

Constant Monitoring Parcels' System that Set Up in Seyhan River Basin and Vegetation Analyses

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1. Introduction

Mediterranean Basin presents the best example for the human impacts on natural structure particularly natural vegetation where the oldest civilisations had taken place. Degradation of nature in Turkey leads the loss of important habitats, endemic and unique plant cover where the plant cover is a perfect indicator that showing us the transformation on nature caused mostly by anthropogenic and sometimes by natural phenomena such as climate change.

Based on the examination of plant cover of Seyhan River Basin on floristic and vegetation viewpoint in this research species distribution and cover levels were indicated in 4-selected different locations which are Kaledağ, Kükürt Basin, Keçikalesi and Katran Çukuru and transects of natural plant cover distribution from each location were taken. Study results will be quite useful to observe the changes on the selected monitoring parcels and to find out the effects of anthropogenic activities and climate change on natural structure and vegetation.

Species distribution and coverage degrees were indicated in 4-selected different locations which are Kaledağ, Kükürt Basin, Keçikalesi, ve Katran Çukuru in this research in which natural vegetation of Seyhan River Basin has been examined and transects of natural plant cover distribution from each location were taken.

Ecological information that were taken from "exemplifying parcels" where studies on flora and vegetation have being carried out will be an useful tool to run a regular monitoring and analyses and evaluations within the project will be also first coming data sets in monitoring.

Changes on both land use patterns in Seyhan River Basin and consequently on vegetation will help us to make accurate presumption for the future and

particularly restoration of degraded areas. Furthermore that information will be used in indication of typical vegetation, landscapes, biotopes and habitats as well as negative effects and protection of natural remnants

Studies on vegetation include quadrant works on exemplifying parcels, field works and coloured pictures where field works in the region cover different plant cover types and formations starting from sea level in Çukurova plan and orcal zones up in the Taurus Mountains.

As rainfall, humidity, wind direction and soil features are the most indicative factors in plant cover distribution transects were selected on the South-North and East-West directions using satellite images. Because particularly topography, climate and soil conditions that also effecting each other are very variable in the region diverse vegetation forms and formations have been appeared from lower plain parts to Taurus orcal zones. Leaving from arid plains up to mountains diversity in the vegetation increases due to rising rainfall and as well as rain-soil relations.

In this research Natural Vegetation of Seyhan River Basin has being investigated within the framework of international project "Impact of Climate Change on Agricultural System" carried out under the cooperation of Tubitak (The Scientific and Research Council of Turkey) and Japanese-RHIN (Research Institute for Humanity and Nature) and results of vegetation analyses that carried out in Kaledağ, Kükürt Basin, Keçikalesi, ve Katran Çukuru where constant monitoring parcels are selected were presented in this paper.

2. Research Area and Method

General situation of research area is given in Figure 1 where Seyhan River Basin starts with Çukurova delta an important coastal ecosystem on ecological bases extends to the Çukurova plain flats with 150 meters in the middle parts goes up to transition areas.. Moving to the north (particularly after Kadirli and Kozan) research area reaches 3000 meters and above in Taurus Mountains.

Aladağ Mountains and middle Taurus rising on the north Adana province and having many features also situate on upper parts of the Seyhan River Basin divided from Bolkar Mountain by Tekir lowlands and Ecmis corridors and bordered by Zamantı River and Tektek Mountains on the north. Highest point is Demirkazık Summit with 3.756 meters (Altan 2000).

Most part of the Aladağlar Mountains has arid and carstic characters while huge block rocks and rock heaps are found on orcal (high mountain) and sub-alpine zones. Apart from springs that flow from mountains, alpine zone with glacial round formed topography represents the areas of rich water existence with many lakes (Altan, 2000).

Examination of Natural vegetation of Seyhan River Basin on the floristic and vegetation viewpoint is aimed in this study as well as assessing and analysing the relationship between plants and growing conditions. Relatively to select "Exemplifying Parcels" that representing the whole basin natural plant formation maps for the basin were produced both from previous literatures and field work on the first hand and pre-classification of natural plant cover formations for Seyhan River Basin was outlined (Figure 2).

Taking the size of the research area into consideration it was decided to choose transects that able widespread sampling in order to carry out an effective fieldwork. For this aim using Landsat 7 ETM satellite images dated 2002 simple classification of the basin was realised and compared with the plant formation map and consequently as given in Figure 3, situation of the constant monitoring parcels with selected locations and simplified classification of natural vegetation in Seyhan River Basin were determined.

As an application of provided information three transects that covering all the plant formations in the

basin came out as alternatives (Figure 4). To decided only one transect amongst three; these transects were examined in the field where natural plant formations that best representing plant diversity and characteristics supported by the satellite images were greatly regarded. Moreover accessibility was taken as a most important criteria presuming that the exemplifying parcels that selected on these transect will be analysed three times a year.

As a result of field examinations and taking all the criterion followed above Transect 1 was chosen as most suitable one. Giving priority to high mountain parts of the basin because the climate conditions become severe in early autumn exemplifying parcels were indicated on the selected transects as covering all the plant formation types.

After completing detailed examination of plant formations total number of 26 20x20 meters in size and total number of 18 100x100 meters in size "Constant Monitoring Parcels" in four different points were selected. These localities are; Kükürt Basin, Kaledağ, Keçikalesi and Katran Çukuru.

Selected parcels on four-above mentioned localities have being analysed at least two times a years with additional two times checking during two years which is based on Braun-Blanquet (1964) method. Furthermore in order to bring out soil characters, soil samples were taken from each parcels which have been examined through chemical and physical features in the laboratory. At the same time comparison of satellite images of Landsat 5 TM dated 1985 with Landsat 7 ETM dated 2002 has been continuing so that it would be possible to indicate changes both on natural vegetation and land uses in the selected transects and their environs.

3. Founding and Results

Vegetation analyses have been carried out selected exemplifying monitoring parcels in above mentioned four different localities at least two times a year for the last two years.

3.1. Kaledağ

Starting at 1100 meters Kaledağ locality can reach up to the level of 1450 meters. On the lower elevations at 1100-1250 meters dominant species are *Pinus brutia* Ten., *Juniperus oxycedrus* and *Styrax officinalis* that are followed by *Quercus pubescens*

Quercus cerris and *Ostrya carpinifolia* on higher parts. On the midpoint elevations Juniperus-Quercus plant associations are found in this location where *Juniperus oxycedrus*, *Juniperus drupaceae*, *Quercus cerris*, *Quercus pubescens* and *Ostrya carpinifolia* are commonly found. *Abies cilicica* is the most dominating species on the upper parts of Kaledağ location (Figure 5).

Plant species and their coverage degrees that indicated though the field works so far in Kaledağ location are given in Table 1.

3.2. Kükürt Basın

Kükürt Basın locality reaches up to sub-alpine zone on the southern parts in Demirkazık hill. Lowest elevation of the locality is 1400 meters while highest elevation is 2100 meters. There are total number of 6 20x20 meters and 4 100x100 meters constant monitoring parcels were selected in Kükürt Basın locality.

Kükürt Basın locality has south, south-east slopes and dominating tree species is *Pinus nigra*. On the lower elevations *Juniperus oxycedrus* is found together with *Pinus nigra*. Moving further upper parts *Cedrus libani* is widely grown (Figure 6) where *Juniperus oxycedrus* is locating in form of bush cover. This is believed to be leading by anthropogenic effects rather than natural factors.

Plant species and their coverage degrees that indicated though the field works so far in Kükürt Basın location are given in Table 2.

3.3. Keçi Kalesi

Starting from 1300 meters Keçi Kalesi locality goes up to 1900 meters. There are total number of 8 20x20 meters and 6 100x100 meters constant monitoring parcels were selected in this locality. On the lower elevations between 1300-1500 meters deciduous and evergreen pines are found in mix forests. Characterising species are *Juniperus oxycedrus*, *Juniperus excelsa*, *Quercus pubescens*, *Quercus cerris*, *Fraxinus angustifolia* and *Styrax officinalis*.

On the upper parts at 1500 meters solid forest of *Pinus nigra* becomes common. On the same

elevations *Juniperus oxycedrus* ve *Quercus pubescens* are sparsely found in *Pinus nigra* forests. On the areas at 1850 meters and above *Cedrus libani* is grown as solid forests. However there are great human impacts on cedar forest (Figure 7).

Plant species and their coverage degrees that indicated though the field works so far in Keçi Kalesi location are given in Table 3.

3.4. Katran Çukuru

Starting from 1150 meters and reaching up to 1600 meters there are total number of 6 20x20 meters and 4 100x100 meters constant monitoring parcels selected in Katran Çukuru locality. On the lower elevations between 1150 and 1400 meters solid deciduous forests of *Pinus brutia* become apparent where *Juniperus oxycedrus*, *Juniperus excelsa* and *Daphne oleoides* are other frequently found woody species. On the upper parts after 1400 meters *Pinus nigra* is mix with *Juniperus excelsa* and *Quercus cerris*. On the elevations after 1500 meters *Cedrus libani* rarely join to dominating solid *Pinus nigra* forests (Figure 8).

Plant species and their coverage degrees that indicated though the field works so far in Katran Çukuru location are given in Table 4.

3.5. Soil Characters

Furthermore soil samples were taken to indicate soil features in all selected constant monitoring parcels and their physical and chemical characters were examined in the laboratory and the results are given in Table 1.

According to soil analyses 9 out of total 26 20x20 meters parcels have sandy-loamy, 6 of them are clay-loamy, 6 of them are only loamy and 5 of them are sandy-clay-loamy soil characteristics. At the same time soils from all parcels have low acid components, low salt and lime ingredient

In general soil samples that taken from exemplifying parcels have almost similar characteristics which proofs that there is not a direct relation between natural vegetation and soil types and therefore physical soil characteristics have not strong impacts on plant cover.

Comparative studies on satellite images of Landsat 5 TM dated 1985 and Landsat 7 ETM dated 2002 have been still continuing. Here indication of both land use changes and vegetation changes on and around the selected parcels are targeted.

At the same socio-economic studies with a parallel programme in rural settlements in the basin were started.

4. References

- Altan, T., 2000. Doğal Bitki Örtüsü, Ders Notları, Ç.Ü. Zir. Fak. Yayınları, Ders Kitapları Yayın NO: A-76, Adana.
- Braun-Blanquet, J., 1964. Pflanzensozioologie. Springer-Verlag, Vien, Newyork.

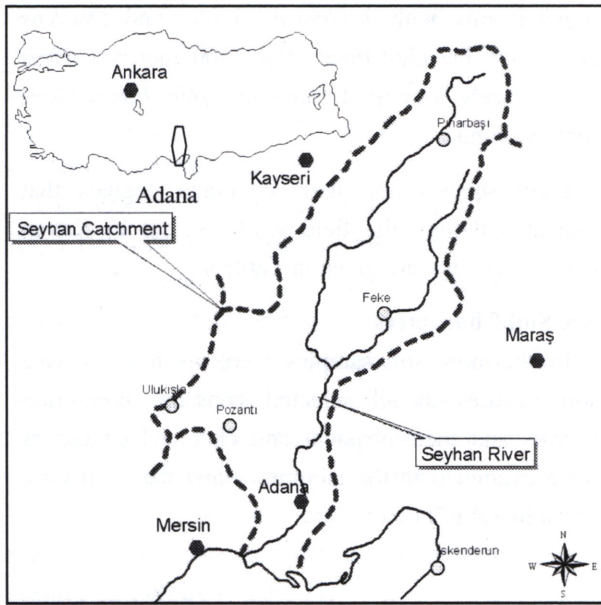


Figure 1. General Situation of Research Area

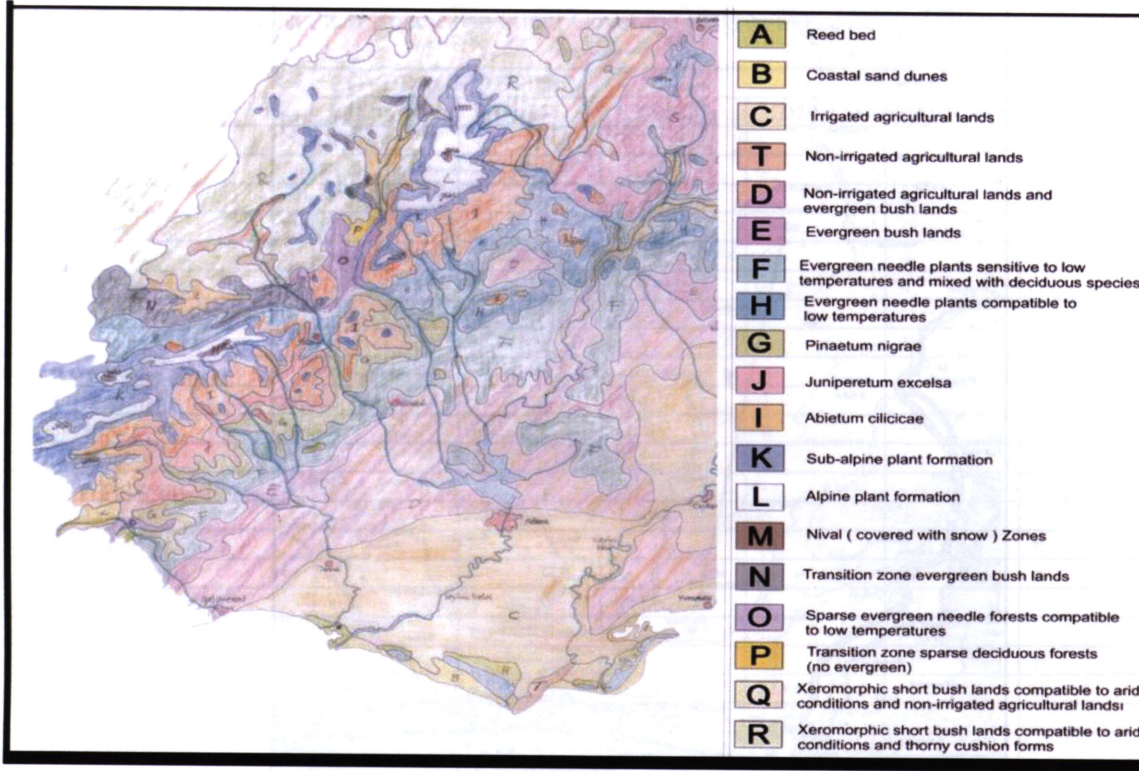


Figure 2 Pre-Classification of Natural Plant Cover Formations for Seyhan River Basin

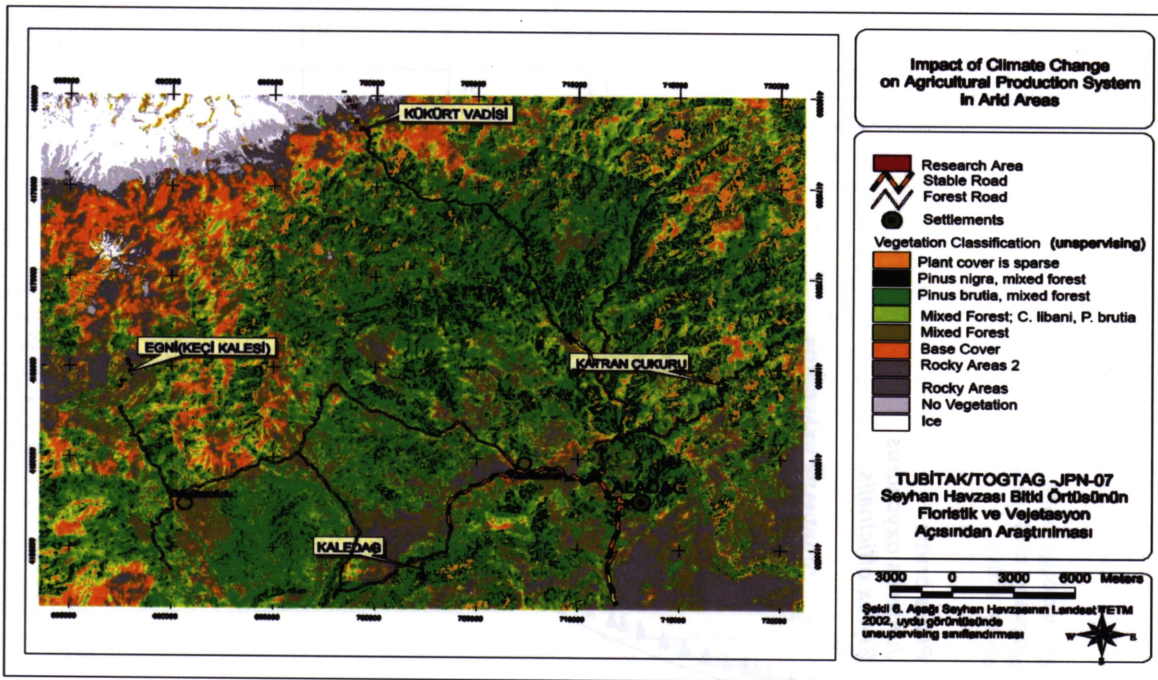


Figure 3 Situation of the Constant Monitoring Parcels with Selected Locations and Simplified Classification of Natural Vegetation in Seyhan River Basin

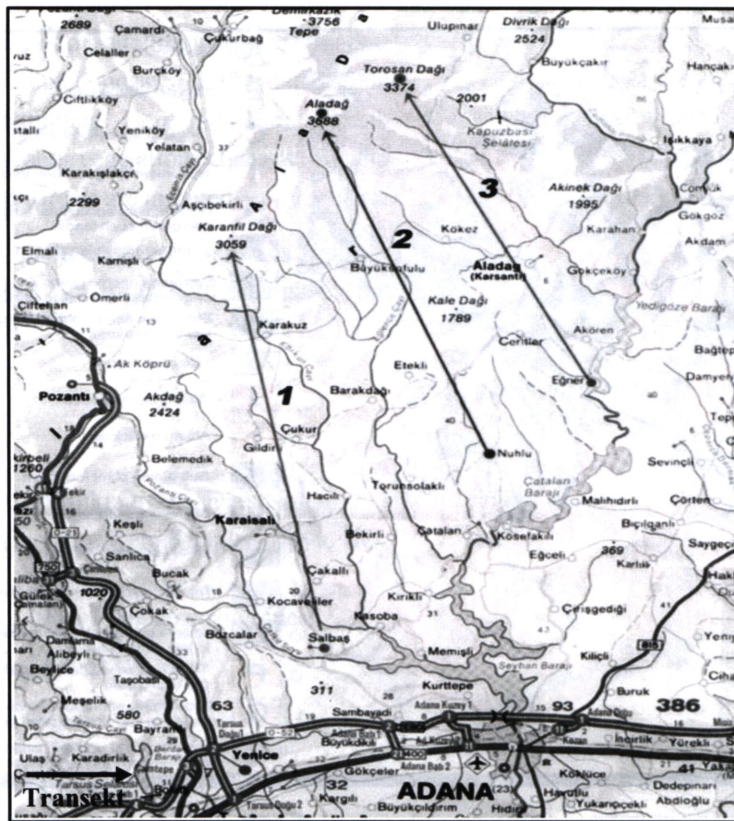


Figure 4 Selected Transects that Representing all Plant Formations in the Basin

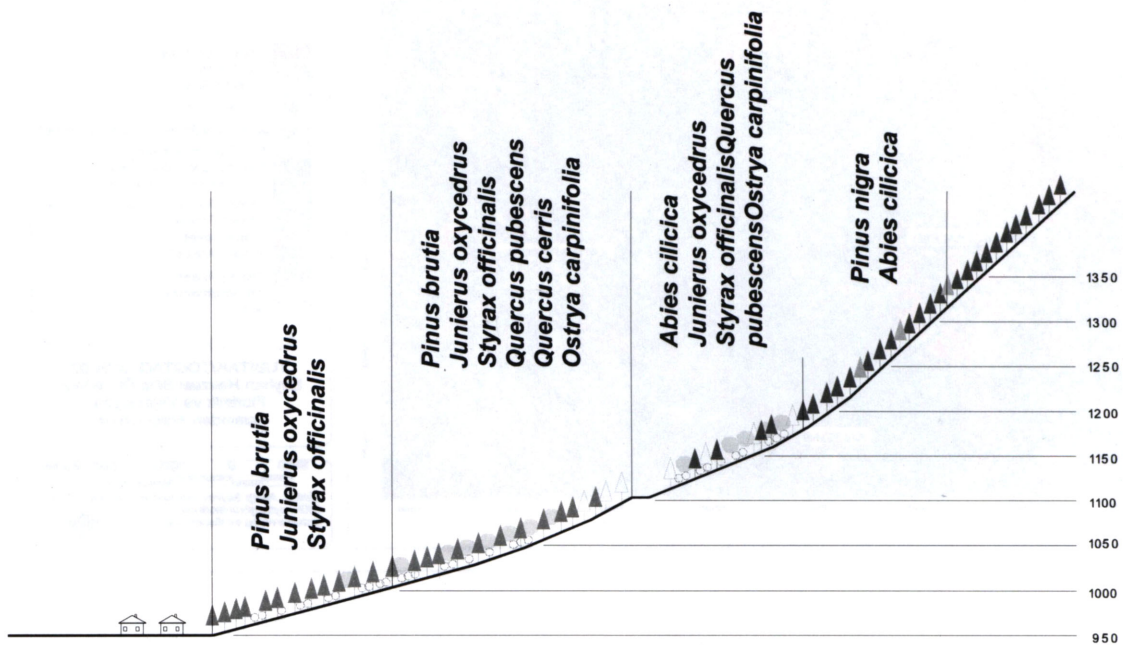


Figure 5 Transect of Natural Vegetation in Kaledağ Locality

Table 1 Indicated Plant Species and their Coverage Degree in Kaledağ Locality

SPECIES	COVERAGE DEGREE					
	KD20.1	KD20.2	KD20.3	KD20.4	KD20.5	KD20.6
<i>Pinus brutia</i>	4	4	2	-	-	-
<i>Pinus nigra</i>	-	-	-	-	-	n
<i>Abies cilicica</i>	-	-	-	3	3	1
<i>Cedrus libani</i>	-	-	n	-	-	-
<i>Juniperus oxycedrus</i>	n	-	-	-	-	-
<i>Juniperus drupaceae</i>	-	-	-	-	n	+
<i>Quercus pubescens</i>	-	n	-	+	-	1
<i>Quercus cerris</i>	-	-	+	-	1	-
<i>Ostrya carpinifolia</i>	-	-	-	n	-	+
<i>Styrax officinalis</i>	1	1	1	1	1	-
<i>Phlomis sp.</i>	-	-	-	n	+	-
<i>Alyssum murale</i>	n	n	2	+	+	+
<i>Ostrya carpinifolia</i>	-	-	-	-	-	-
<i>Salvia sp.</i>	-	-	-	n	+	+
<i>Teucrium chamaedrys</i>	-	-	-	n	-	n
<i>Cirsium lappaceum</i>	-	-	-	n	-	n
<i>Helichrysum armenium</i>	-	-	-	n	n	-
<i>Stachys cretica</i>	-	-	-	n	n	-
<i>Asphodeline damascena</i>	-	-	-	-	-	n
<i>Dianthus zonatus</i>	n	-	n	-	-	n
<i>Torilis leptophylla</i>	n	-	-	-	-	-
<i>Alyssum peltarioides</i>	n	-	-	-	-	-
<i>Festuca anatolica</i>	n	n	-	-	n	-
<i>Rubus sonchus</i>	-	n	-	-	-	-
<i>Cheilanthes marantae</i>	-	n	n	-	-	-
<i>Fragaria vesca</i>	-	n	-	-	n	-
<i>Xeranthemum annum</i>	n	-	-	-	-	-
<i>Asyneuma limonifolium</i>	-	-	-	-	n	n
<i>Astragalus creticus</i>	-	-	-	-	-	n
<i>Zizypus lotus</i>	n	-	-	-	-	-
<i>Verbascum sp.</i>	-	n	-	-	-	-
<i>Stachys pinetorum</i>	-	n	n	-	-	-
<i>Daphne sericea</i>	-	-	n	-	-	-

n: Rare +: Sparse 1: %25 2: %50 3: %75 4: %100

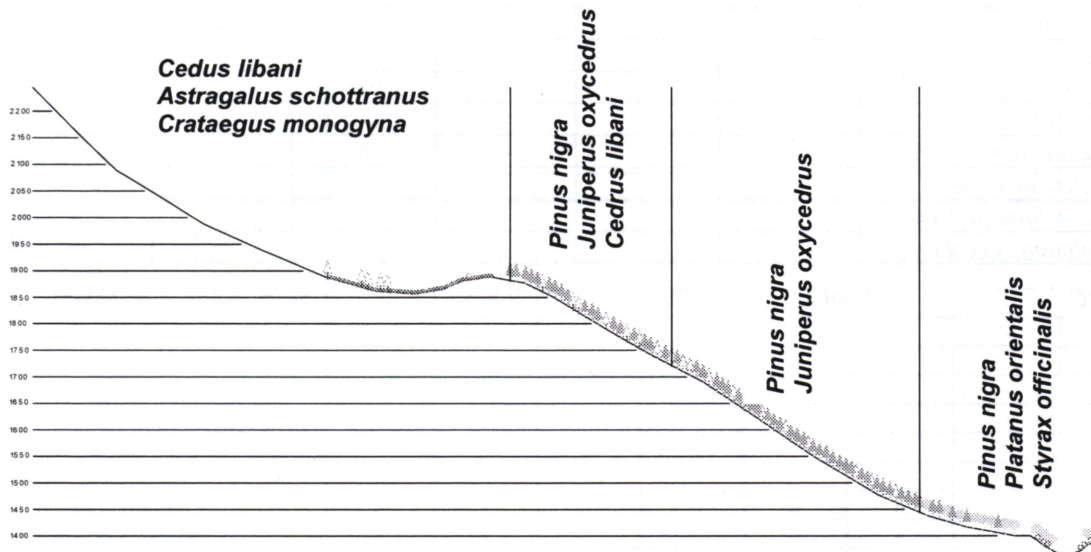


Figure 6 Transect of Natural Vegetation in Kükürt Basin Locality

Table 2 Indicated Plant Species and their Coverage Degree in Kükürt Basin Locality

SPECIES	COVERAGE DEGREE					
	KH20.1	KH20.2	KH20.3	KH20.4	KH20.5	KH20.6
<i>Pinus nigra</i>	1	1	1	-	-	-
<i>Juniperus oxycedrus</i>	1	1	1	-	-	-
<i>Cedrus libani</i>	-	-	n	-	-	-
<i>Criptomeria japonica</i>	n	-	-	n	-	-
<i>Alyssum minus</i>	+	-	-	+	-	-
<i>Scabiosa sp.</i>	+	-	-	-	-	-
<i>Themeda sp.</i>	+	+	+	-	-	-
<i>Cardulus sp.</i>	n	-	-	-	-	-
<i>Echinops ritra</i>	n	-	-	-	-	-
<i>Asphodeline damascena</i>	n	n	+	n	n	n
<i>Galium consanguineum</i>	n	1	+	n	-	-
<i>Alyssum corsicum</i>	+	+	n	-	-	-
<i>Silene compacta</i>	n	n	n	n	-	-
<i>Dactylorhiza osmanica</i>	n	-	-	-	-	-
<i>Marrubium anisodon</i>	n	+	-	-	-	-
<i>Nepeta stricta</i>	n	-	-	n	n	-
<i>Alyssum murale</i>	1	-	-	n	-	-
<i>Ziziphora tennior</i>	+	-	-	+	-	-
<i>Astragalus creticus</i>	+	-	-	-	-	-
<i>Bromus sp.</i>	n	-	-	-	-	-
<i>Sideritis syriaca</i>	n	-	-	n	-	-
<i>Galium verum</i>	-	-	1	-	n	n
<i>Sedum lanolicum</i>	-	-	n	-	-	-
<i>Dianthus zonatus</i>	-	-	n	n	-	n
<i>Amygdalus orientalis</i>	-	-	-	n	-	-
<i>Astragalus schottranus</i>	-	-	-	4	4	4
<i>Verbascum sp.</i>	-	-	-	+	n	+
<i>Onopordum sp.</i>	-	-	-	+	-	-
<i>Achillea cappadocica</i>	-	-	-	n	n	-
<i>Festuca anatolica</i>	-	-	-	n	n	+
<i>Galium sreheanum</i>	-	-	-	n	n	-
<i>Rosa canina</i>	-	-	-	-	+	+
<i>Daphne sericea</i>	-	-	-	-	n	n
<i>Echinops ritro</i>	-	-	-	-	n	-
<i>Helichrysum armenicum</i>	-	-	-	n	+	-
<i>Thymus leucotrichus</i>	-	-	-	-	+	-
<i>Hypericum lanuginorum</i>	-	-	-	n	-	-
<i>Acantholimon venestum</i>	-	-	-	-	n	n

n: Rare

+: Sparse

1: %25

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3: %75

4: %100

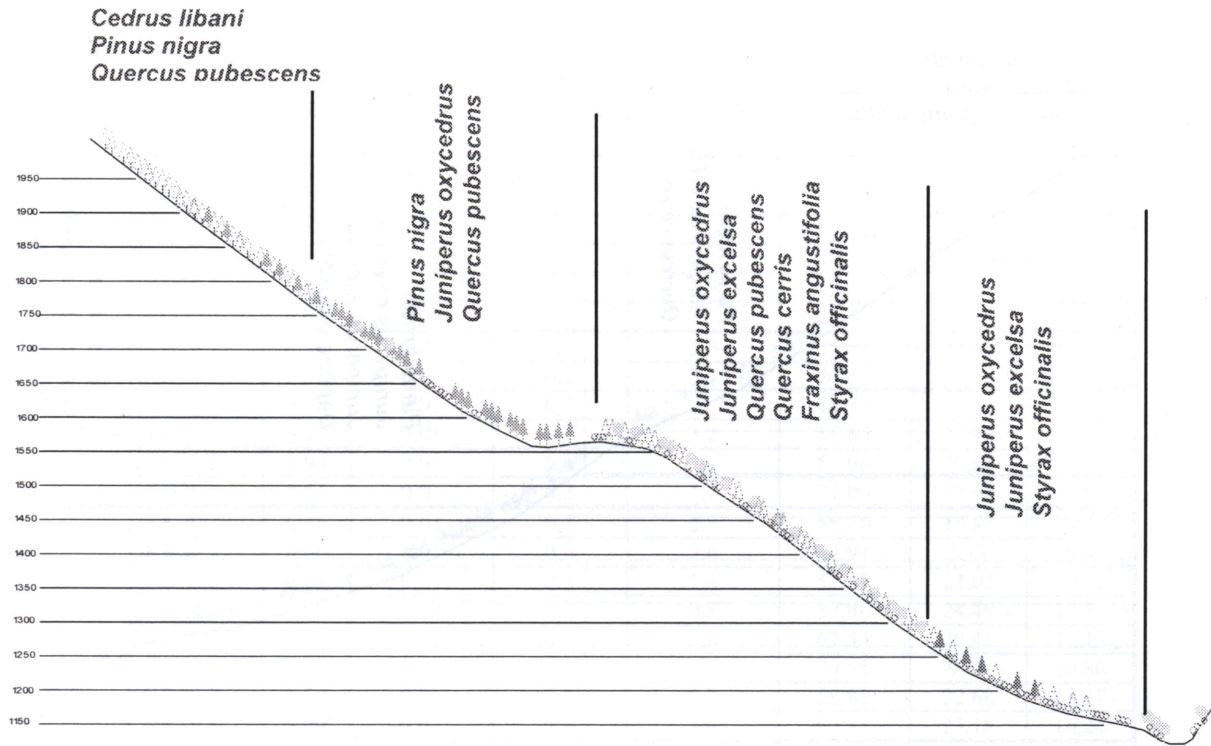


Figure 7 Transect of Natural Vegetation in Keçi Kalesi Locality

Table 3 Indicated Plant Species and their Coverage Degree in Keçi Kalesi Locality

SPECIES	COVERAGE DEGREE							
	KK20.1	KK20.2	KK20.3	KK20.4	KK20.5	KK20.6	KK20.7	KK20.8
<i>Juniperus exelca</i>	1	-	1	-	-	-	-	-
<i>Juniperus oxycedrus</i>		1	-	-	n	n	1	-
<i>Strax officinalis</i>	1	1	1	-	-	-	-	-
<i>Quercus cerris</i>	+	1	-	-	-	-	-	-
<i>Quercus pubescens</i>	-	-	1	-	n	n	-	-
<i>Fraxinus angustifolia</i>	+	-	-	-	-	-	-	-
<i>Cedrus libani</i>	-	-	-	-	-	-	3	1
<i>Pinus nigra</i>	-	-	-	4	2	3	n	-
<i>Euphorbia sp.</i>	n	n	-	-	-	-	n	-
<i>Aegilops sp.</i>	+		-	-	+	+	n	n
<i>Asphodeline damascena</i>	n	n	+	-	-	-	-	n
<i>Galium consangineum</i>	+	-	-	-	-	-	-	-
<i>Echinops ritro</i>	n	-	-	-	-	-	-	-
<i>Avena sp.</i>	n	-	-	-	-	-	-	-
<i>Themeda sp.</i>	1	1	-	-	-	-	-	-
<i>Rosa canina</i>	-	n	n	-	-	-	-	-
<i>Amygdalus orientalis</i>	-	+	-	-	-	-	-	-
<i>Bromus sp.</i>	-	n	n	-	-	-	-	-
<i>Galium sreheanum</i>	-	-	+	-	-	-	-	-
<i>Verbascum sp.</i>	-	-	+	-	-	-	-	-
<i>Carduus natans</i>	-	-	n	-	-	-	n	+
<i>Thymus leucotrichus</i>	-	-	+	-	-	-	-	-
<i>Astragalus creticus</i>	-	-	-	-	n	n	n	-
<i>Astragalus schottramus</i>	-	-	-	-	-	-	n	+
<i>Festuca anatolica</i>	-	-	-	-	-	-	n	-
<i>Sedum laconicum</i>	-	-	-	-	-	-	n	-

n: Rare

+: Sparse

1: %25

2: %50

3: %75

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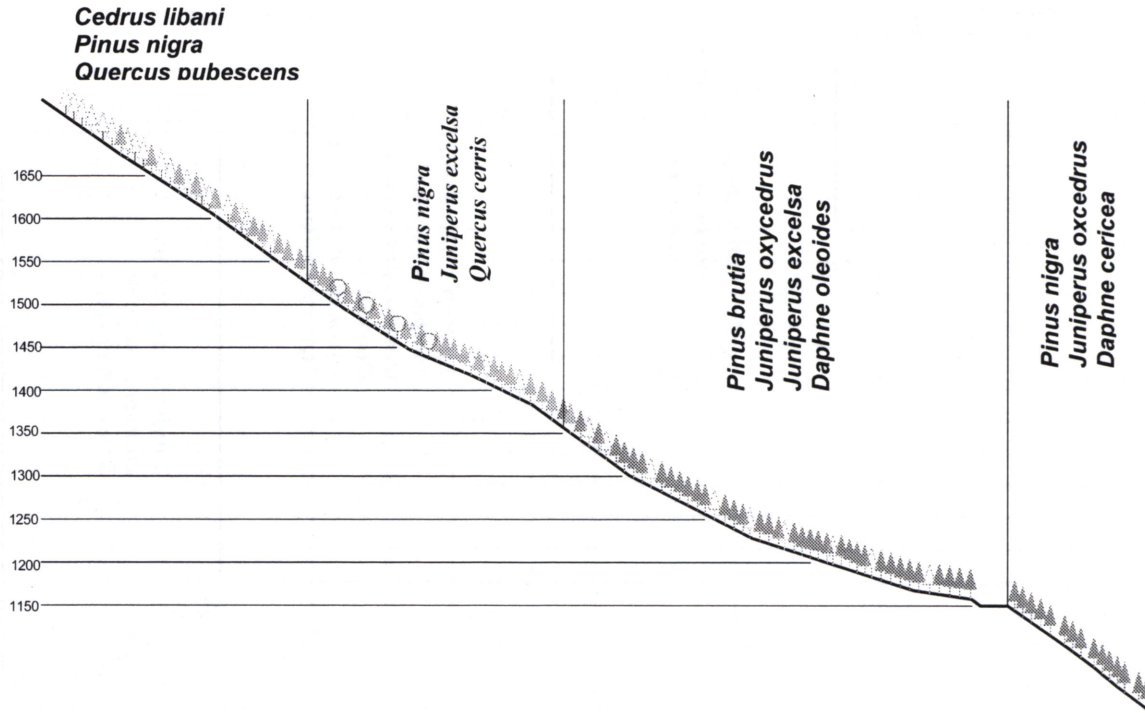


Figure 8 Transect of Natural Vegetation in Katran Çukuru Locality

Table 4 Indicated Plant Species and their Coverage Degree in Katran Çukuru Locality

SPECIES	COVERAGE DEGREE					
	KÇ20.1	KÇ20.2	KÇ20.3	KÇ20.4	KÇ20.5	KÇ20.6
<i>Juniperus exelca</i>	-	-	-	+	+	n
<i>Juniperus oxycedrus</i>	n	n	n	-	-	-
<i>Strax officinalis</i>	-	n	n	-	-	-
<i>Quercus cerris</i>	-	-	-	-	+	n
<i>Pinus brutia</i>	2	2	3	2	-	-
<i>Pinus nigra</i>	-	-	-	-	2	3
<i>Cedrus libani</i>	-	-	-	-	-	n
<i>Daphne oleoides</i>	+	n	-	-	n	+
<i>Centaurea sp.</i>	+	+	-	-	-	-
<i>Alyssum mouradicum</i>	n	-	+	-	-	-
<i>Centaurea ptosimopappoides</i>	+	+	+	+	-	-
<i>Phlomis capitata</i>	+	-	-	-	-	-
<i>Teuchrium chamaedrys</i>	+	-	-	-	-	-
<i>Thymus leucotrichus</i>	n	n	-	-	-	-
<i>Asphodeline sp.</i>	-	n	-	+	-	-
<i>Alyssum mouradicum</i>	-	n	-	-	+	-
<i>Alyssum peltarioides</i>	-	-	-	+	1	1
<i>Festuca anatolica</i>	-	+	-	-	-	-
<i>Scutellaria megalospis</i>	-	+	-	-	-	-
<i>Viciva sativa</i>	-	n	n	-	-	-
<i>Xeranthemum annum</i>	-	-	+	-	-	-
<i>Origanum micranthum</i>	-	-	n	-	-	-
<i>Centaurea cheirolapha</i>	-	n	+	+	1	+

n: Rare

+: Sparse

1: %25

2: %50

3: %75

4: %100

Table 5 Results of Soil Analysis of the Samples that Taken from Research Area

Parcel	Panel No	pH	Salt %	Ece dS/m	CaCO ₃ (%)	Soil Structure (%)		
						Sand %	Loam %	Clay %
Kaledađı	KD20.1	5.96	0,02	0,6	2,3	52,25	28,88	18,86
	KD20.2	6.27	0,03	0,8	2,8	34,87	33,39	31,74
	KD20.3	6.64	0,01	0,5	2,3	37,02	43,32	19,66
	KD20.4	7.10	0,03	0,3	2,6	40,61	29,04	30,35
	KD20.5	6.37	0,03	-0,2	2,9	43,13	32,87	24,00
	KD20.6	6.62	0,04	-2,1	3	33,48	35,96	30,56
Kükürt Basın	KH20.1	6.36	0,01	0,5	2,6	27,74	35,18	37,08
	KH20.2	6.27	0,00	0,2	3,4	50,60	39,18	10,23
	KH20.3	6.48	0,01	0,3	3	48,75	33,33	17,92
	KH20.4	6.49	0,01	0,5	3,2	61,65	22,68	15,67
	KH20.5	5.94	0,01	0,6	3	57,08	20,83	22,08
	KH20.6	5.51	0,01	0,3	1,7	71,06	17,02	11,91
Keçi Kalesi	KK20.1	6.76	0,01	0,3	2,7	55,70	15,83	28,47
	KK20.2	6.60	0,01	0,3	2,6	63,91	5,13	30,96
	KK20.3	6.63	0,01	0,3	1,8	57,87	23,02	19,11
	KK20.4	6.06	0,00	0,2	0,8	57,96	24,49	17,55
	KK20.5	6.26	0,00	0,1	2,6	67,43	20,41	12,16
	KK20.6	6.70	0,01	0,3	2	79,51	9,63	10,86
	KK20.7	6.50	0,01	0,2	2,3	58,85	22,68	18,47
	KK20.8	6.99	0,01	0,3	2,4	60,57	23,18	16,24
Katran Çukuru	KC20.1	6.66	0,01	0,4	1,8	63,11	9,69	27,20
	KC20.2	6.45	0,02	0,2	0,7	37,45	33,73	28,82
	KC20.3	6.45	0,01	0,3	2,25	28,49	37,46	34,05
	KC20.4	6.58	0,01	0,3	1,6	51,02	29,07	19,91
	KC20.5	6.66	0,01	0,4	2,5	54,64	24,17	21,19
	KC20.6	6.52	0,01	0,3	2,5	42,79	31,03	26,18

At the same socio-economic studies with a parallel programme in rural settlements in the basin were started.