

## Understanding the spatial and historical characteristics of agricultural landscapes in Istanbul

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### **Abstract:**

In this paper, we will try to find out the potentials of agricultural landscape mosaic of Istanbul, which still contains the inherent traces of the local agrarian culture, even though it has been absorbed and embedded in the mass production urban spaces. We pursue a process oriented, spatial and culture based modeling approach with the emphasis on the potentials of agricultural landscape mosaic of Istanbul. Our findings showed that urban agriculture, especially bostan, has been an indisputable part of Istanbul's historic development and is an important opportunity to maintain sustainable urban landscape and viability of urban society.

This study primarily uses theory and methodology from geography, geographic information science, and landscape ecology to analyze land use dynamics in the study area. The study consists of four parts. First, the description of the general characteristics and environmental facts of the study area are given. The second part contains the historical background of the agrarian culture and its spatial traces, which existed in today. The third part has been conducted at the interactions between agricultural land-uses and other land use types and the ambitions within spatial planning to define an ordered typology. Ikonos images dated June 2005 has been used for the analyses in Geographical Information Systems' (GIS). Finally, the findings of the case study are summarized, along with arguments that underline the need for further case studies of agricultural uses at intra and peri urban landscapes.

**Keywords:** *Urban agriculture, agrarian culture, agroecosystems, landscape character assessment, landscape fragmentation, GIS application.*

### **Introduction:**

We are living in the age of the city, also called "urban century". Our planet reached to a critical point, in that the urban populations will, soon, outnumber the rural population (Baser et al., 2007). Every year, the world's urban population is increasing by about 70 million, equivalent to seven new megacities (UNDP, 2010). Moreover, UN Habitat (2010) reported that between 1950 and 2010 humankind has endured its most rapid expansion, from 2.5 billion to 6.9 billion people. While globalization and dynamics of the

economic developments redound the ascendancy of the cities, the authorities intended to involve action at international, national, regional and local levels with emphasizing the issue of urban sustainability. The negotiation process started with Agenda 21 in Rio on June 14, 1992 and continued at the 1996 UN City Summit in Istanbul (Deelstra & Girardet, 2005).

Today, the degree of urbanization exceeds 80% in developed countries (Antrop 2004). In the case of developing countries, the level of urbanization is lower than in developed countries; however, the rate of urbanization is five times faster (Lopez et al., 2001). In Turkey, the urbanization rate is higher than in other developing countries (Keles 2004), particularly since the 1950s. Between 1960 and 2000, the urbanization increased from 25.1% to 65% (DPT 2000). Industrialization has played a major role in the development of Turkish cities, particularly given the migration triggered by industrialization. Although agriculture accounts for 40% of employment in Turkey, its share in overall income has fallen progressively, declining from almost 50% of GNP in 1950 to around 15% of GNP in 1993, and 13% of GNP in 2003. The relatively poor showing of the agricultural sector reflected, in part, government policies that had made rapid industrialization a national priority (Country Studies 2003). Subsequently, the decline of the agricultural sector for almost 6 decades has driven many people from rural areas (Country Studies 2003). Additional factors such as advances in the transportation network have also contributed to these changes.

As a result, a substantial amount of prime agricultural land is being transformed into different land uses. Although no official statistics exist on the rate of agricultural land conversion in Turkey, some research (e.g., Doygun 2005, Alphan & Yılmaz 2005, Aksoy et al., 2004, Maktav et al., 2002) reveals the general trend: urbanization occurs at the expense of agricultural land and decreases the per capita amount of arable land that remains. This can cause agricultural expansion into wetlands and other ecologically valuable areas or unsustainable intensification of agriculture to increase food production in the remaining land (e.g., excessive use of chemicals, water, and energy; Alphan and Yılmaz 2005). The concept of controlling growth to preserve farmland is not yet a part of land use policy. Turkey's national policy for agriculture is to develop an organized sector with a high competitiveness that holistically considers the economic, social, environmental, and international aspects of agriculture, within the framework of efficient resource use, to supply food to a growing population while ensuring food security (Keskin and Bircan 2002). Major highlights of this policy include increased production levels and crop yield, increased agricultural income, rural development, protection of natural resources, and sustainable agriculture. However, no Turkish legislation deals with the different issues faced by the agricultural sector, and the expansion of urban areas continue to undermine the efficiency of the agricultural policy.

Eventually, population growth and the immigration from rural to urban settlements forces us to criticize our basic paradigms, not only about the urban environment, but also focusing on the basic requirements for life: food, energy, fiber, waste and other life-support services. In this context, meeting the food requirements of cities comes into view as a critical problem, which must be solved for the sustainable future of cities.

**Urban agriculture:**

In the next few decades' humankind will encounter a turning point on fulfillment of its own basic requirements for life. This process brings us to improve new strategies for surviving on earth, not only concentrate on growing our own food but also contributing to environmental, social and economic cycles. Nearly in last two decades, the diverse benefits of urban agriculture have been recognized with the scientific surveys and ongoing institutional projects especially performed in the developing countries in East Asia, Middle East, Africa and Latin America.

Urban farming has existed throughout history and played roles both in feeding cities and in recycling urban wastes (UNDP,1996). For instance, the pre-industrial cities had been structured with self-sufficient food supply infrastructures and ecologically closed-loop system. Additionally, in times of crisis, like war or recession, growing food in cities has always been essential to urban people (Deelstra & Girardet, 2005). Forman (2008) remarked that the historical integration of the food-growing activities occurred in the most cities in the past. But also, he criticized the potential spaces, which is covered with hard surfaces or imitations of nature in the form of city parks by city planners and developers. Remnant farmland areas in suburban or peri-urban areas also provide many values to their communities (Forman, 2008). Forman (2008) describes the urban agriculture as "growing food in and close to cities". On the other hand, the definition of Mougeot (2005a) brings a new insight to the concept of urban agriculture through the description of its secondary dynamics: *"urban agriculture is an industry located within (intra-urban) or on the fringe (peri-urban) of a town, a city or a metropolis, which grows and raises, processes and distributes a diversity of food and non-food products, (re-)using largely human and material resources, products and services found in and around that urban area, and in turn supplying human and material resources, products and services largely to that urban area.* (Mougeot, 2005a).

In this study, we will elaborate on the history and current spatial and non-spatial characteristics of the urban agriculture of İstanbul. The city still contains the inherent traces of the local agrarian culture, even though, it has been absorbed and embedded in the mass production urban spaces.

**Method:**

This study primarily uses theory and methodology from geography, geographic information science, and landscape ecology to analyze land use dynamics in the study area. The premise of this work is that the complex relationships between environmental and human factors during urbanization, and their consequences for agricultural patterns in a wider context, can be better understood with a landscape ecological focus on spatial patterns and processes. Subsequently, we pursue a process oriented, spatial and culture based modeling approach with the emphasis on the potentials of agricultural landscape mosaic of İstanbul.

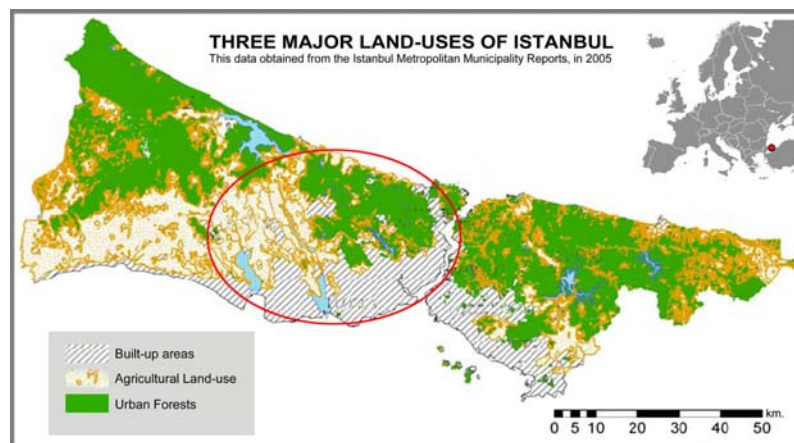
The study consists of four parts. First, the description of the general characteristics and environmental facts of the study area are given. The second part contains the historical background of the agrarian culture and its spatial traces, which existed in today. The literature review and historical photographs and materials gained from site surveys have been used for revealing the current and past agrarian narratives of İstanbul.

The third part has been conducted at the interactions between agricultural land-uses and other land use types and the ambitions within spatial planning to define an ordered typology. Ikonos images dated June 2005 has been used for the analyses in Geographical Information Systems' (GIS). The already rectified satellite images were mosaicked, and then a histogram equalization procedure was applied for image enhancement. The images were registered to UTM (Zone 35) coordinate system with the WGS84 datum. An on-screen digitization technique was used to map all the agricultural patches. The attribute table includes columns such as the type of practice, primary production, neighborhood properties. The software (ArcGIS 9.3) automatically calculates each entry's area and perimeter. Because this is an ongoing study, only the initial findings of the analyses (between the historical peninsula on the east to Buyuk Çekmece on the west) are presented in this paper (see Figure 1.).

Finally, the findings of the case study are summarized, along with arguments that underline the need for further case studies of agricultural uses at intra and peri urban landscapes.. Our predictions about the historical development of agricultural land uses in Istanbul provide a quantitative and spatial basis for restoration and management of the traditional food production system of the city.

#### The study area:

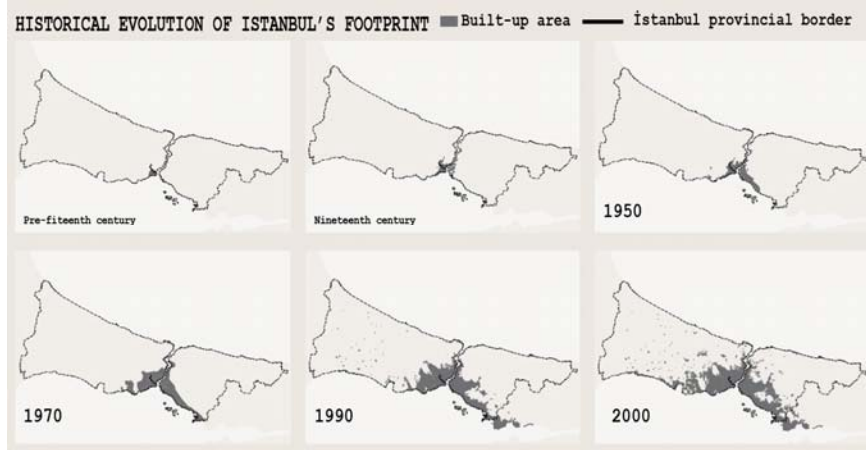
Beyond the great historical and cultural values, which have symbolized the city, Istanbul is the economic capital of Turkey as the core of industrial and financial development of Turkey. Throughout the history, the city has always been the capital of the civilizations, which had settled around it, embracing both western and eastern cultures. Through its unique location as a passageway between Europe and Asia, today, the city symbolizes the front door of Turkey opened to the world (Baser et al., 2007).



**Figure 1.** The agricultural, built-up and forest land-use map of Istanbul (Istanbul Metropolitan Planning Report, 2005), the studied area with GIS is circled.

Istanbul covers an area of 480,577 ha. with a sloping topography formed by several hills, valleys and river basins. The green structure of the city mainly defined by the north forests which cover 2.164 km<sup>2</sup> area representing 40% of

the whole city, and built areas have expanded along the south coasts on both sides of the Bosphorus (Istanbul Metropolitan Planning Report, 2005).



**Figure 2.** Urban expansion in Istanbul between 15<sup>th</sup> and 21<sup>st</sup> centuries (Urban Age, 2009).

As a result of the growing industrial land uses and migration from rural Anatolia, the city expanded through an uncontrolled process since 1970s (Figure 2). Because of the influx of migration, built areas have overwhelmed the north forests and the ecological resources of the city.

Today, 15 percent of the Turkey's population lives in Istanbul (13 million), which is equal to the population of 37 cities in the country. If the current population growth continues, the number of inhabitants in Istanbul would increase to 19 million in 2020 (Istanbul Metropolitan Planning Report, 2005). As being the socio-economic center of Turkey, Istanbul acts as a black hole in terms of migration from other cities due to the economic and financial problems of the country. Further, the population density and business activities have a much higher ratio than the average of the country, overloading the carrying capacity of the city on a daily basis; as well as, the unbridled urban expansion creates serious and non-returnable pressures on natural resources even on the city itself (Baser et al., 2007).

Although, 14.3% of the province is covered by the first degree agricultural land (Istanbul Metropolitan Planning Report, 2005). the food supplience of the city mostly depends on the surrounding cities and the South Mediterranean region. On the other hand, according to the strategic plan report of the municipality, it has been projected that service and industrial sectors will be driving forces of the main economic structure of the city in the next decades (Istanbul Metropolitan Planning Report, 2005).

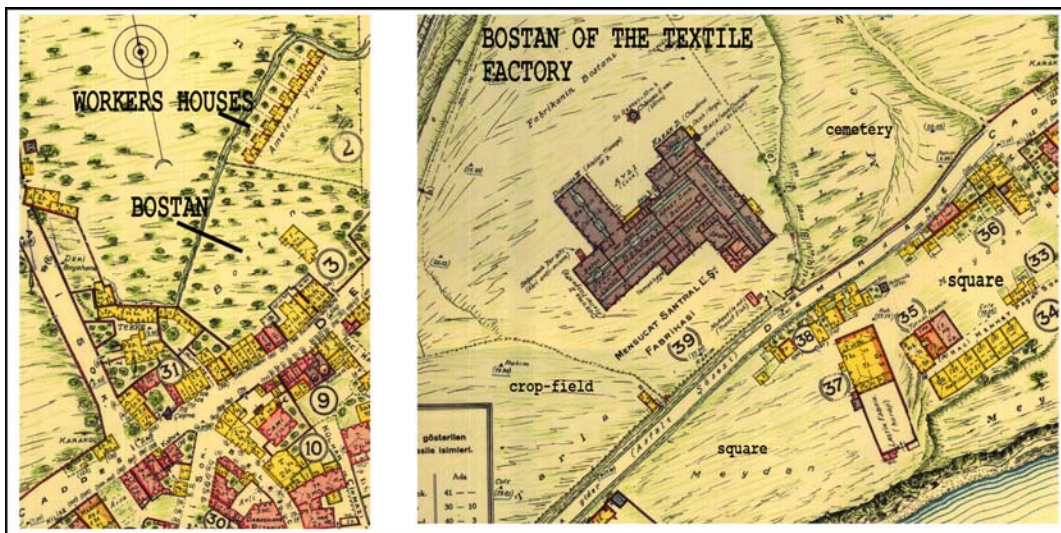
Turkey National Statistic Institution reported that, between 1997 and 2002, İstanbul's agricultural areas have been reduced 15 percent; especially croplands, vegetable gardens and orchards have been transformed into built up areas. Moreover, approximately 2,5 percent of the total housing area established on the most fertile agricultural lands (Istanbul Metropolitan Planning Report, 2005). Built-up land undoubtedly occupies what would previously have been used for agricultural purpose in Istanbul.

Throughout history, since the population growth and urban density have brought new typologies and urban landscapes to Istanbul, the challenge to the clone-stamp urban planning decisions with region-specific planning strategies, which embraced both the city's historical and traditional potentials and natural resources, must be developed for the future sustainability.

### **The historical traces of agrarian culture in Istanbul**

Beyond the great historical and cultural values, because of its unique location as a passageway between Europe and Asia, Istanbul has been established, layer by layer, on the ruins of the previous civilizations. The layering character in time and space has caused culturally diverse and structurally rich landscape features in Istanbul.

The peri-urban and intra-urban agriculture has a long historical background in Istanbul. During the Ottoman times, the city dwellers had settled inside the city walls, and the urban pattern gradually changed towards the walls leaving some orchards, crop fields and vegetable gardens embedded into the urban fabric. The traditional vegetable gardens and orchards named as “Bostan” were the characteristic structures of the urban landscape (Figure 3). Although bostans were distributed throughout the city, they were always clustered around reliable sources of water, along creeks, artesian springs, and where wells tapped high water tables (Kaldjian, 2004). Outside the walls there were numerous crop fields and large scale bostans produce the food supply of the city (Figure 4).

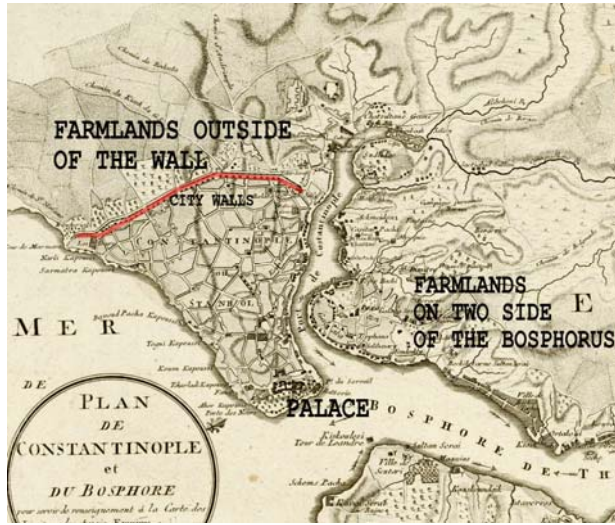


**Figure 3.** Remnant bostans in the urban pattern in 1939 still used by local people (taken from the Pervitich maps, 2000).

According to Kaldjian(2004), at these times, the vegetables were sold in wholesale and retail markets, and production was integrated into the city's food and commercial networks. The bostans are part of Istanbul's identity: Different neighborhoods were known for the specialty crops of their gardens.

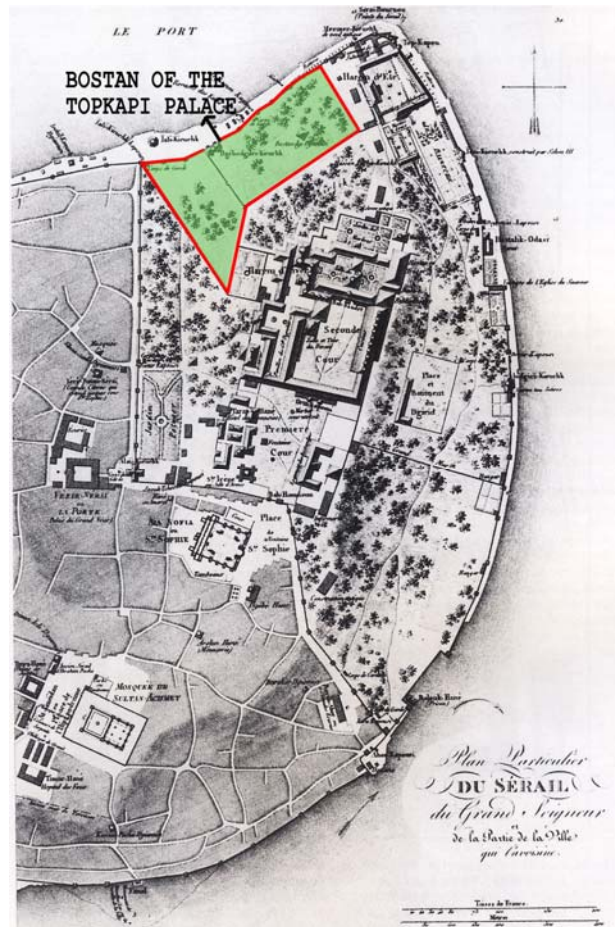


Eremya Çelebi K  m  rciyan (1637-1695), who is well known author with the texts about Istanbul's daily life and environment in the 15th century A.D., mentioned many bostans located on the different districts of the city by giving the details which vegetable is famous in where (Andreasyan,1988). According to K  m  rciyan's descriptions about Sultan's Palace, the palace presents itself as a city with its many buildings, gardens and bostans. In the Ottoman Palace, the management of the food supply from its bostans was an absolute rule and a tradition for the Sultans (Tavernier, 1675; Andreasyan,1988) (See Figure 5).



**Figure 4.** Istanbul city map in 1800s (Anonymous)

Although, Istanbul had always been more than a seat of agrarian empires, Byzantine and Ottoman (Keyder, 1999), vegetable production in and around Istanbul changed little from the end of the Ottoman Empire until the 1950s and not drastically until the 1970s (Keyder, 1999, Kaldjian, 2004). Istanbul's bostans became truly endangered in the 1980s, when massive population growth combined with political corruption and speculative investment in housing and development to make real estate the highest profit sector in Istanbul (Keyder, 1999; Kaldjian, 2004). Eventually, during the modernization process, a new land use mosaic has been structuring, while agricultural and natural patches have gradually disappeared due to uncontrolled expansion of the urbanization. Diverse settlement patches, industrial and mass agricultural land-uses and over scale transportation corridors has re-defined the Istanbul's landscape, hence challenging the traditional landscape characteristics of the city (See Figure 6. & 7.).



**Figure 5.** Plan of Topkap   Palace in the beginning of the 19<sup>th</sup> century, from Melling (Necipo  lu,2007).

The historical agrarian traces of the city prove that the bostan agro ecosystem, rooted in our cultural

antecedents, would have a potential being as a solution incubator for the future planning activities toward a sustainable urban environment in Istanbul. In this sense, before making an action plan in order to brace the role of agricultural potentials, we should begin with understanding the substantial agrarian typologies in the complex landscape mosaics of Istanbul.



**Figure 6.** Changing of Yedikule bostan area in different times, 1939-1966-1982-2010 (Aerials: Database of Istanbul Metropolitan Municipality, Map: Pervitich maps, 2000).



**Figure 7.** People on work in their bostans left in 1920, right in 2009 (Anonymous).



### Analyzing the agrarian landscapes of Istanbul (Mapping with GIS tools):

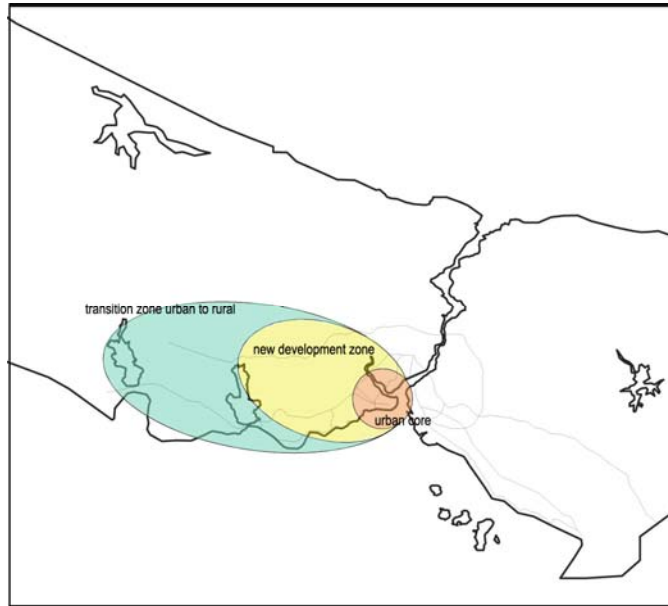
According to Hough (2004) the causes of the general problems dealing with in the regional environment have taken their roots from the cities where many social and environmental conflicts exist. Mougeot (2005a) points out that urban populations are setting new standards and cities must reinvent themselves with new references. The challenge of the landscape designers and researchers starts here with exploring new design strategies, which create a paradigm shift (Forman, 1995; Wu, 2006; Mussaccio 2009), perceiving the urban systems as solution incubators for a sustainable future rather than problem originated and threatening environments.

Antrop (2006) pointed out two different approaches to the concept of sustainability in relation to landscapes: The first is the preservation of traditional techniques in rural or pastoral landscapes and the second refers to landscaping principles for future development. Many of today's cities function very differently from those we have inherited from history, and relationships with the environment are changing (Deelstra & Girardet, 2005:43).

Forman (1995) noticed that the conceptual framework of natural spatial arrangement between and inside the ecosystems, in terms of land-use, maximizes the ecological integrity of land mosaics. A similar spatial arrangement can be discovered in and around metropolitan scale of urban landscape. If so, the challenge of designers should be to discover that arrangement and to explore the possibilities in this mosaic for creating sustainable environments (Forman, 1995).

Sustainable agriculture means agriculture that conserves land, water, and plant and animal genetic resources, does not degrade the environment, and is economically viable and socially acceptable (FAO, 1996). Among the most serious constraints to achieving sustainable agriculture is the loss of agricultural land due to urbanization. Therefore, monitoring of this change is necessary. The initial findings of our case study yielded three trends prevailing in the study area from east to west; which we named as historical urban core, new development zone and transition zone (Figure 8.)

The analysis of the historical urban core reveals somewhat expected results that this area has the least amount of agricultural patches (Table 1). The size of the agricultural patches ranges between 10.8 m<sup>2</sup> and 0,25 ha. The patches



**Figure 8.** The diagram shows that the changing structure of Istanbul's agricultural mosaics from east to west (Baser, Tunçay, 2010).

have a form of very narrow strips as indicated by the relatively high perimeter to area ratio. These small scale agricultural activities take place on the state property, especially along the remnants of the historic wall. The distances of other small patches to this line of agricultural land is greater than any other areas of the study area, hence making the practice less ecologically and economically viable, but rather socially significant.

**Table 1.** *Changing spatial characteristics of agricultural uses in the study area (Başer, Tunçay, 2010).*

Core	New development	Transition
Patch number: 416 Class area: 16,93 ha. Min. Patch size: 10,8 m2 Max. Patch size: 0,25 ha Mean patch size: 407,03 m2 Perimeter. to area: % 21,06	Patch number: 1375 Class area: 405,13 ha. Min. Patch size: 12,14 m2 Max. Patch size: 22,04 ha. M. patch size: 2946,43 m2 Perimeter. to area: % 5,61	Patch number: 2302 Class area: 4171,89 ha. Min. Patch size: 56,01 m2 Max. Patch size: 169,98 ha. M. patch size: 18122,87 m2 Perimeter. to area: % 2,80

New development zone comprises almost 230% more agricultural patches than the core area. In this zone, the landscape is occupied by 405.13 ha. of agricultural uses. Subsequently, the mean patch size is larger, and the average patch shape is less narrow. The construction of anthropogenic means fragments agricultural patches into smaller parcels, making them less efficient and sometimes leading to a loss of biodiversity in the agricultural land. The isolation of agricultural uses by roads and housing developments are very common in this zone. Moreover, even though no official statistics exist, interviews with farmers (Esbah, 2007) indicates that the growing population around the remaining agricultural areas would lead to increased vandalism, trespassing, and traffic that make farming more difficult in such areas.



**Figure 9.** *Some examples for agricultural land uses from historical core (left) and new development zones (right) (Anonymous).*

In the transition zone from urban to rural, the mean patch size is the largest and the patch number is the highest among all the zones. The patch shape becomes less convoluted, and large enough to comprise a core area, hence yielding almost %50 improvement in the perimeter to area ratio. The agricultural patches mostly neighbors with patches of similar character. Abandonment of agricultural land in anticipation of imminent urban development is common on the western part of the study area. Previous research showed that these abandoned agricultural patches will be mostly transformed into residential uses (Deniz 2005).



**Figure 10.** Examples from agricultural lands and fragmented patches by residential land-use in the western part of Istanbul, the transition zone (Anonymous).

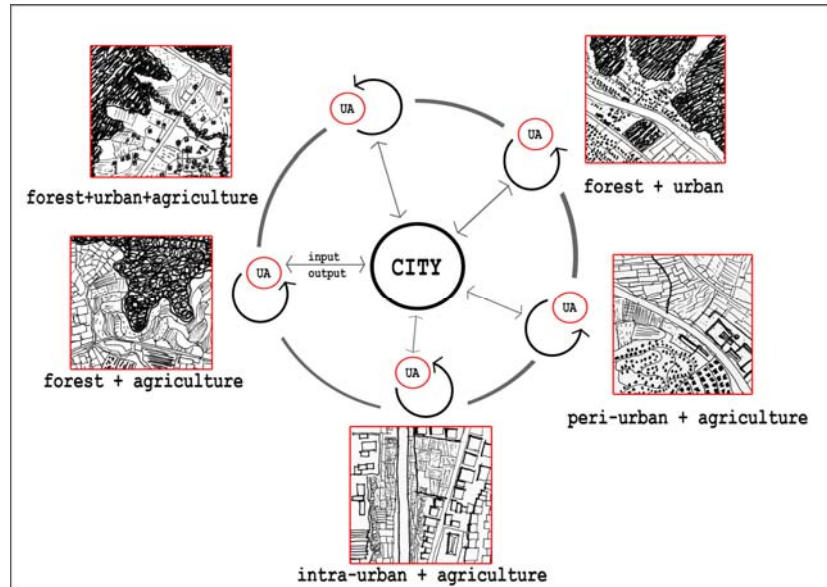
In sum, the findings of our case study yielded three trends prevailing from west to east in the study area: from larger to smaller in size; from more connected to less connected in structure; from greater widths to very narrow strips in shape. Sustainable agriculture means agriculture that conserves land, water, and plant and animal genetic resources, does not degrade the environment, and is economically viable and socially acceptable (FAO, 1996). Among the most serious constraints to achieving sustainable agriculture is the loss of agricultural land due to urbanization. Therefore, monitoring of this change is necessary.

Our site investigations show that the landscape mosaic of Istanbul consists of five different spatial combinations of urban agricultural land-uses with the alternate intersections of the urban, forest and agricultural patches. (see Figure 11). Residents of Istanbul who live in the towns on the edges and lands closed to the forest, manage their live hood with conventional agricultural works, collecting food product from urban forests and beekeeping. At the same time, the agricultural activities existing in both intra and peri-urban mosaics take place in vegetable gardens, orchards and crop fields.

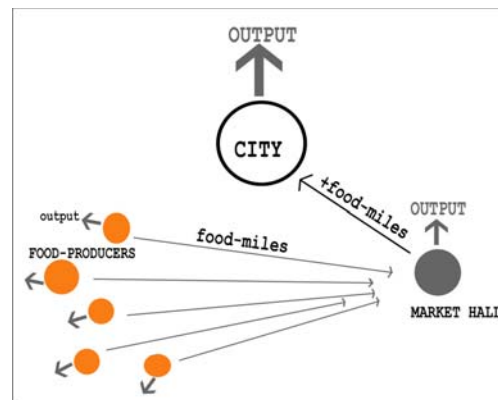
We believe that, the modeling and diagnosing the functional symbiosis among these mosaics would be important for the future sustainability of the city from environmental, economic, social and cultural aspects. As we have shown that with this study, potentials in the agricultural mosaic of the city both in time and space, could open the ways for a variety of opportunities in order to achieve an agro-ecosystem model of the city (Figure 11).

The ongoing processes of the current food supply system of Istanbul undermine the future sustainability of natural resources. One-way process urban food supply system (see Figure 12.) has threatened the natural resources and also urban viability. The food and other materials brought from surrounding provinces has been collected in the central market hall and distributed to the local markets. Every unit in this system separately release

their outputs (waste, CO2 etc.) to the environment, also the system is doubled the food miles. In addition to those, urban residents who has never experienced with the production process of the nutrients, alienated from the nature by admitted as consumers of the food market.



**Figure 11.** The proposed closed-loop agro ecosystem model for Istanbul (Başer, Tunçay, 2010).



**Figure12.** Current one-way food supply system model in Istanbul (Başer, Tunçay, 2010). Istanbul.

#### Conclusion:

As one of the fastest growing metropolis of Europe, Istanbul comprises many cultural and physical assets in its urban landscape, and deserves better attention for promoting sustainable agricultural programs. Considering that the city will provide food, shelter and infrastructure to nearly 20 million people by the next few decades, we can comprehend the apparent role of urban agriculture in creating sustainable and livable environments in

Istanbul has considerable cultural, social and environmental potential for implementing urban agriculture programs. Due to its geographical location, water and soil resources, and heterogeneous landscape characteristics, Istanbul enables production of various agricultural products, hence facilitating diversity in urban agriculture. Since the 70's, the city has received migration from Anatolia as a result of national industrialization policies. Unsustainable agricultural policies, promoted after 80's, further supported migration and formation of slum districts. Those people living in



these illegal housings have continued their agricultural practices in vacant urban lots. As a matter of fact, they have never lost their ties with soil and nature. Thus, the signs of bostan culture still exist in Istanbul one way or other. Urban agriculture proposes an economic incentive. People see it as a job opportunity. Therefore it is socially adaptable and economically applicable. The roots of this culture should be traced; these areas should be protected and reclaimed. The "bostan" system could be a model to increase economic diversity, while contributing to the food supply of the city.

There are obstacles in urban agriculture. One of the biggest drawbacks is the absence of an institute or organization to promote sustainable agricultural programs in the biggest metropolis of Turkey. In order to expand the urban agriculture applications, local authorities and ministries should be more responsive and conscious. The other shortcoming is the industrial agriculture, status quo, in which the quantity of the production is highly regarded rather than quality. The current land use development trend in Istanbul, which is highly affected by the speculative land allocations, is another threat preventing the use of potential lots for agriculture and the sustainable use of bostans.

In conclusion, urban agriculture, especially bostan, has been an indisputable part of Istanbul's historic development and is an important opportunity to maintain sustainable urban landscape and viability of urban society.

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