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Climate Classification and Evaluation Using Methods and Formulas by Authors Such as Erinc, Thorntwaite, De Mortanne: A Case Goksu Basin

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ABSTRACT. Climate can be defined as average weather conditions that do not change over a wide area for many years. Climate in any geographic region or basin; physical activities such as soil formation, vegetation, settlement, agriculture, irrigation and energy production can affect human and economic activities. Therefore, it is very important to determine the climate type of a region or basin. In order to determine the climate type of any region, researchers generally use long annual data (35-40) obtained from meteorological events such as precipitation, temperature, evaporation, pressure, wind etc. From past to present, researchers such as Thorntwaite, De Mortanne, Erinc have developed various methods and formulas to determine the type of climate. In this study; The climate methods and formulas developed by Erinc, Erinc, Thorntwaite and De Mortanne were applied in general of Goksu Basin and in the north and south of the basin. The purpose of its application in the south and north of the basin is to define the micro-climate characteristics. With these applications, the results of the authors' climate classification index are as follows Accordingly, it can be said that the Erinc formula(formula 1) index result(Table 2) is successful in general and locally with its semi-humid, semi-arid feature, and the developed Erinc formula(formula 2) index result(Table 3) is partially successful with its semi-arid feature. The climate classification index results of Thorntwaite and De Mortanne formulas (formulas 3,4), on the other hand, were inconsistent and insufficient in the entire basin and locally as they correspond to the moist index classifications. To test the validity of the authors' climate index classifications, the current vegetation cover of the basin, ground cover (ndvı) and images representing the north and south of the site were used. After all, when these are evaluated together; While the application results of Erinc and Developed Erinc formulas were successful in reflecting the climatic characteristics of Goksu Basin, application results of Thorntwaite and De Mortanne formulas were insufficient. In addition, this study revealed the importance of developing a climate method and formula that can even determine local microclimate conditions, rather than general formulas that try to classify the general climate conditions of the world.

Key Words: Climate type, Thornthwaite-Erinc formulas, classification, Goksu Basin.

1.Introduction

Climate is expressed as the average of weather events that have not changed for many years in a wide region or basin. Meteorology is a branch of science that studies the circulation and course of weather events such as precipitation, temperature, humidity, pressure and wind. Therefore, meteorological data such as rainfall, temperature and humidity, which are active in any geographical area, are used to determine the type and characteristic of the climate of the area where it is effective.

Climate is the totality of meteorological events that characterize the average state of the atmosphere at a point on the earth [23]. Meteorology and climatology follow the same purpose in dealing with these events [2]. In determining the climate type of a place, only the pressure, temperature, pressure and winds in that place or only humidity and precipitation are not sufficient. Considering the climatic elements together gives an idea about the climate in that place[2].

In Turkey, the occurrence of seasonal weather types, but also the climate of the time and the elements of the climate factors taken into account to explain the stretch characteristics of the distribution according to the space which they can be divided into two large groups. 1-Planetar agents (macro-conditioning agents) related to the location of the country and general circulation conditions; 2-Thermal and dynamic modifications (regional and local climatic agents) that occur depending on the geographical characteristics of the country [16]. Average weather conditions that have not changed for many years in a very large area are called climate [17]. Climate is the average state of annual and seasonal weather conditions determined by long observations in any location. Climate elements are formed by temperature, precipitation, cloudiness, humidity, pressure and wind, etc.[3].

There are many types of climate in the world. However, as in every discipline, large climate zones have been revealed by bringing together more or less common features of the scattered climate types in climatology[13]. Climate classification is extremely important in terms of determining different environments in the world and evaluating the relationships between environments and human activities. In this respect, climate classification has been made in the world using various measures[3]. Although many scientists have developed various formulas and made climate classifications, there are differences of opinion among them. Therefore, it has not been possible for every formula developed for climate classification to give perfect results.

In Turkey, climatology study conducted by the branch manager; Climate classification methods of researchers such as Koppen, Trewartha, Aydeniz, Erinc, Thorntwaite and De Mortanne were examined[8]. These methods, climate data from 1971-2000 years in Turkey have been implemented across the country basis. The parts of these general application results corresponding to the research field can be explained as follows. According to Köppen, the research area has the symbol Cs and is classified with temperate climates and high climates. Trewartha provided an example of climate classification similar to the Köppen classification. Again, according to De Mortanne[9], the basin corresponds to the step-semi humid climate classification, while Erinc[15] and Aydeniz[10] present semi-humid conditions in the climate classification. In Thorntwaite[38], it is the equivalent of the symbol B1, and it is stated that the study area offers a humid climate feature.

Since the vegetation cover of any area is shaped under climatic conditions, it is the main indicator to be taken into account when making climate classification. Climate may be regarded as the single factor that exerts the largest influence on vegetation distribution and its characteristics on a glabal contex[31]. Changes in terrestrial vegatation can modify local regional and global climate at diurnal, seasonal, and long-term scales[6],[4],[11]. These vegetation-induced changes imply that warming enhanced vegetation growth and lengthened growing season[39]. The land and atmosphere are interlocked by coupled Hydrologic and energy cycles that are majör part of the earth's climate System[35]. Climate change has affected the global distribution of vegetation from the distant past and will likely affect it into future[30].

The Mediterranean Basin represents the largest area of Mediterranean-type ecosystems (MTEs), in the world, covering a complex landscape with a large amount of topographic and climatic heterogeneity. While coastal areas are extensive because of the large archipelagos and islands within the Mediterranean, much of this area consists of mountainous terrain with many areas above 2000 m elevation and peaks reaching as high as 4500 m. The geographic position of the Mediterranean Basin is also an important factor in understanding the biodiversity of this region[7].
The climatic features of the Mediterranean Basin are often used to define this region, but the range of dominant and widespread woody species such as holm oak (Quercus ilex) and olive (Olea europea) are also used as bioindicators of the region. The large area of the Mediterranean Basin, coupled with its topographic and climatic heterogeneity, makes for complex assemblages of vegetation types. There are extensive woodlands dominated by both evergreen and deciduous species of oak and evergreen sclerophyllous shrublands of many forms[32]. These shrublands are often differentiated into types depending on the height of the vegetation. Tall sclerophyllous shrublands that may include small evergreen trees are termed maquis. Several species of Mediterranean pine may be present in this community[32].
Studies show that geological, pedological and geomorphological landscape structures have a significant effect on vegetation distribution[27],[28],[33],[34]. Furthermore, geomorphological heterogeneity, in general, and the presence of rock outcrops and rock fragments on the surface, in particular, have been linked in several studies to a high presence of trees and shrubs[5],[29] and has a high annuals diversity[36]. Climate change impacts forest ecosystem health through rises in mean temperature, variations in precipitation regimes, and the enhancement of extreme weather event frequencies. Forest health monitoring activities are actions aimed at detecting conditions and changes in tree species and in forest communities[19]. Several studies have observed a strong interdependence between changes in plant community and changes in soil properties in Mediterranean ecosystems [21],[14],[12]. These close relationships are observed through both time and space[37].
For these reasons, it is necessary to compare the site with the existing natural vegetation to determine whether the results of the climate classification applied at any site are valid. Because the type and characteristics of the vegetation cover of any site; It is shaped under the control of climatic factors such as precipitation, temperature, evaporation and humidity. That is, the success or failure of any climate classification method or formula will be revealed when the applied climate classification results are compared with the vegetation cover characteristics of the actual site.
In this study; Based on the above-mentioned explanations, Thorntwaite, De Mortanne, Erinc, Erinc climate type and classification methods and formulas were applied specifically for Goksu Basin. Goksu Basin; Topographically, Tufanbeyli and Sarız surroundings are located in a basin surrounded by mountains, while the south has a rugged topography divided by steep and deep valleys. Due to the different morphological characteristics of the basin, locally; Climate parameters such as temperature, precipitation and evaporation also differ. Therefore, the methods and formulas of the aforementioned authors were applied separately in the north and south of the basin, as well. The resulting application results were evaluated by making comparisons both within and between each other. As a result, the success or insufficiency of these obtained climate index results was tested with the existing plant estrus of the field.

2.Study Area

Goksu Basin(Adana-Seyhan) is an important sub-basin of the Seyhan Basin, most of which is located in the eastern part of the Middle Taurus Orogenic belt within the borders of the Mediterranean Region, Adana part. The basin extends in the northeast-southwest direction and is located between 37°33'-38°40' north latitudes and 35°35-36°41 east longitudes(Figure1). The Tahtalı Mountains extending in the northeast-southwest direction in the west of the basin are surrounded by the Dibek mountainous mass extending in the northeast-southwest direction in the east, and the Binboga Mountainous mass in the same mountain unit in the northeast. The basin extends in the northeast-southwest position with an area of approximately 4392 km²[26]. The Goksu River originates from the şarlak spring in the southern parts of Govdeli Mountain in the northwest of the basin. The river collects large and small streams and streams from the surrounding mountainous areas and merges with the Zamantı river in the downstream part of the basin.

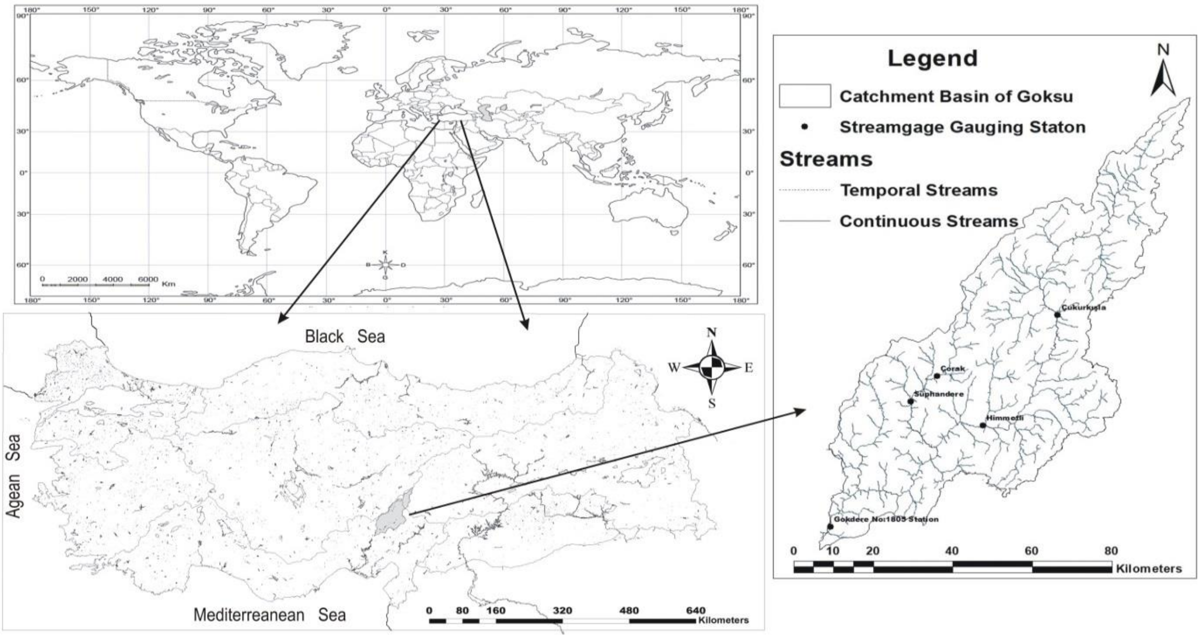


Figure1: Location of Goksu Basin

The study area is hydrologically important with its rugged topography consisting of steep and deep valleys. Therefore, many dams, hydro-electric power plants and ponds have been built on the river branches in the basin. Various rocks of different ages and formations take place in the basin in the geological process from the Paleozoic to the Quaternary.
Due to the altitude of the basin from 300 m to about 3000 m and its current morphological structure, significant differences have occurred in temperature and precipitation values. This situation, while 900 mm to 1200 mm of precipitation falls on the south of the basin and the mountainous high parts, the temperatures start from 8 °C in the north and increase to 19 °C in the downstream part of the basin. In terms of plant geography, the Upper Seyhan Basin is in the Iran-Turan Region, and the Lower Seyhan Basin is in the Mediterranean Region. In terms of natural vegetation, the basin consists of the Southern Anatolia Mediterranean Plant Community, the Southern Anatolia Cedar-Fir Mountain Forests and the Alpine Plant Communities[1]. This situation is also reflected in the vegetation cover of the basin, while plant species such as maquis and red pine, characteristic of the Mediterranean climate type, are widely distributed in the south, while plant species adapting to the terrestrial climate type such as lichen and shroud are widely distributed in the north. Accordingly, in the study area, which overlaps with the distribution areas of the above-mentioned plant geography, the plants are from south to north; various plant species such as maquis, pinus brutia, pinus nigra, cedar, abies, juniper and steppe show distribution.

3.Material And Methods

3.1.*Materials*

The materials of the study area consist of perennial (1966-2017) climate data(Table 1) such as temperature, precipitation, evaporation, pressure, wind, etc., and vegetation cover, soil cover (ndvı), 30(×)30 meters resolution asteroid-gdem(USGS Lansat-8) and related visuals. These climate data were obtained from hydro-meteorological gauging stations located in the basin (Figure 2).

Table 1: Perennial climate data used to determine the climate type of the Goksu Basin (1966-2017).

Months	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Temperature (°C)	2	2.8	6.4	12.2	15.8	20.2	24.3	24.4	20.5	14.7	7.1	3.5	12.8 °C
Temperature (°C) (South of Basin)	4.3	5.6	9.3	13.9	18.1	22.7	26.4	26.5	22.7	16.6	13.3	5.9	15.2 °C
Temperature (°C) (North of Basin)	-3.8	-3.8	0.6	6.6	11.2	15.3	19.3	19	14.2	9.1	2.6	-2.1	7.3 °C
Precipitation (P)	90	76.3	79.7	83.2	94.2	65.2	25	25.1	36.4	59.9	98.7	126.8	860.6 mm
Precipitation (P) (North of Basin)	51.3	48.2	57.4	62.4	56.2	33.6	12.4	11.3	18.1	44.9	60.8	61.1	517.5 mm
Precipitation (P) (South of Basin)	131.2	94.8	108.2	118.1	88.5	36.6	7.8	12.3	17.8	60.2	108.7	135.5	919.7 mm
Evapotranspiration (ET) (Penman-Monteith)	13.1	13.4	24.2	34	41.4	59.9	65.9	42.3	36.4	28.9	27.7	12.2	437.2 mm
Evapotranspiration (ET) (South of Basin)	29.7	29.5	41.2	54.2	65.1	94.8	108	61.1	59.8	47.7	29.7	26	646.8 mm
Evapotranspiration (ET) (North of Basin)	0.0	0.0	21.7	43.4	52	76.4	70.4	6.9	12.8	32.5	31.5	00	347.6 mm
Water Excess (North of Basin)	41	40.8	22.8	6.7	3.5	-	-	-	-	-	-	60	174.8 mm
Water Excess (South of Basin)	68.3	50.1	42.8	28.8	33.7	-	-	-	-	-	-	111.6	335.3 mm
Water Lacking (North of Basin)	-	-	-	-	-	-	11.2	72.1	32.7	-	-	-	116 mm
Water Lacking (South of Basin)	-	-	-	-	-	-	-	41.6	5.3	-	-	-	46.9 mm

Source:[24], (It was benefited from the Evaluation of Evaporation and Runoff in the Goksu Basin according to the Methods of PENMAN and THORNTHWAITE).

3.1.1.Meteorlogical Data Used in the Research Area.

In the study, station data located in the Goksu basin were used to create perennial climate data (Table 1). These stations are; streamgage gauging station (SGS) belonging to five (5) electricity administration studies (EAS), eight (8) snow monitoring station (SMS) belonging to electricity administration studies (EAS), four (4) being a meteorological station belonging to the state hydraulic works (SHW) a total of 17 hydro-meteorological stations (Figure 2).

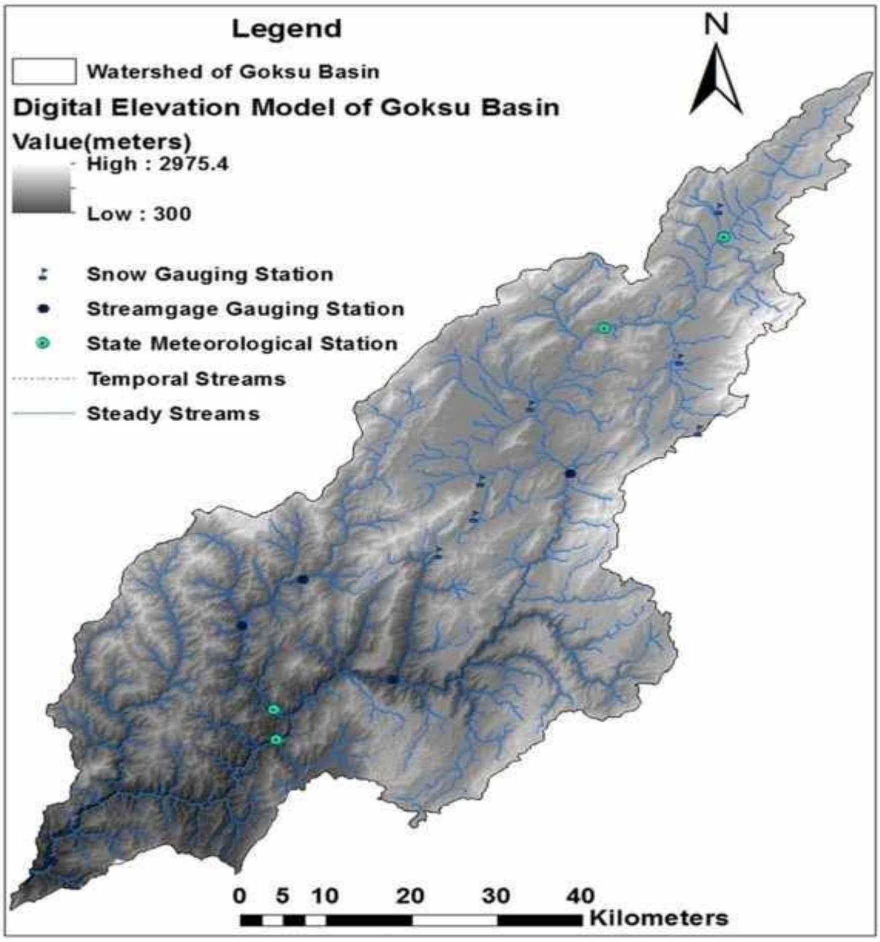


Figure 2: Distribution of Hydro-Meteorologic Stations in Goksu Basin (**Source**: It was benefited from Aster-gdem 30×30 resolution digital elevation model)

3.2.Methods

This work; It is limited to the Goksu Basin and it is aimed to determine the type of climate specific to the basin. In order to determine the climate type of Göksu Basin, climate classification formulas of authors such as Erinc, Developed Erinc, Thorntwaite, De Mortanne and geographic information systems(Gis) and remote sensing (Rs) techniques are the methods used. In these climate classification index calculations, long annual climate data (Table 1) belonging to the basin mentioned above were used as material. Among these formulas, De Mortanne and Erinc climate classification formulas are based on precipitation and temperature values to determine humidity and drought conditions. Thorntwaite and Developed Erinc climate classification formulas are based on precipitation and evaporation values.

When the long annual climate data of the study area (Table 1) are examined carefully; There are significant differences in temperature-precipitation and evaporation values between the south and north of the basin. For this reason, taking into account the distinct meteorological difference between the south and north of the basin, the methods and formulas of the mentioned authors were applied locally as well, in the general of the area, in the south and north. The reason why the climate classification formulas are applied locally, especially for the basin, is to determine the micro-climate characteristics of the site. The details of the climate classification formulas of these authors are given below.

3.2.1.Formulas Used to Determine the Type of Climate in the Study Area.

Erinc Formula (Formula 1)

$$ım = \frac{P}{Tom}$$

$ım$; It refers raiınfall effiency İndex, P ; It refers annual average rainfall amount (mm), Tom ; It refers annual high-temperature (ºC), According to Erinc formula, precipitation efficiency index was calculated by dividing the annual average amount of precipitation mathematically by the annual average high temperature. In addition, temporal index values were revealed by performing the same mathematical operation on a monthly basis (Table 2).

Developed Erinc Formula (Formula 2)

$$ım = \frac{12 \times GET}{Tom}$$

$ım$; It refers drought İndex, GET ; It expresses average actual evaporation per month(mm), Tom ; It refers annual average high-temperature(ºC). In the calculation of drought index according to the improved Erinc formula, it was obtained by dividing the numerical value obtained by mathematically multiplying the monthly average real evaporation amount by twelve (12) months of the year by the annual average high temperature. At the same time, these calculations were made on the basis of months and the temporal change of the climate type was also determined (Table 3).

Thorntwaite Formula (Formula 3)

$$ım = \frac{100s + 60d}{n}$$

$ım$; It refers humidity ındicator, s ; It refers annual surplus of water (cm), d ; It refers annual water deficiency (cm), n ; It expresses potantial evapotranspiration amount per year (cm). According to the Thourntwaite formula, the annual excess water is mathematically multiplied by one hundred (100), and the results obtained by multiplying the resulting value by the annual water shortage by sixty (60) are summed. By dividing the sum of these calculated values here by the annual potential evaporation amount, the result of the climate index was obtained.

De Mortanne Formula (Formula 4)

$$Iy = \frac{p}{T + 10}$$

Iy ; It refers annual drought indice, P ; It refers annual rainfall amount (mm), T ; It refers annual average temperature (ºC).

$$Ik = \frac{P \times 12}{t + 10}$$

Ik ; It refers monthly drought indice, P ; It refers amount of the most drought month (mm), t ; It refers average temperature of the most drought month (°C). According to the De Mortanne formula, the annual drought index can be calculated by dividing the annual precipitation amount by the result obtained by adding ten (10) to the annual average temperature. Again, in the formula, the monthly drought index is calculated by adding ten (10) to the average temperature of the driest month with the precipitation amount of the driest month, and the drought index is determined by summing the annual and monthly drought indices mathematically and dividing them into two (2).

3.2.2.Materials Used in the Comparison of the Climate Formulas İndex Results in the Study Area.

In this stage of the method, in determining the validity of the climate classification index results stated in detail above, the stand map(Figure 3/A) of the basin, soil cover(ndvı)(Figure 3/B) and field photographs are the test materials used. Because most authors working on climate have stated in many studies that there is a close relationship between vegetation cover and climate type. It is undoubtedly a known fact that the climatic conditions prevailing in any area shape the plant species and cover of the area it has in its impact area. In the light of these reasons, it was aimed to determine the success or inadequacy of the climate classification formula index results of the mentioned authors.

In order to achieve this aim, the current stand map(Figure 3/A) of the study area, the soil cover(ndvı)(Figure 3/B), the field photographs(Photos 1) representing the south and north of the basin are used. Because in the content of these materials; They are important materials because they have characteristics that can reflect the climate type, such as plant species and distribution in the basin, vegetation cover. In addition to these, the field photographs, which are thought to clearly reflect the local climate difference, have been taken into account as an important test parameter in evaluating the climate classification index results for the south and north of the basin.

As a result, here as a method, perennial climate data belonging to the field with a correct logical setup, climate classification formulas of authors such as Erinc, Improved Erinc, Thorntwaite, De Mortanne have been successfully applied in determining the climate type of the Goksu Basin. For the validity or insufficiency of the climate classification index results obtained as a result of the application, the stand map of the basin, soil cover (ndvı), field photographs constitute the test materials used.

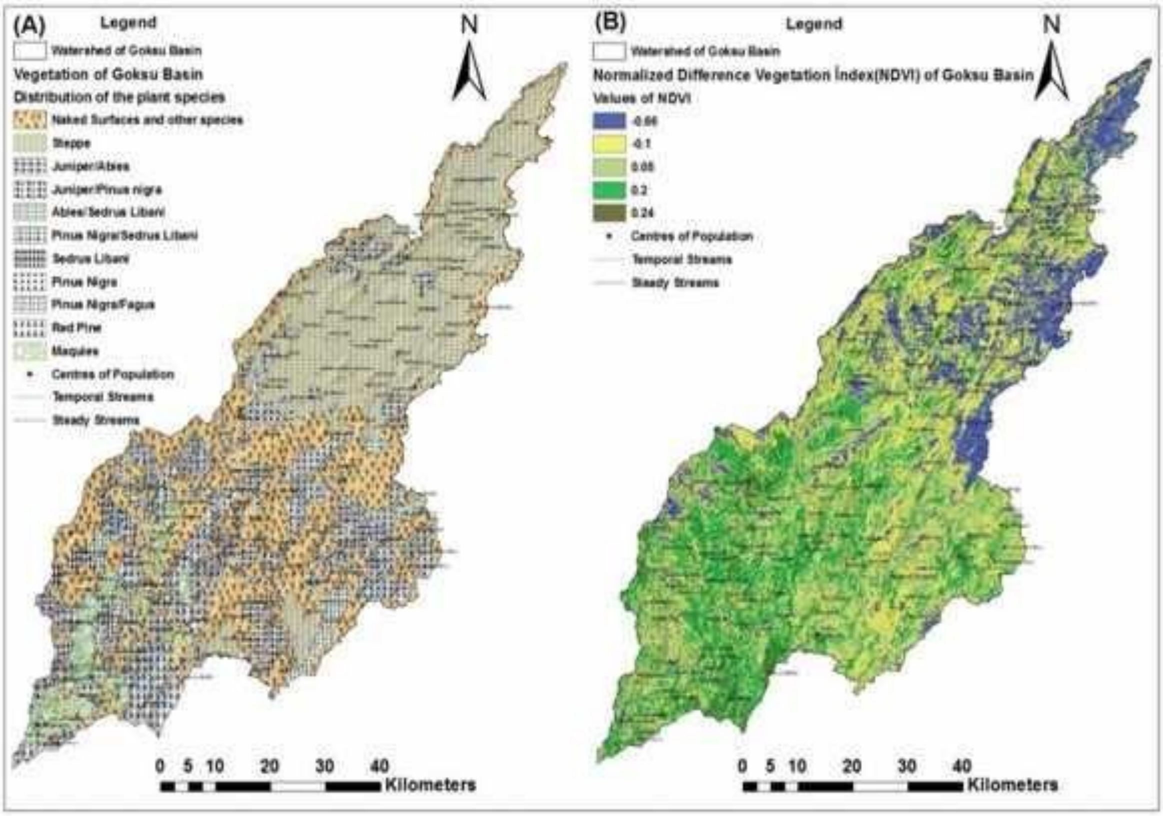
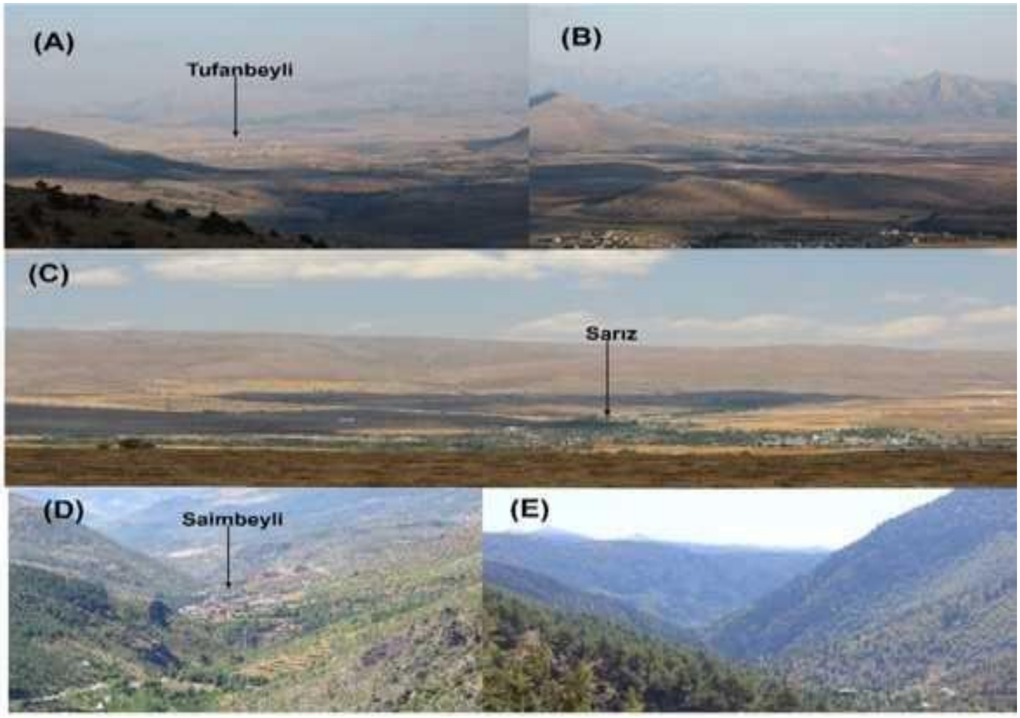


Figure 3: Distribution of Vegetation species (A) and Normalized Difference Index Values (B) in Goksu Basin **Source**:[25], (It was benefited from PhD thesis).



Photos 1: A-B-C Photos of the Goksu Basin represent the north of the field, and D-E Photos represent the south of the basin.

4. Findings

In this section, the findings regarding the index results of the formula used in determining the climate type of the Goksu basin are explained. In addition, findings of the harmony of the vegetation cover distribution of the field and the soil cover (ndvı) were determined and their visual equivalents of the basin were determined.

4.1.Index Results of Climate Formulas Used in the Study Area

According to Erinc formula (formula 1) index results, Tufanbeyli and Sarız surroundings in the north of the field show semi-arid climates with an annual index value of 15.4, while Feke and Saimbeyli surroundings in the south of the basin offer semi-humid climate characteristics with an index value of 24.6.The average of the basin has a semi- humid climate with an index value of 24.1 (Table2).When the temporal progress of Erinc formula index results is analyzed; Around Tufanbeyli and Sarız, January and February are very humid, December and March are humid, April and November are semi-humid, and the period from May to November is semi-arid. On the other hand, in the southern part of the basin, around Feke and Saimbeyli, December, January, February are very humid, March is humid, and the period from March to December has semi-humid conditions. According to this formula, the mean of the basin was found to be very humid in December, January, February, humid in November and March, and semi-humid climatic conditions from May to November(Table 2).

Table 2: The Period of Drought in Goksu Basin According to Erinç Formula

Months	J	F	M	A	M	J	J	A	S	O	N	D	Annual
İndex Values North of Basin	70	61.1	33.9	24.5	20.8	18.2	15.8	15.8	17.7	20.7	30	50.6	15.4
İndex Values South of Basin	62.2	55.3	42.1	34.2	29.3	27.1	25.4	24.9	26.3	30.3	39.6	58	24.6
İndex Values Average of Basin	76.1	67.2	45.2	34.8	29.8	26.8	24.4	24.1	26.2	30.4	41.5	64.7	24.1
İndex Scale Perhumid	Perhumid				humid				Semi-humid			Semi-drought	
Index Color													

Source:[25] (It was benefited from PhD thesis).

According to the developed Erinç Formula (formula 2), the north of the area is semi-arid with an index value of 20.2, the south of the basin is semi-arid with an index value of 19.3, and the basin average is again semi-arid with an index value of 19.7(Table 3). Here, according to monthly index results, semi-humid conditions prevailing Tufanbeyli and Sarız surroundings with index values ranging from January to June, with index values ranging from 26.7 to 30.3, while in July and August it offers values close to the very dry border with index values of 8.9 and 9. However, in September and October, it enters the semi-arid period with index values of 14.5 and 19.7, the semi-humid conditions in November and semi-arid climates again in December. While semi-humid climaticconditions prevail from December to July in Feke and Saimbeyli regions in the south of the basin, it offers semi-arid climatic characteristics from June to November. In November, a semi-arid and semi-humid climatepattern appears on the border. In the average index values of the field, semi-humid climatic conditions appear from November to June, while semi-arid climatic conditions appear in the period from July to October(Table 3).

Table 3: The Period of Drought in Goksu Basin According to Developed Erinç Formula.

Months	J	F	M	A	M	J	J	A	S	O	N	D	Annual
İndice Values NorthofBasin	30.3	27	27	27.5	31	26.7	8.9	9	14.5	19.7	27.5	20.4	20.2
İndice Values SouthofBasin	30.3	27.2	22.9	24.6	25.2	24.3	8.1	8	14	18.8	23	25.6	19.3
İndice Values Averages	30.4	27.2	24.6	26	26.7	24.3	8.5	8.4	14.2	19.2	24.9	24.3	19.7
İndex Scale	Perhumid			humid				Semi-humid				Semi-drought	
İndex Color													

Source: [25], (It was benefited from Phd thesis).

According to the Thorntwaite formula (formula 3), with an index value of 111.7, the basin is generally seen as having a very humid climate type. On the other hand, the inner parts of the basin corresponding to Tufanbeyli and Sarız surroundings are humid with an index value of 52.6,while the surroundings of Feke and Saimbeyli correspond to the humid climate class with an index value of 52.4 (Table 4).

According to the De Mortanne formula (formula 4), the result that appears in general of the basin is seen to be included in the humid climate classification with a drought index of 23.2. It is seen that in

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Tufanbeyli and Sarız surroundings corresponding to the northern parts of the basin, it is humid with an index value of 24.3, and that the south of the basin offers humid climatic conditions with an index value of 27 (Table 4).

Table 4: Index Results of Climate Classification Formulas Applied in Goksu Basin

Formulas Applied	Drought Classification (Average)	Drought İndice	The Local Stiuation of Basin			Drought İndice
			South (Downstream, Valley and Slope	Drought İndice	North (The Surrounding Tufanbeyli and	
Erinç Formula	Semi-humid	24.1	Semi-humid	24.6	Semi-drought	15.4
Thorntwaite Formula	Humid	111.7	Humid	52.4	Humid	52.6
De Mortanne Formula	Humid	23.2	Humid	27	Humid	24.3
Developed Erinç Formula	Semi-drought	20.2	Semi-drought	19.3	Semi-drought	19.7

Source: [25] (It was benefited from PhD thesis).

4.2.Comparison of the Vegetation and Soil Cover (ndvı) Characteristics of the Study Area with the Applied Climate İndex Results

In this chapter; The index results of the climate formulas applied in the basin by researchers such as Erinc, Developed Erinc, Thorntwaite, De Mortanne; It has been compared with the actual vegetation and soil cover(ndvı) characteristics of the basin. In other words, when the vegetation cover and soil cover features are compared among themselves, they are considered as complementary criteria. These criteria are the main data used to test the index results obtained from the formula application results.

In the soil cover(ndvı)classification shown in Goksu Basin; -0.66 to -0.1 values bare surfaces, rocky and water surfaces, -0.1 to 0.05 values range, vegetation weak steppe or pasture areas, 0.05 to 0.01 values range, shrub-shrub land, vineyard-garden and cultivated-planted areas, 0.01 to The range of 0.2 values corresponds to scrub-scrub, scrub-mixed forest areas, and 0.2 to 0.24 values range to dense forest areas(Figure 3/ B).

In the study; It has been observed that the distribution of the actual vegetation cover of the site is quite compatible when compared to the soil cover (ndvı). Accordingly, the north of the basin; While the range of -66 to 0.5 ndvı creates bare rocky pasture areas with weak vegetation, it corresponds to steppe areas in a similar way in real vegetation distribution. In the south of the basin, the range of 0.01 to 0.24 ndvı; shrub, scrub, maquis, mixed and dense closed forest areas, while here again harmoniously, it corresponds to forest areas with high canopy levels such as maquis, pinus brutia, pinus nigra, abies, oak, cedar. Thus, it was determined that the distribution of vegetation cover and soil cover(ndvi) characteristics of the basin largely complement each other(Figure 3/B).

Based on these data, steppe vegetation distribution areas were taken as the basis of semi-arid climate type indicators, while distribution areas corresponding to plant species such as maquis, pinus brutia, pinus nigra, cedar, abies were used to determine the humid, semi-humid climate type. In addition, these criteria are supported by visuals taken from the field (Photos 1).

5. Discussion And Results

Various climate types have been identified with the different climate classification index results of the authors mentioned above in the findings section. In particular, the climate classification formula index results, which were applied separately in the whole of the study area and in the north and south of the basin, presented the following results different from each other.

Accordingly, Erinc and developed Erinc formula index results correspond to different climate types such as semi-humid and semi-arid in the south and north of the basin(Table 4). Here, the difference in the course of precipitation and temperature parameters observed both in the basin in general and locally is reflected in the applied climate formula results. In this respect, it can be said that the parameters in these climate classification formulas are successful in reflecting local geographical conditions. In addition, Erinc formula index results successfully determined the temporal course of the basin climate on a monthly basis. Developed Erinc formula index results; While it successfully reflects the climate type in the north of the basin, it has remained far from making a successful climate classification in general and in the south. So it is partially successful.

Although Thorntwaite and De Mortanne climate classification index results reveal different numerical values, they correspond to humid climatic conditions throughout the basin and locally(Table 4). However, both the general and local meteorological conditions of the Goksu basin present distinct differences from each other in the north and south. Therefore, the climate classification index results of Thorntwaite and De Mortanne authors are incomplete or insufficient to determine the climate of the area in general and locally in the basin. Because these index results do not have the vegetation cover specified in the index. From this, it was understood that the parameters and index range in the climate classification developed by these authors did not take into account local geographical and meteorological differences.

The consistency and validity of all these climate formula index results were tested by comparing them with the existing vegetation characteristics of the basin. According to Erinc climate formula results, while the basin generally has semi-arid features, the south shows semi-humid and the north shows semi-arid features(Table 4, Photos 1). The northern part of the basin, Tufanbeyli and Sarız surroundings, successfully reflect the semi-arid climate type with steppe vegetation. In the south of the field, in Saimbeyli and Feke regions, it has formed a suitable base for semi-humid climate type with plant species such as maquis, pinus brutia, cedar, pinus nigra, abies. The climate type of the basin has been successfully determined in general and locally as these benchmark results form a great integrity with the vegetation distribution and soil cover (ndvı) characteristics(Figure 3, Photos 1).

In the improved Erinc formula climate index results, while the basin generally presents semi-arid climate type characteristics in the northern and southern areas, this situation only confirms the northern parts of the basin. On the other hand, it corresponds to the semi-arid climate type in the general and southern parts of the basin. However, there is no empty vegetation in the south of the basin, which may indicate the semi-arid climate. On the contrary, in this part, plant species such as maquis, pinus brutia, cedar and pinus nigra, which adapt to the Mediterranean climate type, are distributed. Thus, when comparing the type and distribution of the vegetation in the south of the site, the index results of the improved Erinc formula are insufficient(Figure 3, Photos 1).

The climate classification index results of authors such as De Mortanne and Thorntwaite do not confirm the existing plant species and distribution of the basin in general and locally. It is not compatible with the existing plant species and distribution of the basin. Therefore, the parameters in the climate classification formulas of the aforementioned authors; The small-scale basin or micro-climate features were insufficient to reflect(Figure 3, Photos 1). As a result, while Erinc climate formula index results applied in the basin successfully determine the climate type of the Goksu Basin in general and locally, the improved Erinc climate classification index results have been partially successful. But, the climate

classification formula index results of Thorntwaite and De Mortanne applied in the basin were insufficient to reflect the climate type of the basin.
The altitude values of the Goksu Basin, varying between 300 m and 2900 m, make it very difficult to determine a correct climate type in general and locally with a standard climate formula due to its different morphological structure such as deep valleys and slopes extending in the northeast-southwest direction, and the basin-shaped Tufanbeyli and Sarız basins in the northeast.

Suggestions

Whether it is a river basin, a small-scale basin or a large-scale field, it is important to determine a valid climate type of the area being studied. Because the planting-planting times of agricultural activities, crop yield, determining the appropriate crop pattern, seasonal water consumption related to irrigation activities, the creation of water structures that provide energy such as surface waters, dams, hydroelectricity, and natural processes, planning in almost all areas. and it will facilitate projecting.
Whether any climate classification formula is applied either on a plain topography surface or in areas with different rugged precipitation-temperature-evaporation values, the importance of the index results obtained with the application reflects the micro-climate climate characteristics in the general area and locally. The sketchy climate classification formulas that do not reflect the meteorological and geographical conditions in general and local are non-standard.

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