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Suitability Analysis of Apiculture (Beekeeping) Activity Areas with Multi-Criteria Method: A Case Study of Adıyaman

Multı-Criteria Yöntemi ile Arıcılık Faaliyet Alanlarının Uygunluk Analizi: Adıyaman İli Örneği

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ABSTRACT
Turkey ranks 2nd in the world in terms of honey production. Due to many factors that favor Turkey, i.e. rich flora properties, topographically suitable fields, and different climate zones, honey production can be done almost year-long.
This study covers Adiyaman province, which is located in the southeast Anatolian region. Adiyaman province, in addition to its topographic diversity, has a rich flora due to the effects of the continental climate and partly Mediterranean climate, acting as a bridge due to the fact that eastern Anatolia, southeastern Anatolia and the Mediterranean region are in the transition zone. The fact that Adiyaman province is rich in flora and topography, as well as being suitable for other features, has allowed many criteria to be used together in the study.
The purpose of this study is to identify areas in the province of Adiyaman that are suitable for beekeeping, taking into account natural and human factors. In this context, the layers formed by natural and human environment elements were taken into account in order to obtain maximum efficiency from the bees. In addition, the expectations of the honey producers were analyzed using Geographic Information Systems (GIS). In this context, the results were redesigned as inappropriate, less suitable, appropriate and most appropriate areas with masking process and results maps were made.
Keywords: Adiyaman, Apiculture, Multi – Criteria

ÖZ
Türkiye, dünya bal üretimi verilerinde 2. sırada yer almaktadır. Türkiye'nin matematik ve özel konumuna bağlı olarak aynı anda dört mevsimin yaşanabilmesi, zengin flora özellikleri, topografik olarak uygun alanlara sahip olması, bal üretiminin hemen hemen yıl boyunca yapılabilen bir faaliyet olmasına imkan tanımaktadır.
Bu çalışma, Türkiye'nin Güneydoğu Anadolu Bölgesi'nin Orta Fırat Bölümü'nde yer alan Adıyaman ilini kapsamaktadır. Adıyaman ili; topografik zenginliğinin yanı sıra Doğu Anadolu, Güneydoğu Anadolu ve Akdeniz Bölgesi'nin geçiş kuşağında olması nedeniyle bir köprü görevi üstlenmiş ve karasal iklim ile kısmen de olsa Akdeniz ikliminin etkilerine bağlı olarak zengin bir floraya sahip olmuştur. Bu zenginlik, çalışmada pek çok kriteri bir arada kullanma imkânı sağlamıştır.
Bu çalışmanın amacı, Adıyaman ilinde arıcılık faaliyeti için doğal ve beşerî faktörleri göz önünde tutarak arıcılığa elverişli alanları belirlemektir. Bu anlamda hem üreticilerin beklentileri göz önüne alınarak hem de arılardan azami verim elde edebilmek amacı ile dikkate alınan doğal ve beşerî unsurların oluşturduğu katmanlar, Coğrafi Bilgi Sistemleri (CBS) kullanılarak analiz edilmiştir. Bu kapsamda elde edilen sonuçlar uygun olmayan, az uygun, uygun ve en uygun alanlar şeklinde maskeleme işlemiyle yeniden tasnif edilmiş ve sonuç haritası üretilmiştir.
Anahtar kelimeler: Adıyaman, Arıcılık, Multi-Criteria

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1. INTRODUCTION

Beekeeping activities date back to tens of thousands of years ago when humans lived in caves. Paintings drawn in caves date back to the 7000s BCE; bee fossils and similar historical findings show that beekeeping goes back a long time (Sancak et al., 2013: 7). As beekeeping has become an agricultural occupation, certain standards have been reached so that bee colonies can grow and shelter in modern beehives instead of bees' natural environment of stone and tree cavities (Burucu, 2017).

Beekeeping has been important in Turkey for a long time, and it has grown to be a significant industry. The Agricultural Economics and Policy Development Institute (TEPGE) established a beekeeping report for world honey production. China ranked first, with 551,000 tons in 2017. Turkey ranked second with 114,000 tons, and Argentina ranked third with 76,000 tons of honey. As the global leader, China makes up 29.6% of total world honey production. EU countries also had a share of 12.3% in honey production in 2017 (TEPGE, 2019). In recent years honey production in Turkey has been one of the major contributors to the national economy.

Turkey's unique topographical and climatic characteristics (climate diversity) have caused the flowering of plants to occur at different times in the regions, allowing the formation of an ecological environment for beekeeping in each region. For this reason, beekeeping can be done in different periods in every region due to the country's natural environment characteristics (Çaglıyan, 2015: 4).

Climate characteristics directly affect beekeeping activities and the efficiency of honey and its derivatives. It is almost impossible to do beekeeping in areas with cool or very hot summers and in rainy and windy areas all year round (Yalcın et al. 2019: 4). The most important of the climate elements is temperature. Too high or too low temperature adversely affects the activity of bees and hence the beekeeping activity. According to some studies, bees are very active between 29-33^{o}C and their activities stop at temperatures above 36^{o}C and below 10^{o}C (Oder, 1989; Tuncel, 1992). In addition to the climatic characteristics, good honey production depends on the abundance of honeybee population and the presence of pollen (Shuel, 2016: 36). Apart from these, many factors affect the colonies and cause an increase or decrease in honey production (Farrar, 1937: 945).

Beekeeping is an economic activity that can be done with less capital compared to other agricultural activities and gains in a short time. There is no need to construct a closed area or purchase land for beekeeping. It can be done even in free time as a second occupation if it is well planned or done in cooperation with other beekeepers. Thousands of people living in Turkey ensure the livelihood of beekeeping activities (Ozkırım, 2018: 49). Therefore, beekeeping is an activity that can be sustained as the main or ancillary source of income for families in rural areas (Kaya, 2008: 53).

Adiyaman is one of the more prominent places in Turkey in terms of beekeeping potential, which is why it was chosen as a case study. Malatya is located in the north of Adiyaman province, Diyarbakir in the east, Sanliurfa in the southeast, Gaziantep in the southwest and Kahramanmaras in the west (**Figure 1**).

Looking at the slope of the province of Adiyaman, it is seen that the slope is higher than the south of the province due to the high roughness of the Southeast Taurus mountain range in the north. The Adiyaman plateau in the south of the province, especially the shores of the Atatürk dam lake and its immediate surroundings, correspond to the areas where the slope is low.

Considering the climatic characteristics of Adiyaman and its surroundings, it is seen that terrestrial climate conditions are effective. The annual average temperature in Adiyaman is 17.2^{o}C. The highest temperature is in July (30.9^{o}C) and the lowest temperature is in January (4.4^{o}C). The total annual precipitation amount of Adiyaman is 719.8 mm. 52.7% (379.6 mm) of this precipitation falls in winter (**Table 1**). This shows that the Mediterranean precipitation regime is prevalent in the region.

As of 2019, Adıyaman ranks 37th in the honey production list produced in Turkey, while it ranks 3rd among the provinces of the Southeastern Anatolia Region. Looking at the amount of honey produced in Adiyaman in the last five years, the highest production was seen in 2017, with 926 tons, while the lowest production was seen in 2015 with 418 tons (**Table 2**). Although there have been fluctuations in honey production in Adiyaman province over the years, beekeeping is becoming an increasingly widespread economic activity in the province. The highest honey production (90 kg per hive) is found in Kars, Erzurum, Bitlis, Kayseri, Tunceli, Agrı, Yozgat, Sirnak, Batman, Hakkari, Bingöl, Van, Mus, Gumushane, Artvin, Giresun, Rize, Erzincan, Bayburt, Adiyaman, Malatya, and Sivas provinces, the Cukurova, Harran, Ergene and Menderes plains, and the Karacadag, Anzer, Ovit, Sultanmurat, Alucra, Camoluk, Zigana, Sahara, Sarıbulut, Santa, and Taurus mountainous areas (Kayral and Kayral, 1983; Şenocak, 1988; Ozkırım, 2018: 50).

Figure 1: Location Map of the Study Area

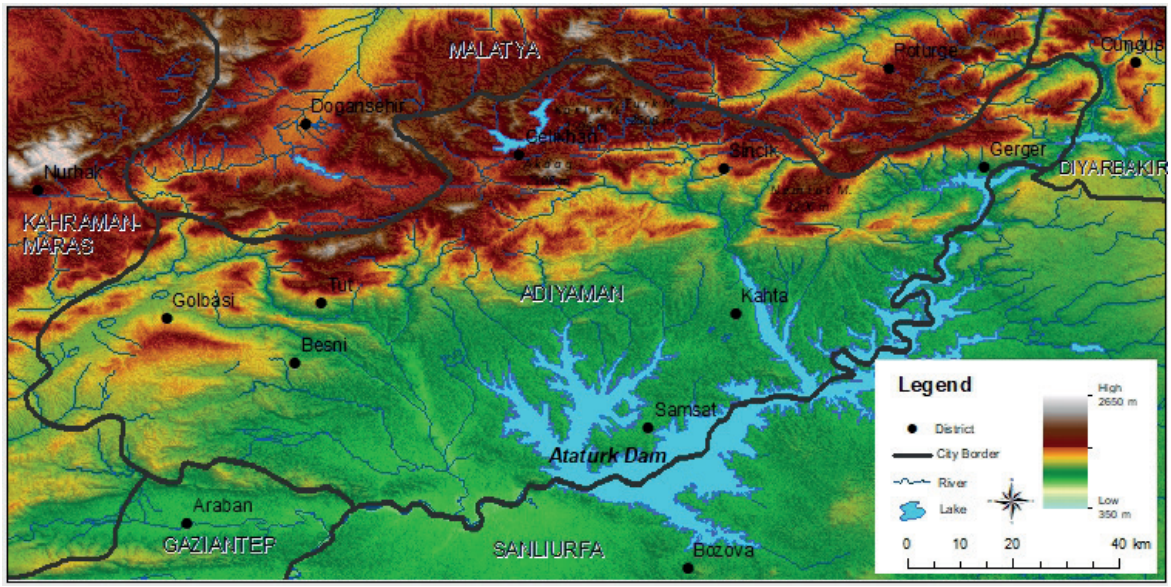

Figure 2: Physical Map of Adiyaman Province and its Surroundings.

Table 1: Monthly Average Temperature and Precipitation Values of Adiyaman (1963-2019).

Adiyaman	J	F	M	A	M	J	J	A	S	O	N	D	Yearly
Average Temperature (°C)	4.4	5.9	9.9	15.0	24.0	26.6	30.9	30.6	25.8	19.1	11.7	6.5	17.2
Average Precipitation (mm)	138.7	102.0	90.1	66.7	42.6	8.4	1.7	1.9	7.6	46.2	75.0	138.9	719.8

Source: MGM (2019)

Table 2: Turkey, Honey Production by Year in the Southeastern Anatolia Region and Adiyaman Province (tons) (2015-2019).

Turkey Ranking (Year 2019 According to data)	Top 10 Provinces with the Most Production	Years				
		2015	2016	2017	2018	2019
1	Ordu	16.601	16.278	16.799	16.994	17.057
2	Mugla	15.206	15.875	15.867	14.777	14.688
3	Adana	9.763	9.477	10.729	10.941	11.077
4	Sivas	3.327	2.861	3.715	5.048	5.029
5	Aydin	4.007	3.958	4.357	4.227	3.693
6	Izmir	2.810	2.742	2.836	2.777	3.007
7	Balıkesir	3.213	3.105	3.261	2.618	2.480
8	Mersin	3.493	3.252	3.864	2.416	2.352
9	Bitlis	1.832	1.747	1.792	2.095	2.125
10	Antalya	2.947	2.394	2.475	2.305	2.084
	South East Anatolia					
11	Sanliurfa	1.502	1.818	1.876	1.909	1.931
17	Diyarbakır	1.732	1.287	1.312	1.234	1.365
37	**Adiyaman**	**418**	**446**	**926**	**540**	**688**
38	Siirt	1.061	1.122	1.786	711	663
42	Batman	154	142	162	168	606
53	Sirnak	447	439	504	373	455
66	Mardin	377	300	292	306	263
73	Gaziantep	142	111	130	171	137
81	Kilis	20	24	28	43	36
Turkey		**107.665**	**105.727**	**114.471**	**107.920**	**109.330**
Southeastern Anatolia Region		**10.373**	**10.514**	**12.011**	**10.979**	**10.502**

Source: TUIK, (2020).

As a sustainable economic field in rural development, beekeeping is important for the development of Adiyaman province. Therefore, the aim of this study was to determine the areas suitable for beekeeping by taking into consideration the natural (topography, climate, flora, and distance to water resources) and human (distance to settlements, distance by highways, and land use/land cover) geography of Adiyaman province.

2. MATERIALS AND METHOD

Various data to be evaluated in this study were obtained from institutions/organizations. Climate data were obtained from the General Directorate of Meteorology. CORINE 2018 was used for flora and land use/land cover, digitized stream data was used for water resources, and Open Street Map (OSM) data was used for distance to settlements and highways.

Geographic Information Systems (GIS) and Remote Sensing (RS) were used in the study. As is known, the techniques developed in recent years to ensure the sustainability and efficiency of the products obtained from beekeeping activities are used in areas such as determining suitable beekeeping places and hive yield. GIS analyses play an important role in agricultural management processes (Cogato et al., 2020: 2; Ostovari, et al., 2019). Therefore, Multi-Criteria analysis performed in ArcGIS 10.4 environment was used as a method in the study. Multi-criteria is one of the most important GIS applications in analyzing and displaying data in the environmental decision-making process (Eastman, 1999: 493). Multi-Criteria offers rich and diverse contents in the decision-making process, planning, evaluation of problems and prioritizing of alternative decisions (Malczewski, 2006: 703; Wang et al., 2018: 4). The role of multi-criteria analysis in different applications has increased significantly as new methods develop (Velasquez and Hester, 2013: 56). Multi-criteria analysis provides a better understanding of natural and human characteristics in the decision-making process. Therefore, this method is one of the most widely used and known methods (Pohekar and Ramachandran, 2004: 367). Multi-criteria analysis involves highly complex processes in which qualitative and quantitative data are brought together (Ceylan and Sarı, 2017: 60). According to the working principle of multi – criteria analysis, various layers are created and pre-

graded, and these layers are converted into a raster data format. After converting to a raster format, they are overlapped and overlaid in the ArcGIS environment with the formula created in line with the user's wishes.

In this study, predetermined factors such as land use/land cover, aspect, slope, climate, elevation levels, and distance to water resources, roads, and settlements were evaluated according to the beekeeping regulations and the layers were scored in terms of their importance. Later, each layer was converted to raster data format and each layer was subjected to a new scoring in terms of its importance.

In determining the suitability for beekeeping activity, the rate of land use type is 30%, the rate of the slope is 20%, and the ratio is 10% in terms of elevation, aspect, rainfall, and distance values according to water resources and roads. In determining these rates, previous studies, opinions of experts, and interviews with those who carry out beekeeping activities in the work area were taken into consideration.

When grading and scoring, the following formula was taken into account. The formula is as follows:

Degree of Compliance = *(Land Use x 0.3)+ (Slope x 0.2) + (Aspect x 0.1) + (Distance to Water Resources x 0.1) + (Precipitation x 0.1) + (Distance to Roads x 0.1) + (Height x 0.1)*

Registration was carried out using this formula. Thus, the provincial land was classified as less suitable, suitable, and most suitable for beekeeping and unsuitable areas.

3. RESULTS

This study, in which areas suitable for beekeeping were determined, covers the province of Adiyaman. In the study, land use, height, slope, aspect, precipitation, distance to water resources and distance to highways were used in determining the areas suitable for beekeeping, and these criteria were ranked (**Table 3**). Separate analyses are shown below, and they take into account the degrees and impact rates of the criteria evaluated in the study.

Table 3: Weights Calculated After Comparison Matrix.

Criteria	Weight
Land Use	0.3
Slope	0.2
Aspect	0.1
Water Resources	0.1
Precipitation	0.1
Roads	0.1
Height	0.1

Land Use Criteria

"Land Use Status" is one of the important criteria for beekeeping activies. Looking at the general land division in Adiyaman province, it is seen that pasture areas occupy the most space (33.9%). Agricultural areas (30.67%) and forestry and scrub areas (23.64%) are also significant (**Table 5**). These lands, which are of vital importance for beekeeping, constitute the majority of the province's land. While most of the forest, shrub lands, and pastures are located in the mountainous area in the north of the province, the majority of the agricultural lands are found on the plateau areas in the south (**Figure 3**).

Table 5: Areas and Rates of Land Use Types in Adiyaman Province.

Land Use Type	Area (km^2)	Rate (%)
Residential Areas	78	1,03
Farming Areas	2306	30,67
Grasslands	2549	33,90
Forest and Shrub Areas	1777	23,64
Bare Areas	325	4,32
Lakes and Streams	446	5,93
Other Areas (Swamp, Reeds, Riverbed)	37	0,49
Total	**7518**	**100,0**

Source: Adiyaman Provincial Directorate of Environment and Urbanization (2017), TUIK (2019)

Table 4: Criteria, Classification and Impact Ratios.

Criteria	Classification						Weights Calculated After Comparison Matrix
	0	1	2	3	4	5	
Land Use	Settlement Areas and Bare Areas	Water resources	Farming areas	Wetlands	Forest Areas	Grassland	0,3
Slope (%)	45 +	20-45	15-20	10-15	5-10	0-5	0,2
Aspect	-	North	NE-NW	E-W	S-SW	SE	0,1
***Distance to Water Resources* (m)**	-	4000 +	4000-3000	3000-2000	2000-1000	1000-0	0,1
***Precipitation* (mm)**	-	450-600	600-750	750-900	900-1050	1050 +	0,1
***Distance to Roads* (m)**	0-200	3400 +	2600-3400	1800-2600	1000-1800	200-1000	0,1
Heigh (m)	-	2500 +	2000-2500	1500-2000	1000-1500	0-1000	0,1

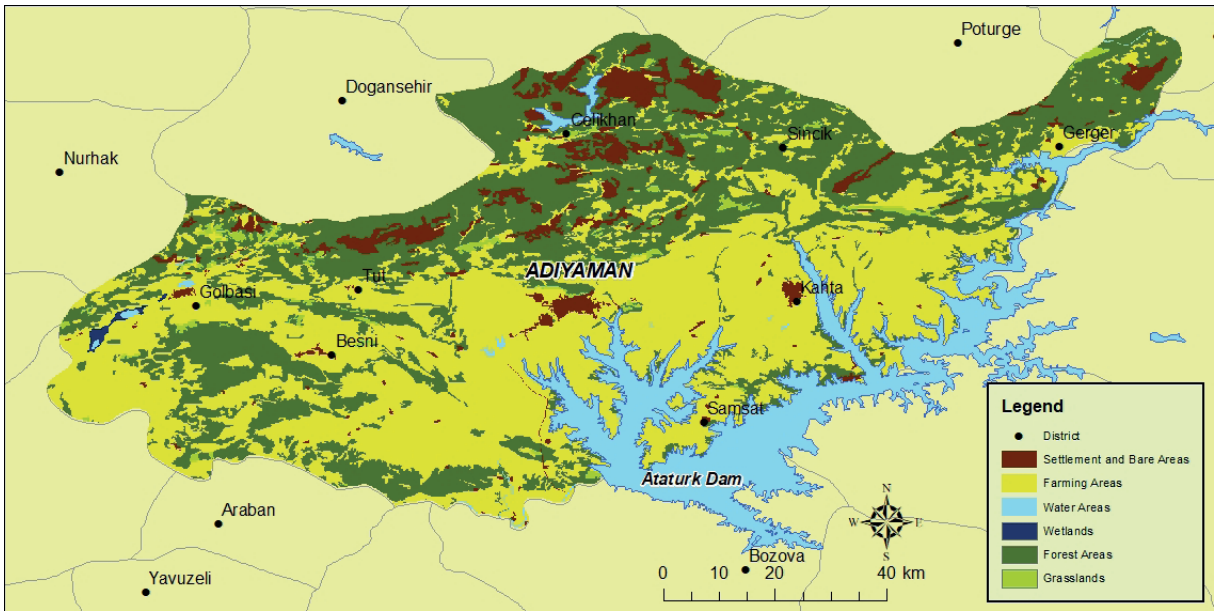

Figure 3: Land Use Map of Adiyaman Province (Produced from 2018 CORINE data).

In the land use criteria, Land Cover is divided into 6 classes, from 0 to 5. The areas with a score of 0 represented the areas that were not suitable for beekeeping activities, and the areas with 5 points represented the most suitable areas for beekeeping activities. In this context, 0 points were given to residential areas and lands with bare and rocky areas. Bare and rocky areas are not suitable for beekeeping since they lack vegetation. Settlements and their immediate surroundings are not suitable for beekeeping, as they are areas where contaminated waste (especially toxic waste from factories located near the settlements) is seen (Tuncel, 1992). Therefore, the settlements in the province and the lands called Naked and Rocky Areas were considered unsuitable areas for beekeeping activities (**Figure 3**). Agricultural Lands were classified as 1, Water Surfaces 2, Wetlands 3, Woodlands 4, and Grazing Lands 5. Among all criteria, the Land Use Criteria were given a 30% significance level to be taken into account in the Multi-Criteria analysis.

Aside from vegetation, which is known as the best place to produce honey, forestry, scrub areas, and agricultural production areas are also important places for bees to make honey, especially in the north, northeast, and west. These areas can provide the floristic richness that bees need. However, farmers who carry out agricultural activities in the fields where agricultural products are grown are not very willing to put hives near their fields. Therefore, those engaged in beekeeping in the region generally prefer forestry, shrub, and pasture areas with high plant species diversity.

Slope Criterion

Slope values in any field also affect beekeeping activities. Knowing the slope conditions of the land to determine the flat and nearly flat areas where the beekeepers can put their hives is important. The lower the slope value, the easier it is for beekeeping. Therefore, the most suitable areas for beekeeping in terms of slope conditions are the areas that create the lowest slope values (0-5%). In this study, in the slope criterion, the effect of which was determined to be 10%, the areas with a slope of more than 45 degrees were scored with 0 points in order not to be evaluated, and the land with a slope of 0-5 degrees was included in the analysis by giving 5 points.

Looking at the slope map, due to the southeastern Taurus mountain range in the north of the province, it is seen that the roughness is more than the south of the province. Therefore, due to the slope conditions and the Adiyaman plateau in the south, the shores of the Atatürk dam lake and its immediate surroundings have especially suitable slope values for beekeeping (**Figure 4**).

Aspect Criteria

The aspect of any slope is an important geomorphological element that has an impact on human activities. It is of great importance whether a slope faces the sun or not, especially in the middle belt and near the pole. The slope facing the sun gets warmer than the slope in the other direction; therefore it creates

Figure 4: Slope Map of Adiyaman Province.

a more suitable environment for human activities. Maintenance is also an important factor in beekeeping activities. South, southeast and southwest facing slopes in Turkey are quite suitable for beekeeping activities. In the beekeeping activities to be carried out in Adiyaman, the slopes facing south, southeast, and southwest should be preferred (**Figure 5**).

In this context, Aspect Criterion was included in the Multi-Criteria Analysis with a 10% importance among other criteria. The province of Adiyaman was evaluated by giving 1 point to slopes facing North, 2 points to slopes facing Northeast - Northwest, 3 points to slopes with an East - West view, 4 points to slopes with a South view, and 5 points to slopes with a Southeast - Southwest view.

Distance to Water Resources Criteria

The reason the Distance to Water Resources criterion is included in the analysis in this study is that water is one of the basic resources needed for bees as well as for humans. Bees need

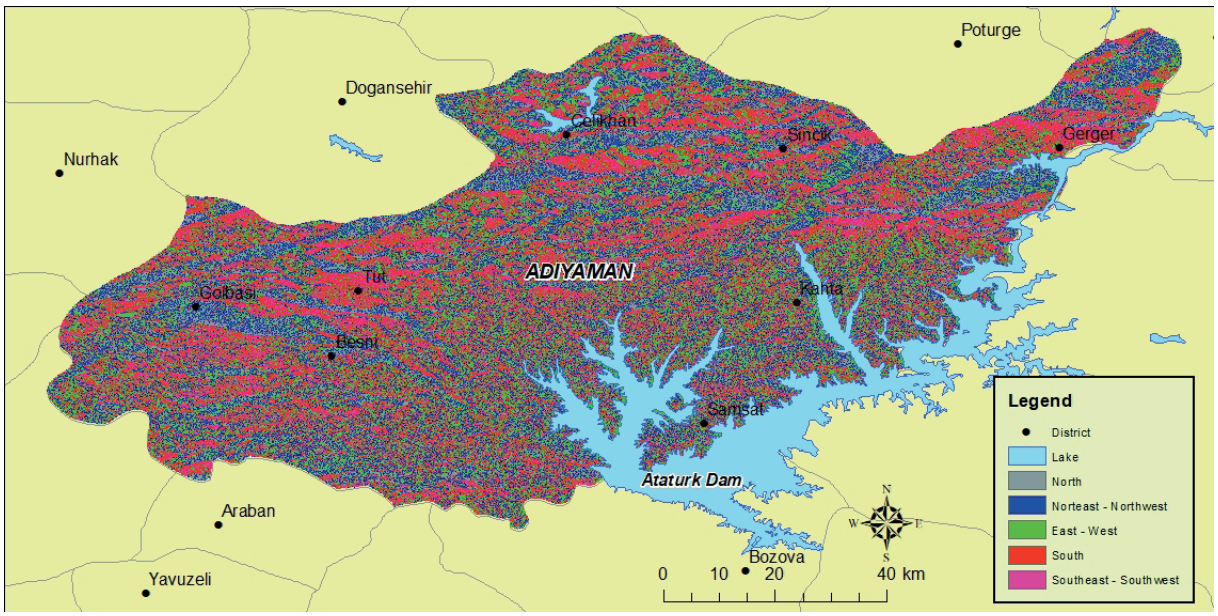

Figure 5: Aspect Map of Adiyaman Province.

water to produce honey, so the beehives must be within the appropriate range from hydrographic sources. The proximity of beehives to water enables bees to obtain the water they need from a closer distance. Therefore, bees that access water more easily try to get pollen from more flowers instead of seeking water.

The following scoring was used for the criterion of proximity to water resources, whose effect on the analysis was determined to be 10%. While 1 point was given to areas with a distance to water of 4001 m and above, 2 points were given to areas between 4000-3001 m, 3 points to areas between 3000-2001 m, 4 points to areas between 2000-1001 m, and 5 points to areas closer to 1000 m.

The existence of both lakes (Atatürk, Cat, and Sırımtas dam lakes and the lakes of Inekli and Azaplı in the southwest of Golbası city) and streams forming the branches of the Euphrates River in the study area provided an important advantage for beekeeping activities (**Figure 6**).The study area forms a dence network with hydrograpchic resources. Therefore, the hydrographic resources of Adiyaman province and its dense stream network enable beekeeping to continue throughout the province.

Precipitation Criteria

Climate characteristics directly affect beekeeping activities in any field as well as the efficiency of the production of honey and its derivatives. It is almost impossible to do beekeeping in areas with cool or very hot summers and in rainy and windy areas all year round (Yalcın et al. 2019: 4).

Rainfall is an important factor that indirectly affects beekeeping activities. As is known, water resources in any region are fed by precipitation. In addition, in the natural environment, plants get the water they need through precipitation.

In the study, the effect of precipitation criterion on the analysis was determined to be 10%. In this context, the classification process was made considering that vegetation cover would be lush in the places with the highest precipitation by establishing the direct proportion with precipitation. The precipitation distribution map of the province was created using the precipitation data of meteorology stations in Adiyaman (**Figure 7**). In the Multi-Criteria analysis, 1 point was given to the land corresponding to the lowest rainfall level (450-600 mm), while the land with the highest rainfall (1051 mm and above) was given 5 points.

Precipitation increases due to the increase in altitude in the study area from south to north. Annual rainfall up to 1200 mm in the high mountainous areas in the north decreases to around 500 mm in the plateau area in the south (**Figure 7**).

Proximity to Roads Criteria

Transport is an important factor affecting all human activities. Proximity to roads is an important criteria for beekeepers with fixed hives as well as nomadic beekeepers who carry their hives. In this sense, an advanced transportation network provides an advantage for beekeeping. However,

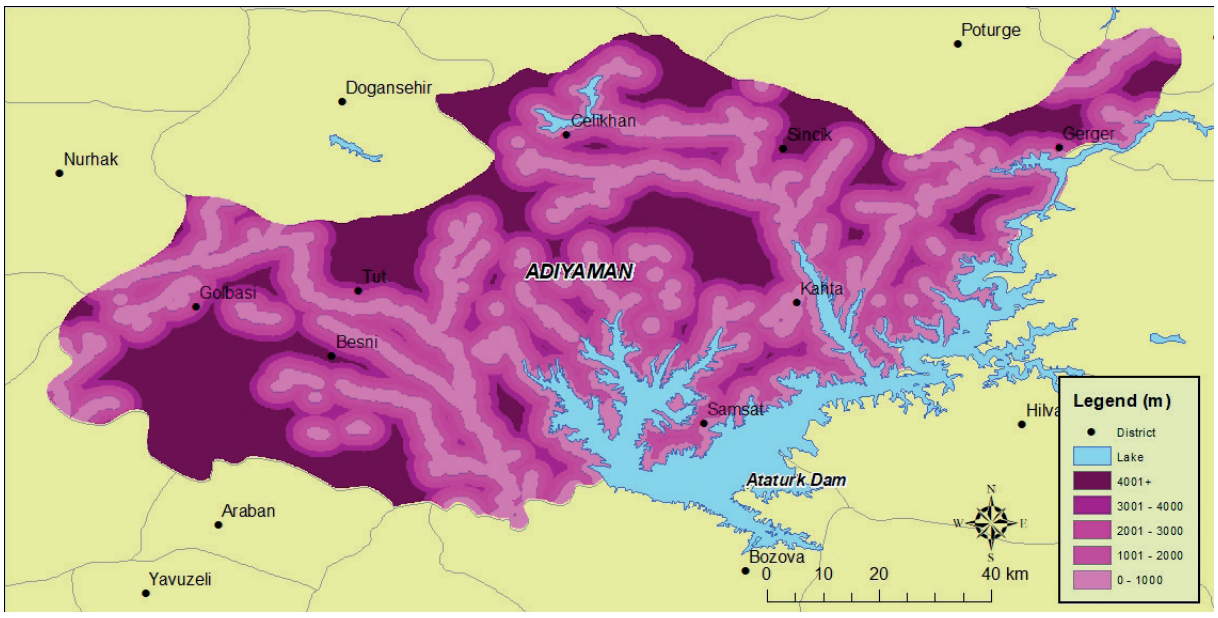

Figure 6: Proximity Map of Adiyaman Province to Water Resources.

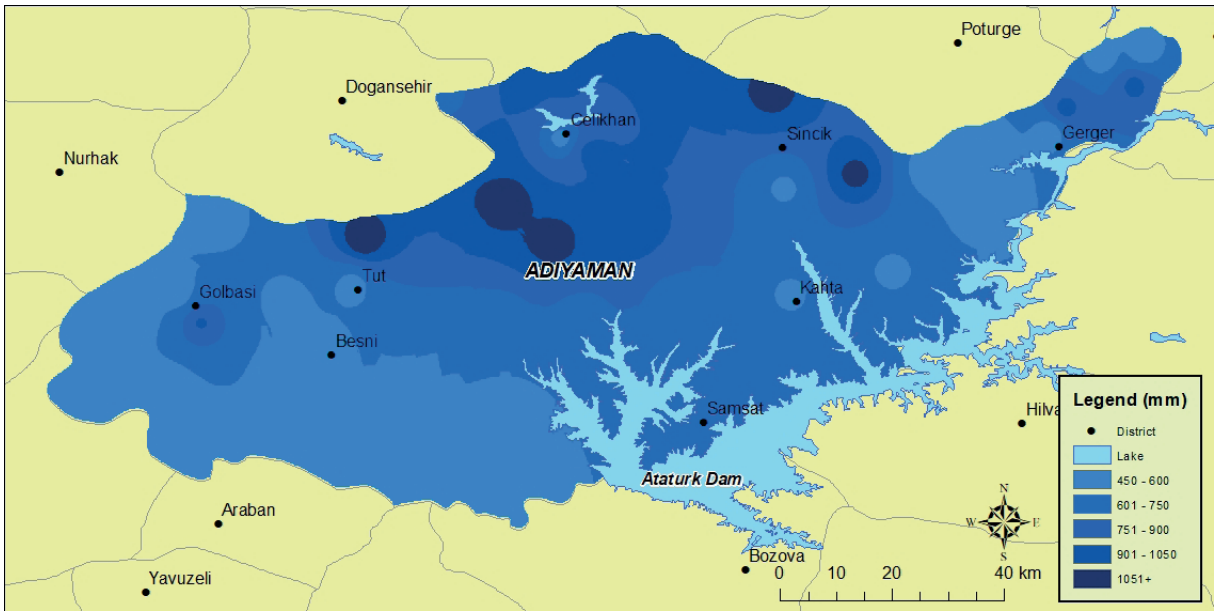

Figure 7: Precipitation Distribution Map of Adiyaman Province.

noisy or dusty roads affect beekeeping activities negatively (Tunçel, 1992).

In the study, the areas between 0-200 m were not evaluated (they were given 0 points) in order to prevent the bees from being affected by toxic gases from vehicles and to reduce the risk of being destroyed by the impact of vehicles. However, the highest score (5 points) was given to the 201-1000 m interval, as proximity to the road was considered important for those carrying out this activity. Another scoring was done in such a way that the scores decreased as the roads moved further away. The effect of this criterion on the analysis was evaluated as 10%.

Looking at the transportation map of Adiyaman province, it is seen that the roads are denser in the south, and the road network is sparse in the mountainous region in the north (**Figure 8**). Since the beekeeping activity in the province is mostly concentrated in the mountainous area in the north, there are some problems in terms of transportation.

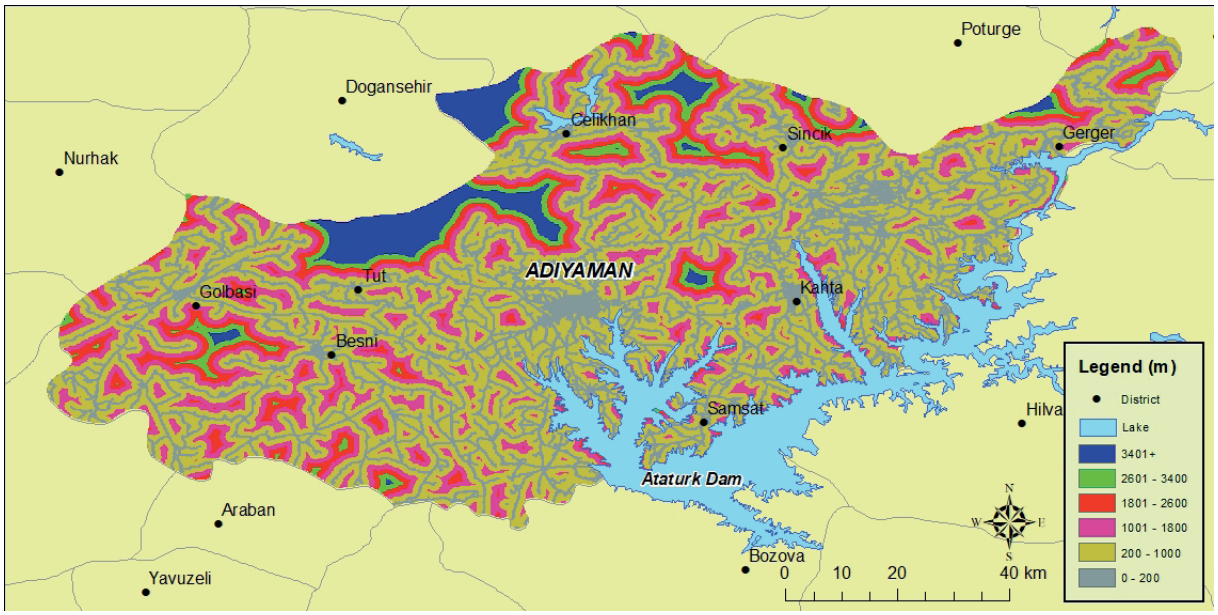

Figure 8: Map of Adiyaman Province Proximity to Roads.

Altitude Criteria

The observation of different altitude levels in Adiyaman province, especially as one goes from south to north, affects all economic activities as well as beekeeping activities. The increase in altitude towards the north has a direct effect on temperature and precipitation values. Therefore, beekeeping activities are also directly affected by this situation. For this reason, beekeeping activities are limited in areas with a high altitude. In the province, there is a decrease in beekeeping activities, especially above the altitude of 1500 - 2000 m (**Figure 9**).

Considering the altitude value of Adiyaman, the most suitable range is 1000 meters and below, and this altitude level is evaluated by giving 5 points. 4 points were given for 1001-1500 meters, 3 points for 1501-2000 meters, 2 points for 2001-2500 meters, and 1 point for 2500 meters and above. In this study, the effect of Altitude Criteria on the analysis was determined to be 10%.

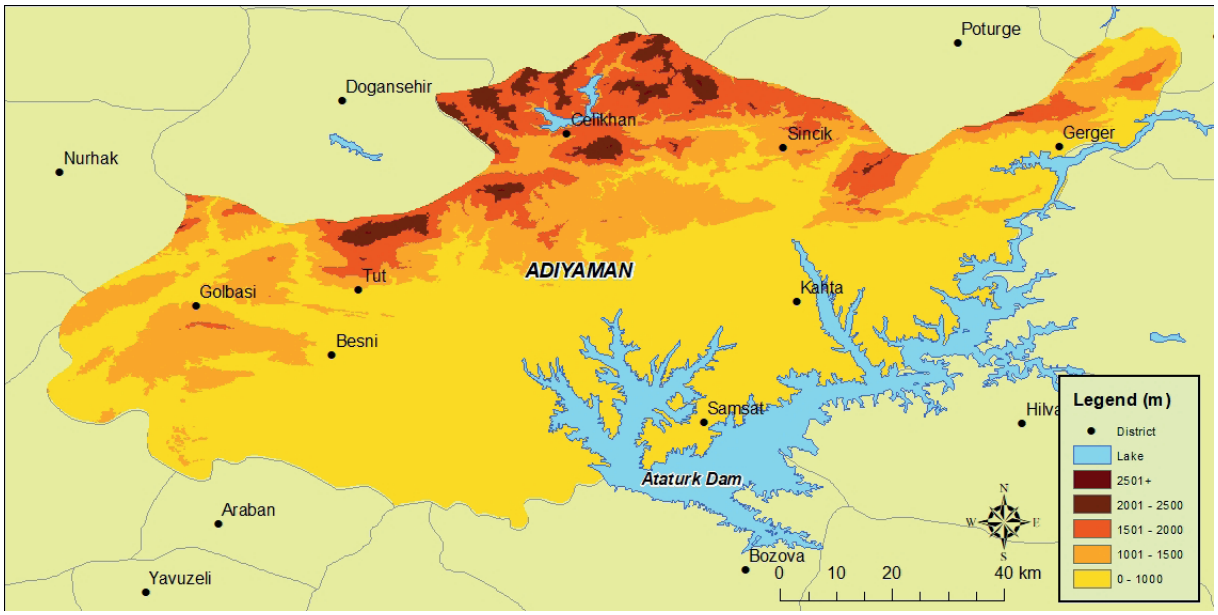

Figure 9: Elevation Map of Adiyaman Province.

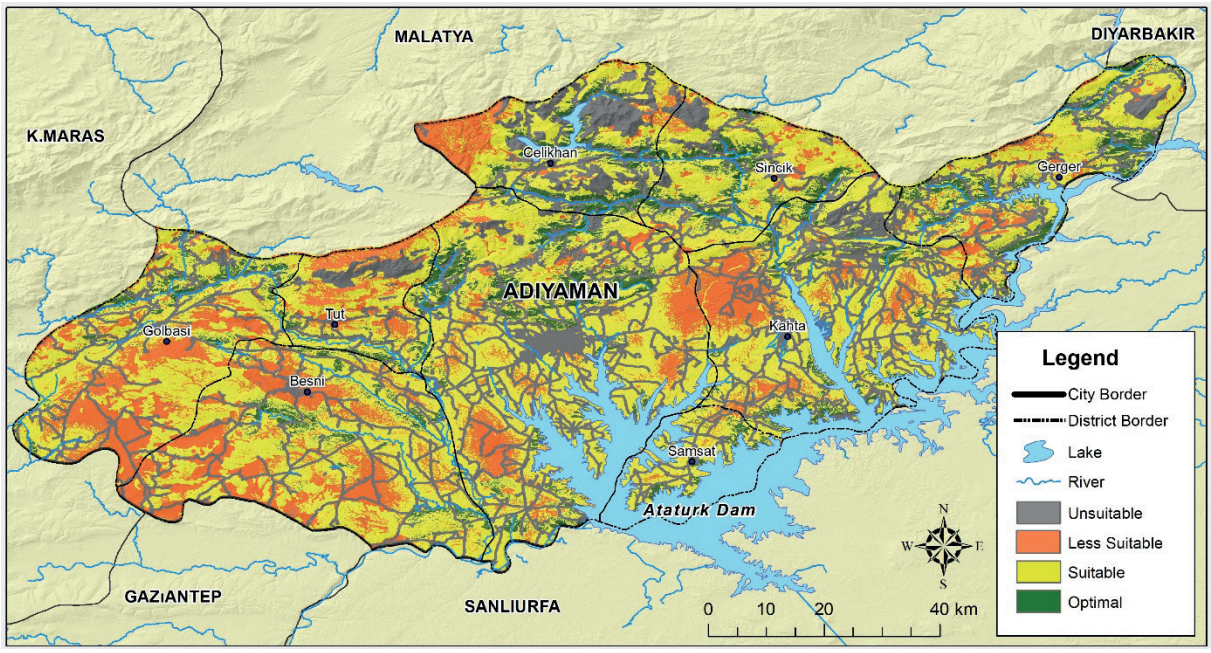

Figure 10: Adiyaman Province Beekeeping Suitability Map.

All districts in the study area (especially the central district of Adiyaman, Kahta, Sincik, Besni, Samsat, Golbası, Gerger, Tut and Celikhan) allow beekeeping activities even if the elevation conditions are not the same. However, for beekeeping to be carried out, other criteria specified in the study must be appropriate, in addition to the elevation factor.

According to the analysis results, the most suitable beekeeping areas in the province correspond to the river valleys and the slopes of these valleys. These are located in the mountainous area in the north and flowing from north to south. Suitable areas are concentrated around the most suitable areas and constitute the class that occupies the most area in the province (50.20%). The ratio of the most suitable areas is 8.06%. Approximately 1/4 (25.26%) of the lands in the province correspond to areas that are not suitable for beekeeping (**Table 6**).

Table 6: Beekeeping Activities of Adiyaman Province Eligibility Classes and Rates (%).

Compliance Class	Area (km²)	Rate (%)
Optimal	606	8,06
Suitable	3774	50,20
Less Suitable	1239	16,48
Unsuitable	1899	25,26
Totals	**7518,0**	**100,0**

Conclusion and Evaluation

This study, in which areas suitable for beekeeping were determined, covered the province of Adiyaman. Most of Adiyaman province is suitable for beekeeping activities in terms of topographic features, climate, water resources, and land cover features. Therefore, beekeeping activities can be carried out in a large part of the working area. However, suitable and most suitable areas should be preferred in order to make beekeeping activities healthy. It is seen that the most suitable areas are especially the mountainous areas in the north of the province, which are rich in floristic aspects. The preferences of beekeeping people, especially in these regions, will enable them to carry out productive, sustainable, and more economical beekeeping activities.

In the study, land use, height, slope, aspect, rainfall, distance to water sources and distance to highways were used in determining the areas suitable for beekeeping, and these criteria were ranked. According to the determined impact rates, the rate of land use type was determined as 30% slope, 20% elevation, aspect, rainfall, and distance values according to water resources, and 10% distance values according to roads. By evaluating 7 criteria together, 4 land types were identified: provincial land unsuitable for beekeeping, less suitable, suitable, and most suitable.

It is thought that carrying out these and similar studies, and especially increasing the number of criteria, will contribute to the determination of more sensitive and more point-oriented beekeeping places. This study creates a model that can be applied to other areas with similar geographical conditions.

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