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Relationship between Population and Agricultural Land in Amasya

Mustafa Ergen

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Abstract

Urban development endangers agricultural and natural areas. It causes the rural population to immigrate to urban areas due to appealing life standards and leads to the extinction of rural areas. In addition, reduced rural population causes urban areas to select rural areas as development areas. This problem of rural areas can be better described in the areas that have completed their urban development but still continue to develop. This article discusses the effect of population in determining the areas which see population increases and are under pressure.

We addressed Amasya in our research. The population in the neighbourhoods of Amasya was determined. The distribution of rural areas in the city plans in the neighbourhoods was determined. Geographical information system was used for these analyses. Pearson's product-moment correlation was used on agricultural and population data obtained from the neighbourhoods. The existence of a negative or positive interaction between population and agricultural areas was shown. This study described the problems of rural areas located in urban areas and indicated their status according to the population, using statistical analysis.

Keywords: agricultural areas, urban development, geographical information system, Pearson's product moment correlation, rural population

1. Introduction

Rapid urbanization puts serious pressure on agricultural land and natural areas [1]. Urbanization has greatly reduced agricultural areas [2]. According to the OECD [3], cities are the most important sources of major problems for rural areas [4]. Uncontrolled development also

reduces biodiversity and depletes natural resources. All these show that urban development endangers agricultural and natural areas.

Urban areas interact with rural areas at various levels, at regional, urban and settlement scales [5]. At the regional scale, urban areas affect rural areas in metropolitan development. At the urban scale, we can talk about the interaction between rural areas and the city at the urban fringe. Finally, at the settlement scale, the interaction between farm buildings and open spaces and the urban square is evident [5]. With this approach, urban development is threatening agricultural land at different scales. This threat plays a key role in decreasing agricultural production in these areas and increasing rapid and often uncontrolled land-use development [6, 7]. Because of decreasing agricultural areas, in the meantime, urban areas may finish all development options in agricultural areas [7].

It causes the rural population to migrate to urban areas due to appealing life standards and leads to the elimination of rural areas. In addition, reduced rural population causes urban areas to identify rural areas as development areas. The problem of rural areas can be better described in areas that have completed their urban development, and still continue to develop.

Rapid urban development brings the risk of destroying agricultural and natural areas. Controlling this development is of great importance; however, many cities were developed without taking this into consideration. Industrialization and urban development have seen many examples of this situation. The main factor is population movement. Cities with increasing population density target agricultural and natural areas as development areas.

Population movements increase urban populations and reduce rural populations. This reduces labor productivity in agricultural areas and causes these areas to remain inactive, and increases the pressure of urban development on these areas. Therefore, protecting these areas was attempted in order to reduce the pressure of urban development on the agricultural and natural areas. However, these efforts could not reduce the pressure of urban development on rural areas, since housing is a primary human need. We put land-use planning under protection, but population movements continue to threaten these planning approaches. As the general demand of population increases continues to concentrate in and around cities [2, 8], it will reduce urban agricultural areas. The roles of growing urban areas in countries where the migration of most of population is seen and land-use development of cities are expected to increase [2, 9].

It is important to analyze the relationship of urban development with population in urban agricultural areas to better understand its effect on urban agriculture, and to generate planning approaches with different points of view towards developed and developing cities. This study aims to reveal the status of urban agriculture in developing cities and the required development strategy. This article discusses the effect of population in determining the areas which see population increases and are under pressure.

2. Area description

The study area was chosen to be Amasya, located in the Central Black Sea region in the north of Turkey. Amasya is a city which borders Samsun, Tokat, Çorum and Yozgat (**Figure1**). Amasya has not completed its urban development yet, but is open to development. There are some areas of urban agriculture within or at the boundaries of the city. It is important to define these agricultural areas and determine their status within urban development.

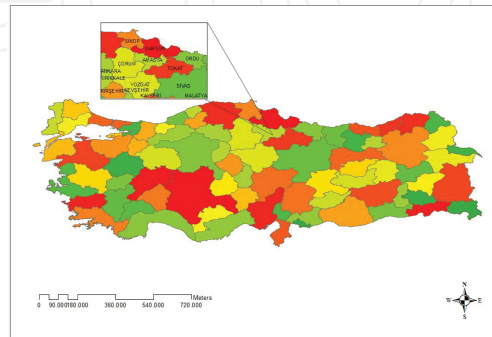


Figure 1. Study area— Amasya city (Turkey).

In addition, Amasya is a city having fertile soil and a history based on agriculture due to rich green areas and watershed characteristics. Therefore, it is an important sample for this research.

3. Material and method

According to the information on agricultural infrastructure from the Amasya Provincial Directorate of Agriculture's website, agriculture is the foundation of Amasya's economy, and 34.3% of the provincial territory consists of agricultural land [10]. In this sense, this study generates important data in terms of examining Amasya's agricultural structure and revealing the impact of urban development on agricultural land.

This study has three main steps. First, the data were organized according to Amasya's urban planning, and the agricultural land-use areas were identified. The population data of its neighbourhoods were obtained from the TurkStat [11] website. Second, the relationship between the agricultural areas and the neighbourhoods' population data was analyzed using Pearson's product-moment correlation. Third, the results of the data were evaluated and analyzed, yielding the study's results for Amasya.

Our study determined the population in the neighbourhoods of Amasya and the distribution of rural areas in the city plans. Geographical information system was used for these analyses. Pearson's product-moment correlation was used with the agricultural and population data obtained from the neighbourhoods. This study described the problems of rural areas located in urban areas and indicated their status according to the population, using statistical analysis.

The urban agricultural areas of the neighbourhoods of Amasya's development plans were analyzed (**Figure2**). The development plan was obtained from the Amasya Municipality for research. The agricultural and other areas were determined from this plan for the purpose of this study. Agricultural areas include vineyards and orchards. Cemeteries, woodlands and green areas were also shown together with other land uses; however, Pearson's product-moment correlation was only used for agricultural areas and population.

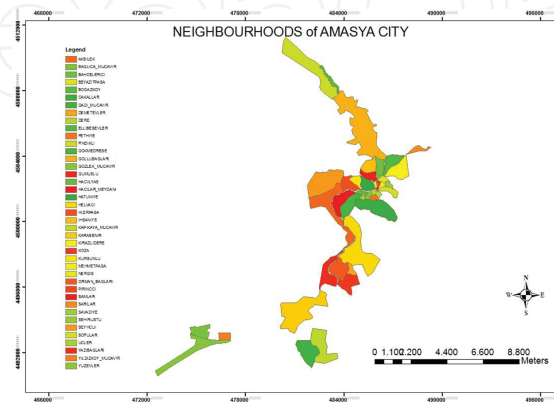


Figure 2. Neighbourhoods map of Amasya city.

The relationship between agricultural areas and population rates in the neighbourhoods was studied using correlation analysis. The product-moment correlation coefficient, which is used in calculations on an interval/ratio scale [12], was used to better understand the relationship between these data. The calculations were done to determine the effect of population growth on urban agricultural areas. Pearson's product-moment correlation formula from the book of Lee and Wong, *Statistical Analysis with Arcview GIS* (2001), was used:

$$r \sum_{i=1}^n x_i y_i / n - \bar{X} \bar{Y} / S_x S_y \quad (1)$$

where n shows the number of neighbourhoods, x_i and y_i show the data obtained by adding the number found by multiplying the number of agricultural areas with the population in neighbourhoods, $\bar{X} \wedge \bar{Y}$ shows the mean of agricultural areas and the population in neighbourhoods, and S_x and S_y show the standard deviations in agricultural areas and neighbourhoods. These results suggest that [12] the correlation coefficient indicates a positive relationship as it approaches +1 and a negative relationship as it approaches -1. Zero indicates a neutral relationship between the data. This analysis yielded the following results for Amasya.

4. Results and discussion

This analysis is important for understanding the pressure of the increase in urban population on rural areas. No agricultural areas remain in some of Amasya's 41 neighbourhoods. Most of

the remaining agricultural areas are located on the city's boundaries. There are fewer square meters of agricultural areas in and around the city center than at the city's edges.

The agricultural areas are indicated by red on the land-use map of Amasya. There is less red color in the center of the city; however, it can still be seen at the edges (**Figure 3**). This suggests that rural areas or urban agricultural areas are gradually being reduced.

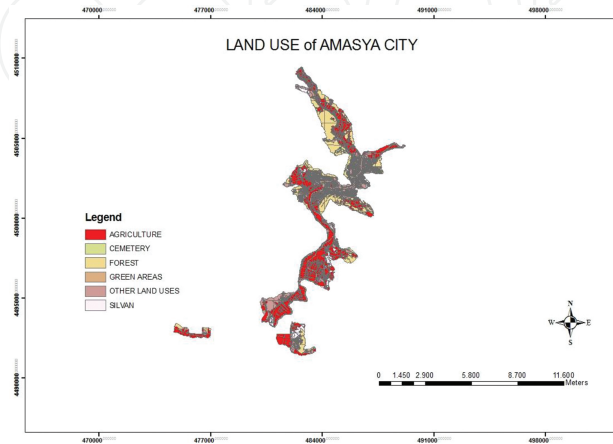


Figure 3. Land use map of Amasya city.

Table 1 indicates that the neighbourhoods with the highest ratio of agricultural land are Göllübağları and Karasenir. However, in Kirazlıdere, Savadiye, Beyazıtpaşa, Sofular, Bahçeleriçi, Pirinçci, Gümüşlü, Fethiye, Şamlar, Nergis, Dere, Hatuniye, Hacılıyas, Üçler, Kurşunlu, Gökmedrese, Şehirüstü, Yüzevler and İhsaniye, agricultural areas have been completely or almost completely destroyed. We can see the agricultural lands starting to get disappeared within the urban development of Amasya.

Layer	Agriculture	Other land uses	Forest	Cemetery	Silvan	Green areas
Karasenir	1,798,586	1,176,519	0	10,142.4	145,374.4	0
Helvaci	1,044,667	669,398.6	321,176.1	10,142.4	172,420.8	0
Cakallar	571,355.4	216,371.3	858,723.4	0	0	0
Orman_Baglari	872,246.6	135,232	0	0	0	0
Demetevler	77,758.42	50,712.01	0	0	84,520.02	0
Koza	368,507.3	270,464.1	0	0	94,662.43	0
Kapıkaya_Mucavir	331,318.5	294,129.7	483,454.5	0	338,080.1	3,380.801
Gollubaglari	1,947,341	997,336.3	1,254,277	162,278.4	10,142.4	0
Sarilar	104,804.8	67,616.02	0	0	0	0
Akbilek	845,200.2	689,683.4	114,947.2	0	20,284.81	3,380.801
Ellibesevler	169,040	432,742.5	0	0	0	10,142.4

Layer	Agriculture	Other land uses	Forest	Cemetery	Silvan	Green areas
Seyhcui	716,729.8	879,008.2	341,460.9	3,380.801	74,377.62	13,523.2
Kirazlidere	3,380.801	4,83,454.5	216,371.3	0	0	0
Savadiye	0	67,616.02	0	0	30,427.21	0
Beyazitpasa	0	141,993.6	0	0	0	0
Mehmetpasa	0	87,900.82	0	0	0	3,380.801
Sofular	0	128,470.4	0	0	40,569.61	16,904
Bahcelerici	0	365,126.5	0	0	3,380.801	20,284.81
Pirincci	0	64,235.22	0	0	0	0
Gumuslu	0	13,523.2	0	0	0	0
Fethiye	0	111,566.4	13,523.2	0	0	0
Samlar	10,142.4	155,516.8	94,662.43	6,761.602	13,523.2	0
Nergis	0	67,616.02	3,380.801	0	0	3,380.801
Dere	0	138,612.8	0	0	0	0
Hatuniye	0	138,612.8	10,142.4	0	0	0
Haciilyas	0	118,328	0	0	0	0
Ucler	0	64,235.22	0	0	0	0
Kursunlu	0	179,182.4	47,331.21	0	0	0
Hacilar_Meydani	250,179.3	571,355.4	0	0	6,761.602	3,380.801
Yazibaglari	828,296.2	273,844.9	0	3,380.801	0	0
Gokmedrese	0	121,708.8	463,169.7	43,950.41	30,427.21	0
Sehirustu	0	54,092.81	3,380.801	0	0	0
Yuzevler	0	74,377.62	0	0	0	0
Hizirpasa	50,712.01	429,361.7	57,473.62	0	0	50,712.01
Findikli	348,222.5	317,795.3	0	3,380.801	135,232	0
Bogazkoy	128,470.4	101,424	57,473.62	0	0	0
Ihsaniye	0	182,563.2	108,185.6	0	6761.602	0
Gozlek_Mucavir	402,315.3	30,427.21	0	0	0	0
Yildizkoy_Mucavir	57,473.62	40,569.61	81,139.22	0	0	0
Baglica_Mucavir	101,424	37,188.81	104,804.8	0	0	0
Dadi_Mucavir	561.213	294,129.7	0	0	0	0

Sources: The data on land-use areas were obtained and designed from the land-use map that was given by the Municipality of Amasya.

Table 1. Data of land uses in Amasya city.

Table 1 shows that urban development is suppressing agricultural areas in Şeyhçui, Hacılar Meydanı and Hızırpaşa neighbourhoods. Moreover, in Akbilek, Karasenir Dadı_Mucavir Area and Fındıklı and Kapıkaya_Mucavir Area, other land uses are dominating the neighbourhoods. Here, other land uses indicate urban infrastructure. It is evident that the city of Amasya has a development-oriented approach, which results in urban development pressure on existing agricultural areas.

In order to make better sense of the available data, Figure 3 should be examined in table format. Accordingly, Table 1 shows the 41 neighbourhoods of Amasya city and the land-use.

As Table 1 shows, other land uses, which indicate urban land uses, exist variably in every neighbourhood. This can be considered to be an indicator that even rural areas of the Amasya city are becoming involved in the urban development process. Therefore, Amasya needs an urban development approach that could protect its agricultural land.

The effect of population growth on rural areas in developed or developing urban areas can be seen, and urban agricultural areas are disappearing in the city. The status of rural areas confined by the city will be indicated, depending on the population movements. The effect of urban development on these areas is even stronger here. Measures for the protection of rural areas from urban development will be determined according to the data provided (Table 2) in the conclusion.

$$n = 41$$

$$\sum x = 98822 \quad \sum y = 11589385 \cdot 51$$

$$\bar{X} = 2410 \cdot 292683 \quad \bar{Y} = 282667 \cdot 9393$$

$$\sum x^2 = 755938164 \quad \sum y^2 = 12104402445096 \cdot 600$$

$$\overline{X^2} = 5809510 \cdot 817 \quad \overline{Y^2} = 79901163902$$

$$Sx = 3553.590491; Sy = 464034.6582$$

$$r = -0.40$$

Neighbourhoods in Amasya	Total population	Total agricultural area	X ²	Y ²	XY
Karasenir	789	1,798,586.083	622,521	3,234,911,897,961.280	1,419,084,419
Helvaci	1.996	1,044,667.48	3,984,016	1,091,330,143,769.550	208,515,6290
Cakallar	403	571,355.3534	162,409	326,446,939,858.838	230,256,207.4
Orman_Baglari	165	872,246.6341	27,225	760,814,190,698.7790	14,392,0694.6

Neighbourhoods in Amasya	Total popu lation	Total agricultural area	X ²	Y ²	XY
Demetevler	304	77,758.42087	92416	6,046,372,016.19605	23,638,559.94
Koza	1.330	368,507.2989	1,768,900	135,797,629,342.5740	490,114,707.5
Kapikaya_Mucavir	484	331,318.4889	234,256	109,771,941,086.9790	160,358,148.6
Gollubaglari	817	1,947,341.323	667,489	3,792,138,228,263.3900	159,097,7861
Sarilar	443	104804.8281	196,249	10,984,051,993.0705	46,428,538.85
Akbilek	6.624	845,200.2269	43,877,376	714,363,423,551.8120	5,598,606,303
Ellibesevler	8.946	169,040.0454	80,030,916	28,574,536,948.8341	1,512,232,246
Seyhcui	16.252	716,729.7924	2,641,27504	513,701,595,313.7470	11,648,292,586
Kirazlidere	2.934	3,380.800907	8,608,356	11,429,814.7728	9,919,269.861
Savadiye	1.152	0	1,327,104	0.0000	0
Beyazitpasa	2.984	0	8,904,256	0.0000	0
Mehmetpasa	1.847	0	3,411,409	0.0000	0
Sofular	519	0	269,361	0.0000	0
Bahcelerici	11.253	0	12,663,0009	0.0000	0
Pirincci	497	0	247,009	0.0000	0
Gumuslu	193	0	37,249	0.0000	0
Fethiye	1.476	0	2,178,576	0.0000	0
Samlar	1.394	10142.40272	1,943,236	102,868,332.9347	14,138,509.39
Nergis	238	0	56,644	0.0000	0
Dere	806	0	649,636	0.0000	0
Hatuniye	168	0	28,224	0.0000	0
Haciilyas	1.941	0	3,767,481	0.0000	0
Ucler	1.691	0	2,859,481	0.0000	0
Kursunlu	2.121	0	4,498,641	0.0000	0
Hacilar_Meydani	12.003	250,179.2671	1,440,72009	62,589,665,686.6931	300,290,1743
Yazibaglari	2.021	828,296.2223	4,084,441	686,074,631,876.4510	167,398,6665
Gokmedrese	1.100	0	1,210,000	0.0000	0
Sehirustu	2.082	0	4,334,724	0.0000	0
Yuzevler	1.492	0	2,226,064	0.0000	0
Hizirpasa	5.774	50,712.01361	3,333,9076	2,571,708,324.3808	292,811,166.6
Findikli	744	348,222.4935	553,536	121,258,904,979.3580	259,077,535.2
Bogazkoy	795	128,470.4345	632,025	16,504,652,540.6188	102,133,995.4
Ihsaniye	1.988	0	3,952,144	0.0000	0

Neighbourhoods in Amasya	Total population	Total agricultural area	X ²	Y ²	XY
Gozlek_Mucavir	199	402,315.308	39,601	161,857,607,051.1350	80,060,746.29
Yildizkoy_Mucavir	163	57,473.61543	26,569	3,303,216,470.5955	9,368,199.315
Baglica_Mucavir	445	101,424.0272	198,025	10,286,833,293.4663	45,133,692.1
Dadi_Mucavir	249	561,212.9506	62,001	314,959,975,921.1580	139,742,024.7

Sources: The data of agricultural areas were obtained and designed from the land-use map given by the Municipality of Amasya. The data of population was obtained from the Turkstat [11] website (<https://biruni.tuik.gov.tr/adnksdagitapp/adnks.zul>).

Table 2. Data for Pearson's product-moment correlation coefficient.

A negative relationship was found between the agricultural areas and population data. The minus value indicates an inverse proportion, that is, the population falls if agricultural areas increase, and vice versa. This relationship shows that the increase in urban population leads to the destruction of urban agricultural areas. If urban agricultural areas and the increase in population cannot be balanced, the urban agricultural areas will be destroyed or eliminated by urban development.

Amasya's development continues, and its urban agricultural areas still exist. However, agricultural areas have decreased due to the increase in urban population. There are no agricultural areas in some neighbourhoods, indicating that urban development has rapidly increased and that the population in rural areas has started to replace the population in urban areas (**Figures 4 and 5**).

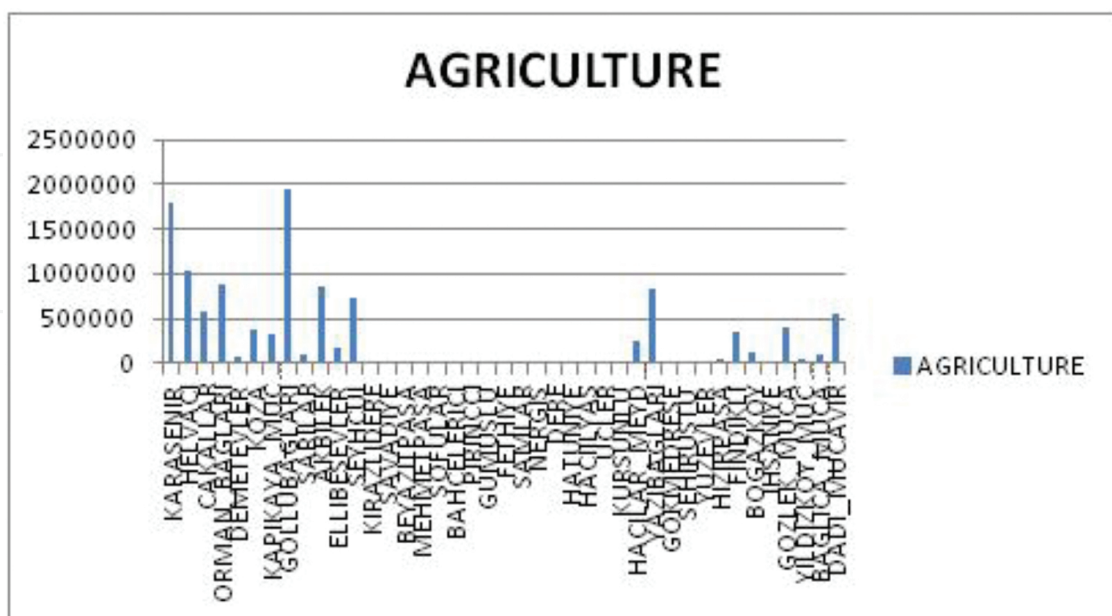


Figure 4. Land use of agricultural areas in Amasya.

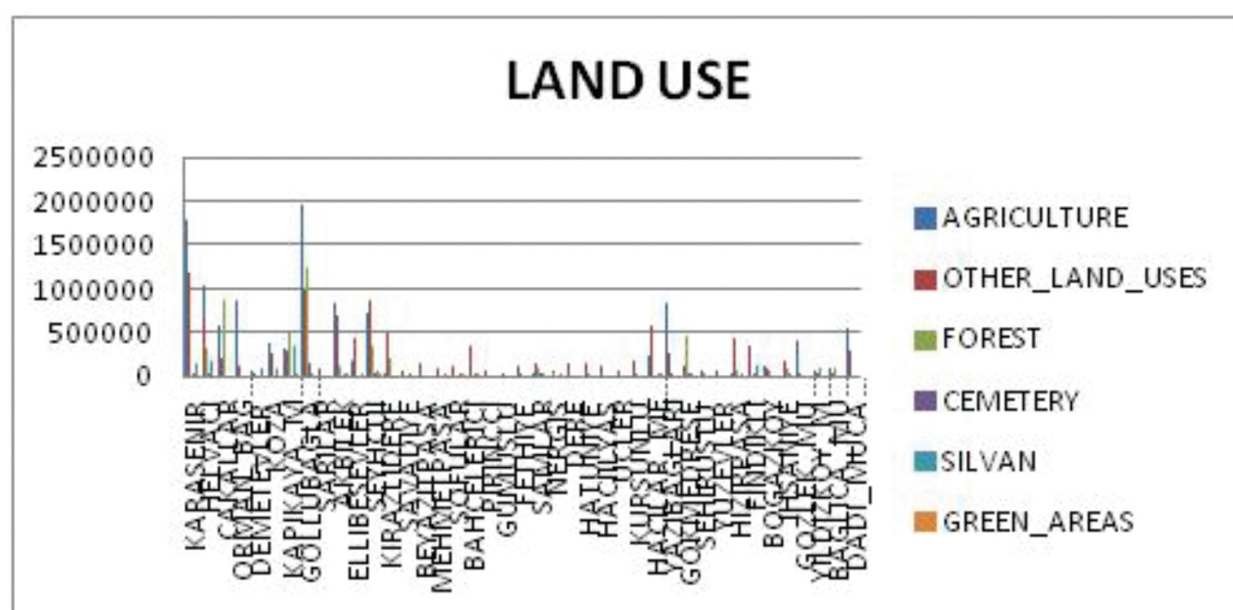


Figure 5. Land use areas in Amasya.

In conclusion, urban development targets rural and natural areas as development areas. It is inevitable that agricultural areas within urban areas be eliminated in time if they lose their special importance in the functions of the city. As a result of this study, Amasya can be an example of the cities that have not completed their urban development due to the inclusion of rural areas. The most important factor is the attempt to develop an approach to protect urban agricultural areas or to determine how to adapt these areas to the economic movements within the scope of urban development in Amasya. If agriculture comes to the fore as an indispensable factor for Amasya, where industrial development has not increased much, then Amasya will be a city that would not lose, but rather protect its rural areas.

Rural areas are usually concentrated in locations with ample water, transportation and production. The best precaution against wasting agricultural land in the urban development process is defining agricultural lands and directing urban development towards areas without agricultural value. Moreover, agricultural incentives and support for farming families should be prioritized.

Author details

Mustafa Ergen

Address all correspondence to: mustafaergen2002@yahoo.com.

Amasya University, Faculty of Architecture, Department of Urban Design Landscape
Architecture, Amasya, Turkey

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