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DETERMINING IMPACT LEVELS OF FACTORS SUCH AS LANDFORMS, SOIL TYPES, AND CORINE LAND USE COVER ON AGRICULTURE AND LIVESTOCK ACCORDING TO ANALYTIC HIERARCHY PROCESS (AHP) IN BASIN OF KESIS STREAM (SOUTHERN TURKEY)

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Abstract

Mankind has always continued its efforts to recognize and benefit from the natural environment in which it has lived since its existence, and it continues this struggle today. However, over time, human beings have begun to realize that the natural processes they encounter in the natural environment have more than one cause. Today, researchers have developed various methods to determine the degree of impact of events that occur due to more than one reason. One of these methods is the Analytical Hierarchy Process (AHP). In this study, the impact levels of landforms, soil types, and CORINE land use/cover on agriculture and livestock were intended according to AHP in the Basin of Kesis Stream. In the study, methods such as Geographic Information Systems (GIS), AHP, Digitization formula, and remote sensing (RS) were used. Based on these methods, the study was embodied with various figures, tables and graphics suitable for the purpose of the study. According to this study, in the Basin of Kesis Stream; impact levels of natural criteria on livestock activities, 25,992% of landforms, 41,260% of soil types and 32,748% of CORINE land use/cover were determined. Likewise, in the basin; 19,580% of landforms, 31,081% of soil types and 49,339% of CORINE land use/cover were effective in the impact levels on agricultural activities. While land use/cover on agricultural activities and soil types on livestock were ranked as the first, landforms had the least impact on both. In the basin, which has a rough and karstic structure; as seen in Figure 3/A, agricultural areas such as range of deposits, polje, and uvala correspond to the 'very important' classification; however, the importance of slope surfaces and other areas gradually decreased. While agricultural fields and slope surfaces had a 'very important' and 'significant' effect on livestock activities, the importance of peak and high plains and rocky steep surfaces was the least (Figure 3/B). Consequently, it can be said that the findings obtained as a result overlap with the current realities of the basin and are successful.

Keywords: Determining, Impact Levels, Agriculture-Livestock, AHP, Basin of Kesis Stream

1. INTRODUCTION

The Basin of Kesis Stream, the study area, has a steep and rough topographic structure, different landforms, various soil characteristics and different land use groups as well as rural settlements. In fact, in the rural settlements, agriculture and livestock are economic activities that complement each other. In the study area, the main occupation areas of the local people were agriculture and livestock along with the range of dry and irrigated agricultural areas consisting of range of deposits, polje, uvala and dolines, a predominantly rural population of 30535 people, and 78617 cattle and sheep and goat (Figure 1, Table 1). The number of other trade/service/sectoral occupations in the study area is limited. Beyond that, trade activities such as carpentry and grain harvesting had emerged in center of Andırın district (in the basin) around the region's natural factors. Natural factors such as landforms, soil types, and land use/cover play an important role on these economic activities. Natural factors of the study area primarily shape economic activities such as agriculture and livestock, provides integrity between the physical conditions and economic activities in the region. Therefore, national and international studies have been carried out by developing various methods such as analytic hierarchy process (AHP), strengths, weaknesses, opportunities and threats (SWOT), remote sensing (RS) to determine the impact shares of the parameters that have an effect on the economic activity or current situation in any region. Analysis and evaluations of some of these studies are given below.

While Saaty (2008) evaluated that decisions included many material elements that need to be traded, he stated how well the measurements should serve the purpose of the decision maker. In addition, while AHP expressed the measurement theory with pairwise comparisons, derivation of priorities was based on expert judgments. While Ishizaka and Labib (2011) examined the development of AHP since its inception in their study, they consider it as an objective study rather than expressing the applications that have emerged since the emergence of methodological developments. They especially emphasized that problem modeling, pairwise comparison, judgment scales, derivation methods, missing matrix, synthesis of weights, sensitivity analysis and group decisions are all important in AHP.

Zhang (2021), in his study, used the AHP method to identify possible risk factors and reduce risks in the construction of the Hangzhov bridge in China. Quezada (2013) In this study, it was stated that the AHP model was used to create the strategy map. Fu (2022) In this study, the fuzzy analytic hierarchy process is used to resolve the uncertainties in the assessment of risks in energy distribution systems. While Vaidya and Kumar (2006) stated AHP as a multi-criteria decision-making tool used in almost all applications, Kücükönder et al., (2013) evaluated it as a multi-criteria approach with more alternatives and criteria. Cengiz and Çelem (2003) define rural development as the rural population's benefiting from the economic, social, cultural and technological opportunities of urban life without migrating and express that the AHP method can be used in the analysis and evaluation stages of development studies.

Seyedmohammadi et al., (2019) emphasized that while evaluating land suitability assessment, planning and development as a multi-criteria decision analysis technique, the use of methods such as AHP based on RS and geographic information systems (GIS) is a flexible and effective framework for evaluating and mapping several different criteria of the crop. Saha et al., (2019) conducted a study in the Basin of Kunur River in West Bengal, India and produced a soil erosion susceptibility map using the AHP method and fuzzy logic modeling. In their study, Tosovic-Stevanovic et al., (2020) stated that the AHP method is a useful tool in structuring distribution channels, evaluating them effectively, and determining various criteria. Roy et al., (2022) In this study, it was stated that the AHP method was used to determine the suitability of agricultural land, taking into account the droughts caused by climate change in west Bengal. Görener (2012) stated in his study that they aimed to develop the SWOT analysis with the AHP method, which is a multi-criteria decision-making technique, in order to determine the importance levels of the criteria determined as SWOT analysis. Akbulak (2016) in his study similarly; SWOT analysis and AHP method were used together in determining the rural tourism potential. In his study, Karaosmanoglu (2023) analyzed temporal and spatial variations on land use/cover by using CORINE (1990-2018) data on the Kesis basin. It is thought that the CORINE 2018 land use/cover data used in this study can be used as an important material in evaluating the agriculture and livestock activities of the basin.

As can be understood from these explanations, the multi-criteria decision-making technique and the methods developed based on it are widely used in national and international studies. Thus, in the study area; It is possible to say that the use of GIS-based AHP model method and additional formulas will be considered appropriate in determining the effect levels of factors such as landforms, soil characteristics and land use/cover on agriculture and livestock activities. It can be said that the agriculture and livestock activities in the basin are shaped under the control of the natural factors of the area. In other words, these economic activities, which are actively carried out in the study, are never independent of the physical natural conditions around it. However, considering that the economic activities living in the basin are based on agriculture and livestock, the question of how these natural factors affect the agricultural and livestock activities of the region is very important.

2. AIMS AND METHODOLOGY

As can be understood from above studies, it has been determined that the GIS-based AHP method has been successfully used by integrating it into many international studies. AHP is a multiple decision making method, which is internationally valid and widely used by researchers. It can be used by integrating with GIS and RS techniques. The aim of the study is to determine the impact levels of factors such as landforms, soil types, and CORINE land use/cover on the agricultural and livestock activities in the basin of Kesis Stream. However, the characteristics of the population living in the region and cultural factors were not included in this study because their effects on agricultural and livestock activities are limited.

This is because knowing the effect levels of the processes that occur with the effect of one or more parameters is very important in making decisions such as plans, projects, and investments in the public or private sector for the region. If the impact levels of the factors affecting the result are not known clearly, effective and rational decisions may not be taken on any issue in the basin. Therefore, it is very important to determine the impact levels of factors such as landforms, soil types and land use/cover that shape basic economic activities such as agriculture and livestock in the basin.

2.1. Materials and methods

2.1.1. Materials

Alos-Palsar (12.5x12.5) meter high resolution digital elevation model of the study area (Figure 2), landforms, soil types and CORINE-2018 Land use/cover, and population and livestock data (table 1) as well as various tables (table 2,3,4,5,6) and figures (figure 3,4) were used to determine the impact levels of natural factors such as landforms, soil types, and CORINE land use/cover on the agricultural and livestock activities in the basin of Kesis Stream (Table 1, Figure 1A/B/C).

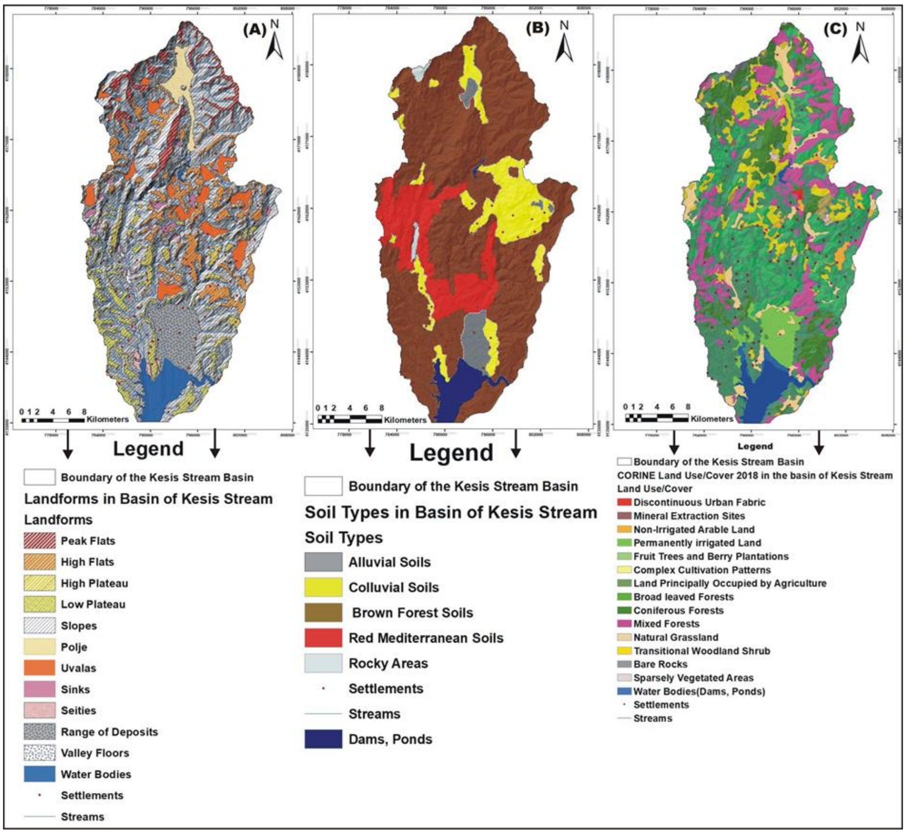

Figure 1- Landforms (A) and Soil types (B), CORINE Land use/cover (C) in the basin of Kesis Stream (Source: Land assets of Kahramanmaraş (1997) and Adana (1996) provinces Karaosmanoglu, et al., 2022, Karaosmanoglu, 2023)

2.1.2. The study area

The study area is located in the Mediterranean region in the southern Turkey, between 37° 19' 00”- 37° 51' 00” north latitudes and 36° 12' 30”- 36° 36' 50” east longitudes (Figure 2) (Karaosmanoglu et al., 2022). This area covers 826.49 km^2 and has a very rough structure and its altitude increases from 163 m to 2300 m from south to north. It has steep and deep V-shaped valleys carved by rivers. When the climate characteristics of the area were examined, it was seen that its temperature decreased from 19 °C to 12.4 °C from south (Kadirli station (1998-2020) to north (Andırın station (1984-1994) and a decrease was detected in annual average temperature values. Karaosmanoglu et al., (2022) determined that the precipitation values ranged from 743 mm in the south and 1473 mm the north in the basin. In the basin of Kesis stream, soil formation (pedogenesis) realize according to these climatic characteristics. Under the effects of the Mediterranean climate conditions that are effective in the basin; brown forest soils, red Mediterranean soils, and alluvial and colluvial soils form in areas where hydrographic processes are effective. The vegetation of the study area, on the other hand, form under the effects of the basin’s landforms, climatic characteristics, and soil types (Karaosmanoglu et al., 2022). In addition to these factors, the basin of Kesis Stream corresponds to a rural settlement with a population of **30.535** people and a total number of cattle (Table 1). When the population and livestock data of the basin are evaluated together with its agricultural lands, landforms and land use elements, it can be asserted that the main economic activities in the area are agriculture and livestock.

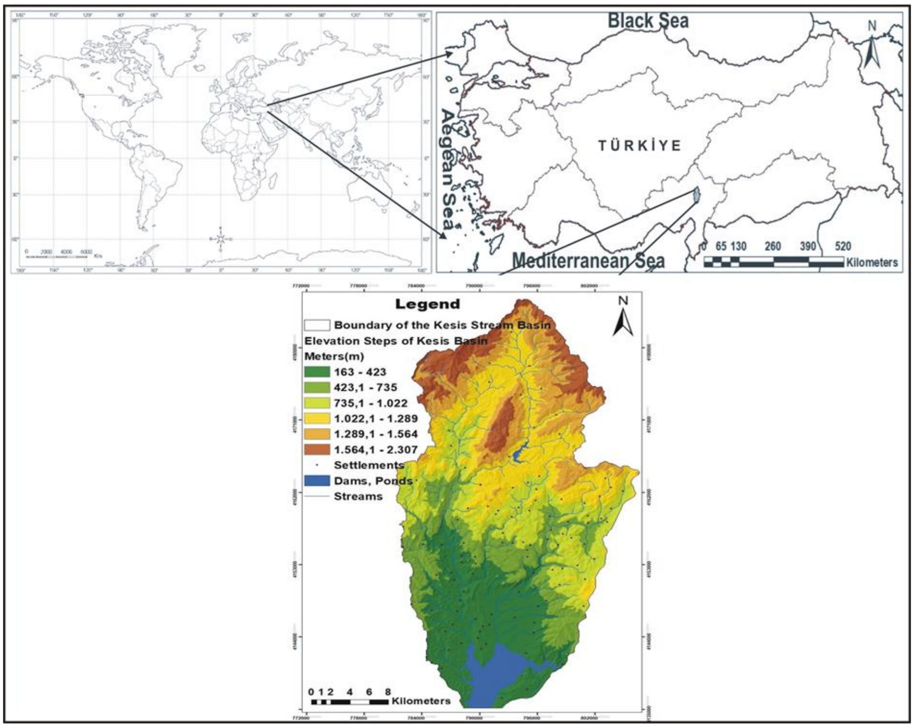

Figure 2- Location map of the Study Area (Karaosmanoglu, at el.,2022)
(Source: https://asf.alaska.edu/data-sets/sar-data-sets/alos-palsar)

Table 1- Population and Livestock Data in the Basin of Kesis Stream (2021)
(Source: data of Turkish Statistical Institute, 2021)

Numbers of cattle (Buffalo+Cattle)	21.915
Numbers of Sheep and Goat	56.702
Total number of animals	78.617
Total Population	30.535

2.1.3. Methods

If the emerging activity or phenomenon has developed under the effects of more than one factor, methods and models that include multi-criteria decision making techniques are generally used. Analytical hierarchy process (AHP) method is widely used in the world in solving the problems with prioritizing impact factors. Therefore, In the study, the GIS-based AHP method was chosen as the right method for the purpose. Thus, in order to determine the impact levels of natural factors on agricultural and livestock activities in the basin of Kesis Stream, GIS-based AHP was used in integration with digitization formula and RS techniques.

In the study; first of all, data on physical factors such as landforms and soil types were obtained benefiting the study of Karaosmanoglu, et al., (2022) (Figure 1A/B). In addition, CORINE-2018 land use/cover data of the basin were obtained with the help of RS techniques (Figure 1/C). Secondly, the landforms, soil types and land use/cover criteria obtained for the basin were divided into alternatives independently of each other (Figure 3).

Thirdly, the alternatives created for the criteria were digitized in such a way that the total numerical value of each criterion was equal to '1' by using decimal ratios(Tables 2, 3, 4). In this digitization process; Numerical values in thousandths, which vary according to the importance of each alternative of the criteria on agriculture and livestock, are given. These digitization values have been prepared rationally by considering the real field characteristics. Fourthly, the digitized alternatives of criteria such as landforms, soil types, land use/cover were transferred to the GIS-based AHP model program and processed with the help of these programs. At the finally, the model program was run and thematic maps were produced with percentages expressing the effect levels of the basin's landforms, soil types and land use/cover criteria on agriculture and livestock (Figure 4). The flow chart of the study is presented below (Figure 3).

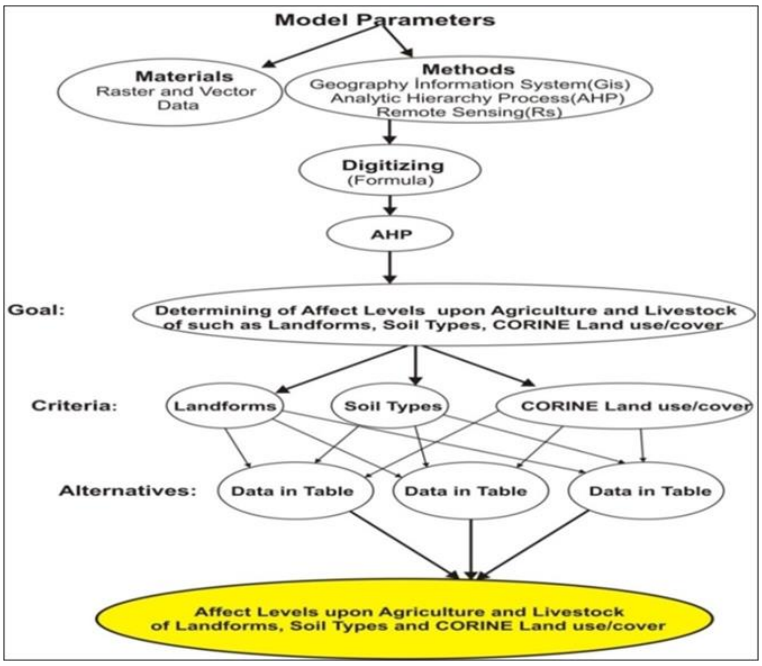

Figure 3- Flow Chart of the study

2.1.4. Digitization formula

Karaosmanoglu et al., (2021) calculated the sub-alternatives of each natural factor according to the formula 1 below.

$$Nf = \sum_{i=1}^{n} Ii = 1 \qquad \text{(Formula 1)}$$

Where, Nf refers to the natural factor, Ii is weighted average, and $\sum Ii$ is the sum of the alternatives. Karaosmanoglu et al.(2021) emphasizes that the sum of the numerical values formed by each natural factor by giving numerical values to the sub-alternatives is equal to '1'. Thus, the purpose of digitization is to make it suitable for the AHP model program, which is a multiple decision making technique, and to process it here (Karaosmanoglu et al., 2021). As is stated in this formula, the digitized alternative data of the criteria were transferred again to the GIS Arc.Map. Then, by using an integrated analytical hierarchy model program with GIS, the impact levels of the natural factors of the basin on agricultural and livestock activities were determined.

2.1.5. The digitization processes of the factors of landforms, soil types, and land use/cover

The digitization processes of the factors of landforms, soil types, and land use/cover are stated below.

2.1.5.1.Digitization processes about impacts of landforms on livestock and agricultural activities in the basin of Kesis Stream

The criterion of landforms has been digitized in order to determine the impact levels on agriculture and livestock in the study area. As stated in the formula above, the sum of the alternatives belonging to the criteria is set to '1'. Here, the landform factor is divided into sub-alternatives and numerical values are given for the impact levels of each alternative on agricultural activities and livestock (Table 2). The impact degrees of the numerical values of the alternatives created for the alternatives on both agricultural and livestock activities were prepared in a rational, consistent and meticulous manner. According to Table 2/B, peak plains and high plains had low values for the impact of landform alternatives on livestock in the basin, while landforms such as valley floors, range of deposits, seities, uvala, doline, polje had higher values. High plateau, low plateau and slope surfaces were digitized with the highest coefficient values (Table 2/B). Here, considering the number of cattle and sheep and goats, agricultural areas and slope surfaces were considered to have the greatest impact.

Table 2- Digitization Processes about impacts of landforms on livestock and agricultural activities in the basin of Kesis Stream.

	(A) Impacts of Landforms on Agriculture in the Basin of Kesis Stream			
	Alternatives (Landforms)	**Digitizing (Coefficients)**	**Lands (Km²)**	**Ratio (%)**
1	Peak Flats	0.010	27.79	3.36
2	High Flats	0.020	71.75	8.68
3	High Plateau	0.040	21.37	2.58
4	Slopes	0.030	518.57	62.75
5	Low Plateau	0.092	41.82	5.06
6	Polje	0.125	18.55	2.24
7	Uvalas	0.097	36.90	4.46
8	Dolines	0.092	7.19	0.87
9	Seities	0.095	4.93	0.58
10	Range of Deposits	0.125	41.45	5.00
11	Valley Floors	0.092	3.58	0.42
12	Water Bodies	0.182	33.39	4.00
	Total of Weighted Average	**1**	**826.49 km²**	**100**
	(B) Impacts of Landforms on Livestock in the Basin of Kesis Stream			
1	Peak Flats	0.040	27.79	3.36
2	High Flats	0.060	71.75	8.68
3	High Plateau	0.125	21.37	2.58
4	Slopes	0.250	518.57	62.75
5	Low Plateau	0.125	41.82	5.06
6	Polje	0.066	18.55	2.24
7	Uvalas	0.066	36.90	4.46
8	Dolines	0.067	7.19	0.87
9	Seities	0.067	4.93	0.58
10	Range of Deposits	0.066	41.45	5.00
11	Valley Floors	0.069	3.58	0.42
12	Water Bodies	0.00	33.39	4.00
	Total of weighted Average	**1**	**826.49 km²**	**100**

In the digitization of the effects of the landforms of the field on agricultural activities, strong coefficients were given to polje, uvala, doline, range of deposits, seities, valley floor and low plateau surfaces due to the fact that they correspond to agricultural areas, peak plains, high plains, and sloping surfaces corresponding to mountainous surfaces were digitized with low coefficients (Table 2/A). The water bodies in the basin were digitized with a high coefficient due to their direct impact on agricultural activities (Table 2/A). It can be asserted that the determination of the impact levels of the alternatives in the digitization processes of the landforms in the basin was rational and successful.

2.1.5.2. Digitization processes about impacts of soil types on livestock and agricultural activities in the basin of Kesis Stream

In digitizing the impacts of soil type factor on agricultural activities in the study area, very high coefficient values were given for the effect of alluvial and colluvial soils on agricultural activity; whereas, rocky and rubble fields were given the least coefficient values. While the secondary high coefficient values were given to the red Mediterranean soil surfaces because these surfaces partially correspond to the agricultural areas, the lower coefficient values were given to brown forest soils because the agricultural activity is highly restricted in these soils (Table 3/A). The effect of grain products such as straw, corn, barley and oat obtained from agricultural fields on livestock activities was important in digitizing the impact levels of the region on livestock. In addition, it was observed that these surfaces were digitized with coefficients close to each other, since forest lands and slope surfaces are also used as pasture lands, especially for sheep and goat farming. Rocky and rubble fields, on the other hand, were digitized by giving the lowest coefficient due to the limited impact on the nutritional needs of animals (Table 3/B). In the basin, the digitization processes of the alternatives belonging to the soil types factor were successfully carried out.

Table 3- Digitization processes about impacts of soil types on livestock and agricultural activities in the basin of Kesis Stream.

	Alternatives (Soil Types)	**Digitizing (Coefficient)**	**Land Amounts(Km^2)**	**Ratio (%)**
	(A) Impacts of Soil Types on Agriculture			
1	Alluvial Soils	0.380	35.52	4.30
2	Colluvial Soils	0.370	111.95	13,55
3	Brown Forest Soils	0.085	560.45	67.81
4	Red Mediterranean Soils	0.160	114.81	13.90
5	Rocky and Rubble	0,005	3.76	0.44
	Total of Weighted Average	**1**	**826.49 km^2**	**100**
	(B) Impacts of Soil Types on Livestock			
1	Alluvial Soils	0.260	35.52	4.30
2	Colluvial Soils	0.260	111.95	13.55
3	Brown Forest Soils	0.255	560.45	67.81
4	Red Mediterranean Soils	0.150	114.81	13.90
5	Rocky and Rubble	0.075	3.76	0.44
	Total of Weighted Average	**1**	**826.49 km^2**	**100**

2.1.5.3. Digitization processes about impacts of CORINE Land use/cover on livestock and agricultural activities in the basin of Kesis Stream

In digitizing the impact levels of the CORINE land use/cover factor on livestock activities, it was thought that agricultural lands and forest lands complemented each other on the livestock activities of the region. Therefore, coefficient values close to each other were given to the alternatives that make up the agricultural lands and forest lands (Table 4/A). In parallel, high coefficients were given in the digitization of dry and irrigated agricultural lands, priority lands in agriculture, mixed agricultural structures, broad-leaved forests, coniferous forests, mixed forests, natural grasslands, and transitional woodland shrubs (Table 4/A). While partially low coefficient values were given for discontinuous urban fabrics and water bodies, mineral extraction site, fruit trees and berry plantation lands and bare rock surfaces were digitized with minimum coefficient values (Table 4/A). In the process of digitizing the effects of the CORINE land use/cover factor on agricultural activity, it was determined that while high coefficient values were given to agricultural lands, very low coefficient values were given to forest lands with sparsely vegetated surfaces (Table 4/B). While discontinuous urban fabrics and water bodies had lower coefficients than agricultural lands, mineral extraction sites were digitized with a very low coefficient and a value of zero (0) on bare rocky surfaces (Table 4/B). In the study area, the alternatives belonging to the CORINE land use/cover factor were appropriately digitized.

2.1.6. Matrix Values of factors of Landforms, soil types, and CORINE land use/cover on Livestock and Agriculture According to AHP in the basin of Kesis Stream

The data detailing the working details mentioned above were entered into the Geographic Information System-based Analytic Hierarchy Process (AHP) model program. After performing the necessary correct procedures here, the program was executed. When the model program operation was completed, the following matrix values, consistency ratio, and percentage rates related to impact levels for natural factors on agriculture and livestock in the Kesis River basin were provided (Table 5,6).

Table 4- Digitization processes about impacts of CORINE Land use/cover on livestock and agricultural activities in the basin of Kesis Stream

(A)	**Impacts of CORINE 2018 Land Use/Cover on Livestock**		
Code-2018	**Alternatives (Land Use/Cover Classes)**	**Digitizing (Coefficients)**	**Lands(Km^2)**
112	Discontinuous urban fabric	0.060	1.35
131	Mineral Extraction Sites	0.005	0.38
211	Non-Irrigated Arable land	0.090	12.87
212	Permanently irrigated land	0.080	37.48
222	Fruit Trees and Berry Plantations	0.008	0.35
242	Complex Cultivation Patterns	0.090	46.09
243	Land principally occupied by agriculture	0.100	230.41
311	Broad leaved Forests	0.090	166.72
312	Coniferous Forests	0.087	92.62
313	Mixed Forests	0.090	116.05
321	Natural Grassland	0.090	5.05
324	Transitional Woodland Shrub	0.090	71
332	Bare Rock	0.010	3.66
333	Sparsely Vegetated areas	0.070	1.94
512	Water Bodies	0.040	40.52
	Total of Weighted Average	**1**	**826.49 km^2**
(B)	**Impacts of CORİNE Land Use/Cover on Agriculture**		
112	Discontinuous urban fabric	0.100	1.35
131	Mineral Extraction Sites	0.005	0.38
211	Non-Irrigated Arable land	0.165	12.87
212	Permanently irrigated land	0.190	37.48
222	Fruit Trees and Berry Plantations	0.135	0.35
242	Complex Cultivation Patterns	0.151	46.09
243	Land principally occupied by agriculture	0.180	230.41
311	Broad-Leaved Forests	0.010	166.72
312	Coniferous Forests	0.010	92.62
313	Mixed Forests	0.016	116.05
321	Natural Grassland	0.010	5.05
324	Transitional Woodland-Shrub	0.012	71
332	Bare Rock	0.00	3.66
333	Sparsely Vegetated Areas	0.011	1.94
512	Water Bodies	0.140	40.52
	Total of Weighted Average	**1**	**826.49 km^2**

Table 5- Matrix Values of factors of Landforms, soil types, and CORINE land use/cover on Livestock and Agriculture According to AHP in the basin of Kesis Stream

Matrix Values of factors of Landforms, soil types, and CORINE land use/cover on Livestock According to AHP in the basin of Kesis Stream			
	CORINE Land use/cover-2018	Soil Types	Landforms
CORINE Land use/cover-2018	1	1	1
Soil Types	1	1	2
Landforms	1	5	1
Matrix Values of factors of Landforms, soil types, and CORINE land use/cover on Agriculture According to AHP in the basin of Kesis Stream			
	CORİNE Land use/cover-2018	Soil Types	Landforms
CORINE Land use/cover-2018	1	2	2
Soil Types	5	1	2
Landforms	5	5	1

3. FINDINGS AND DISCUSSION

Table 5 matrix values were created according to the AHP evaluation scale (Saaty, 1980) on agriculture and livestock activities in the study area. It can be said that soil types and landforms of CORINE-2018 land use/cover have equal importance on livestock activities. Soil types of the basin, when compared with land use/cover and landforms, have equal importance with land use/cover, but more important than landforms. Landforms are of equal importance when compared to land use/cover. It is possible to say that their landforms is close to each other with soil types (Table 5). Again, according to the same evaluation scale, It can be said that land use/cover has more importance on the agriculture of the basin when compared to soil types and landforms. Soil types have close importance with land use/cover, but they are more important than landforms. When compared with landforms, land use/cover and soil types, it is possible to say that they have values close to each other (Table 5). These comparative matrix values, which emerged in the study, consistently determined the effect levels of the basin's land use/cover, soil types, landform criteria on agriculture and livestock in percentages. Accordingly, the percentage distributions are analyzed below.

The results of the AHP indicated that while the landforms (25.992%), the CORINE land use/cover (32.748%), and the soil types (41.260%) had an impact on the livestock activities of the basin, they were effective on agriculture activities by 19.580%, 49.339%, and 31.081%, respectively (Table 6). Accordingly, soil types had the primary effect on the livestock activity of the basin, which was followed by land use/cover and landforms (Table 6). In the agricultural activities, while land use/cover was in the first place, soil types had a secondary effect. It was observed that the landforms factor had the least effect on agricultural and livestock activities in the basin (Table 6).

Table 6- Consistency Ratio and Impact Levels of Landforms, soil types and CORINE land use/cover factors on Agriculture and Livestock According to Analytic Hierarchy Process(AHP) in the Basin of Kesis Stream

Impact Levels of factors of Landforms, soil types, and CORINE land use/cover on Livestock According to AHP in the basin of Kesis Stream		
Criterions	**Impact Levels-Ratio (%)**	**Consistency Ratio(CR)**
Landforms in the Basin of Kesis Stream	25.992	0.052
Soil Types in the Basin of Kesis Stream	41.260	0.052
CORINE Land Use/Cover	32.748	0.052
Total Ratio	**100(%)**	
Impact Levels of factors of Landforms, soil types, and CORINE land use/cover on Agriculture According to AHP in the basin of Kesis Stream		
Landforms in the Basin of Kesis Stream	19.580	0.052
Soil Types in the Basin of Kesis Stream	31.081	0.052
CORINE Land Use/Cover	49.339	0.052
Total Ratio	**100(%)**	

In addition, Figure 4 shows the areal distributions of the natural factors in the basin according to the AHP results. Classifications were made as 'very important', 'important' and 'least important'. When the spatial distribution of the impact levels of the natural factors on agricultural activities of the basin was analyzed, it was observed that the surfaces of slopes and plateaus corresponded to the 'very important' and 'important' classification as opposed to agricultural lands (Figure 4/A). Conversely, bare rocky and peak flats corresponded to the 'least important' classification on their surfaces (Figure 4/A). Similarly, in the spatial distribution of the impact levels of natural factors on livestock activities, it was determined that agricultural lands and slope surfaces and plateau lands corresponded to 'very important' and 'important' classification groups. It can be asserted that peaks and high plains correspond to the 'least important' classification (Figure 4/B).

When all these explanations and analyzes are discussed, it is necessary to evaluate whether the data produced are valid and consistent. For this, a careful study was carried out by taking into account the real natural conditions of the basin, both in the creation of the data of the basin and in the digitization processes. Alternatives constituting each criterion belonging to the research area were digitized by thinking rationally. If the consistency ratio of the model outputs (Table 6) according to the results of the AHP model program had a value above 0.10, the validity of the study could be discussed or questioned. It could even be thought that the coefficients corresponding to the alternatives created with thousandth values in the digitization processes might be mistaken.

Because the AHP model program has accepted the consistency ratio of the model outputs up to 0.10 numerical values as successful. AHP model program outputs did not accept the consistency rate above 0.10 as successful. However, the model output results of criteria such as land use/cover, soil types and landforms of the basin showed a consistency of 0.052. This consistency rate proves the accuracy and validity of the data generated for the basin, digitization and AHP model program implementation processes.

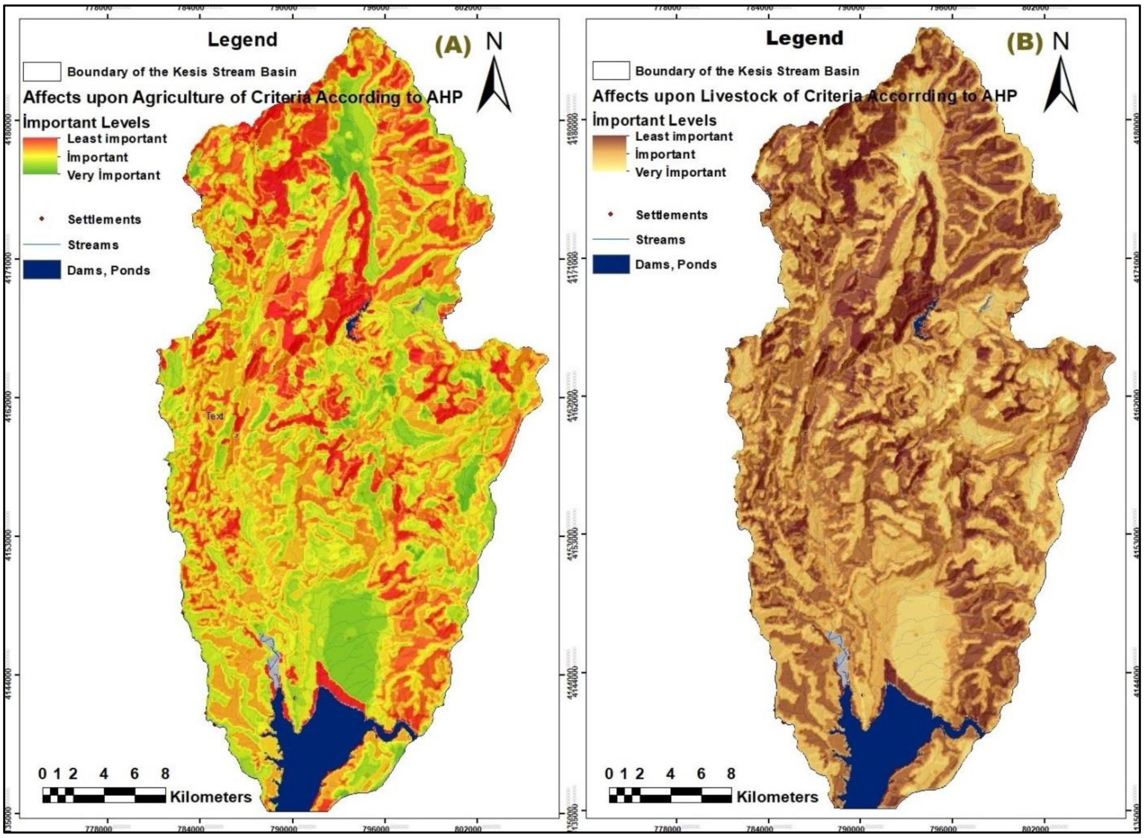

Figure 4- Dispersion of İmportant Levels on Agriculture(A) and Livestock(B) of Landforms, Soil Types, and CORINE Land use/cover According to AHP in the basin of Kesis Stream

4. CONCLUSIONS

Karaosmanoglu et al (2022) stated in their study that climate and landforms have the main effect on the soil characteristics and land use/cover of the basin and are shaped under the control of two factors. The AHP model was not included in the program as a criterion, since the climate is homogeneous throughout the basin and does not show variability. However, in the beginning, while the climate and landforms of the area, soil characteristics and land use/cover were shaping, later soil characteristics and land use/cover elements played a more dominant role on the agriculture and livestock activities of the basin. This situation is clearly observed in the results of the AHP model program. In addition, it was determined that the surfaces such as range of deposits, polje, uvala, plateau within the landform units overlap with the surfaces with high agricultural and livestock values on soil properties and land use/covers(Figure 4).

Consequently, the AHP was applied rationally and consistency in the study area. It was understood that the factors of the basin and the digitization processes of the alternatives were carried out rationally, as they were based on real field data. The consistency rate of 0.052 for both livestock and agricultural activity levels proves the validity of the digitization processes. In the AHP model results; it was determined that the land use/cover and soil types of the basin were predominantly determinants of agricultural and livestock activities with a rate of 74-80%. The landforms factor had a weak effect on agricultural and livestock activities with a rate of 19-26% compared to the other two criteria. According to all these results, land use/cover and soil characteristics should be taken into consideration in the decision processes of any plan, project or investment planning on the region. However, in addition to these criteria, landforms criteria should be included in the projects and plans without ignoring them.

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