



Urban Development Policy and Land Use Distributions in the Neighborhoods of Amasya, Turkey

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ABSTRACT

This study examines land uses in the neighborhoods of the city of Amasya to determine which of them have similar land uses. This was done using agglomerative hierarchical cluster analysis and the Ward method. The neighborhoods of Ormanbağları and Yazıbağları were found to have similar characteristics and were designated as cluster 1. Dere and Yüzevler are cluster 2. Cluster 3 consists of only one neighborhood, Nergis. Hacıilyas and Prinçci are in cluster 4.

Based on the analysis of Amasya, these neighborhoods should have similar planning decisions. This will help to make planning more sustainable in Amasya. It is important to note that similarities among neighborhoods should be taken into account in development plans. This research presents a more consistent planning approach for land use distribution based on neighborhoods' needs. It shows that urban development policy should consider land use distribution in neighborhoods in order to achieve sustainable and livable urban development.

Keywords: urban development, land uses, agglomerative hierarchical cluster analysis, neighborhoods, development plans

1. Introduction

Urban areas should arrange land use in sustainable way. This means that it needs to distribute all necessary social facilities at the same living standards, at the same accessible distance and using the same approach for all urban areas. In addition to the problems that arise due to the rapid pace of urban development, it is noteworthy that land use distribution is not planned well. As a result, problems arise as to how urban development policy should plan land use in cities and how to create equal opportunity and access to social facilities.

This is why it is necessary to determine the land use distribution in urban planning zones for neighborhoods and make planning decisions accordingly. To understand this, we have identified similar development patterns in the neighborhoods of the Turkish city of Amasya using cluster analysis. Accordingly, neighborhoods with similar land uses should be planned using similar planning approaches.

Areas with the same potential for sustainable planning need the same planning approaches. In order to make land use more efficient and more effective, similar areas should be identified for similar planning approaches.

Land suitability analyses, beginning with Ian McHarg's *Design with Nature* (1992), are used to find suitable land use areas in urban development and to reduce the negative impacts of unplanned decisions on urban development. John Randolph supported McHarg's work with research conducted in 2004. He emphasized that land use should not be randomly selected for urban development. Malczewski (2004) showed that geographic information systems is one of the most important tools for land suitability analysis and land development.

Planning decisions should be based on the land use distribution because it helps to understand the land uses that neighborhoods need. Development policy should focus on land use problems to develop neighborhoods sustainably. Municipalities are responsible for the planning and development of land uses in Turkey's cities. Local authorities have the authority create more sustainable and healthy planning development.

In recent years, hierarchical cluster analysis has been widely used to understand how land use evolves and where similar areas are clustered. This study seek answers to these research questions:

1. Where is same land uses clustered in Amasya, and which neighborhoods have similar land use distribution?
2. Based on this similarity, how should an urban development approach be developed in areas where land uses are concentrated?
3. How can urban planners create more sustainable urban development policies?

This research examines land uses in Amasya and which neighborhoods have similar land uses. Based on this analysis, inferences are drawn about how urban land use should be developed for them. This will help to develop sustainable urban development policies for each neighborhood and determine the neighborhoods' land use needs according to land use distribution in the current development plan.

2. Materials and Method

2.1. Study Area

Amasya was chosen for this research because of the historical background and values that makes its planning tradition important. However, Amasya has not had consistent and comprehensive urban planning. Amasya is in the Black Sea region (Figure-1) with Tokat to the east, Samsun to the north, and Yozgat and Tokat to the south (Turkstat, 2012). The research area extends from longitudes $34^{\circ} 57' 06''$ - $36^{\circ} 31' 53''$ and from latitudes $41^{\circ} 04' 54''$ - $40^{\circ} 16' 16''$ (Turkstat, 2012).

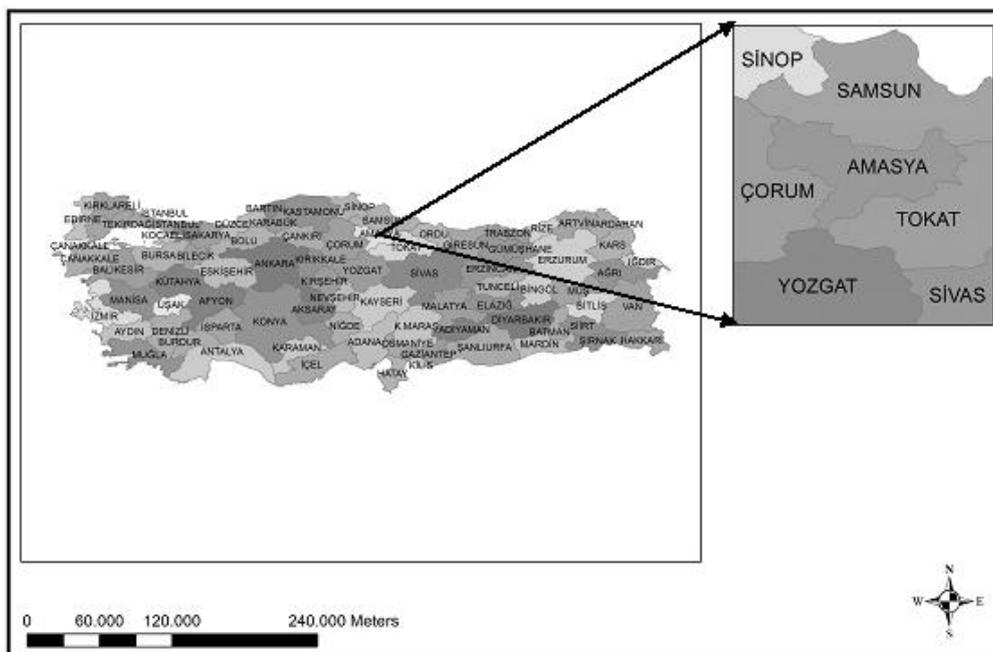


Figure-1. Study Area



For the analysis, 1/1,000 development plans obtained from the Amasya Municipality were used. Land uses are the main objective of this analysis of their distribution in Amasya's neighborhoods. The neighborhoods need at least basic land uses such as health areas and green areas, and they should be accessible to everyone in the city. Urban development policy should take into consideration land use distribution for the sustainable development.

This analysis measured how similar land uses in the neighborhoods are to each other in terms of planning decisions are dispersed. With this method, this study endeavors to establish whether or not the neighborhoods have balanced development has been shown between land uses. It also shows whether the neighborhoods have developed similarly.

ArcGIS was used for this analysis, and the land use distribution in each neighborhood was assessed. Considering the urban planning approach in the development plan prepared by the municipality, the similarities of the neighborhoods' land use distributions. The fact that municipalities have to do urban planning using these plans led us to choose to study them. The data were gathered from the development plans that the municipality prepared and used for cluster analysis.

Cluster analysis refers to similar or dissimilar groups that consist or do not consist of multivariate data (Everitt, 2005; Ozus et al., 2012). Cluster analysis is generally related to a correlation matrix and can be analyzed in various ways (Robinson, 1998).

The cluster analysis used agglomerative hierarchical analysis and Ward method. This method was developed by Ward (1963) (Murtagh and Legendre, 2011). However, Lance and Williams (1967) did not consider the Ward method, the updating formula of which was first investigated by Wishart (1969) (Murtagh and Legendre, 2011).

When the distance between two clusters in the Ward method is combined, it takes into account how much the sum of squares will increase. This attempts to obtain the smallest ratio in the combined points to determine the most similar clusters. It means that the Ward method is one of the most accurate methods to define similar data in clusters. This makes the Ward method one of the most commonly used analytical methods for agglomerative hierarchical analysis. These were the reasons why Ward method was used for understanding similar land uses for neighborhoods in Amasya in this article.

When the squared Euclidean distance is analyzed, the dissimilarity matrix can be revised using the Lance-Williams formula during clustering: (Wishart, 1969; Gan et al., 2007):

$$D(C_k, C_i \cup C_j) = \frac{|C_k| + |C_i|}{|C_k \cup C_i|} D(C_k, C_i) + \frac{|C_k| + |C_j|}{|C_k \cup C_j|} D(C_k, C_j) - \frac{|C_k|}{|C_k \cup C_j|} D(C_i, C_j)$$

The land use data from Amasya's development plan was converted from NetCAD to ArcGIS data. The maps in ArcGIS were placed in their WGS 84 UTM zone. The ArcGIS data was normalized using MatEdit (Burba et al., 1992), which was developed by the project ECOMANAGE. The method begins with an analysis of normalization, which eliminates redundant variables from the database. Agglomerative hierarchical analysis was then done using XLSTAT. This determined the similarity of the neighborhoods' urban development based on land use distribution in the development plan. The similarity of urban development in terms of land use distribution indicated which neighborhoods need new urban planning approaches.

3. Results

When we look at the land use distribution in Amasya's urban development pattern, it is noteworthy that the green areas are generally located in the city center, and the agricultural areas are distributed away from the center (Figure-2). The core of land uses for urban development appears to be located in the central part of the city. Important areas such as educational areas and healthcare facilities are located Amasya's central neighborhoods.

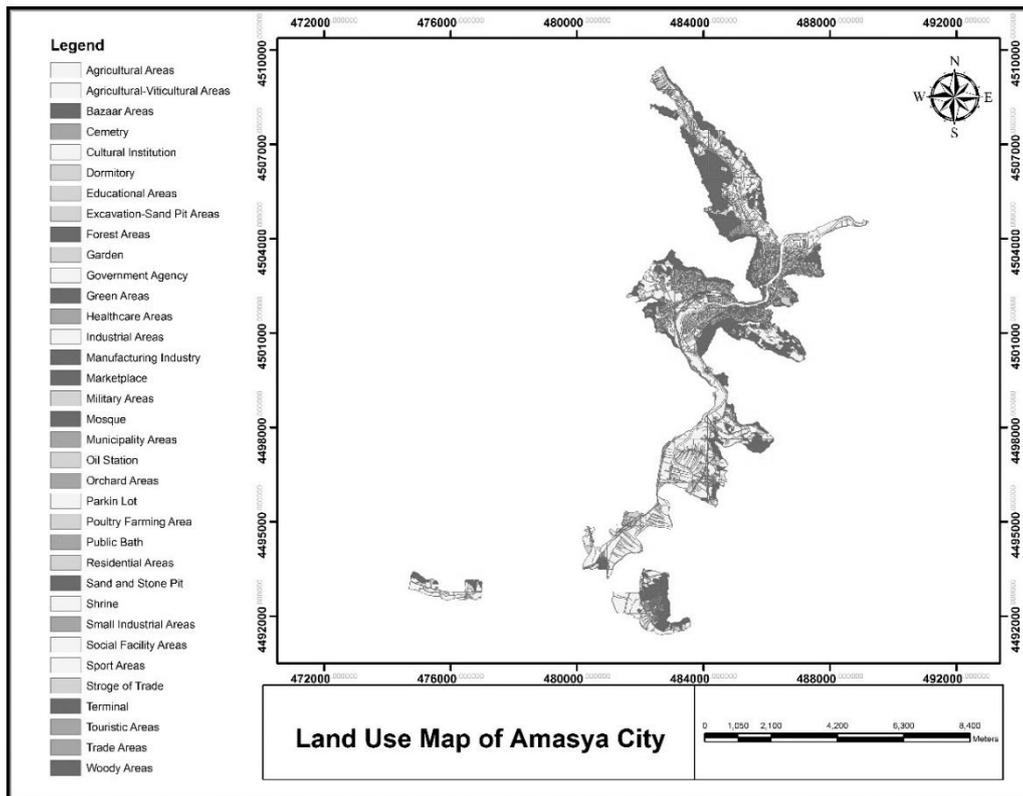


Figure-2. Land Use Map of Amasya

The analysis identified four clusters. When we look at the similarities of the neighborhoods, those in the city center show a similar development pattern. Clusters 2, 3 and 4 are located in the center of the city. Cluster 1 is not. The neighborhoods in the periphery are similar (Figure-3). Urban planning development should approach cluster 1's 33 neighborhoods the same way as the others. This gives the local authorities the ability to plan development according to the neighborhoods' needs.

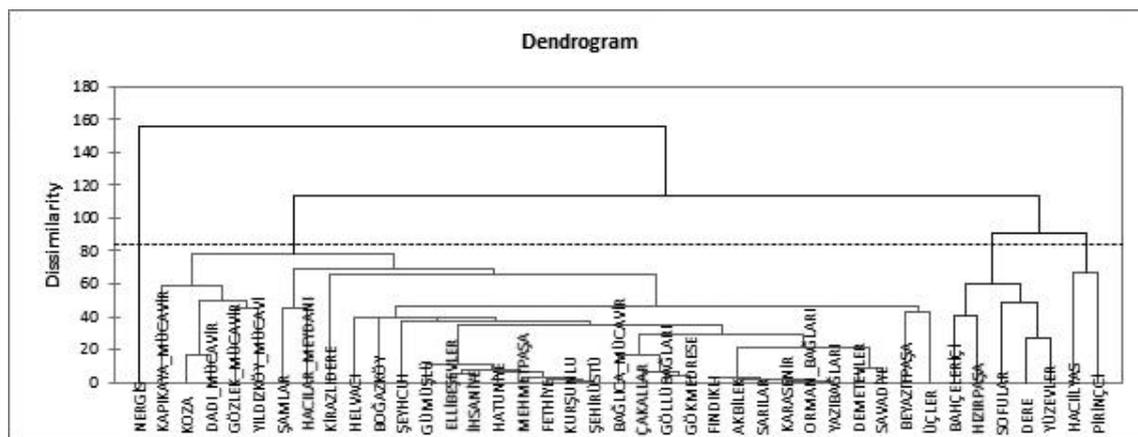


Figure-3. Cluster Analysis Dendrogram

In order to make the clusters more understandable, the dendrogram was converted into a table, illustrating in detail which areas are more similar to each other. There are 33 neighborhoods in the first cluster, 5 neighborhoods in the second cluster, 1 neighborhood in the third cluster and 2 neighborhoods in the fourth cluster. The third cluster has only one neighborhood, and thus needs a unique development approach.



Table-1. Results by Class

Class	1	2	3	4
Objects	33	5	1	2
Sum of weights	33	5	1	2
Within-class variance	0.7353	0.4798	0.0000	0.1509
Minimum distance to centroid	0.5860	0.3412	0.0000	0.2747
Average distance to centroid	0.8264	0.5647	0.0000	0.2747
Maximum distance to centroid	1.2033	1.0395	0.0000	0.2747
	KARASENİR	SOFULAR	NERGİS	HACİİLYAS
	HELVACI	BAHÇELERİÇİ		PİRİNÇCI
	ÇAKALLAR	DERE		
	ORMAN BAĞLARI	YÜZEVLER		
	DEMETEVLER	HIZIRPAŞA		
	KOZA			
	KAPIKAYA MÜCAVİR			
	GÖLLÜBAĞLARI			
	SARILAR			
	AKBİLEK			
	ELLİBEŞEVLER			
	ŞEYHCUI			
	KİRAZLIDERE			
	SAVADIYE			
	BEYAZITPAŞA			
	MEHMETPAŞA			
	GÜMÜŞLÜ			
	FETHİYE			
	ŞAMLAR			
	HATUNİYE			
	ÜÇLER			
	KURŞUNLU			
	HACILAR MEYDANI			

YAZIBAĞLARI
GÖKMEDRESE
ŞEHİRÜSTÜ
FINDIKLI
BOĞAZKÖY
İHSANİYE
GÖZLEK MÜCAVİR
YILDIZKÖY MÜCAVİR
BAĞLICA MÜCAVİR
DADI MÜCAVİR

Table-1 shows that the neighborhoods of Karasenir, Ormanbağları and Yazıbağları in cluster 1 are quite similar. Sarılar, Fındıklı and Akbilek are all similar and similar planning approaches should be proposed for these neighborhoods. Similarities between the neighborhoods of Dere and Yüzevler are observed in cluster 2. Also, in cluster 2, Sofular is similar to Dere and Yüzevler. In cluster 4, Piriñçi and Hacilyas neighborhoods are similar. Nergis is alone in cluster 3, so it needs a unique planning approach.

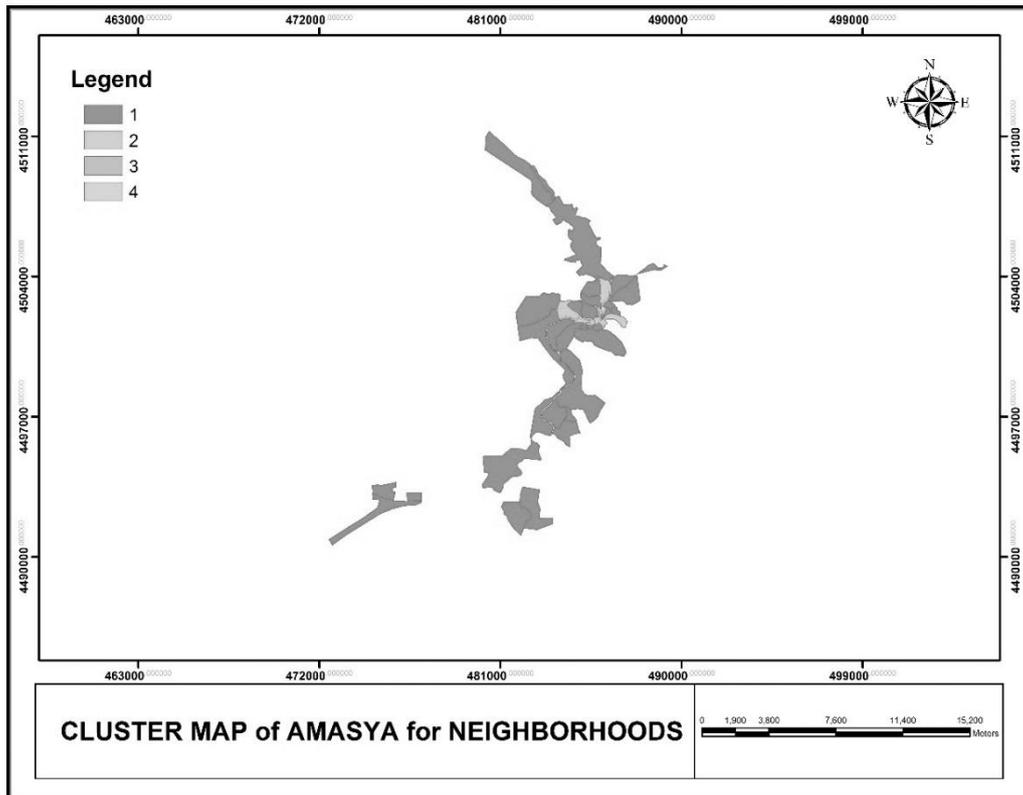


Figure-4. Cluster Map of Neighborhoods

This cluster map shows that clusters 2, 3 and 4 are in the center of the city. Most of the neighborhoods are in cluster 1. Urban development policy should focus on where important land uses are needed in neighborhoods. The analysis give us to decide how to arrange our planning policy in the clusters. For example, cluster 1's Karasenir, Yazıbağları and



Ormanbağları have the same land use characteristics in terms of green areas, and they need green areas in Amasya's planning for future implementations.

Table-2. The Distances Between the Class Centroids

	1	2	3	4
1	0	0.6924	1.0598	0.8133
2	0.6924	0	0.8904	0.5224
3	1.0598	0.8904	0	1.0873
4	0.8133	0.5224	1.0873	0

When we look at the distance between the class centroids of the clusters, cluster 4 and cluster 2, and cluster 1 and cluster 2 are similar. Cluster 3 is far from all the other clusters. This analysis indicates that the local authorities can use the same planning approaches in clusters and even between clusters when there is a connection to evaluate for Amasya's development. The local authorities should consider land uses and their development based on the neighborhoods' similarities. They indicate what Amasya's neighborhoods need for sustainable development.

Land uses give a clue to understand development of city and to make more concentration of needs of neighborhoods for land uses. For example, Amasya's agricultural areas are located outside the city. Green areas such as parks are located in the center of the city. There are very few forest areas or agricultural areas in the center of the city, which indicates that these areas may disappear due to urban development in Amasya.

Table-3. The Distances Between Central Objects

	1 (HACILAR MEYDANI)	2 (DERE)	3 (NERGİS)	4 (PİRİNÇCİ)
1 (HACILAR MEYDANI)	0	0.6051	1.0879	0.5990
2 (DERE)	0.6051	0	1.0281	0.5673
3 (NERGİS)	1.0879	1.0281	0	1.0973
4 (PİRİNÇCİ)	0.5990	0.5673	1.0973	0

When we look at the distance between the neighborhoods with the median values in each of the four clusters, it is noteworthy that Hacılar Meydanı and Piringçi are close to each other. Dere is also similar to Hacılar Meydanı and Piringçi. Land use distribution should be the primary consideration of urban development planning decisions. Ensuring that neighborhoods' land use needs are met by the planning decisions of the local authorities requires taking the clusters' similarities into consideration.

Cluster analysis makes it easy to determine what kind of planning approach should be used for which neighborhoods. For example, cluster analysis indicates that clusters 1, 2 and 3 have green areas, but cluster 4 does not, so the local authorities should focus more on the development of green areas in cluster 4. Cluster 4 does not have any healthcare facilities and needs more attention from the local authorities. Cluster analysis also enables us to understand where more or less attention to the development of land uses is needed. For example, no development of green areas is needed in cluster 2, but the analysis also



indicates that green areas should be a major consideration in development policy because they are lacking in many neighborhoods.

Similar planning approaches should be adopted in the neighborhoods of Karasenir, Yazıbağları and Ormanbağları in cluster 1, Sofular, Dere and Yüzevler in cluster 2, and Piringçi and Hacıilyas in cluster 4.

For more sustainable and better planned urbanization, our research in Amasya shows which neighborhoods have the same characteristics. For example, cluster 2 is in the center of the city, which means that its neighborhoods are host to primary urban land uses such as settlements and healthcare facilities. On the other hand, cluster 1 includes many more neighborhoods, which need land use planning for sustainable urban development in Amasya's periphery.

Urban development policy should consider these outcomes of the analysis:

1. Neighborhoods in the same clusters such as Yazıbağları and Ormanbağları in cluster 1 should have similar planning approaches to their urban development.
2. This analysis gives planners the option to focus on more specific land uses where they are needed, for instance in Savadiye, which needs to plan active green areas because it has no green areas or forest areas. It has only woody areas, meaning there are no available green areas for public use. Therefore, these neighborhoods need to be designed and planned for people's use.
3. Planning policy should focus on four different strategy and four different land uses for the clusters.

4. Conclusion

This study used a method to make land use planning in Amasya more understandable and sustainable by identifying the similarities of its neighborhoods and clarifying their land use needs. The cluster analysis shows which neighborhoods need some land uses more than others. It used a proximity matrix (Euclidean distance) to determine the neighborhoods' similarities. This study can serve as a guide for the local authorities' planning of land uses according to the neighborhoods' specific needs. It will also help to make urban development more sustainable. Several studies have focused on how land uses change and tried to explain the differences between the past and the present. This study identifies similarities in neighborhoods' land use distributions to guide more sustainable urban planning decisions. Its results indicate that urban planning policy needs to plan land uses for neighborhoods. In this approach, land use distribution offers clues for future planning decisions. For example, one neighborhood has much more green areas, and the other neighborhood has none or not enough. This can help to understand how to plan land uses in urban development. If urban development policy considers the results of this study, it can achieve more balanced and sustainable development. This study's method can give urban development policy a new dimension and offers a more balanced way of distributing land uses in cities. It is useful for future studies and urban development planning in Turkey. It can also be adapted to other fields of study.

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