District

Culinary Culture expresses a holistic and unique cultural structure consisting of food, food, and beverage types that provide nutrition, the process of their preparation, cooking, storage, and consumption, the associated space and equipment, the tradition of eating and drinking, and the beliefs and practices developed within this framework.

Traditional food culture in Turkish society is a combination and result of natural and cultural lifestyles with regional differences. The richness and diversity of traditional food in various regions of Turkey can also be seen in Yalvaç's traditional food (Öncü, 2011). (Figure 1).

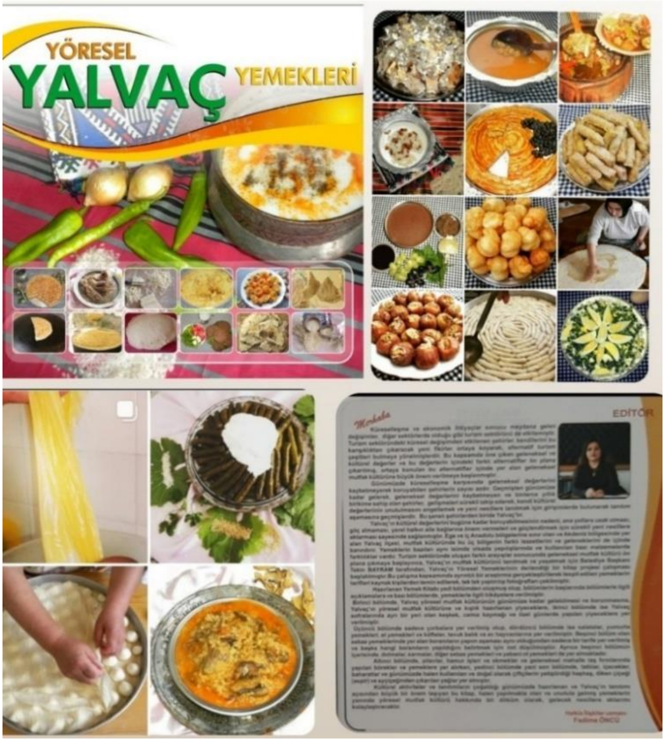

Figure 1. “Local Yalvaç Foods" Book (Original Photo: Fadime Öncü, 2011).

Yalvaç gastronomy has a rich variety of flavors suitable for different tastes, with flavors that differ from region to region. When this wealth is evaluated in terms of rural tourism, it depends on many factors. To determine this richness, research was carried out by Fadime Öncü, a Public Relations Specialist, within the scope of the project of Yalvaç Municipality, and the book "Local Yalvaç Foods" was written. Yalvaç gastronomy generally consists of dishes prepared with cereals and various vegetables grown in the region, with or without meat, soups, olive oil dishes, pastries, and dishes prepared with wild herbs grown in nature.

Today, the majority of the people in Yalvaç live in two-story houses in a garden. In Yalvaç houses, there is usually a small hall at the entrance to a wide hall. The rooms and the kitchen have a connection with this hall. The location of kitchen is close to the entrance. Kitchens with an average size of 8-10 m^2 generally have a connection with a balcony or garden. In the kitchens, there are mostly stationary work centers with ceramic or marble surfaces. Food preparation and service tools are placed in cabinets or shelves above and below the work centers (Öncü, 2011).

The families in Yalvaç preserve their food in various ways. The most common drying method is applied especially in the production of fruits, vegetables, tarhana, noodles, bulgur, cereals, and pastırma.

Homemade tomato paste and pickles are also common. Families living in Yalvaç prefer to consume foods rich in vitamins, minerals, and protein, and high-calorie value, generally tea for breakfast, and to consume vegetables such as various fruits, cucumbers, and tomatoes for snacks.

In Yalvaç Region, special food lists are prepared for special and ceremonial days such as religious holidays, weddings, births, circumcision, death, hidrellez, bagel and mat burning ceremony, Sunday tradition, and Sunday prayer. For example, in hidrellez; hidrellez wheat, gölle, dried nuts, and fresh and dried fruits are consumed. Dovga soup, roasted meat, stuffed leaves, spring rolls, and curd baklava are served at the feast table. In circumcision weddings, it is usually served as wedding soup with yogurt, tas kebab, or stew with chickpeas, pilaf, compote, and semolina halva.

For special occasions, it has also created unique food varieties such as göce, pastrami, buffalo cream, honey, molasses, yogurt, bulgur, etc.

The open-air market held on Mondays in Yalvaç city center is called the yogurt market. All dairy products are sold in this market. The local producers of the majority of dairy products are women.

In Yalvaç, dishes were cooked in earthen pots or tinned copper pots of different sizes, placed on a metal plate in wood-heated stoves, or on a stove. Today, stoves and ovens working with tubes and electricity have replaced the stoves used in the past. In the past, wooden spoons were used for cooking and eating, and it was served on copper and zinc plates of various sizes. Today, these tools and utensils have been replaced by pots, ladles, and spoons made of stainless steel. However, in some regions, wooden spoons and copper pots are still used. Since the food is mostly juicy, the spoon is the main eating tool. In recent years, forks and knives made of steel are in almost every home. In addition, the habit of eating from a single bowl is still maintained in rural areas. Dishes are placed on a large tray (usually made of tinned copper) called "Sini" or on a wooden tray, by placing bowls and plates (serving plates) (Öncü, 2011).

4.5. Local Gastronomy Values of Yalvaç District

Gastronomy values (Local Cuisine) of the Yalvaç District were examined in 7 different categories.

- Meat and Dough Meals (Table 7).
- Soups (Table 8).
- Salad Types (Table 9).
- Vegetable food (Table 10).
- Beverages (Non-Alcoholic) (Table 11).
- Desserts (Table 12).
- Dairy products (Table 13).

Table 7. Meat and dough meals of the Yalvaç District (Öncü, 2021)

Meat and dough meals of Yalvaç District	Figures
Keşkek	
It is the crown of traditional Yalvac Cuisine. As it is eaten at meals, it is also eaten for breakfast by being cooked in pots in traditional neighborhood ovens on weekends when the whole family is together. This tradition continues today. Pottery and ladle are still used in the making of Keskek. Keskek is cooked in a pot with content pastrami, keskeklik wheat, salt, water, and oil (Öncü, 2011).	(Orijinal Foto: Fadime Öncü, 2021)

Yalvaç ekmeği (*Yalvaç bread)*

Yalvaç cuisine has a rich variety in terms of bread types. In Yalvaç's traditional neighborhood stone ovens, different flavors of bread are produced by adding oil, poppy, potatoes, cartilage, and bulgur flour to the uniquely smelling bread made from leavened dough. In towns and villages, there are also durable phyllo bread made from unleavened dough in ovens or tandoors, and bread types made from corn flour. Among the materials used in neighborhood bakeries while making bread; are dough trough, uğra, eseran, dough cloth, dough board, breadboard, bread iron, sönge for sweeping the inside of the oven, and shovels are used to throw fuel into the oven. Gazel (dried tree leaves), stubble, çirp (thin tree branches), large straw, and chickpea shells are used as fuel in the oven. (Öncü, 2011)

Orijinal Foto: (Öncü, 2021).

Hamursuz

Boiled potatoes without pulp are peeled and mashed into puree to make them soft and stringy. Flour is sieved into a bowl or a dough bowl and the dough is kneaded by adding enough salt, water, and mashed potatoes into it. The dough, which is rested for half an hour, is praised by hand on the dough board and divided into meringues. If desired, butter or lard can be melted and mixed with sunflower oil, tahini, and salt to make it ready. Dough meringues are opened on the bread tray and the mixture prepared in sufficient quantity is spread with a ladle. After it is opened a little more by hand, it is rolled into a roll. The forming roll is wrapped around both sides and when it comes together in the middle, one side is placed on top of the other side and it is turned into a meringue. After resting for half or an hour, it is rolled out by hand on the dough board, egg yolk is brushed, and sesame seeds are added and cooked. Baked pastries are laid out on clean dough cloths to cool (Öncü, 2011; Göde 2017).

Orijinal Foto: (Öncü, 2021

Water Pastry *(Su böreği)*

In making water pastry, the dough formed by a mixture of flour, egg, and salt is turned into phyllo dough. Meat or cheese mortar is put into the phyllo dough boiled in hot water, cooked, and served to the table (Öncü, 2011).

(Orijinal Foto: Fadime Öncü, 2011)

Bread Vaccination ***(Ekmek aşı)***

Traditional neighborhood bakery bread is usually used for bread vaccination (Ekmek aşı). Stale bread at home is cut into small pieces and fried in the oven. Bread is arranged on the plate to be served. Onion is cooked and two or three eggs are broken into it. It is boiled by adding broth or normal water and poured over the bread. Let it rest for about five minutes and serve (Öncü, 2011).

(Orijinal Foto: Fadime Öncü, 2011)

Pisi Meatballs ***(Pişi Köfte)***

Pisi Meatballs are the only meatballs unique to the region made with meat in Yalvaç.

In a large bowl, mix ground beef, flour, black pepper, salt, and thyme by kneading. It is divided into small meringues, flour is added to the bottom and top, and it is pounded to open like a round bagel. Meatballs thinned by pounding are fried in hot oil on both sides and served hot (Öncü, 2011).

(Orijinal Foto: Fadime Öncü, 2011)

Table 8. Soups of Yalvaç District (Öncü, 2021)

Soups	Figures
Goce Soup or Goce Tarhana) ***(Göce Çorbası veya Göce Tarhanası)***	
Goce Tarhana is soaked. When it softens, the soaked water is filtered and placed in the pot, and water is added. In a separate bowl, 1 spoon of yogurt is brought to the consistency of buttermilk and added to the soup put in the pot. Stir until it boils. After cooking for about 5-10 minutes, some of the fried cream oil is poured into it and left to rest. Serve garnished with the remaining cream oil	 (Orijinal Foto: Fadime Öncü, 2011)
Slurry Soup ***(Bulamaç Çorbası)***	
For Slurry Soup, the flour is crushed in cold water and turned into a slurry, and put on the stove. When it starts to boil, bulgur is added. In a separate pan, the bacon chopped into small pieces is added and fried in oil. Roasted pastrami is added to the boiling slurry soup. After the soup is cooked and rested, it is served.	 (Orijinal Foto: Fadime Öncü, 2011)
Ovmaç Soup ***(Ovmaç Çorbası)***	
For Ovmaç Soup, a teaspoon of salt is added to the flour and mixed thoroughly with water. The mixture is passed through a sieve to form parts. It is released into the boiling water. Oil and tomato paste is fried in a small pan and added to the boiling dish. After boiling for 5 or 10 minutes, the food is rested and served by adding fried cream oil on it.	 (Orijinal Foto: Fadime Öncü, 2011)
Buckthorn Soup **(*Topalak Çorbası*)**	
For Buckthorn Soup, flour, bulgur, 1 spoon of tomato paste, and 1 spoon of oil are mixed and kneaded. It is rolled into the size of a marble and kept for a while. 2 tablespoons of oil and finely chopped onion are roasted in the pot. Then, 1 tablespoon of tomato paste is added and frying is continued. A sufficient amount of water is poured on it and left to boil. Pre-prepared buckthorn is cooked by releasing it into boiling water. After the meal is rested, it is served.	 (Orijinal Foto: Fadime Öncü, 2011)

Bulgur Soup *(Bulgur Çorbası)* For Bulgur Soup, pastrami and oil are put in a pot and fried and boiled by pouring a sufficient amount of water on it. It is continued to be boiled by adding salt, bulgur, and chickpeas until they are cooked. After the food is cooked, it is placed in bowls and served by adding red pepper flakes, if desired. (	 Orijinal Foto: Fadime Öncü, 2011)
Dovga Soup *(Dovga Çorbası)* For Dovga Soup, the rice is sorted and washed, put in the pot, and mixed by adding yogurt, flour, and eggs. The mixture is brought to the consistency of ayran and prepared for cooking. It is stirred on the stove until it boils. After boiling, add salt and optionally meat or chicken broth. After the rice is cooked, the soup is left to infuse. The soup is served in bowls, decorated with fried cream oil or butter, black pepper, or mint if desired.	 Orijinal Foto: Fadime Öncü, 2011)
Lentil Juicy Meal *(Mercimekli Sulu yemeği)* For the Lentils Juicy Meal, the lentils are washed and boiled in a pot with water. In a small pan, oil and tomato paste are fried and added to the boiled lentils together with the bulgur. When the food is cooked, it is left to rest. It is served in bo	 (Orijinal Foto: Fadime Öncü, 2011)
Miyane Soup *(Miyane Çorbası))*	 Orijinal Foto: Fadime Öncü, 2011)

Table 9. Vegetable Dishes of Yalvaç District (Öncü, 2021)

Vegetable Dishes	Figures
Bean Borani *(Boranı)* Beans, spinach, broad beans, zucchini, potatoes, poppy grass, wild herbs, etc. grown in the Borani food season. It is made from vegetables. For example, the Bean Borani meal is sorted out, finely chopped to half an inch width, and washed. A sufficient amount of water is poured over the beans placed in a flat pot, put on fire, and boiled. Bulgur is released into the boiled and boiling beans and salt is added. When the food absorbs the water, it is extinguished with a little water. In order not to cut the yogurt, the boran is cooled a little. Boran is lubricated with fried cream oil and yogurt with garlic or plain smashed yogurt upon request. The top of the boran placed on the plate is decorated with fried cream oil and served.	 (Orijinal Foto: Fadime Öncü, 2021)
Stuffed *(Dolma)* Stuffed food is made of zucchini, leek, green tomatoes, eggplant, etc., depending on the season grown in the region. It is made from vegetables. For example, for Stuffed Zucchini, zucchini is peeled, washed, and cut into cubes. The peppers are sliced one inch thick. The minced meat put in the pot is fried with oil. The peeled and chopped tomatoes are added to the minced meat and roasted for five minutes, then chopped zucchini and peppers are added and sufficient water is poured and cooked. When the zucchini is cooked, salt is added and bulgur is mixed. The cooked food is taken down from the fire in a slightly juicy state and served.	 (Orijinal Foto: Fadime Öncü, 2011
Roasting Dry Peppers *(Kuru Biber Kavurması)* For roasting dry peppers, dry peppers are boiled and the water is filtered. It is fried in oil and served with yogurt. In addition, after boiling dry peppers, a Menemen dish is made with eggs.	 (Orijinal Foto: Fadime Öncü, 2011)

Table 10. Salads of Yalvaç District (Öncü, 2021)

Salads	**Figures**
Salads	
It is cooked by adding eggs to boiling water in a small pan. Crushed yogurt is poured over the cooked eggs arranged on a plate. It is served garnished with fried cream oil.	(Orijinal Foto: Fadime Öncü, 2011)
Onions (*Soğanlama)*	
For scalding, eggs are cooked solid and their shells are peeled. It is chopped into a large bowl in the form of regular-size cubes. Onion and parsley are cleaned, washed, and finely chopped in another bowl. Salt, oil, and lemon are added, blended well, poured over the eggs, and served by mixing the eggs without scattering them.	(Orijinal Foto: Fadime Öncü, 2011)

Table 11. Beverages (Non-Alcoholic) of Yalvaç District (Öncü, 2021)

Beverages (Non-Alcoholic	**Figures**
Herbal Teas ***(Bitki Çayları)*** Due to the geographical and climatic conditions of the region, it has many natural plant species. Natural plants collected in the season are duly dried for tea making and teas are made.	 (Orijinal Foto: Fadime Öncü, 2011)
Maternity Sherbet ***(Loğusa Şerbeti)*** Relatives, neighbors, and acquaintances who come to visit the woman giving birth bring food and food such as milk, yogurt, eggs, and soup along with various gifts. "In the maternity house, guests are offered puerperal sherbet, milk, sweets, and biscuits. The Maternity woman is fed milk and dairy foods, onions, bulgur, lentils, sherbet, sweets, etc., with the belief that her milk will increase. Especially chickpeas, beans, and some fruits, which are thought to be harmful are not allowed to be eaten.	 (Orijinal Foto: Fadime Öncü, 2011)

Table 12. Desserts of Yalvaç District

Desserts	Figures
Güllaç ***(Güllaç)***	
Güllaç leaves, which are sold as ready-made packages and made from starch, are cut in 20 cm length and 10 cm width. Cut Güllaç leaves are soaked in warm water and laid on a clean tablecloth. Since the leaves of Güllaç, which soften quickly, are sensitive, they are not soaked all at once, but wetted part by part, by putting the pre-prepared curd skin as much as the inside of the wrap, it is wrapped in the size of a wrap and placed in a tray. The syrup boiling on the stove is poured hot into the Güllaç tray with a ladle. The tray, which is placed on the stove, is turned and cooked by boiling evenly. The cooked gullaç is taken from the stove and left to cool. In Ramadan Iftar dinner invitations, after it has cooled, crushed walnuts are placed on the slices and placed in the middle of the table with its tray. In addition, the groom with his tray is placed in the choke and sent to the boy's house.	(Orijinal Foto: Fadime Öncü, 2011)
Kesmik Baklava ***(Kesmik Baklava)***	
For the Kesmik Baklava, milk, oil, vinegar, eggs, and salt are whisked. The dough is kneaded as soft as an earlobe by adding as much flour as it takes in. For the baklava dough to roll out better, the dough is kneaded and rested overnight. Fourteen small meringues are made from the dough (enough to be laid on seven under and seven on top) and placed in a clean bag to keep it soft. Seven meringues are rolled thinly into phyllo with flour one by one. The rolled phyllo dough is crumpled and laid on a greased baklava tray on a rolling pin so that it disperses like clay in the mouth. Pre-prepared curds are placed on it proportionally and in series. The dough rolled out of the remaining seven meringues is laid on top and the baklava is sliced into squares. Oil is poured on it with a spoon or ladle, and it is cooked in a preheated oven or a local oven until golden brown. After the baklava has cooled, the previously prepared warm syrup is poured over it and left to soak in the syrup. Kesmik baklava is sent to the boy's house in holly for a taste of the feasts and engagements.	Orijinal Foto: Fadime Öncü, 2011)

Poppy Jelly ***(Haşhaşlı Pelte)*** For Poppy Jelly, the poppy is crushed with water in a pot, mixed with molasses and flour, and boiled. When it reaches the consistency of pudding, it is poured into bowls and left to cool. It is served by adding cinnamon or crushed walnuts upon request.	 (Orijinal Foto: Fadime Öncü, 2011)
Poppy Halva ***(Haşhaş Helvası)*** For Poppy Halva, molasses is boiled together with oil in a pan. Poppy and flour are added to the molasses that is boiling, and it is constantly stirred with a wooden spoon. When it thickens and becomes a solid consistency, it is removed from the stove, and mixing is continued. It is served hot or cold upon request.	 (Orijinal Foto: Fadime Öncü, 2011)
Starch Halva (*Nişasta Helvası)* For Starch Halva, put oil, sugar, starch, and water in a saucepan and stir continuously until it solidifies over the fire. When halva is cooked, it is rested and served.	 (Orijinal Foto: Fadime Öncü, 2011)
Fig Dessert ***(İncir Tatlısı)*** For Fig Dessert, milk is put in a pot and cooked. When it starts to boil, it is cut by adding yogurt water and continuing to boil. The milk, which is cooled by taking it from the fire, is poured into a strainer and strained to obtain curd. The curd is put into a large bowl and a tea glass of sugar is added and mixed to make it ready. Dried figs are washed. It is softened by soaking it in hot water. After the stems of the figs are cut, they are filled with curd. Stuffed figs are arranged on the tray, and syrup prepared in advance is poured over them and boiled for 5-10 minutes on low heat. It is served with walnuts on the figs.	 (Orijinal Foto: Fadime Öncü, 2011)

Table 12. Dairy products of Yalvaç District

Dairy Products	**Figures**
Camız (Buffalo) Cream *(Manda Kaymağı)* One of the indispensable flavors of the Yalvaç breakfast table, the region-specific Camız (Buffalo) Cream is made in the Salur neighborhood of Yalvaç. It is consumed plain or with honey at the breakfast table. Camız cream, which is a completely handmade, additive-free, and natural product, is kept in a cool place as it is not resistant to heat. Since Camız (Buffalo) milk has a high-fat content, one kilogram of cream comes out from about seven or eight liters of milk. Tools and equipment such as milk trays, strainers, and milk tubs are used in making cream	 (Orijinal Foto: Fadime Öncü, 2011)
Dolaz For Dolaz, the milk collected in the cauldron is boiled until it takes on a caramel color. Dolaz is poured into pouches and filtered. When it comes to consistency, it is mixed with butter and put into glass storage containers. It is eaten for breakfast. It is used as a sauce in pasta, soup, egg, etc	 (Orijinal Foto: Fadime Öncü, 2022)
Fried Cream Oil (*Kızartılmış Kaymakyağı)* Fried Cream Oil is used as the main sauce of local Yalvaç dishes. Put the cream in the pan and add a little oil to it. It is fried until golden brown, with or without salt, as desired. If desired, its oil is filtered and mixed with oil, put into storage containers, and served	 (Orijinal Foto: Fadime Öncü, 2011)

Some of the gastronomic activities that are held regularly in the Yalvaç region and the planning approaches related to these activities and the gastronomic values of Yalvaç are summarized in Table 13.

Table 13. Gastronomic activities implemented in the Yalvaç Region

Name of Activities	**Event Venue**	**Distance to City**	**Conditions of Participation in the Event**	**Why It's Made**
Pisidia Antiokheia Culture, Tourism and Art Festival; Traditional Cooking Contest	Yalvaç	Merkez Center	Living in Yalvaç	Promoting Yalvaç's Gastronomic Values and Continuing its Sustainability
Bağkonak Water Eye Festival	Bağkonak Village	27,4 km.	Cutting the votive sacrifice and serving rice to the guests present	Making a Votive, Making a Wish
Özbayat Kelek Festival	Ozbayat Village	16,7 km.	Becoming a Kelek Maker	Introduction of Keleks Produced in the Village

5. Conclusion and Recommendations

Today's multi-faceted changes (global epidemic, climate change, water-food-energy crisis, economic problems, etc.) have changed the tendencies of domestic and foreign tourists and made them prefer destination areas integrated with different tourism options.

From this point of view, tourists coming to Yalvaç District visit mostly for religious, historical, and cultural reasons. Yalvaç's archaeological and historical values (especially Pisidia Antiokheia Ancient City and Men's Sanctuary, which is considered an important center for faith tourism) attract foreign tourists. Yalvaç Region has the potential to be an important tourism destination with its diverse tangible and intangible cultural and natural values (especially archaeological, historical, traditional architecture, gastronomy, traditional handicrafts, etc.).

With the city of Yalvaç receiving the title of "Cittaslow" in 2012, an important opportunity has been obtained to preserve, sustain and bring in tourism tangible and intangible cultural heritage values (Çelmeli et al., 2020). Yalvaç Region is a center where many types of tourism such as cultural tourism, rural tourism, agro-tourism, eco-tourism, and gastronomic tourism meet.

For this reason, Yalvaç's tangible and intangible heritage values should be related within the scope of cultural tourism, according to their realities (e.g. space, products, services, and activities) for each of the tourism types such as cultural tourism, gastronomy tourism, agro-tourism, eco-tourism, and rural tourism. In this context, holistic strategic planning and management of the Yalvaç region should be the main target. The gastronomic culture of the Yalvaç District is a complementary and supportive component to increase tourism development in the region.

Strategic actions have been proposed for the development and sustainability of the gastronomic tour of the Yalvaç Region.

- Local identity values of the Yalvaç region should be determined.
- Yalvaç's cultural and natural tourism inventory should be prepared and a database should be created in the GIS environment.
- Strategic policies and actions for the production and cultivation of food and products in the Yalvaç region should be envisaged.
- Local product production should be given priority in agricultural areas in and around the city.
- Local product pattern planning should be done for each village in the Yalvaç region according to the current conditions (climate, soil, topography, etc.).
- Educational and cultural activities for gastronomy tourism should be carried out.
- Events should be organized for the promotion and information about gastronomic tourism.

- An effective and participatory Governance Organization should be established within the scope of Cultural Tourism (for all types of tourism).
- Gastronomic tourism routes should be created for the Yalvaç region and associated with the Isparta region.
- Local product sales stands should be established.
- • The number of restaurants with the concept of eating local products should be increased.
- Financial support should be given to domestic producers.
- The supply and use of local plant seeds and materials should be encouraged.
- A local seed bank should be established.
- Organic farming techniques should be expanded in agricultural areas.
- Quality and safe food production should be encouraged and food certification should be initiated.
- A geographical indication registration certificate should be obtained for Yalvaç local products.
- Local product branding efforts should be expanded.
- Agroforestry systems production techniques should be preferred in marginal and vacant lands in rural areas.
- Support should be given to sheep and cattle farms.
- Pasture areas should be improved and their quality and yield should be increased.
- The production of forage crops should be encouraged.

- Organizations should be made for the processing, storage, exchange, and distribution of products and foods.
- Infrastructure and facilities should be established for the processing of products.
- The number of Rural Agricultural Development Cooperatives should be increased and a family business union should be established.
- Retail and wholesale sales of the products produced should be done by the cooperative and family business.
- Organic compost fertilizer facilities and warehouses should be established.
- Organic waste and residues should be recycled (compost fertilizer, food supply for street animals, etc.) and converted into added value.

M. Kemal Atatürk's saying "The foundation of the Turkish Republic is culture" is an important guide that indicates the importance of cultural values.

The culture and national values of a nation are an indispensable and important value to protect and ensure its sustainability without losing anything from its essence. These values are a trust that should be passed on to future generations. Among these values, "Culinary Culture" is the most important cultural heritage value of our country, and it is of great importance to protect and ensure sustainability.

As a result, the sustainable tourism policy of the Yalvaç region should be aimed to protect the local natural and cultural heritage values, keeping them alive, using them rationally, and developing the local economy. It should be turned into a holistic cultural tourism brand together with all the stakeholders of the Yalvaç Region.

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The article complies with national and international research and publication ethics. Ethics Committee approval was not required for the study.

Author Contribution and Conflict of Interest Disclosure Information

All authors contributed equally to the article.

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