



Investigation of the effect of urban growth on agricultural areas: A case study in Konya/Türkiye

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Abstract

Today, urban areas are growing rapidly and accordingly they are replacing areas such as agriculture, forest and pasture. Urban growth has the most determinant effect on emerging land use changes. The loss of farmland due to urban growth has become a growing concern worldwide for both environmental and food security reasons. It is essential to implement land use control by determining the spatial behavior of urban growth. In this study, based on CORINE data, the spatial models of urban growth and its impact on agricultural lands in and around Konya/Türkiye city center between 1990-2018 were analyzed. Between 1990 and 2018, 7564.91 ha of agricultural land was transformed into an urban area.

1. Introduction

More than half of the world's population lives in urban areas due to important factors such as better living conditions, work and education. It is predicted that approximately 66% of the world's population will live in urban areas by 2050 [1]. The expansion of urban areas is associated with local or regional factors such as population growth, economy, land use policies [2]. Urban growth is a complex and dynamic process that often has reverse effects on land use. Uncontrolled and unplanned urban development can often cause irreversible environmental changes [3]. For example, as a result of uncontrolled urban development, green areas are destroyed, natural habitats are destroyed, local ecosystems are deteriorated, and a great pressure is created on water resources. Uncontrolled urban development causes an increase in air, water and soil pollution. This can lead to environmental health problems such as respiratory diseases, pollution of water resources and reduced soil fertility. It can also cause inadequate transport infrastructure and traffic problems. Unplanned and uncontrolled urban development may pose an increased risk to natural disasters. Congested and unplanned settlements become more vulnerable in natural disasters such as floods, earthquakes and landslides. This can lead to loss of life, property and long-term recovery processes.

Urban growth has the most determinant effect on emerging land use changes. In order to fully understand land use changes and urban growth, it is necessary to identify the social, economic and spatial variables that affect it [4, 5]. Agriculture is an indispensable sector for rural development and an important component of national development [6]. The loss of farmland due to urban growth has become a growing concern worldwide for both environmental and food security reasons. In many countries there is debate about how the conversion of farmland to urban use should be managed [7]. The high prices in energy and food prices due to wars, epidemics and droughts have increased the interest in agricultural lands in the world [8]. Despite this, agricultural land continues to be destroyed by urban growth. Agricultural lands are a crucial resource for sustainable food systems. A land management and planning approach is essential for increasing the productivity of agricultural lands and ensuring

their sustainable development [9]. As high levels of urban growth put enormous pressure on agricultural areas, it is vital to protect these areas for sustainability [10]. Spatial policies must be implemented effectively to determine the direction of urban growth and to implement effective control of land use [11].

Understanding spatial and temporal changes can be simplified using remote sensing data and geographic information systems (GIS) [12, 13]. Developments in GIS technologies have made it progressively used as a spatial decision support system [14] and offers very powerful analysis opportunities for many disciplines [15]. GIS applications are very important not only for visualization and data management, but also for interpreting alternates spatially and play an important role in managing complex relationships [16, 17]. The CORINE Land Cover database provides publicly available data for many EU countries, providing digital maps produced from classification of satellite imagery to analyze land cover and land use changes at a regional scale [18].

This study analyses the spatial patterns of urban growth and its impact on agricultural lands in and around Konya city center during the 1990-2018 period based on CORINE data.

2. Material and Method

2.1. Study area

This study was carried out in Konya city center, Türkiye. Konya is Türkiye's largest province in terms of area and the sixth most populous city. Konya city's area is 39,000 km². In Konya, which is located (36°22'-39°08' N, 31°14'-34°05' E) in the southern part of the Central Anatolia region [19] as shown Figure 1. According to Turkish Statistical Institute's 2021 data, the population of the Konya is approximately 2,300,000 [20].

Konya is one of the oldest settlements in Anatolia. The history of the settlement in Konya goes back to prehistoric times. Çatalhöyük, the oldest and most developed Neolithic settlement center ever found, is within the borders of Konya. The city, which was the capital of the Anatolian Seljuk State for many years, is also home to the tomb of the Islamic thinker Mevlana (Rumi), which attracts worldwide attention. Visited by millions of tourists from all over the world every year, Konya has an important potential in terms of history, culture and faith tourism [21].

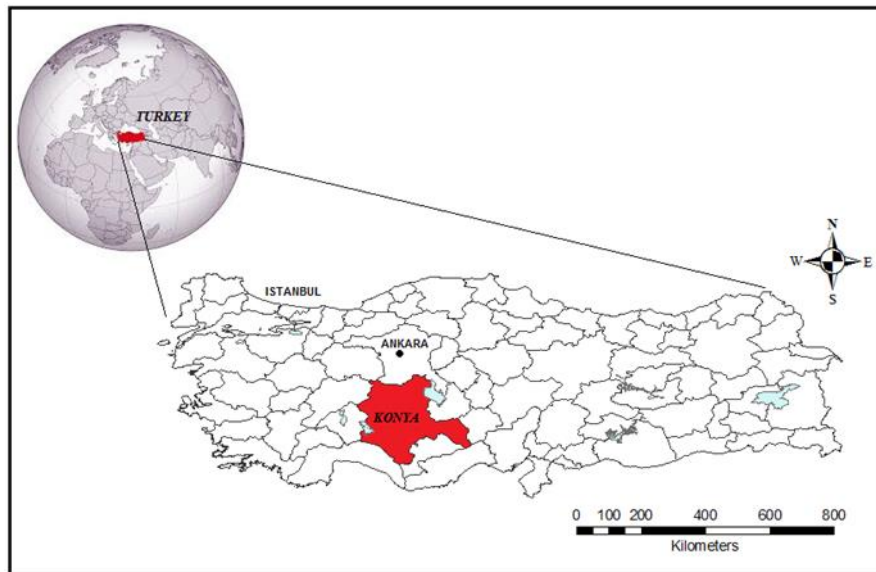


Figure 1. The geographical position of study area

2.2. Dataset

Within the scope of the study, the CORINE data set [22] was used for the land use data of the province of Konya for the years 1990 and 2018, since the land use changes between the years 1990-2018 were examined. CORINE is a land cover database covering European countries including Türkiye [23]. Land use capability data of agricultural lands were obtained from the Agricultural Land Evaluation and Information System (TAD Portal) (<http://tad.tarim.gov.tr>) software of the Ministry of Agriculture. The data used were analyzed and visualized using ArcGIS 10.5, a GIS software. In the study area, the changes in urban areas between 1990 and 2018 were determined by performing the intersection process. Statistical data for these areas are presented. The pressure of urban change areas on agricultural areas has been explained.

2.3. Geoprocessing

Comprehensive spatial analyses were carried out within the scope of the study with ArcGIS, a GIS software, of the land use data of 1990 and 2018 obtained from the CORINE data. With the intersection operations, the areas that have undergone changes in the 28-year period were determined and the rates of change were calculated with the help of software, and modelling and analysis were carried out.

3. Results and Discussion

In the study, using the CORINE data of the years 1990 and 2018, the urban areas for the city center of Konya, which is the study area, were arranged with the help of ArcMap 10.5, a GIS software, and shown in [Figure 2](#).

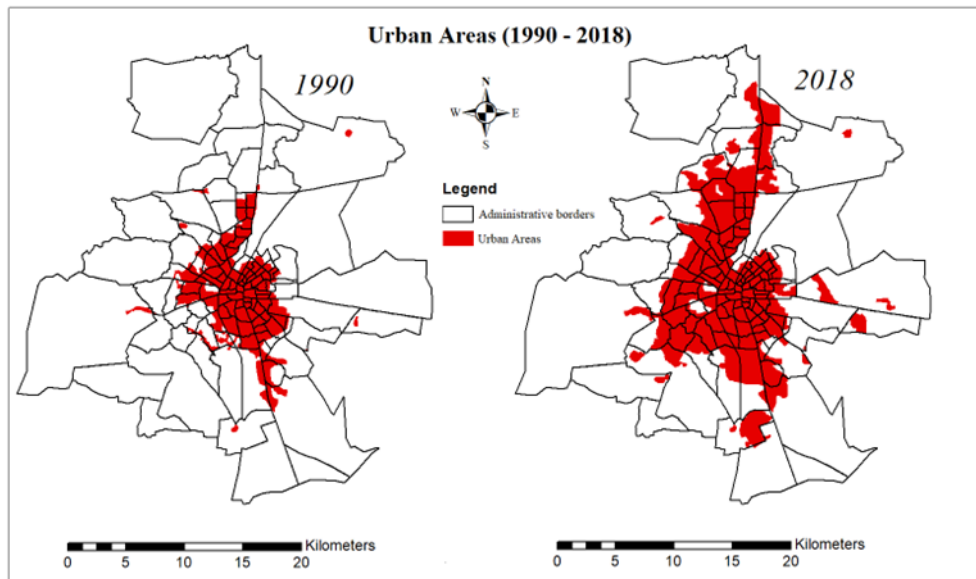


Figure 2. Urban areas in 1990 and 2018

According to the calculations made from the map in [Figure 2](#), while the urban areas were 6867.57 ha in 1990, this value increased to 16636.81 ha in 2018. This means an increase of 142.24% in urban areas. While the population of Konya city center was 515 thousand in 1990, it became 1 million 315 thousand in 2018. According to these values, the increase in population was 155%. The rate of increase in the population of Türkiye between 1990-2018 is 45%. In this case, the population growth rate in the city center was 3.44 times higher than the population growth of the whole country. The most important reason for the population increases in Konya is due to economic reasons. In addition to Konya being the most important agricultural center of Türkiye, the industrial sector has developed considerably in the last 30 years. This situation triggered migration from rural areas and other provinces to Konya. The population increase of 155% versus the increase of 142.24% in the urban area is quite parallel to each other.

In Türkiye, lands are classified between I and VIII degrees according to their usage capabilities. I, II- and III-degree lands are the lands that can be cultivated in the best, easiest and most economical way. According to the law, they cannot be used outside of agricultural applications. IV-degree lands are called marginal lands and can be removed from the agricultural area when deemed necessary. V, VI-, VII- and VIII-degree lands are areas that are not suitable for agriculture in any way, but can create a natural habitat or can be used as a resting place and national park by people [24]. The land use capability values for the work area are shown in [Figure 3](#). Surprisingly, all of the most fertile grade I, II and III lands are located in the expansion areas of the city.

The rapid increase in urban areas has put a very high pressure on agricultural areas and has caused very high decreases on these areas. Agricultural areas, which were 26893.60 ha in 1990, decreased by 35% to 17479.46 ha in 2018. [Figure 4](#) shows agricultural lands transformed into urban areas between 1990 and 2018. According to the values calculated with the help of ArcGIS software and presented in [Figure 5](#), between 1990 and 2018, 80.38% of agricultural areas were transformed into urban areas and 5.87% into industrial areas. 77.43% of the urban areas formed between these dates were obtained from agricultural areas and 9.31% from pasture areas. The pressure of urban growth on agricultural areas is clearly demonstrated by these values. According to [Figure 4](#), the region with the highest urban growth between 1990 and 2018 occurred in the northwest and southwest parts of the city center. The reason for the density in these regions is that the areas that were completely agricultural land in the 1990s were exposed to a very rapid urbanization in a period of approximately 30 years. Today, this area has

become one of the most exclusive areas of the city, where luxury and expensive residences are located. The areas to the south of the city are areas with intense urban change. These areas are mostly in a structure consisting of gardens and low-rise residences and have received more attention after the Covid-19 pandemic that started in 2019.

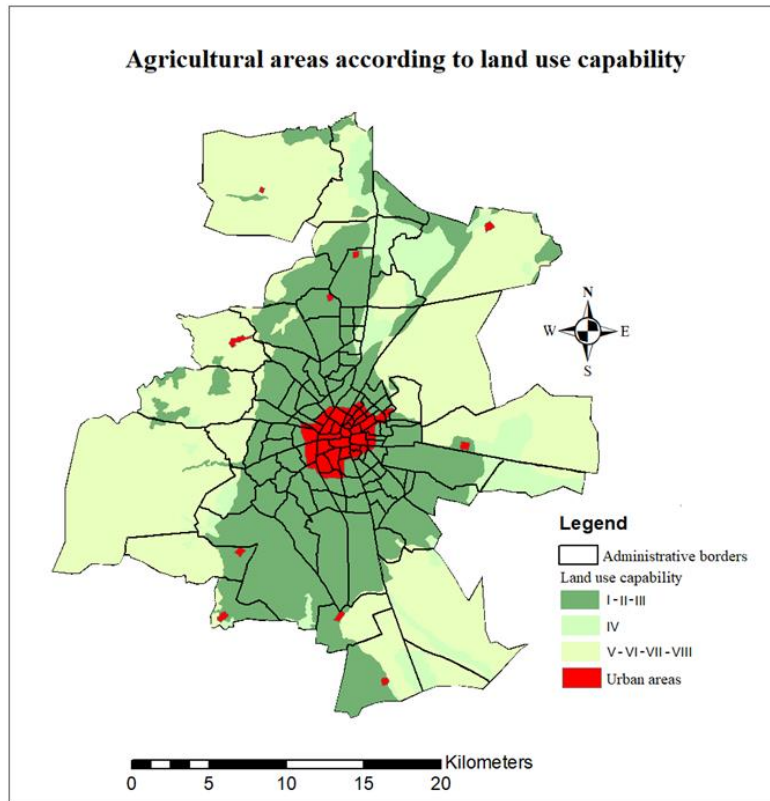


Figure 3. Use capability of the lands in the study area

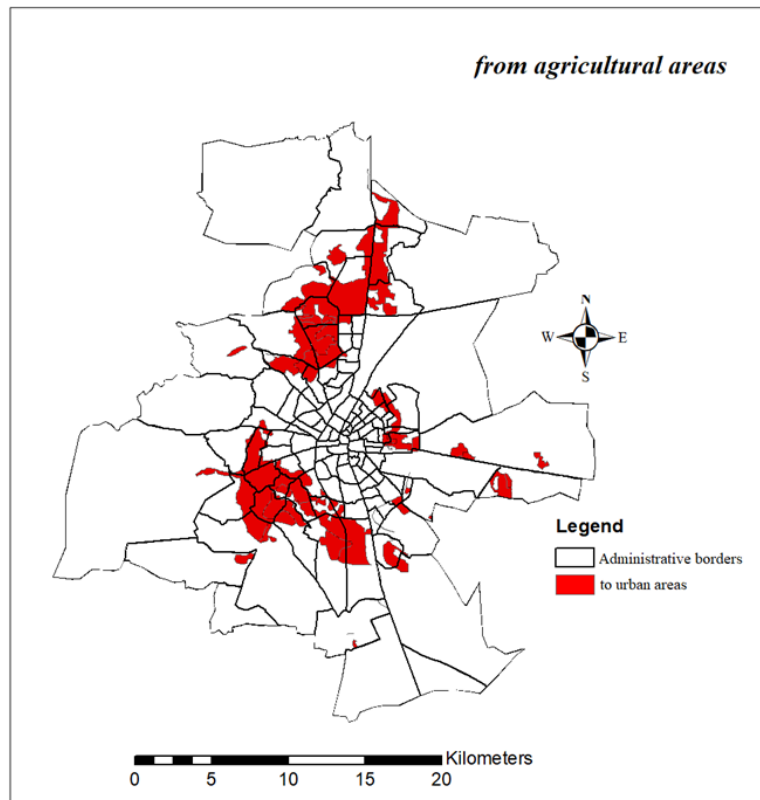


Figure 4. Transformation from agricultural areas to urban areas between 1990-2018

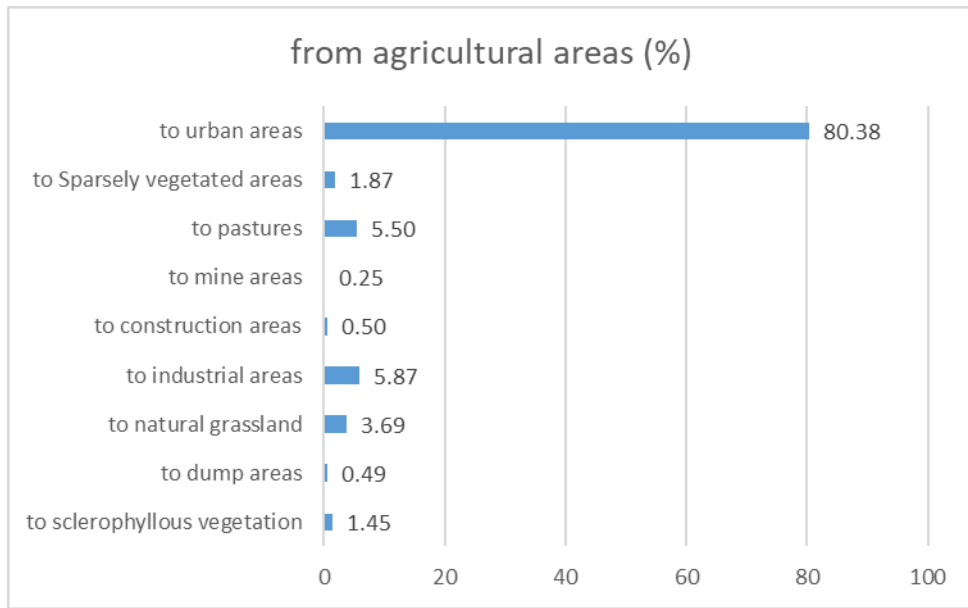


Figure 5. Land use rates where agricultural lands have been transformed

Figure 6 shows the values between I and VIII degrees, which are an indicator of the productivity of the regions that have transformed from agricultural to urban areas in a 28-year period. Accordingly, 6158.82 hectares of the most fertile soils, grade I, II and III, were spent on urban areas. The ratio of less productive IV and VIII grade lands, which are actually areas that can be used as urban areas, is 2081.19 ha. In other words, the most productive lands of the city were destroyed as urban areas. In today's conditions, access to food has become difficult due to various negativities such as wars and diseases. However, these emerging values are very thought-provoking.

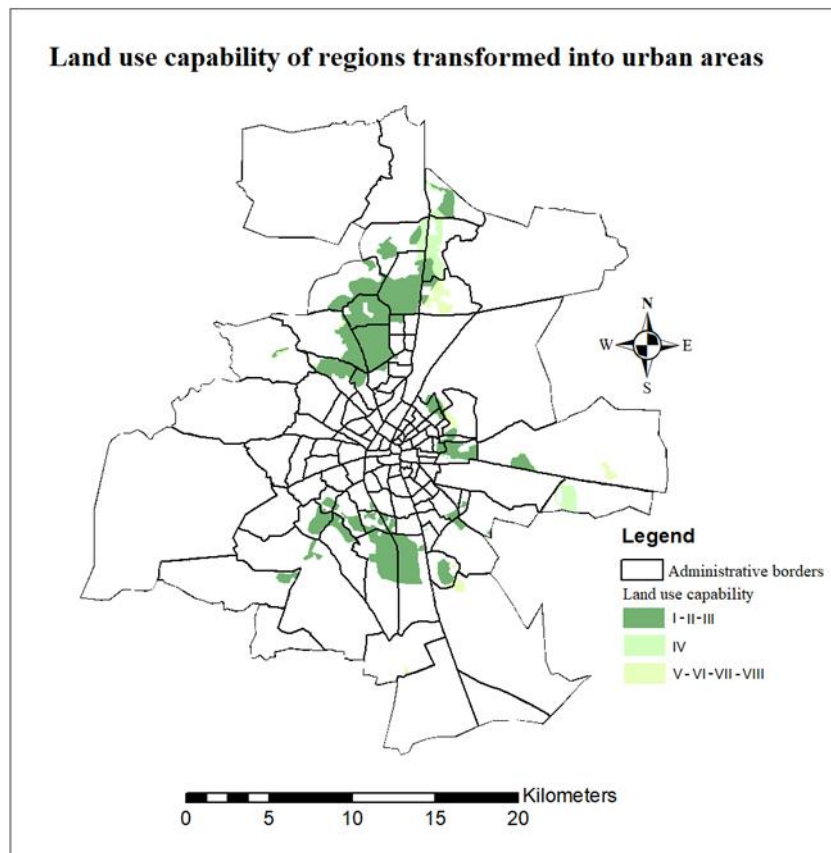


Figure 6. Land use capability of regions transformed into urban areas between 1990-2018

The biggest factor in the unconscious destruction of agricultural lands has been urbanization. Although agricultural lands were protected by law, agricultural lands were rapidly destroyed due to illegal constructions or by prioritizing rent. Most of the time, illegal construction has increased due to unconscious zoning amnesties.

Although all zoning amnesties have been issued to date, their scope has always been greater than the previous one [25]. With the Soil Conservation and Land Use Law No. 5403, enacted in 2005, the protection of agricultural lands was bound to stricter rules.

4. Conclusion

The pressure on urban areas can be caused by a variety of factors, including an increase in population density, ineffective planning or regulation of land use, infrastructure deficiencies, and social and economic inequalities. These pressures are tried to be dealt with by various policies and strategies by city administrations. Approaches such as sustainable urban planning, infrastructure development, environmental protection, social policies and participatory management can offer solutions to reduce pressures in urban areas and promote sustainable urban living. With this study, based on land use data between 1990-2018, the rate and nature of the urban pressure on agricultural areas in Konya has been revealed. In the transformation into urban areas, the weight is concentrated in the northwest and southwest regions of the city center. The most important reason for the urban development in the northwest direction is that these areas are physically easy areas for construction. However, these regions have fertile agricultural lands and are in the alluvial soil class, which is not suitable for settlement in terms of geology. The planned actions of the two universities and local administrations in this region for regular urbanization paved the way for urbanization. The southwestern part of the city is mostly made up of residences with gardens for hobby purposes. Between 1990 and 2018, 7564.91 ha of agricultural land was transformed into an urban area. In addition to climate change, access to food is difficult due to ongoing wars and epidemics. The global food crisis makes its presence felt in this period. Recently, the number of countries that have restricted the export of food products has been increasing. For this reason, agricultural lands have become more important than ever before. The importance of agricultural areas emerges once again. With the Soil Conservation and Land Use Law No. 5403 enacted in 2005 in Türkiye, the protection of agricultural lands is bound to stricter rules. It has been prevented that fertile agricultural lands go beyond agricultural purposes. A planned and programmed urban growth ensures effective use of resources, improves infrastructure, observes social balance and equality, protects the environment, and encourages economic development. For these reasons, planning and programming are important for the sustainable growth of cities.

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Conflicts of interest

The authors declare no conflicts of interest.

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