



Examination of sustainable land management at the urban scale

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Abstract

The rapid and uncontrolled growth of the world population is a pressure factor on natural resources and lands. This pressure causes the uncontrolled use and consumption of both natural resources and lands. In the last century, cities have been growing both in terms of population and area, and agricultural lands have been transformed into urban areas. This means the shrinkage of agricultural lands and there are worrying consequences for the future of our world. In order for the world to be a more livable place and to meet the needs of future generations, it is inevitable that the sustainability approach should be adopted in every field. Preventing the narrowing of agricultural lands and using urban lands by managing them correctly is related to how correctly the land management is applied. However, when land management is considered together with the basic principle of sustainability, it can contribute to the future of our world and minimize the pressure factors. In this study, by looking at land management with the basic principle of sustainability, examinations were made on the Izmir Tire city sample and sustainable suggestions were made for urban lands through zoning implementations and parcellation plans. As a result, it was emphasized that zoning implementations and land requiring expropriation should be planned from the perspective of sustainable land management and brought to the city.

1. Introduction

Land; "part of the earth", "a certain part of the earth that is not covered by water", "territory of the land" in western languages, and "everything that is the earthly part of the world, under, above or fixed on it, subject to possession and usage rights" [1] has also been defined. Soil, on the other hand, was initially called "the piece of land that is cultivated for nourishment", but over time it was defined as "a finite natural resource that cannot be reproduced, that provides all the necessities of human life, that is faced with deterioration due to the activities of the increasing population and natural events." [2].

As it can be understood from the definitions, human beings have felt the need to dominate/possess (property) the part of the earth they live on and to use and manage it (land management) in order to sustain their own life in the course of historical development. This need has made territorial dominance an indicator of power over time, and since ancient times, states have fought each other to gain or not lose land. The states that dominate have started land measurement studies in order to know the borders of the lands they live in, to use them more qualified, to manage and to plan. This situation led to the emergence and development of the concept of cadastre.

2. The Emergence of Land Management

Since the land basically has more than one feature and function, the correct use of all these features and functions has led to the need for a qualified management policy. A well-functioning land administration is only possible with good land policy and management [3]. According to the definition first put forward by Dale and McLaughlin, land management; It is the decision-making process in which land resources are allocated in accordance with the needs and wishes of human beings within the framework of political and social theories, legal and administrative regulations [4]. Land management according to the International Federation of Surveyors (FIG); defined as the process by which the use and development of Land resources is managed [5]. According to the definition made by the United Nations Economic Commission for Europe (UNECE), land management; It is all of the actions related to the management of land for sustainable development, both economically and environmentally [1].

As it can be understood from the definitions, land management is the process of managing the actions that are put forward or planned to be put on the land, and these actions should also be sustainable. With this approach, it is concluded that land management policies should be considered together with the concept of sustainability, since land is a finite natural resource.

2.1. The concept of sustainability and sustainable land management

The rapid increase in the world population has increased the pressure on the correct use of natural resources over time and this pressure has increased in environmental problems with industrialization [6]. The pressure on natural resources and the environment, along with population growth and industrialization, has led experts to seek solutions at the local and global level. In this context, the limitation of the Bruntland Report (Our Common Future) to the use of natural and cultural resources as "meeting the needs of the present without compromising the ability of future generations to meet their needs" [7] brought the concept of sustainability to the agenda.

Sustainability literally means "the ability to be permanent". The purpose of sustainability; It is the preservation of today's skis, which exist in physical, social, economic and ecological terms, without being consumed, and their transfer to future generations [8]. The development of lands, which are defined as a finite natural resource in accordance with the purpose of sustainability, without being consumed and their transfer to future generations, has led to the concept of "Sustainable Land Management".

Land management according to the sustainability principle expressed in 1992 Rio Earth Summit Agenda 21, which is considered a turning point all over the world; It has been expressed as "all actions related to the management of the land for sustainable development, both economically and environmentally".

Sustainable land management; problems related to land use, such as meeting the needs of nutrition, shelter and subsistence, providing a quality life, protecting natural habitats, protecting and developing the environment and natural resources, determining the most suitable land uses for the continuity of the economy, providing and developing technical infrastructure. It plays an important role in the development of the necessary policies, plans and decisions to detect these and similar problems [9].

3. Studies on Sustainable Land Management

Boansi [10] mentioned that the complexity of Ghana's urban land use planning is a major challenge for managing urban growth and city governance, and made implications for sustainable city development in Ghana using Ejisu Municipality as a case study.

Garouani et al., [11] based on the urban sprawl and serious environmental problems caused by the population growth rate in Fes, one of the oldest cities in Morocco, examined the relationship between urbanization and land use changes and their effects on the cityscape. Satellite imagery and census data were used to identify the different land use change and growth patterns of the city for the period 1984-2013, and the resulting maps show that the amount of urban or developed land increased by approximately 121% between 1984 and 2013, and the agricultural and forest areas of rural areas and on the other hand, decreased by 11% and 3%, respectively.

Malashevskiy et al., [12] have analyzed the preconditions and general aspects of inter-economy land survey in modern conditions of Ukraine, in line with the perspectives of peer land exchange practice, with reference to the fact that land exchange is a common way of streamlining existing land tenure and land use. Measures recommended to be implemented on the basis of land exchange were selected and according to the current legislation of Ukraine, the main types of documents for land management that could achieve a precedent land exchange were defined.

Omollo et al., [13] investigated the extent to which housing developers in Kenya complied with land subdivision planning regulations, a case study of Kisii Township. Although the recommended minimum plot size is 0.1 ha in the Jogoo, Nyamataro and Nyanhwa neighborhoods of Kisii Town, the minimum recommended plot size for the Egesa, Daraja Mbili, Mwembe and Nyamage neighborhoods is 0.05 ha, where 84%, 100% and 88% of the

developers respectively did not comply. However, 83%, 46%, 58% and 63% of the developers found that they did not follow this order.

Masri et al., [14] argue that with the rapid growth of urban environments around the world, there is an increasing need to develop more innovative and efficient land management systems. Stated that the 3D cadastre implementation process was initiated to support better land management services.

4. The Relationship Between Sustainable Land Management, Population and Cadastre

4.1. Pressure of the population on land management

The world population has been increasing exponentially from past to present. So much so that the world population; It was calculated as 461 million in 1500s, 954 million in 1800s, 1.6 billion in 1900s, 2.5 billion in 1950 and 6.1 billion in 2000. The population growth rate was calculated as 0.05%, 0.3%, 1% and 1.7%, respectively [15]. According to the United Nations Population Projection, it is calculated that the world population will reach 9.6 billion in 2030, 10.3 billion in 2040 and 12 billion in 2050. In the related report, it is predicted that the population of Türkiye will be 80.7 million in 2017, 88.4 million in 2030 and 95.6 million in 2050 [16].

Population growth also means more consumption, but this situation is a pressure factor on natural resources and lands. In order to meet the supply (food, water, electricity, living space, service, etc.) brought by the increasing population, states, official institutions, private sector and industrial organizations are taking new steps and developing projects. The pressure of the new living space, especially as a result of population growth, drags the municipalities to work on the revision of the zoning plan, and this causes the allocation of agricultural lands for non-agricultural purposes. According to the Sustainable Use of Agricultural Lands Working Group Report included in the Tenth Development Plan, the agricultural land area in our country has started to shrink since the early 1990s [17]. Salvati et al [18] draw attention to the problem of urban sprawl in the Mediterranean region, suggested that urban sprawl triggers land cover changes and directly affects cropland and forest areas by fragmenting them.

As it can be understood from the research above, population growth primarily targets natural resources and brings along problems in the correct use or management of resources. This situation has led humanity to work on the correct management of resources, and first of all, the necessity of registering the lands has emerged. The idea of registering the lands as both a resource and a living space (private property) led to the start of cadastral studies, which is the basis of land management.

4.2. The History of Cadastre Works in Türkiye

The ownership of most of the lands of the Ottoman State belongs to the state. The right to use the lands was given to those who were useful in wars. These persons, who are defined as living persons, are entitled to receive a certain amount of tax from the farmers who cultivate the land. Over time, this system deteriorated, and the right of use was transferred by taking the dirliks, which were left unclaimed, with the taxes in exchange for cash. As in a land arrangement where the lands belong to the state and there is no private property right, immovable property titles called tahrir were made from time to time in order to make the state contribution fair. This writing information aimed to determine the approximate surface area by defining the boundaries of the allocated land. Allotment documents containing this information have created an assurance for the assigned concessionaire. Residences and workplaces in cities and towns are registered to private individuals. The units responsible for keeping these special records were established title deed offices [19].

Cadastral works were made in Konya with the law called "Consistency of the Law on Restriction and Change of Property", which was put into effect in 1912. The Republic of Türkiye preserved the existing institutions that were transferred from the Ottoman Empire at the beginning, developed these institutions in time to be compatible with the modern Republic, and made the necessary legal arrangements for this. The reorganization of the Ottoman State Land Administration and the establishment of the land policy and land management of the Republican period were determined as priorities.

Right after the establishment of the Republic, in 1924, the General Directorate of Land Registry was established, and in 1925, the "General Map General Directorate Law" numbered 657 and the "Cadastre Law" numbered 658 came into effect. With these laws, cadastral units were added and the institution was transformed into the General Directorate of Land Registry and Cadastre [20].

With the entry into force of the Cadastre Law, cadastral works started in 1925 primarily in Ankara, İstanbul, İzmir, Bursa and Konya. General Directorate of Mapping supported cadastral studies by producing 1/500, 1/1000 and 1/2000 scale plans in Ankara, İstanbul, Kocaeli and Malatya between 1925-1936.

During the first implementations, new legal regulations were required and the following new legal regulations were made: Law on the Liquidation of Those Who Lost their Values of Land Registry in 1929, Law on the Land Registry Office and the Organization of the Land Registry Guard in 1932, Cadastre and Land Registry Law in 1934, Land Registry Law in 1934, The Law on the Organization and Duties of the General Directorate of Land Registry

and Cadastre in 1936 and Forest Restriction and Cadastre Law in 1937. When these laws are looked at in their entirety, it is understood that they are the legal bases that are the natural requirement of the first thought project and the necessary institutional arrangements. In the "Cadastre and Land Registry Law" dated 1934 and numbered 2613, the first thoughts and principles in 1925 were expressed in more detail. This law also stands out in terms of containing guiding and guiding explanations that will ensure that the implementation takes place without pause [21].

4.3. Land cadastre and land management information system in Türkiye

The Cadastre and Land Registry Law No. 2613 has been implemented only in urban areas within the provincial and district municipality borders since 1934. No significant cadastral work has been done in rural areas. A land cadastre was put into practice in 1950, in the days when mechanized agriculture started in Türkiye, which has large rural areas and limited economic opportunities, only after the Second World War.

Land cadastre studies have gained a new momentum with the establishment of the Land Cadastre and Photogrammetry Department in 1955 and the application of the aforementioned and recommended photogrammetry method since the beginning of cadastral studies with the participation of engineers trained in Türkiye. The first photogrammetric studies were carried out in 1957 and 1958 with the identification photographs created by drawing the parcel boundaries on the enlarged aerial photographs, but since these could not be converted into cadastral plans, this method was abandoned and the standard stereo evaluation method was applied. First, 1/5000 scale photogrammetric maps were produced, and then these maps were converted into cadastral maps with field studies. Starting from 1963, cadastral studies were accepted in a planned manner and as a working group in the State Planning Organization, and Standard Topographic Cadastral Maps were produced within the framework of five-year and annual development plans and programs [21].

Land cadastre studies, which started first in the urban area and then included rural areas, today, the use of advanced technologies such as global positioning systems, electronic tacheometers and digital photogrammetry has enabled the collection of more sensitive land data and accelerated the cadastral renewal studies. With the development of Geographic Information Systems (GIS), cadastral maps have been replaced by cadastral information systems. The Land Registry and Cadastre Information System (TAKBİS) developed by General Directorate of Land Registry and Cadastre in this field is an important breakthrough and start. TAKBİS is also an important step and development for the Land Management Information System (AYBS) as it allows the attribute information of the parcels (neighborhood, location, layout, island, parcel, surface area, quality, etc.) to be queried. However, although there is no effective land administration system in our country, in order to develop a new information system approach called the Turkish Land Administration System (TAİS), the opinions of all stakeholders are sought and similar systems of European countries are examined [22].

5. Method

The aim of this study is to evaluate the land management studies planned and implemented in our country together with the concept of sustainability and to make suggestions on them. Within the scope of the study, the Tire district of İzmir was handled and examined.

Within the scope of the study, the "Küçükmenderes Plain Büyükova Conservation Area" map obtained from the İzmir Provincial Directorate of Agriculture and Forestry and the "Zoning Plans" and "Parcellation Plans" obtained from the Tire Municipality were evaluated from a sustainability perspective.

6. Examination of Sustainable Land Management on the Sample of İzmir Tire

6.1. Geographic location

Tire is one of the southern districts of İzmir, located in the west of our country, and is adjacent to Ödemiş, Bayındır, Torbalı, Selçuk districts and Aydın province. Some of the lands of the Küçükmenderes Plain (Figure 1), which has been declared as Büyükova Conservation Area by the Provincial Ministry of Agriculture and Forestry due to its location, are located within the borders of Tire district [23]. Most of the lands outside the Tire district center are fertile agricultural lands and are of great importance for agricultural development. Good implementation of sustainable land management in both urban and rural areas is important for the future of Tire and Küçükmenderes Plain in order to prevent non-agricultural use of agricultural lands and to support sustainable life in the city center of Tire.



Figure 1. Büyükova Conservation Area Map (Küçükmenderes Plain)

6.2. The First Zoning Planning Works in Tire

The basis of the first planning activities dates back to 1984. In this period, there are city plans that were not approved but tried to be implemented as a draft, and zoning permission was given according to these plans. However, the implementation of the city plans did not take long, and as a result of the planning work carried out by the Ministry of Public Works and Settlement, the 1/1000 scale Implementation and 1/5000 scale Master Development Plans were approved by the Ministry and entered into force in 1984.

The 1984 plans, which were understood to have not responded to the development of the Tire city center in 1996, were included in the revision study and approved by the Tire Municipality Council on 28.02.1997 and entered into force after the suspension period. Over the years, new residential areas have been added to the revision zoning plan sheets approved in 1997, and many changes have been made in the existing plan decisions until today.

When the plans and plan notes were examined, approaches to sustainability such as parks, public spaces and garden distances were identified, but not many explanations were found in terms of sustainability in the plan explanation report. However, when viewed from the general framework, it is thought that the plans have good intentions to support sustainability, especially in terms of ensuring the protection of large park areas and requiring minimum parcel size in some regions.

6.3. Starting Zoning Implementation, Development Readjustment Share (DRS) and Public Partnership Interest (PPI)

After the approval of the zoning plans in the district in 1984, the need for the regulation of urban areas began to emerge with the increase in population. In the 1/1000 scaled Implementation Zoning Plan, new development areas have been determined apart from the existing urban settlement (residential area), and zoning implementation and parcellation plan studies have been started so that these areas can be used in accordance with the zoning plan. The first zoning implementation are generally in the direction of creating new housing areas and the Development Readjustment Share (DRS) deduction has been determined to meet the reinforcement areas (Road, park, parking lot) in the zoning plan. Official institutions and school areas were created with the Public Partnership Interest (PPI) deduction. Official institution areas and school areas created with the PPI continue to exist today due to the shared ownership structure, and the management and evaluation of these lands have been interrupted due to expropriation problems. So much so that there are 102 shareholders in total in an official institution area of 27 thousand m², and the number of shares in the land registry by inheritance is increasing day by day. There are cases of expropriation and confiscation without expropriation in many of these immovable properties, and some of the cases still continue today. With the abolition of the Public Partnership Interest (PPI) on July 10, 2019, the problems of expropriation in the areas of official institutions have been prevented.

6.4. Parcellation Plans and Factors Affecting Urban Land Production

Although most of the parcellation plans approved within the scope of the zoning implementations made according to the zoning plan in the district are for residential and commercial purposes, new properties were registered in the land registry by making parcellation studies for the Small Industry in the east of the city center and the Organized Industrial Zone in the north.

Parcellation plan studies differ according to the zoning status, building structure, number of floors, garden distance and Floor Area Ratio (TAKS) and Building Coverage Ratio (KAKS) values of residential/commercial or industrial zones. All of the factors affecting urban land production are summarized below.

6.4.1. Residential and commercial parcels

Although most of the residential and commercial parcels have south-north extensions, the average road widths have increased from a minimum of 7 meters to a maximum of 30 meters. The number of floors generally changed in direct proportion to the width of the road; It has been determined as 2 and 3 floors under 12 meters, 4 floors between 12 and 17 meters, 5 floors at 17 meters and above, 8 floors in boulevards where the road widths are 20 meters and above, and 10 floors in 2 zoning islands located in the city center. It is seen that the property areas are tried to be kept large in direct proportion to the number of floors in the parcels created as a result of the parcellation plan. When this situation is evaluated from the perspective of sustainable land management, it is thought that balancing the increase in building density and number of floors with property size will make positive contributions in terms of urbanization, but at the same time, the Floor Area Ratio (TAKS) and the Building Coverage Ratio (KAKS) should be examined in this context. In residential and commercial areas, 4 separate construction schemes have been adopted as adjacent, split and twin.

6.4.1.1. Adjacent structure

Although there are no TAKS and KAKS values in the adjacent settlement form, the building floor areas are determined according to the garden distances. Generally, the front garden and back garden are either 3 meters or half the height of the building, depending on the parcel depth. In areas with a front garden, this distance is generally 4 meters.



Figure 2. Example of Adjacent Structure

6.4.1.2. Discrete structure

There are two different TAKS and KAKS calculations in the form of discrete structuring. TAKS 0,40 – KAKS 0,40 x Number of Floors was applied to the building blocks where there is no statement in the zoning plan. In the zoning islands that have a statement in the plan; 0.36/1.08 in 3-storey building blocks, 0.30/1.20 in 4-storey building blocks, 0.30/1.50 in 5-storey building blocks, Precedent 1.60 in 8-storey building blocks and Precedent in 10-storey building blocks It is set at 2.00. In the mountainous area in the southernmost part of the city and in the flat area in the northernmost part of the city, the 3-storey construction style and the precedent ratio of 0.60 were determined, and the density of construction in these areas was tried to be kept low.

There are also two different applications in garden distance applications in the form of separate arrangement. Since the first period parcellation plans after 1984 were prepared according to the 4 meters front garden distance design, although the current legislation decisions say that the front garden distance cannot be less than 5 meters, the implementation in these areas is continued as 4 meters according to the zoning plan note. In building blocks where the front garden distance is 4 meters, the side garden distance is 3 meters and the back garden distance is 3 meters depending on the parcel depth or half the height of the building.



Figure 3. Example of Discrete Structure

6.5.1.3. Twin structure

The twin order structure is based on the logic of applying the split order in the form of twin blocks. According to this logic, as a result of the parcellation plan of two separate parcels located adjacent to each other, since the dimensions of the parcel front were not suitable for the separate arrangement, a note was added to the zoning plan in these regions, thus paving the way for structuring in the form of twin layouts. In this form of construction, $TAKS\ 0.40 - KAKS\ 0.40 \times \text{Number of Floors}$ is applied.



Figure 4. Example of Twin Structure

6.4.2. Industrial Parcels

6.4.2.1. Industrial parcels within the implementation zoning plan

These are the Implementation Development Plan parcels under the control of the municipality. These parcels are at least 5 thousand m^2 in size as per the plan grade. The building equivalent ratio has been determined as 0.40 and the building heights are 6,50 meters on 2 floors, excluding technological buildings. The front yard distances vary as 10-15-25 meters depending on the road the parcel faces. Side garden distances are all 5 meters.

6.4.2.2. Small industrial area parcels

The second different form of industrial parcels is the Small Industrial Area. This area is under the responsibility of the Municipality, but under its own administration. Within the scope of the parcellation plan in the region, zoning blocks based on the island parcels have been created and the construction precedent is 1.00. The construction height is a maximum of 7.00 meters. In the region where the front garden distance is 7.00 meters, a minimum of 6 meters of side garden space should be left between the independent structures.

6.4.2.3. Organized industrial area parcels

The third form of industrial parcels is the Organized Industrial Zone. This area is under the responsibility of the Organized Industry Directorate under the Ministry of Industry. According to the plans approved by the Ministry of Industry, the minimum parcel area is 3 thousand m², the minimum parcel front is 30 meters and the parcellation plan has been approved. The building precedent for industrial parcels has been determined as 1.00. Garden distances are determined according to the property area table in the plan notes.

7. Conclusions and Recommendations

Sustainable land management emerges as an important element and approach to the liberation of cities and rural areas as a result of rapidly increasing population and uncontrolled consumption of natural resources. The growth of cities by destroying agricultural lands day by day is not sustainable for the future. Instead, the necessity of managing urban lands with the right approaches from the perspective of sustainable land management in cities is a necessity for cities.

The foundation of land management was laid with cadastral studies in our country and supported by zoning implementation. Subdivision plans created as a result of zoning implementations should both produce new building areas and create sustainable and livable areas. Subdivision plans for sustainable lands should be kneaded with sustainable techniques and should be open to interdisciplinary recommendations. So, what is trying to explain from the interdisciplinary recommendations?

As it is known, the discipline of surveying distributes the remaining areas after the Development Readjustment Share (DRS) interruption on the basis of the minimum parcel front, depth and area determined by the zoning plan or legislation, within the scope of the subdivision plan, in a way that is closest to the regions where it is located and, if possible, detached. So, how much does this distribution method, which is made by looking at the parcel dimensions and the areas of the owners after the cut, supports sustainability? Or is this perspective sufficient to support sustainability? No, it is not. Because the concept of sustainability is a comprehensive approach that is kneaded by different disciplines and in a way, each discipline develops new studies in its own field. Opinions and opinions should be sought from fields such as architecture, urban planning, landscape architecture and sociology in order to support sustainability for concepts such as minimum parcel dimensions and areas, mass designs, calculations regarding TAKS and KAKS, and minimum garden area and garden distances per capita, especially during the parcellation phase. It should be ensured that subdivision plans, one of the most important elements of land management, evolve into a sustainable land management approach.

Meşhur [24] argued that "The gains or losses caused by the forms of production of zoning parcels should be questioned by considering the urbanism and architecture dimension of planning. In this context, although the understanding of producing zoning parcels that dominates the current implementation process seems to serve the interests of the immovable owners in the short term, it creates a serious quality problem in the context of ignoring the formation of urban space, which affects both the value of the immovables and the quality of the urban environment in the long term. It is observed that it creates negative effects". This study is thought to be guiding in terms of revealing the importance of considering the subdivision plan processes from the perspective of the discipline of architecture.

The official institution areas created as a result of the PPI cut within the scope of the legislation in the past have become the problematic areas of today and this situation has been clearly seen in the district of Tire, which is the study area. Official institution areas, in which dozens of people are shareholders with the PPI cut, are against the logic of sustainable land management. In the areas created with the PPI, public investments cannot be realized and are subject to lawsuits by the shareholders. In order to prevent such situations, the PPI deduction was abolished from the legislation, but the immovables created in the past have not been used or subject to a public investment until today.

With the sustainable land management approach, official institution areas etc. created with the cut of PPI immovables should be included in the investment program by the relevant institutions and organizations, and they should be expropriated and brought to the public and the city. Considering that the most important factor supported by sustainable land management in cities is sustainable urbanization, it is of great importance that public investments are implemented without interruption for livable cities.

It is not possible to draw an optimistic picture for the future of the world unless precautions are taken and the understanding of sustainability is not adopted in all areas. Therefore, it is necessary to adopt sustainable land management as a basic principle both in the city and in the countryside before it is too late, and this basic principle should form the basis of all land-related studies such as cadastre and parcellation plan.

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Author contributions

Nazif Güler: Conceptualization, Methodology, Data Supply, Data Curation, Writing-Original draft preparation, Validation, Visualization. **Mehmet Ertaş:** Writing-Original draft preparation, Reviewing and Editing.

Conflicts of interest

The authors declare no conflicts of interest.

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