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# Determination of ecological conditions and geographical distribution of vegetation in the Goksu basin

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## Article Info

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**Abstract**
On the ecological conditions and distribution of vegetation in any geographical area; The mutual interaction of factors such as climate (temperature-precipitation), topography (altitude-mountain extent), soil plays an important role. In addition, these factors also determine the ecological and geographical distribution of vegetation at micro and macro levels. In this study, geographic information systems (GIS) are used as a method and here; Digital elevation model of the basin (30x30), multi-year climate data (precipitation, temperature), Erinc climate type results, soil distribution, stand distribution, plant profiles and field photographs are the materials used in the study. By processing these data, the type and distribution of vegetation in the Goksu basin were determined. According to these findings, physical factors such as altitude and the extent of the mountains have created significant differences in the precipitation and temperature distribution of the basin. This difference was clearly observed in the Erinc climate classification results, and the south of the basin presented humid and semi-humid climate characteristics, and the north presented semi-arid climate characteristics. These climatic conditions also affected the soil formation and type, causing a wide distribution of non-calcareous brown soils and non-calcareous brown forest soils in the field. As a result of all these conditions, plant species showed different vertical and spatial distribution. In the part from the south of the basin to Saimbeyli, plant species such maquis, pinus brutia, pinus nigra, Cedrus libani, Abies, Juniperus are distributed, while in the north, oak species such as oak, Bromus torhentallus, Astragalus, Thymus have been distributed. Thus, factors such as climate, topography and soil played an important role in the spread of vegetation and species in the Goksu Basin.

**Keywords:** Geography İnformation System (GİS), Topography, Vegetation, Ecology, Goksu Basin

## 1. Introduction

The planetary and geographical factors such as the angle of incidence and seasonal variation of the sun's rays, the circulation of the general atmosphere, the distribution of land, sea and oceans, the altitude, the extent of mountainous areas, and the wide terrestrial conditions surrounded by mountains provide the main climatic conditions on the earth. Climate is expressed as the average of weather events that do not change for many years in a large region or weather. Since there is a very close relationship between climatic conditions and vegetation, most climate researchers have addressed this fact. In other words, under the influence of the climatic conditions prevailing in any geographical area, the ecological conditions and distribution of the vegetation are shaped. Therefore, the climate type, which is effective on the area, is the main determining factor on the ecological conditions and geographical distribution of the vegetation.

Climate can be considered as the single factor that has the greatest global impact on vegetation distribution and its characteristics (Prentice, 1990) [27].

Changes in terrestrial vegetation; it can change local, regional and global climate on daily, seasonal and long-term scales (Bounoua *et al*., 2000; Bonan, 1997; Dickinson and Hendersen-Seller, 1998) [11, 25]. These changes caused by vegetation mean that warming increases plant growth and the growing season is prolonged (Zhou *et al*., 2001) [32]. Terrain and atmosphere are interconnected by dual hydrological and energy cycles that are a major part of the Earth's climate system (Sorooshian *et al*., 2005) [23]. Climate change has affected the global distribution of vegetation from the distant past and will likely affect it into the future (Nobre *et al*., 2006) [21]. The Mediterranean Basin represents the largest Mediterranean type ecosystem (MTE) area in the world, comprising a complex terrain with a great deal of topographical and climatic heterogeneity. Although the coastal areas are extensive due to the large archipelagos and islands in the Mediterranean, most of this area consists of mountainous terrain with many areas above 2000 m altitude and peaks reaching 4500 m altitude. The geographical location of the Mediterranean Basin is also an important factor in understanding the biodiversity of this region (Blondel *et al*., 2010) [10]. The climatic features of the Mediterranean Basin are often used to describe this region, but the dominant and common woody species such as *Quercus ilex* and *Olea europea* are also used as bioindicators of the region. The vast area of the Mediterranean Basin, combined with its topographic and climatic heterogeneity, form complex assemblages of vegetation types. There are extensive woodlands dominated by both evergreen and deciduous oak species and shrubs with evergreen *sclerophylls* in many forms (Rundel and Cowling, 2013, p. 212) [28]. These shrubs are often divided into species depending on the height of the vegetation. Tall *sclerophyllous shrubs* that may contain small evergreen trees are called *maquis*. Several Mediterranean *pine* species can be found in this community (Rundel & Cowling., 2013, p. 212) [28].

Studies show that geological, pedological and geomorphological landscape structures have a significant impact on vegetation distribution (Leschen *et al*., 2008; Maestre and Cortina, 2002; Schiller, 1982; Schiller *et al*., 2007, p. 148) [20, 29, 30]. In addition, geomorphological heterogeneity in general and the presence of rock outcrops and rock fragments in particular have been associated with the presence of high amounts of trees and *shrubs* in various studies (Burnett *et al*., 1998; Nichols *et al*., 1998, p. 372) [12, 22] and has high annual diversity (Svoray *et al*., 2005, p.338) [31]. Climate change affects forest ecosystem health through increases in average temperature, changes in precipitation patterns, and increased frequency of extreme weather events. Forest health monitoring activities are actions aimed at detecting conditions and changes in tree species and forest communities (Bussotti and Pollastrini, 2017).

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 Southern Anatolian Mediterranean Plant Community, Southern Anatolian Cedar-Ficus Mountain Forests and Alpine Plant Communities (Altan *et al*., 2007) [1]. Due to its high topography, the region is divided into three vertically, namely the Mediterranean Sub-section, where the typical Mediterranean climate prevails, the Mediterranean mountain section where mountain forests are located, and the high-mountain meadow section where *herbaceous* plants grow (Atalay, 1994, 2002, 2008) [5, 6, 8].

In this study; It is aimed to determine the ecological conditions and geographical distribution of the vegetation in the Goksu Basin. First of all, the general physical characteristics of the basin will be determined with the Aster-Gdem (30x30) digital elevation model (DEM). The species and spatial distribution of vegetation will be determined with the current stand map obtained from the institutions of the basin. In addition, the plant-profiles, which express the vertical difference in the type and distribution of vegetation, will be analyzed. It will be supported by visuals of the land in order to express concretely the type and distribution of vegetation in the field.

### 1.1 Area of Study

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), (Karaosmanoglu & Gunek 2021) [18, 19]. 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(Karaosmanoglu & Gunek 2021) [18, 19]. In the study area, the high slope values due to the relative elevation differences increased the bed slopes of the rivers in the basin and at the same time, having a tectonically cracked and faulted structure contributed to this process (Karaosmanoglu & Gunek 2021) [18, 19]. This situation also affected the vertical ecological and geographical distribution of vegetation. There are rocks of different ages and various lithological features from Paleozoic to Quaternary in the basin. These; It consists of rocks such as marble, dolomite, limestone, conglomerate, reef limestone, sandstone, neritic limestone, conglomerate, talus and alluvium. These rocks correspond to the surfaces where the topography is high and karstification is effective. On the other hand, rocks such as shale, marl, claystone and mudstone crop out throughout the basin. Within the morphological structures such as polje, uvala, doline and karst depression that developed due to these lithological factors, the species and geographical distribution of the vegetation also changes.

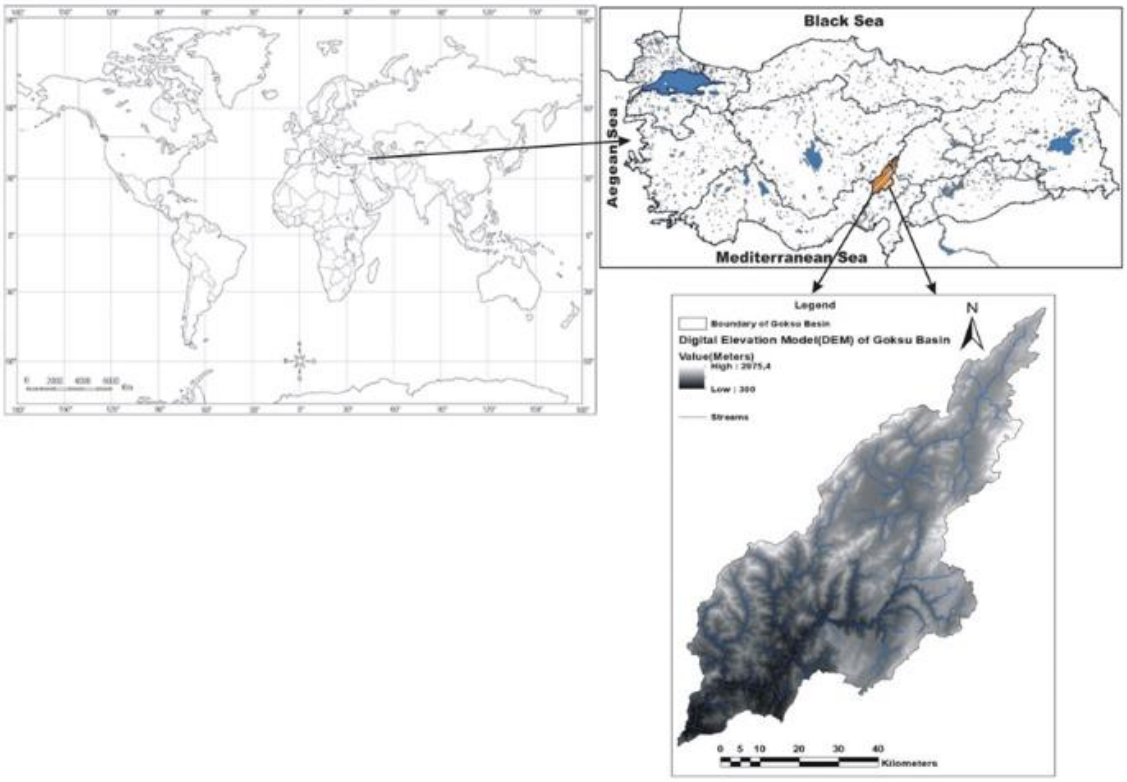



**Fig 1:** Location of Study Area

The northern and southern parts of the basin have different climatic characteristics. While the southsoutheast of the field reflects relatively Mediterranean climate characteristics in the regions of Feke and Saimbeyli, the influence of terrestrial climate characteristics is observed in the north-northeast of the field, Tufanbeyli and Sarız regions. This situation can be clearly observed in the temperature and precipitation values obtained from the station data in the basin. In the northern parts, there is an increase of 510 mm in the basin bottom and 850 mm in the surrounding mountainous areas. In the southern parts, while precipitation increases in the Feke region compared to the Adana basin, there is a high amount of precipitation of up to 1150 mm on the slopes affected by humid air masses. With the increase in elevation, it shows a decrease of about 140 mm in average annually in Saimbeyli. In the south of the basin, the annual average temperature is about 19 C.(Karaosmanoglu & Gunek 2021) [18, 19]. In the study area, various large soil groups such as non-calcareous brown forest soils, brown forest soils, chestnut soils, red Mediterranean soils, alluvial and colluvial soils were formed in the basin with the effect of parent material, climate, topography, vegetation and time. In the south of the basin where humid and temperate climatic conditions prevail, the forest soils are widely distributed, while plant species such as maquis, pinus brutia, pinus nigra, and Cedar show the distribution, while in the north, under the influence of the continental climate, Bromus torhentallus, Astragalus, plant species such as Thymus are observed.

## 2.Materials and Method

### 2.1.Materials

Perennial climate data of the study area (Table 1), Aster-Gdem (30x30) digital elevation model, physical map produced in Arc.Map with the help of geographic information systems (GIS) (Figure 4), map of soil distribution (Figure 2) map of stand distribution (Figure 3), plant profiles (Figure 3, C-C1, B-B1, A-A1), Climate classification according to Erinc and Developed Erinc formulas (Table 2) and visuals of the site (Picture 1,2) constitute the materials. In the study; According to the perennial climate data and climate classification index results, it is aimed to reveal the effects of the climate type that is effective in the basin on the type and distribution of vegetation. The soil characteristics and distribution of the basin and the ecological conditions and distribution of plant species in the area were compared. With the help of the current stand map, it is aimed to establish the relationship between the species and spatial distribution of the vegetation, the plant profiles and the physical (elevation) conditions of the plant species in the basin.

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

| Months | O | Ş | M | N | M | H | T | A | E | EK | K | A | Ort. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 919.7mm |
| 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 |
| Lack of Water (North of Basin) | - | - | - | - | - | - | 11.2 | 72.1 | 32.7 | - | - | - | 116 mm |
| Lack of Water (South of Basin) | - | - | - | - | - | - | - | 41.6 | 5.3 | - | - | - | 46.9 mm |

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

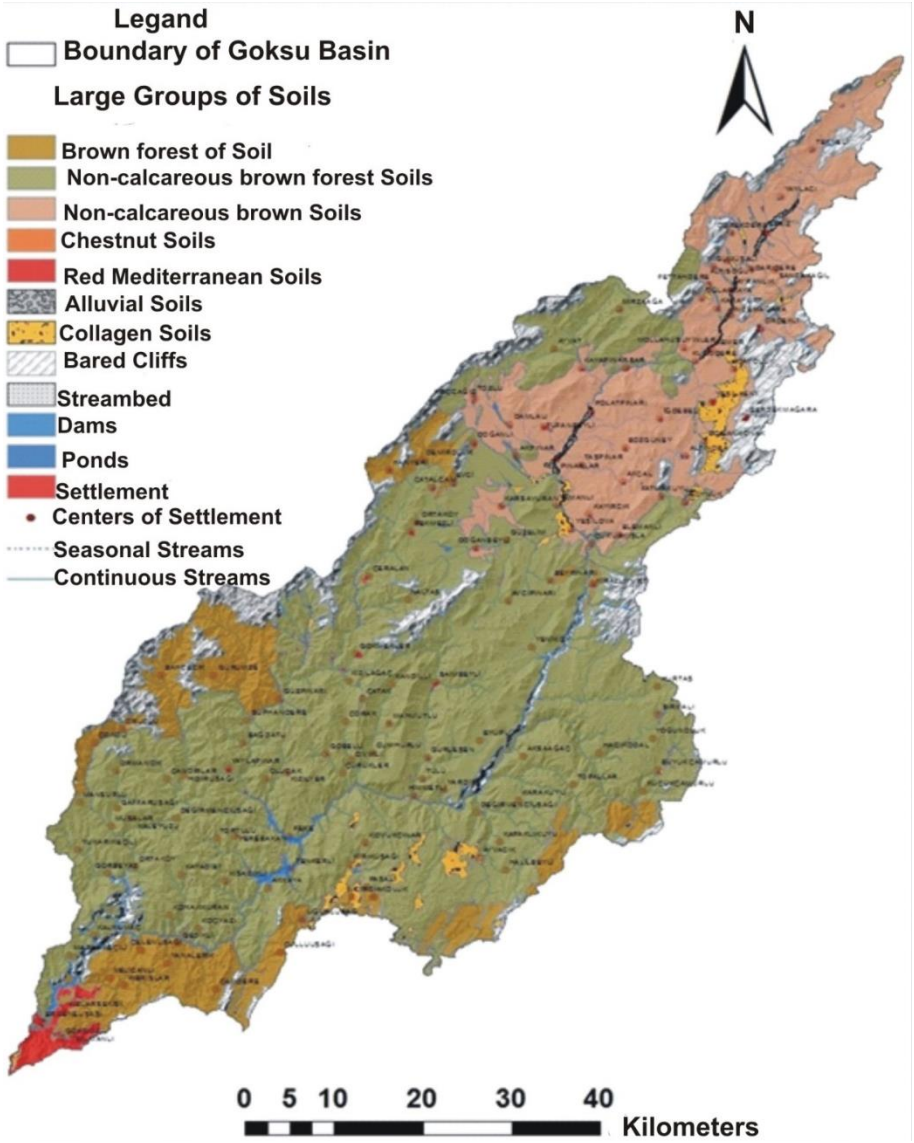



**Fig 2:** Distribution of Soil Groups in Goksu Basin,(Source: It was benefited from published PhD Thesis, Karaosmanoglu, 2020) [17].

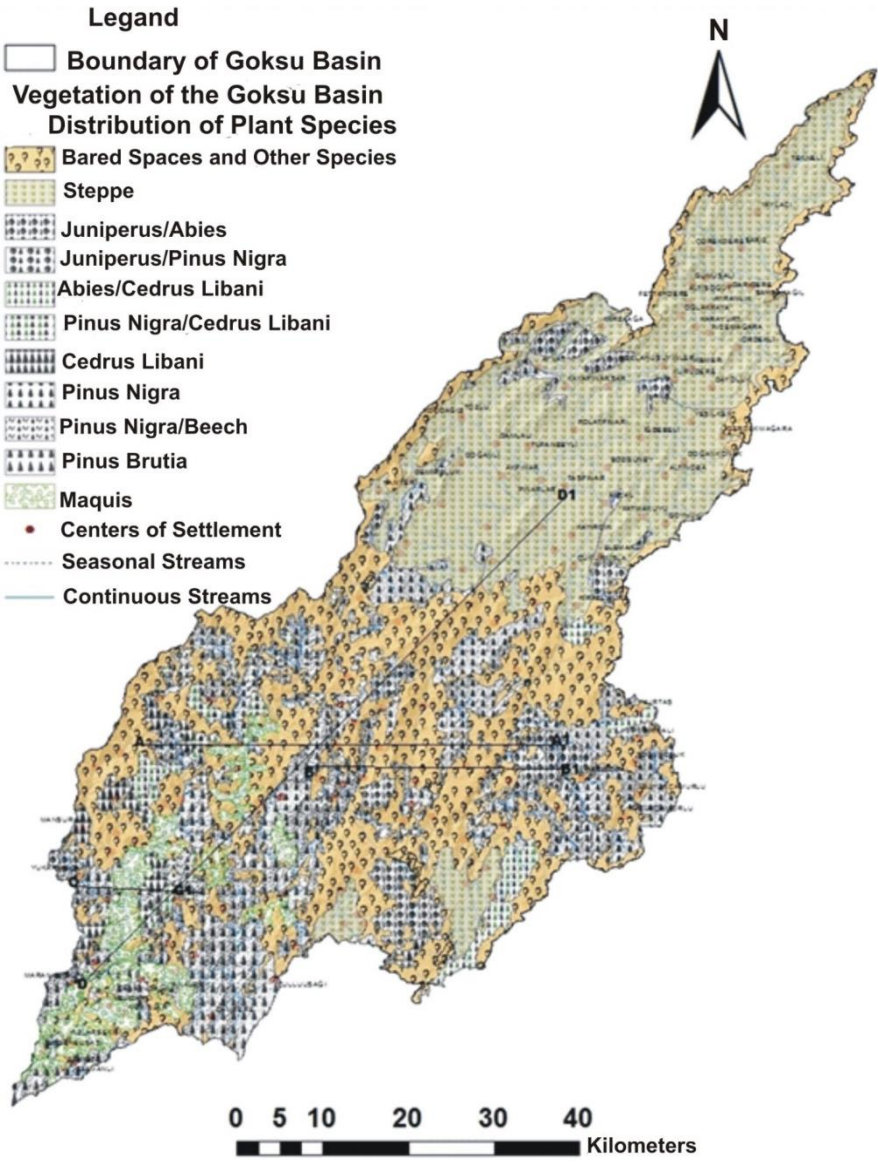



**Fig 3**: Distribution and type of Vegetation in Goksu Basin. (Source: It was benefited from published PhD Thesis, Karaosmanoglu, 2020) [17].

### 2.2. Method

In the study, geographic information systems (GIS), climate classification analysis results and field trip-observations constitute the methods applied in the field to determine the species and geographical distribution of the vegetation of the basin. Thanks to the geographical information systems, the data produced on the type and distribution of vegetation in the Goksu basin can be easily compared with the visuals of the land. Thus, it can be easily evaluated and analyzed by comparing it with the current stand map corresponding to the type and distribution of vegetation.

## 3.Findings and Discussion

The mutual influence of climate, topography and soil characteristics on the ecological conditions and geographical distribution of vegetation in the Goksu basin has been observed. Particularly, the shape of the basin surrounded by mountains in the north of the field, and the rather rough structure of the south consisting of steep and deep valleys, have affected the temperature and precipitation distribution in the field, resulting in the formation of different climate types within the basin. This situation clearly revealed the relationship between climate and topography in the field.

These mentioned conditions in the research area also shaped the formation processes of the soil. In the pedogenesis processes of the soil; Many researchers have stated that factors such as climate, parent material, topography and time are effective. While the factors mentioned in the Goksu Basin are effective on soil formation, it is possible to say that climate and topography factors come to the fore among these factors. In fact, the vegetation of the basin played a dominant role in the formation of the soil, which started with mechanical thawing at the beginning, and especially in the shaping of the soil type in the later stage. Thus, by adding vegetation to soil formation processes, it played an important role in determining the type of soil. Below are the evaluation and analysis of the climate-soil-topography factors that affect the type and distribution of vegetation in the Goksu Basin.

### 3.1. The Effects of Climate on the Species and Distribution of Vegetation in the Goksu Basin

Since Turkey is not over the source area of any air mass, it is under the influence of air masses entering from other regions according to the seasons. While it is under the influence of polar air mass intruding from the north in winter, it is under the effects of continental tropical air (cT) masses intruding

from the Sahara in summer (Atalay, 2010). The change in the annual course of the air masses as a planetary system was observed in the temperature and precipitation values in the southern and northern parts of the basin (Table 1). In the studies carried out; The significant difference in these temperature and precipitation values led to the formation of different climate types in the south and north of the field (Table 2).

**Table 2:** Index results of climate classification formulas applied in Goksu Basin.

| Formulas Applied | Drought Classifcation (Average) | Drought İndice | Local Situation of the Basin | | | Drought İndice |
|---|---|---|---|---|---|---|
| | | | South of Basin | Drought İndice | North of Basin | |
| Erinc Formula | Semi-humid | 24.1 | Semi-humid | 24.6 | Semi-drought | 15.4 |
| Developed Erinc Formula | Semi-drought | 20.2 | Semi-drought | 19.3 | Semi-drought | 19.7 |

***Source***: It was benefited from published PhD Thesis, (Karaosmanoglu, 2020) [17].

According to these studies, according to the Erinc formula index result, the basin is generally semi-humid, semi-humid in the south and semi-arid in the north. As a result of the improved Erinc formula index, it was stated that the area has a semi-arid climate feature in general and locally. It is possible to say that the Erinc formula index results from these determined climate type classifications better reflect the micro-climatic conditions of the Basin. These different climatic conditions determined the ecological conditions of plant species and distribution in the basin. In other words, climate is the most important ecological factor that determines the main characteristics of plant species and plant communities on earth and their distribution areas. The common effects of climate elements such as temperature, humidity, precipitation, wind and light play an important role in shaping the vegetation of a place (Gunal, 2013). As mentioned above, climatic factors such as temperature, humidity, precipitation, wind and light show significant differences between the northeastern parts of the field and the southern and southwestern parts of the Goksu Basin.

This situation affects the growing conditions of the vegetation in the research area and also controls the plant species and diversity (Karaosmanoglu, 2020) [17]. These conditions show the distribution of species corresponding to the characteristic Mediterranean climate type such as *maquis* and *pinus brutia* in the south of the basin, while in the north, *Bromus torhentallus*, *Astragalus*, *Thymus*, *Euphorbia*, *Festuca* species are distributed.

### 3.2. Relationships between Soil Formation Processes and Vegetation in the Goksu Basin

The first factor for soil formation is the breakdown and crumbling of parent material. Following these processes, decomposition occurs when the minerals in the rocks break down and become free. As a result of decomposition, plant residues accumulate, minerals that do not decompose accumulate and hydrotic acids are formed and ions become free (Atalay, 2006). The processes mentioned here are; These are the processes of disintegration and decomposition of the soil in the initial phase with the effect of climate. Depending on the nutrients released by the dissolution of the rocks in any area, the vegetation begins to grow slowly. As a result of the settlement of moss, lichen, various grasses, shrubs and trees anywhere; Plant roots develop, and various organic acids formed with the mixing of plant residues with the soil and humus increase further decomposition and decomposition. Thus, vegetation and the soil creatures that come with it play a very important role in soil formation (Atalay, 2006).

Here, the decomposition processes of the parent material in the basin and the subsequent nutritional values created the ecological growing conditions of various organisms and plant species under different chemical processes. In this way, ecological growing conditions of plant species that adapt to the seasonal changes of the climatic conditions of the area have been created.

After these processes, soil formation processes took place in the Goksu Basin, in which various soil organisms and plant residues gradually increased their effect, while the effect of the parent material gradually decreased. When it comes to current conditions; Although the effect of parent material such as alluvial and colluvial soils based on topographical effect is observed in the basin, soils such as non-calcareous brown forest, non-calcareous brown soils show widespread distribution (Figure 2). Thus, the presence of vegetation, the effect of which increased in the basin, became the main usa determining the soil types.

According to this, in the southern parts of the basin, which corresponds to semi-humid climatic conditions according to the Erinc climate climate classification type, where the Mediterranean climate type prevails, plant species such as maquis, red pine, black pine, cedar, and fir have ecological growing areas on the non-calcareous brown forest soils (Figure 2,3). Again, in the northern parts of the basin, which corresponds to semi-arid climate conditions according to the Erinc Climate classification type, where terrestrial climatic conditions are dominant, plant species such as Bromus torhentallus, Astragalus, Thymus are generally ecological habitats on non-calcareous brown soils. has found. However, there are also distribution areas of non-calcareous brown soils on the gorge and slopes, which correspond to the transition areas of humid air masses (Figure 2,3).

When all these processes are analyzed together; Under different climatic conditions in the Goksu basin, soil formation started with the effect of parent material and topography, and in the advancing pedagonesis processes, soil organisms and plant existence created ecological growing conditions, and vegetation-soil formation went into a close interaction. In the current process, soil formation played an important role in determining the soil type under the dominant effect of vegetation.

### 3.3. The Effects of Topographical Characteristics (Elevation-Mountain Extending) on the Species and Distribution of Vegetation in Goksu Basin

Study area; It has a very rugged topography with altitude values varying between 300 m and 2900 m, especially in the southern parts, steep and deeply split valleys by rivers, and mountainous masses extending in the northeast-southwest direction (Figure 4). This topographic structure of the basin prevented the formation of general climatic conditions throughout the basin, and different climate types were formed in the northern and southern parts. This situation affected the

species and distribution of vegetation in the basin both vertically and spatially (Figure 3). Significant differences in the vertical type and distribution of vegetation in the basin are clearly observed in the established plant profiles (Figure 3, C-C1, B-B1, A-A1).

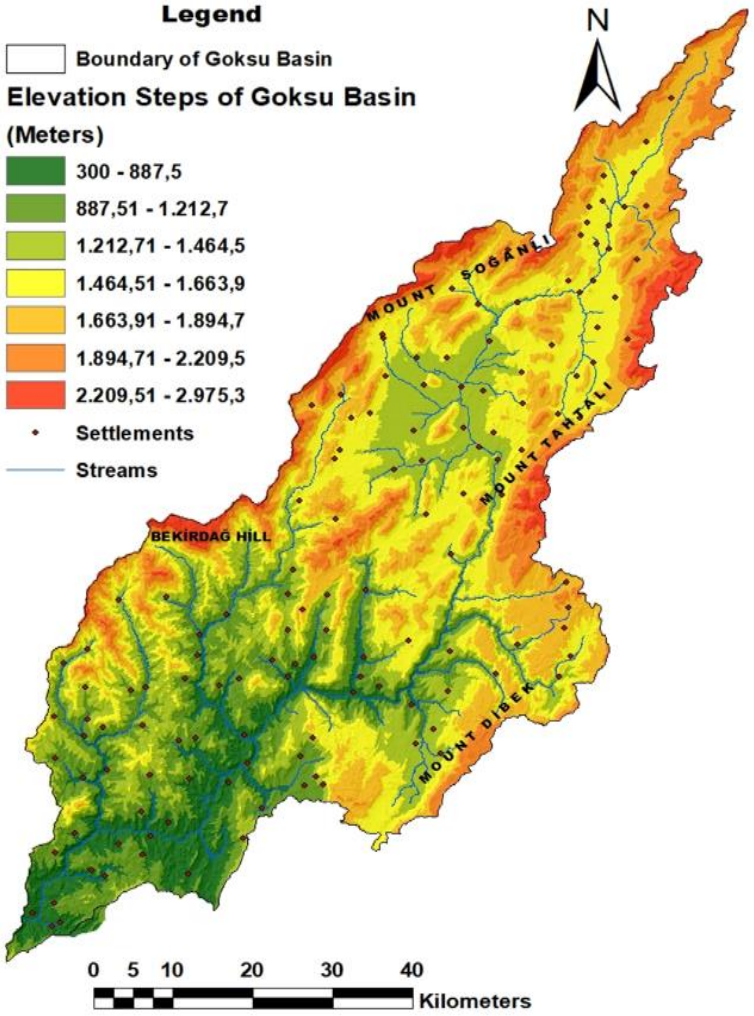



**Fig 4:** Physical Map of Goksu Basin, Source: It was benefited from published PhD Thesis, (Karaosmanoglu, 2020) [17].

*Pinus Brutia*; The climax tree of the Mediterranean climate zone is *pinus brutia*; *Maquis*, on the other hand, is a tree species that forms the lower layer of the *pinus brutia*. The dominance of the maquis in the Mediterranean climate region is the result of the removal of the red pine forest (Atalay, 2002). In the southeastern parts of the basin, it can be said that the *pinus brutia* species found a habitat between 1083-1275 m on the southwestern slopes of the Salam Stream Valley, in accordance with the evaluations given above. It is possible to encounter maquis species in local areas where *pinus brutia* species are not seen in various parts of the Salam Stream valley floor (Karaosmanoglu, 2020) [17], (Figure 5, C-C1).

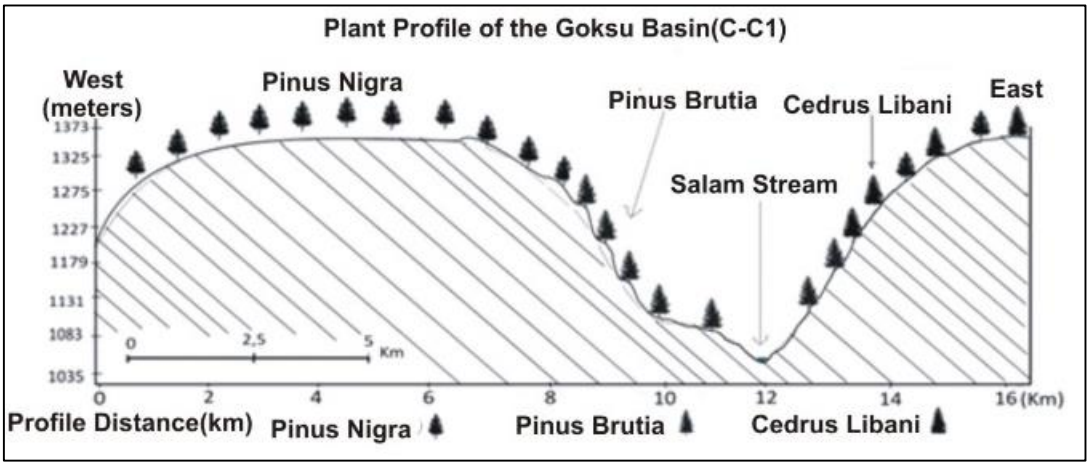


**Fig 5:** Plant Profile of Goksu Basin(C-C1), Source: It was benefited from published PhD Thesis, (Karaosmanoglu, 2020) [17].

*Taurus Cedar*; Taurus cedar, which grows on all kinds of parent materials, grows best on limestones in the Mediterranean phytogeographic region (Atalay, 1994a:211). Accordingly, the *Taurus Cedar* finds a suitable habitat on the eastern slopes of the Asmaca Stream Valley (Karaosmanoglu, 2020) [17] (Figure 5, C-C1). It has been determined that the *Taurus cedar* is distributed in various places in the study area, as well as sometimes forming vertical belts at certain elevation levels (Picture 1).

*Pinus Nigra*; It is common in areas showing transition characteristics between humid, semi-humid temperate regions and continental climate regions (Atalay, 1983a: 148). *Cedars* are common on the slopes of the Taurus Mountains facing the Mediterranean, and *pinus nigra*'s are common in the interior (Atalay, 1987c and 1990a). On the western slopes of Saimbeyli Stream, *pinus brutia* species are found at the bottom and *pinus nigra* species at high levels, while *abies* and *juniperus* species have an ecological habitat on the eastern slope (Karaosmanoglu, 2020) [17], (Figure 6, B-B1).

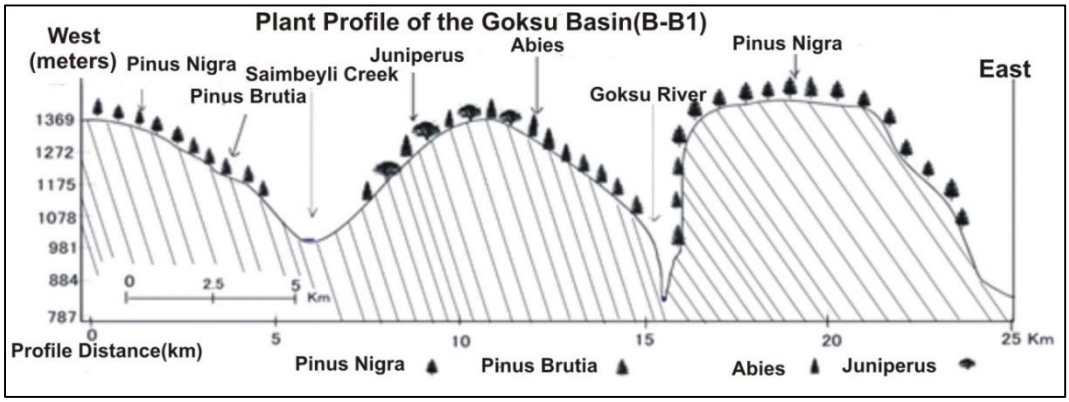
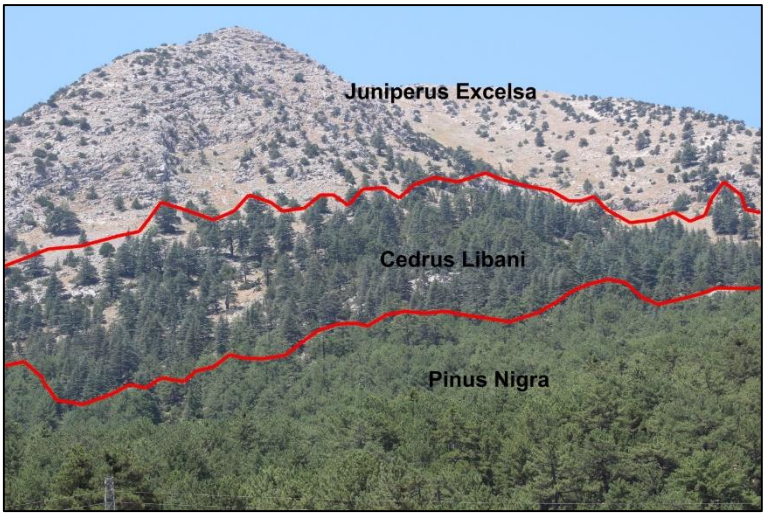



**Fig 6:** Plant Profile of Goksu Basin(B-B1), Source: It was benefited from published PhD Thesis, (Karaosmanoglu, 2020) [17].

*Juniperus* forests; *Juniperus excelsa* and *juniperus foedidissima* forests are generally seen in the Taurus Mountains. On the higher parts, Juniperus communis subsp. Nana is usually found (Donmez, 1976), (Picture 1).




**Pic 1**: Vertical Change of Plant Species such as *Pinus nigra, Cedrus libani, Juniperus* in the Goksu Basin, (looking northwest from the Saimbeyli highway).

There are tree species such as *pinus brutia* towards the eastern slopes of the Asmaca Stream Valley, *pinus nigra* with the increase in altitude, and *cedrus libani* at higher levels. As the altitude values decrease again towards Coraklı Valley, *cedrus libani /pinus nigra* continues in an alternating manner, while *pinus brutia* species are distributed in the lower levels. On both slopes of the Saimbeyli Valley, there are *Juniperus* and *Abies cilicica* species (Karaosmanoglu, 2020) [17] (Figure 7, A-A1). It has been determined that the plant species and distribution differ according to the altitude levels here. Especially *Juniperus* species are found on high karstic surfaces where temperature values decrease and soil formation is not fully developed.

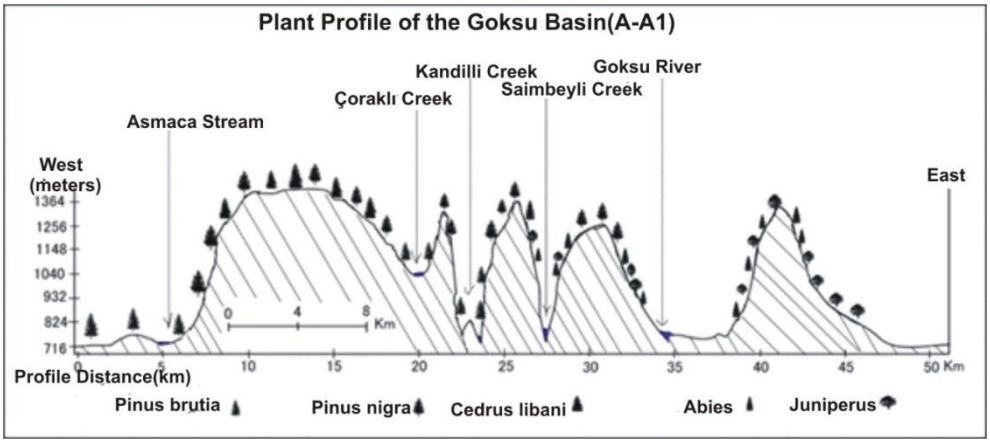



**Fig 7**: Plant Profile of Goksu Basin(A-A1), Source: It was benefited from published PhD Thesis, (Karaosmanoglu, 2020) [17].

Especially on surfaces with *juniperus* species; It indicates that precipitation and temperature values have decreased, however, a transition to terrestrial processes has been observed (Karaosmanoglu, 2020) [17]. Static factors such as the increasing altitude values in the southwest-northeast direction from the downstream of the basin, the changing altitude in short distances, and the morphological structure of the field, while being effective on the temperature and precipitation values of the basin, also played an important role on the plant species and diversity (Karaosmanoglu, 2020) [17] (Figure 8, D-D1). As a result of these, the plant ecology of the basin has been shaped. The plant species forming a habitat environment in Goksu Basin depending on the mentioned factors are *maquis, pinus brutia, pinus nigra, juniperus/cedrus libani, cedrus libani/Abies, pinus nigra/juniperus and Bromus torhentallus, Astragalus, Thymus* from southwest to northeast. It is possible to say that it forms species reflecting the *steppe* vegetation (Figure 8, D-D1).

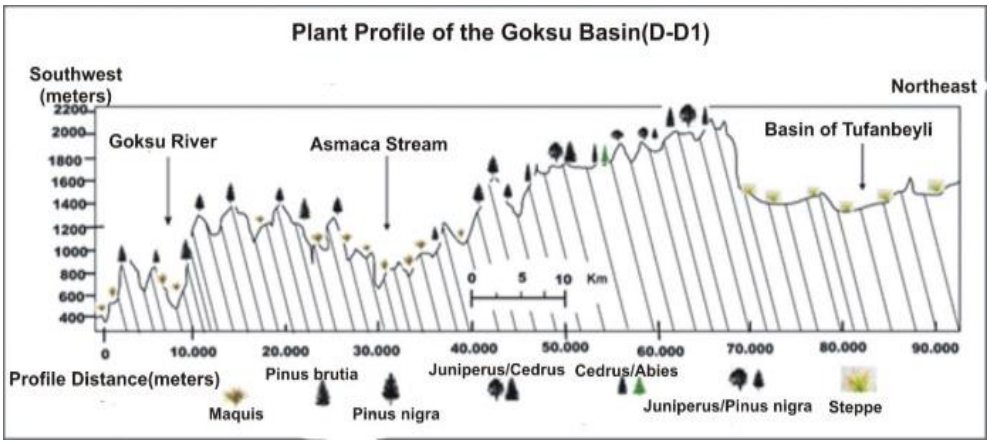



**Fig 8:** Plant Profile of Goksu Basin(B-B1), Source: It was benefited from published PhD Thesis, (Karaosmanoglu, 2020) [17].

Under the mutual strong influence of climate, soil and topography factors, plant species in the Goksu basin had various distribution areas (Table 3). Accordingly, plant species such as *maquis, pinus brutia, pinus nigra/cedrus libani, Abies/cedrus libani* have widespread distribution areas in the southern parts of the basin, where the Mediterranean climate is effective and the non-calcareous brown forest soils corresponding to the semi-humid climate type are distributed (Table 3). In the basin, *steppe* (Picture 2*)* plant species such as *Bromus torhentallus, Astragalus, Thymus* and other mountain meadows have the highest distribution area and ratio (Table 3). All these processes not only determined the species and ecological habitat of the vegetation in the basin, but also affected its geographical distribution.

**Table 3:** Areas Covered by Plant Species in Goksu Basin and Their Rates (2020).

| Plant Species | Areas ($Km^2$) | Rates (%) |
|---|---|---|
| Juniperus/Abies | 21.2 | 0.48 |
| Juniperus/Pinus Nigra | 15.54 | 0.36 |
| Steppe | 1321 | 31 |
| Abies/Cedrus Libani | 84 | 1.92 |
| Pinus Brutia | 448.3 | 10.21 |
| Pinus Nigra | 455.1 | 10.36 |
| Pinus Nigra/Beech | 25.2 | 0.58 |
| Pinus Nigra/Cedrus Libani | 44.3 | 1.0 |

| | | |
|---|---|---|
| Cedrus Libani | 75.3 | 1.72 |
| Maquis | 180.26 | 4.11 |
| Mountain Meadows and Other plant species | 1722.1 | 39.22 |
| **Total** | **4392 Km²** | **100** |

***Source***: It was benefited from published PhD Thesis, (Karaosmanoglu, 2020) [17].


**Pic 2:** (A) View of the Tufanbeyli Basin, where the *steppe* vegetation is observed, from the northwest, (B) *Astragalus*, one of the common plant species in the basin.

## 4.Conclusions and Suggestions

In this study, the species and geographical distribution and causes of vegetation in the Goksu basin were determined. Accordingly, in the type and distribution of vegetation in the basin; It has been understood that factors such as climate, soil, topography have the main effect. In order to determine the climate type of the basin, according to the Erinc Climate classification formula, vegetation and species that adapt to semi-arid climatic conditions in the north of the basin and semi-humid climatic conditions in the south have developed (Figure 3). According to this; 1-In the southern parts of the basin where semi-humid climatic conditions are effective; It has created ecological growing conditions for plant species such as *maquis, pinus brutia, pinus nigra, cedrus libani* and *abies*. 2- In the northern parts of the basin, where semi-arid climatic conditions are effective, species corresponding to the *steppe* vegetation (Picture 2) such as *Bromus torhentallus, Astragalus, Thymus* have found a habitat.

Although the effect of parent material and topography was observed at the beginning in the Goksu basin under a certain climate condition, it was determined that the effect of vegetation gradually increased in the progressive soil formation processes. In the current situation, vegetation has turned into a factor that largely determines the shaping of the soil type in the basin (Figure 3). In the type and distribution of vegetation in the basin; It is observed that there is a close relationship between soil and plant and plays an important role in the formation processes.

A bowl-shaped basin in the northern parts of the study area and a rugged topography consisting of steep and deep valleys in the southern parts (Figure 4) determined the type and distribution of vegetation in the basin. This morphological structure of the basin and the changing high altitude conditions in short distances changed the temperature-precipitation conditions at the local scale, as observed in the plant profiles (Figure 4, C-C1, B-B1, A-A1), from low to high *maquis, pinus brutia, pinus nigra*, It also affected the vertical distribution of plant species such as *cedrus libani*, *abies*, and *juniperus* (Picture 1). In addition, the mountainous areas in the basin and the extension of the valleys in the northeast-southwest direction, the humid air masses penetrated through the valleys, thus expanding the distribution area of plant species with moisture demand. As seen in Figure 8, D-D1 plant profile of the basin, it was determined that the plant species showed a clear change both in the vertical direction and by adapting to different climatic conditions. As a result, climate, soil and topography factors played an important role in the type and distribution of vegetation in the Goksu basin.

### 4.1. Suggestions

In studies to be conducted on plant species and distribution, as well as endemic species in any geographical area, first of all, the climate, topographic features and soil formation processes should be examined in detail, and the relations between each other should be determined thoroughly. Then, the effect levels of the vegetation on the soil formation process should be determined and the plant species and distribution of the area should be explained in a rational way.

### Abbreviation

**C°:** Temperature; **cT**: Continental Tropical Air; **ET**; Evapotranspiration; **GİS**: Geography İnformation System; **MTE**: Mediterranean Type Ecosystem; **P**: Precipitation.

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