SUPPLEMENT: 1

COMMUNICATIONS

DE LA FACULTÉ DES SCIENCES
DE L'UNIVERSITÉ D'ANKARA

Série C_2: Botanique

TOME 23 ANNÉE 1979

Ecological and Sociological Studies on the Vegetation of Afyon, Bayat-Köroğlubeli and its Environment

By

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Ankara, Turquie

Communications de la Faculté des Sciences de l'Université d'Ankara

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Adres: Fen Fakültesi Tebliğler Dergisi Fen Fakültesi, Ankara, Turquie.

Ecological and Sociological Studies on the Vegetation of Afyon, Bayat-Köroğlubeli and its Environment

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SUMMARY

This phytosociological and phytoecological study was carried out in 1975, 1976 and covers the depressed area between Bayat village and Köroğlubeli in Afyon.

Hills and mountains of the area are often dominated by andesitic rocks while lower areas are covered by Neogene sediments.

The climate of the area; with dry summer and low air moisture; is of transitory type belonging to the Mediterranean character in between Central Anatolia and West Anatolia. The present plant cover of the area even shows in conformity with climate. The *Cistus laurifolius* and *Populus tremula* communities have recently come into being after the destruction of *Pinus nigra subsp. pallasiana.* Both the communities of *Artemisia campestris* and *Hypericum heterophyllum* are more of Irano-Turanian type, and often occur in the transitory areas between Central Anatolia and other regions.

I–INTRODUCTION

In general, in the phytosociological and pyhtoecological studies the vegetation types and plant communities of the studied area are described first and the environmental conditions producing these communities are put forward. In this paper, the authors have tried to describe the plant communities representing the vegetation of Bayat extension of Emirdağ massive of Afyon province and, described the relations between these communities with their environment (ecology).

In the mentioned area, this is first phytosociological and phytoecological work and, we feel that has to some extent been a contribution to Turkish flora and to the vegetation of the area.

II–THE STUDIED AREA

A–GEOGRAPHY AND GEOMORPHOLOGY

The studied site covers an area of 60 km^2, within the Köroğlubeli public park along the highway between Bayat corner and Ankara-Afyon, and lying within the borders of Afyon state in the Aegean region. It is bordered by the Eğerli Dağ in the north, Bayat road in the east, Ankara-Afyon road in the sout and, Ağın Dağ and Bey Dağ in the west and comprise some Bayat elongations of Emirdağ massive, steep hills of Köroğlu, Asar, Gülbek and Yelekkaya. The botoms of these hills are generally connected with the open depressions. There is hardly any intractable part in the area.

The Bağlık site on the west of Bayat corner represents the lowest altitude (1100 m.), while the Köroğlu top (1526 m.) represents the highest altitude. The areas lying between these altitudes are generally composed of different inclined from 20–40 percent.

B–GEOLOGY

The limestone and dolomite of upper carboniferous-permtriassic age with homogenous structure are present on a base composed of clayeyschist of devonian age that has got changed into phyllite in the Emirdağ massive. At the top lies a series of schist, hornstein and limestone (Fig. 1).

STRATIGRAPHY:

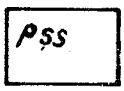
PALEOZOIC

The Şam Dağ massive lying in the study area is in general composed of phyllite and muscovitschist-quartzschist type rocks including the great muscovits and these are of devonian age.

Devonian paleogeography shows that grainy stuff has come from the west that is from the Menderes massive and, occurrence of big and thick conglomerate levels is affliated to this. Even micaschist is present here in the form of pebbles and degree of metamorphosis is higher than secondary rocks.

Abbrevations

Permo-Carbon



Clayeyschist and phyllates of paleozoic (Devon)

Recristalized Marbles of Jurassic—Lower Cretaceous

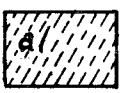
Hornstein—Ophiolites series of Mesozoic

Pebbles and Conglomerates of late pliocene

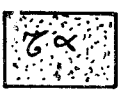
Lacustrine limestones of early Neogene

Lacustrine limestones of Sarmatien—Pontien

Mixed volcanic lacustrine series of Neogene

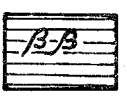


Allivium



Trachiandesite

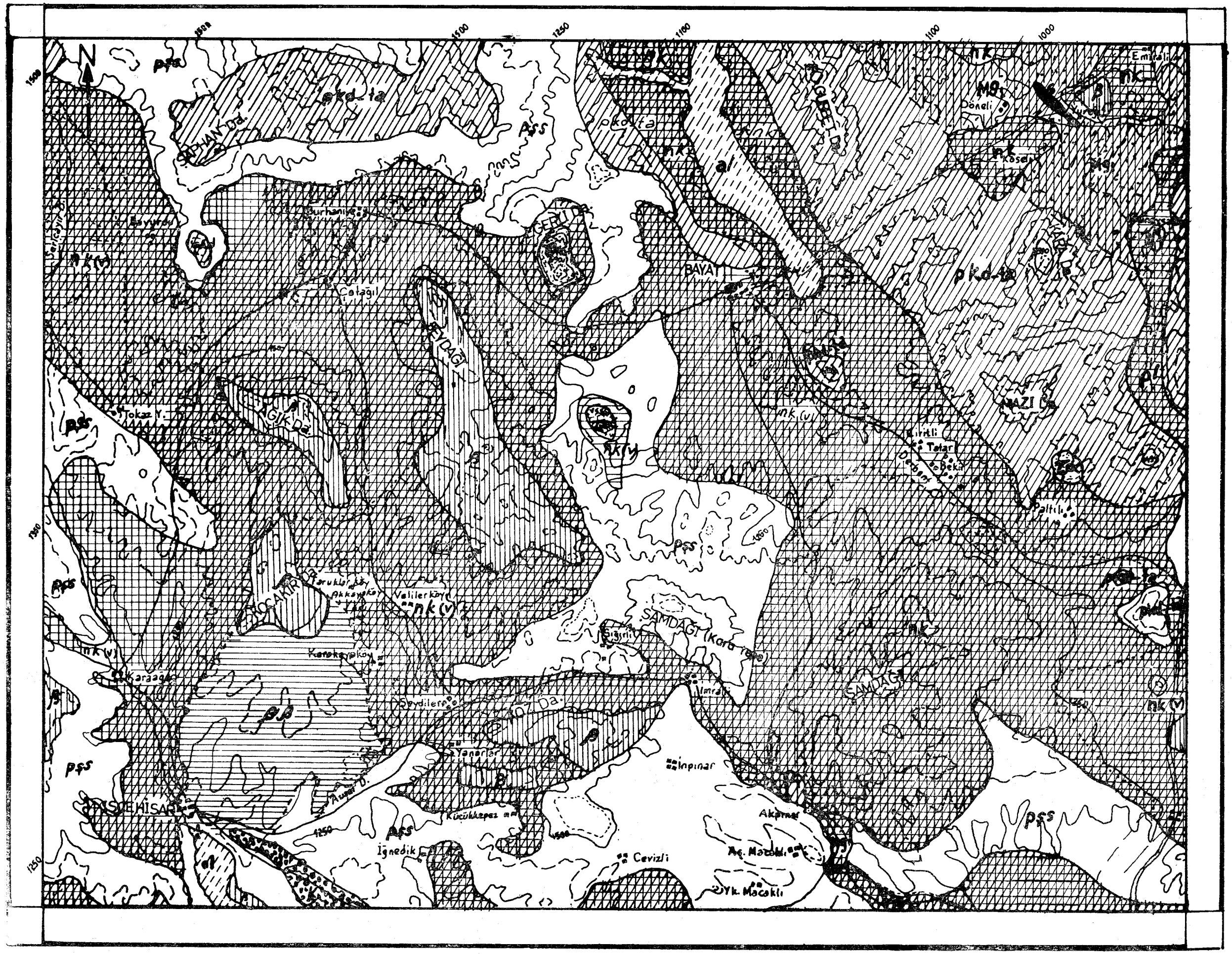
Basalts



The mixtures of lava, tuff, basalt and sediments.

Marbles (Devon)

Fig. 1: Geological map of Afyon-Emirdağ (Aziziye) and its environs



NEOGENE

The young strata of the region are of rocky nature. The neogene-pleistocene rocks present in the study area generally occur as follows from the old towards the young:

a) Brown, sandy-marl layers: These are slightly twisted; along with the additions; lying at intervals formed of acidic tuff and limestone. Miocene (?).

b) White and light grey coloured marl, marl-limestone and hard limestone: Represent Sarmation-Pontion fresh water fauna; horizontal deposition or shows variation to a little extent.

c) Deposition of a mixture of tuff, limestone and hight coloured marl of the intermediate effusive rocks. Middle paleocene.

The mountainous system in the study area has got divided between Şam Dağ, Paşa Dağ and Bey Dağ on a large scale and has got separated into several small basing filled in during Neogene. The contents of these basing area a formation of either volcanic tuff or lacustre, fluvial and tuff elements, in short these are sediments that could be colled as "volcano-telmatic". Ligh coloured marls are depositied as a mixture with tuff and tuffit levels, at places thin layers of hard limestone are visible. The large tuff or spongy stones, Lapil layers and cross layered sands, give changing view at paces.

d) Dasıt, tracheits and andesitic-trache with latitic effusive rocks. Middle Paleocene.

In the parts formed of Emirdağ limestone of the Emirdağ massive, firstly strong eruptions of the acidic and heavy gascous magmas has started and, due to this surrounding valleys and caves have got filled up with liparite and tuff.

e) Thick altituated gravel that is generally cemented: These are as marn an graphite containing jips in the internal parts of the basin. Upper paleocene.

f) Basaltic effusives (plasioclase-basalt, leucite-basalt, olivine-basalt). Plio-Pleistocene.

The basalts; seen as lava flow or in general as thin covers and distributed in the study area; are the youngest volcanic productions of the region.

g) Terrace gravels and block shaped running water soils. Pleistocene.

h) Eloya sediments, plato-thin layers of silt, debons of the slopes and young alluvions of the valley depressions. Holocene.

III– MATERIAL AND METHOD

The material consists of the climatic and geologic data, plant specimens collected from the area and, soil samples collected from the plant communities present in the area.

The climatic data was taken from the archives of the Meteorology Genel Müdürlüğü, Meterological bulletin (25), and geological data from the geological reports (8) of Maden Tetkik Arama Enstitüsü, Ankara. The climatic data was evaluated according to De Martonne-Gottman (1942) and Gaussen. All the plant species of the area were collected during the definite periods in the years 1974 and 1975, twenty soil samples were taken from the required sites, and all these were identified and analysed in the herbarium and soil Laboratory of the Botany Department of the Science Faculty, Ankara University. The in formation concerning the major soil group of the area was col lected from Toprak-Su Genel Müdürlüğü of Köyişleri Bakanlığı (1).

Field studies were carried out according to the method of Braun-Blanquet and vegetation classified in to communities according to the Preferential-Dominant-Constant species (14).

IV–CLIMATE AND SOILS

A–CLIMATE

The climate of the region is of a transitory character between the Mediterranean climate and semidry areas of the Central Anatolian plateau. It was evaluated according to De Martonne-Gottman's (1942) following formula:

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

I: Monthly drought index
P: Monthly rainfall (mm)
t: Mean monthly temperature (°C)

This formula is used to find out the dry and rainy months. The monthly drought indices (I) of the region in accordance with this are as follows:

I: 44.83 II: 44.54 III: 34.44 IV: 24.51 V: 25.40 VI: 14.89 VII 4.93 VIII: 3.54 IX: 7.83 X: 12.62 XI: 13.16 XII: 42.46

The driest month of the region is August, I equal to 3.54. As it is shown from table too, the index values of three months (Jully, August, September) of Emirdağ are below 10; and these are rather dry. The months of June, October and November, with index values lying between 10–20, are semidry. The rest of the months are rainy. According to these results there is a good conformity between the index values and climatic diagramme of Emirdağ (fig. 2).

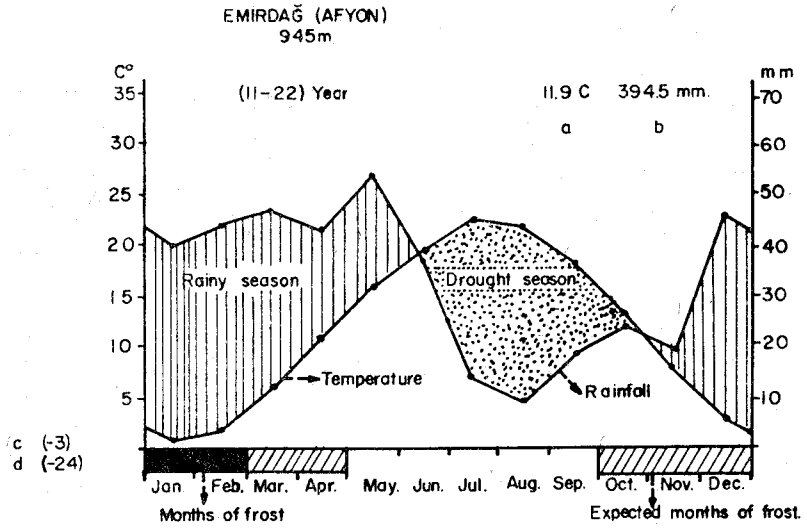


Fig 2_Climatic diagram of Emirdağ.

a= Mean annual temperature (°C)
b= Mean annual rainfall (mm)
c= Mean minumum temperature of the coldest month (°C)
d= Annual minumum absolute temperature (°C)

The study site lies on the transition between inner Aegean and inner Anatolian region. This transitory phase even can be seen in the climate also to some extent. A perusal of fig. 2 shows that second half of June, July, August, September and first half of October are dry and hot. In general, months of January and February have continuous frost; in the months of March, April, October, November and December only some days show frost.

De Martonne-Gottman's (1942) drought index formula is as follows:

$$I = \frac{\frac{P}{T+10} \quad \frac{12\,p}{t+10}}{2}$$

P: Annual rainfall (mm)
T: Mean annual temperature (°C)
t: Mean temperature of the driest month (°C)
p: Rainfall of the driest month (mm) (This value has been multiplied by 12, the number of months in a year)
10: A constant used so that values are not negative.

These drought indices can be classified, according to characteristics of Turkey, as follows:

I $<$ 10 Semidry
I: 10–15 Semidry-slightly humid
I: 15–20 Semidry-humid
I $>$ 20 Humid and humid cold.

The substitution of Emirdağ data in the formula gives us the I value as 10.78. According to this the climate of the studied region is semidry-slightly humid.

The index values in greater part of the Mediterranean and the Aegean region lie between 10–15. These regions too, like our study area, are semidry-slightly humid. The index values of Central Anatolia, part of southeast Anatolia and Iğdır plain are below 10 and are thus semidry areas. The index values of our study area are near 10 as such and it is shown a transition zone between the semidry and semidry-slightly humid regions.

TEMPERATURE

Mean annual temperature is 12° C. Mean maximum temperature is more or less 30°C during the months of July and August. The mean minimum temperature being –3°C and –2.3°C during the months of January and February. The mean number of days with strong frost and a minimum temperature (below-10°C) is 3.6 in January, 3.1 in February and 0.8 in December. Alongwith this, the number of days with highest values are January and February. The daily maximum temperature differences are 22°C during the months of July and August.

PRECIPITATION, EVAPORATION, RELATIVE HUMIDITY AND SNOWY DAYS:

Mean annual rainfall is 394.5 mm. The July and August receive minimum rain (10 mm.). The mean maximum rainfall is 54 mm. during the mounth of May. The distribution of seasonal rainfall in accordance with its decreasing value is as follows Spring, Winter, Autumn and Summer. The rainfall during Spring and winter seasons is more than twice the amount of rainfall during Autumn and Summer seasons.

The mean annual evaporation is 1061 mm and it is much higher than the annual precipitation. Maximum evaporation again occurs in the months of July and August (180 mm.)

Mean relative humidity is as low as 45 % during the months of July and August. Mean maximum relative humidity occurs (70–80 %) during the months of November, December and January, when the plants are not in an active phase.

The mean of snow covered days are 6.6 in January, 6.1 in February and 3.8 in December.

B–SOILS

The soils of the study area being in general sandy show high permeability, good porosity and are good for leaching. The pH varies from 6.8–7.6 and thus these could be considered as being neutral in character. The soil analysis shows following

TABLE 1. CLIMATIC DATA OF EMİRDAĞ

	MONTHS / YEARS	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	ANNUAL
Mean temperature°C	1964–1974 (11)	0.6	1.8	6.2	11.0	15.7	19.5	22.6	21.9	18.5	13.1	7.6	3.0	1.9
Mean maximum temperature°C	”	4.5	6.5	11.9	17.2	22.2	26.5	30.4	29.9	26.6	20.3	13.5	7.1	8.1
Mean minumum temperature°C	”	–3.0	–2.3	1.0	4.9	9.0	11.5	13.6	13.4	10.8	7.0	2.6	0.2	5.8
Mean of daily maaximum temperature difference°C	”	15.5	15.8	19.1	19.2	20.1	21.0	22.2	22.1	21.7	20.1	17.8	14.5	23.1
Mean number of the frosty days	”	20.9	17.4	11.2	2.6	—	—	—	—	—	0.6	7.4	15.5	75.3
Mean number of the extremely frosty days	”	3.6	3.1	—	—	—	—	—	—	—	—	—	0.8	7.5
Mean precipitation mm	1953–1974 (22)	39.6	43.8	46.5	42.9	54.4	36.6	13.4	9.4	18.6	24.3	19.3	46.0	394.5
Mean evaporation mm.	1935–1973 (39)	22.1	29.9	55.8	87.5	104.0	127.2	178.9	183.6	126.5	75.9	41.9	27.6	1060.7
Mean relative humidity %	1964–1974 (11)	71	69	62	54	51	47	43	46	47	54	63	71	56
Mean number of the snowy days	1954–1974 (21)	6.6	6.1	1.8	0.3	—	—	—	—	—	0.1	0.8	3.8	19.8
Mean wind speed m/sec	1966–1974 (9)	1.2	1.5	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.1	1.1	1.3	1.2
Direction of the fastest wind and its speed m/sec	”	17.2 SSW	13.6 SW	17.4 NE	14.7 SSW	21.0 SW	9.6 SSW	18.8 NNW	13.2 NNW	18.8 SSW	10.4 SSW	10.6 SSW	21.0 SSW	21.0 SSW

texture classes; sandy, loamy sand and sandy loam. As such, the percentage of available water (4.10–16.00) is low. Except the soils supporting *Populus tremula* and *Artemisia campestris* communities, those supporting *Cistus laurifolius* and *Hypericum heterophyllum* are poor in organic matter content. The $CaCO_3$ content of the soils supporting these communities is nil or very little. The large soil groups of the region, according to our findings; are as follows:

–NONCALCAREOUS BROWN FOREST SOILS (N)

Soils with A (B) C profiles. A horizons is well developed in these soils with a porous structure. The organic matter of A horizon is in general of acidic nature.

(B) horizon is not well developed, brown or dark brown, granular or block shaped with circular angles. There is no clay deposition or little deposition in (B) horizon. The limits of the horizon show a gradual transition. Depth normally is 40–70 cm.

– NONCALCAREOUS BROWN SOILS (U)

Soils with A (B) C profiles. The crumbling upper soil brown or light brown, B horizon being pale reddish brown in colour. There is generally good leaching and upper soils are more acidic than lower ones, lower soils are alkaline.

– BROWN FOREST SOILS (M)

These are included in the calcimorphic group of interzonal soils and are characterised by their development on calcareous parent material. These possess weakly developed horizons as compared to zonal soils of the region where they are present. A (B) C horizons are present and show a gradual transition from one to another. Depth in general is 50-90 cm.

The agricultural land around Bayat is formed of brown forest soils.

– BROWN SOILS (B)

These calcified soils are zonal with ABC profiles. There is large amount of Calcium present in the profiles. The eroded parts show only A and C horizons.

– NAKED ROCK AND ROUGH STONES (ÇK)

These areas are covered by disintegrated or partially disintegrated hard rock and stones and named as (ÇK) type of land due to the fact that there is no question of soil development till there is no soil cover on it. According to this, this area is not used for agriculture, as forest land and as grazing land. They are used as hunting area, mine or as stone-quarry.

– ALLUVIAL SOILS (A)

These are the soils accumulating from sediments carried by running waters. Slightly inclined, with (A) C profiles and young azonal soils.

Different layers are formed from the sediments accumulating at different times depending upon the intensity of sedimentation and time. Upper soil passes into lower soil unnoticably. The organic matter shows wide variations depending upon the climate, drenage and use of the soil.

V–VEGETATION

A-GENERAL CHARACTERS OF THE VEGETATION AND FLORA

The study area lies in the transitory zone between the Mediterranean and Irano-Turanian floristic regions. *Pinus nigra subsp. pallasiana* community is in particular spread in the mountainous parts of the transitory areas between the Mediterranean and Irano-Turanian floristic region.

The climax vegetation in the area 15-20 years ago was *Pinus nigra subsp. pallasiana*. The heavy destruction of this

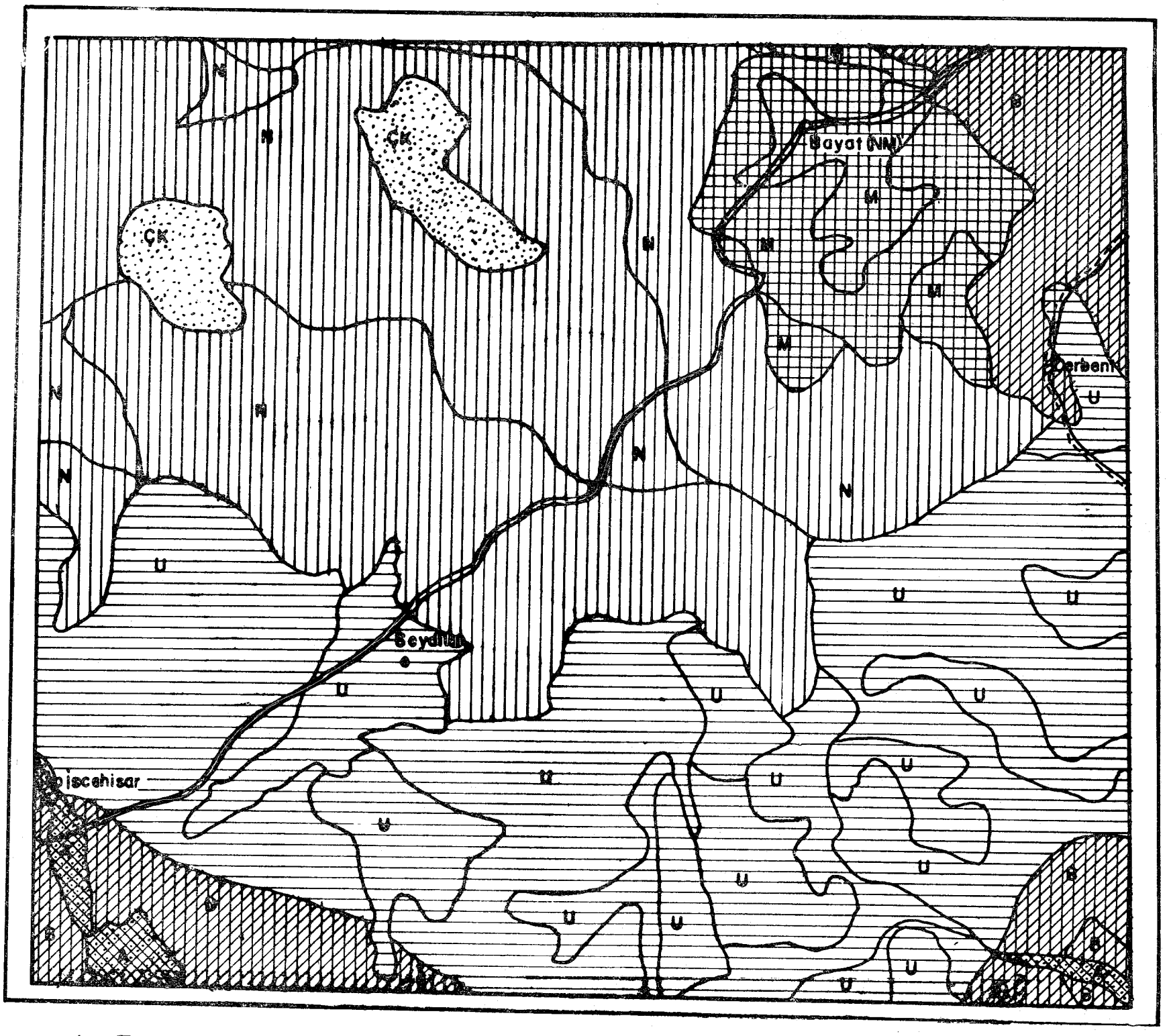


Fig. 3: The main soil groups of the study area Scale: 1/100 000

N Noncalcareous brown forest soils

U Noncalcareous brown soils

M Brown forest soils

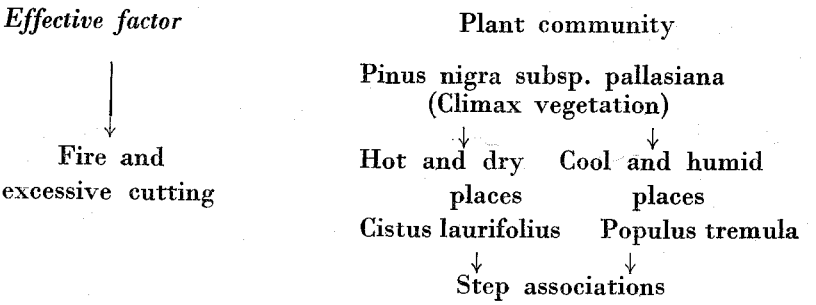
B Brown soils

A Alluvial soils

ÇK Naked rock and stones

community through the biotic factors like fire, intensive cutting and grazing has let to the domination of *Cistus laurifolius* in its place.

Cistus laurifolius and *Populus tremula* can protect themselves easily because of their resistance to fire and possession of well developed rhizomes. The destruction of the climax vegetation of *Pinus nigra subsp. pallasiana*, by such biotic factors in a short time, has resulted in the development of two important plant communities, in affliation to the habitat, of the study area. This destruction has in particular led to the occurrence of *Cistus laurifolius* community on the hot and dry places of southern slopes, and *Populus tremula* community on the cool and humid places of the northern slopes. The procedure of regression of the vegetation in the area is as follows:



Four plant communities have been observed in the study area Out of these *Cistus laurifolius* community forms a continuous cover whereas *Populus tremula*, *Artemisia campestris* and *Hypericum heterophyllum* communities are found in the form of fragments.

In the transitory areas of the destructed parts of the *Pinus nigra subsp. pallasiana* community, there are prominent areas showing a competition between *Pinus nigra subsp. pallasiana* and *Cistus laurifolius* or *Populus tremula.* In addition to this, present in the open areas of the forest from the begining have wet meadows. The plant cover of the mountainous area; as a whole, ends in a steppe or cultivated are as in the lower plains where bases and valleys join each other. The eastern slopes of

the Eğerli Dağ; forming northern limit of the area; there mixed and deformed *Oak* communities open to grazing. The trees cover of this community is 50 % with dominant species as *Quercus cerris*.

In a part of the area covered in general by *Cistus laurifolius* in the Köroğlubeli, Afyon Forest Department has started as reforestation project from 1969. An area of 2757 hectares will be reforested and out of this plantation of 750 hectares has been completed. The seedlings planted are mainly those of *Pinus nigra*. The other species tried, though on a very small scale, is *Cedrus libani*.

314 different species have been collected from the area. The life forms, survival period and ratio of the families is shown below:

LIFE FORMS (%)

Hemicryptophytes	(H)	43.63
Therophytes	(T)	35.03
Geophytes	(G)	8.60
Phanerophytes	(P)	7.32
Chamaephytes	(Ch)	5.41

SURVIVAL PERIOD (%)

Perennial	59.24
Annual	35.03
Biennial	5.73

RATIO OF THE FAMILIES (%)

Compositae	12.10
Gramineae	10.51
Leguminosae	9.55
Cruciferae	7.64
Caryophyllaceae	7.32
Labiatae	6.37

Scrophulariaceae	5.10
Liliaceae	4.78
Rosaceae	3.82
Rubiaceae	3.18
Umbelliferae	3.18
Boraginaceae	2.78
Papaveraceae	2.55
Other families	21.02

B–PLANT COMMUNITIES

1–*CISTUS LAURIFOLIUS L. COMMUNITY*

This community is formed in the areas after heavy destruction of *Pinus nigra subsp. pallasiana* (Black pine) community due to the biotic factors like fire and cutting. Inspite of its distribution between 1100–1500 m, without any consideration for the exposition, it is highly successful on the dry and hot south slopes.

The depth of soils in the *Cistus laurifolius* community lies between 30–80 cm, being poor in organic matter (0.43–2.78 %) and, distributed in sandy and loamy sand in nature. The ratio of sand is more in these soils and ratio of available water does not exceed beyond 13 percent (Table 2,3).

The community shows two layers in vertical. First is a shrub layer dominated by 80–120 cm *Cistus laurifolius* shrubs and second herbaceous layer being 20 cm. In the general, the total plant cover is 60–85 % and shrub cover varies between 60–75 percent. The cover of herbs varies between 10–20 percent. The species forming herbaceous layer are generally small-sized therophytes. The majority of the species found in this layer complete their life cycle by the end of June. The permeability of these sandy soils is high and during the second half of June and months of July, August and September; due to the severe drought conditions; unfavourable environment exists for the surface rooted

TABLE 2. PHYSICAL ANALYSIS OF THE SOILS SUPPORTING CISTUS LAURIFOLIUS L. COMMUNITY

No	Depth cm	$CaCO_3$ %	Sand %	Silt %	Clay %	Texture	Saturation %	Field capacity (Water %, 1/3 Atm)	Wilting point (Water %, 15 Atm)	Available water for the plant %
1 a	0–10	—	92.14	2.06	5.80	Sand	31.25	9.38	5.28	4.10
1 b	20–70	—	91.96	3.53	4.51	Sand	28.50	9.99	5.23	4.76
2 a	0–6	—	77.41	16.11	6.48	Loamy sand	38.15	11.45	6.22	5.23
2 b	10–50	—	87.76	6.43	5.81	Sand	30.15	10.30	6.15	4.15
10 a	0–10	—	77.71	16.48	5.81	Loamy sand	46.25	16.00	5.80	10.20
10 b	20–50	—	81.83	13.35	4.82	Loamy sand	37.11	14.90	4.90	10.00
13	0–35	—	71.53	14.05	14.42	Sandy loam	36.32	13.85	5.00	8.85
15 a	0–10	—	67.41	24.73	7.86	Sandy loam	50.00	19.85	6.58	13.00
15 b	15–50	—	67.41	18.54	14.05	Sandy loam	48.40	19.00	6.15	21.85

TABLE 3. CHEMICAL ANALYSIS OF THE SOILS SUPPORTING CISTUS LAURIFOLIUS L. community

No	Deptp cm.	pH	Conductivity m.mhos/cm.	Organic matter %	Carbon %	N %	Water soluble Cations meq/It			Fxchangeable cations meq/100 gr.			C.E.C meq/100 gr.	Useful P ppm.
							Na	K	Ca+Mg	Na	K	Ca+Mg		
1 a	0–10	7.0	0.182	2.06	1.940	0.098	0.821	0.095	1.120	0.80	0.22	9.38	10.40	7.86
1 b	20–70	7.1	0.064	1.03	0.597	0.051	0.200	0.022	0.405	0.97	0.23	8.50	9.70	6.92
2 a	0–6	7.2	0.098	1.03	0.597	0.057	0.111	0.031	0.702	0.75	0.30	8.75	9.85	7.21
2 b	10–50	7.2	0.078	0.81	0.469	0.038	0.143	0.077	0.568	0.96	0.34	7.98	9.28	7.00
10 a	0–10	7.2	0.075	2.78	1.612	0.139	0.182	0.063	0.535	1.20	0.28	14.00	13.08	9.19
10 b	20–50	7.1	0.081	0.72	0.417	0.031	0.169	0.071	0.603	1.02	0.38	9.52	10.92	8.96
13	0–35	7.1	0.117	0.43	0.249	0.021	0.295	0.080	0.876	1.12	0.38	10.90	11.38	8.00
15 a	0–10	7.3	0.117	1.70	0.986	0.082	0.293	1.041	1.050	1.04	0.32	11.40	12.71	6.92
15 b	15–50	7.3	0.072	1.24	0.719	0.069	0.980	0.032	0.641	1.80	0.33	11.20	13.30	6.85

herbaceous species. These unsuitable environmental conditions are the only reason for the extremely poor plant cover inthe area.

The flowering period of *Cistus laurifolius* is June, inspite of its spread through seeds, it spreads more quickly through rhizomes and is an evergreen xerophytic shrub. The leaves of *Cistus laurifolius* with thick cuticle (24), form the major part of the organic remains in the soil. In addition to this late decomposition of the leaves helps in the stabilisation of these soils with surface erosion, through their effect on the productivity.

The other species met with alongwith the shrub layer of *Cistus laurifolius* are *Juniperus oxycedrus subsp. oxycedrus* and *Pinus nigra subsp. pallasiana.* The probable characteristic species of the community are: *Cistus laurifolius, Salvia grandiflora, Alyssum strigosum, Galium floribundum, Linaria simplex, Zizyphora taurica, Sedum pallidum var. pallidum, Arabis nova, Silene supina subsp. pruinosa, Holosteum umbellatum var. glutinosum* and *Verbascum insulare.* The important companions with high frequency are: *Bromus tectorum, Logfia arvensis, Acinos rotundifolius, Bromus squarrosus var. squarrosus* and *Veronica chamaepitys.* The species with double frequency occured in the community are as follows: *Poa nemoralis, Silene compacta, Arenaria serpyllifolia, Apera spica-venti, Trifolium campestre, Stipa barbata, Asperula stricta, Alyssum murale subsp. murale var. murale, Pilosella auriculoides, Euphorbia myrsinites, Scorzonera eriophora, Verbascum flavidum, Arabidopsis thaliana, Sideritis montana, Moenchia mantica subsp. mantica, Tragopogon longirostris, Thymus zygioides.* The species with single frequency occured in the community are as follows: *Chamaecytisus hirsutus, Petrorhagia alpina subsp. olympica, Herniaria incana, Hypericum heterophyllum, Galium aparine, Bromus sterilis, Scleranthus annuus, Linaria genistifolia subsp. genistifolia, Aegilops ovata, Globularia trichosantha, Chrysopogon gryllus, Trifolium speciosum, Leontodon asperrimus, Malabaila secacul, Moenchia mantica subsp. caerulea, Aira elegans, Carduus nutans, Marrubium globosum, Caucalis platycarpos, Fumaria parviflora Melica ciliata, İris schatti, Senecio vernalis, Xanthium spinosum, Viola parvula, Aethionema arabicum.*

Table 4. Cistus laurifolius L. Community

Life form																				
	No. of quadrat	13	39	47	14	3	18	11	54	45	44	12	48	8	19	4	1	2		
	Area m²	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		
	Altitude m	1280	1450	1410	1250	1410	1280	1350	1230	1370	1400	1370	1370	1350	1460	1400	1500	1470		
	Exposition	NW	SW	SW	N	E	E	E	NE	NE	SW	E	S	SW	SE	SW	S	S		
	Inclination %	20	20	20	5	5	35	20	25	10	25	25	30	25	20	25	15	20		
	Main rock	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.		
	Coverage %	70	70	80	60	80	70	80	75	85	60	70	60	80	60	60	65	70		
	Height of the sbrubs m	0.75	1.00	0.75	0.60	0.75	1.00	0.75	1.00	1.00	0.75	0.75	0.60	1.00	0.75	0.75	1.00	1.00		
	Cover of the shrubs %	60	70	75	60	70	60	70	70	70	60	65	60	75	60	60	60	60		
	Height of the herbs cm	20	10	10	10	15	25	20	15	15	10	15	10	10	10	10	10	15		
	Cover of the herbs %	20	10	10	15	20	10	20	20	25	15	10	15	10	10	10	20	20	Frequency %	Frequenz class
	The characteristic species of the higher communities:																			
Pn	Quercus cerris	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	100	V
Pn	Juniperus oxycedrus subsp. oxycedrus	+1	11	+1	+1	+1	.	11	+1	+1	+1	+1	+1	.	.	+1	+1	+1	82	V
Pn	Pinus nigra subsp. pallasiana	+1	+1	.	.	+1	+1	.	+1	.	.	+1	.	+	.	.	.	+1	47	III
	Probable characteristic species of the community:																			
Pn	Cistus laurifolius	44	44	54	44	44	44	44	44	44	44	44	43	44	43	43	43	43	100	V
Ch	Salvia grandiflora	+1	+1	+1	.	+1	11	+1	+1	+1	11	+1	+1	+1	+1	11	+1	+1	94	V
T	Alyssum strigosum	+1	+1	+1	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	94	V
T	Galium floribundum	+1	+1	.	+1	+1	+1	11	11	+1	11	11	11	+1	11	+1	+1	11	82	V
T	Linaria simplex	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	.	+1	+1	.	+1	+1	+1	82	V
T	Ziziphora taurica	+1	11	11	11	+1	.	.	.	11	11	+1	11	+1	.	+1	+1	11	76	IV
T	Sedum pallidum var. pallidum	.	.	+1	+1	+1	+1	+1	.	11	+1	.	.	+1	+1	+1	+1	11	71	IV
T	Arabis nova	+1	11	+1	.	+1	.	+1	.	+1	.	+1	.	+1	+1	.	+1	+1	65	IV
H	Silene supina subsp. pruinosa	.	.	+1	+1	.	+1	+1	+1	.	+1	+1	+1	+1	+1	.	.	.	59	III
T	Holosteum umbellatum var. glutinosum	.	+1	+1	.	.	.	.	+1	+1	+1	.	.	.	+1	+1	.	.	41	III
H	Verbascum insulare	.	.	+1	.	+1	.	.	+1	.	.	.	.	+1	.	+1	+1	+1	41	III
	Companions:																			
T	Bromus tectorum	11	+1	+1	+1	11	11	11	+1	+1	11	11	+1	+1	11	+1	+1	11	100	V
T	Logfia arvensis	+1	+1	+1	+1	+1	+1	+1	11	+1	+1	+1	11	.	+1	+1	+1	+1	94	V
T	Acinos rotundifolius	+1	+1	+1	+1	+1	+1	+1	+1	11	+1	+1	+1	.	+1	.	+1	11	88	V
T	Bromus squarrosus var. squarrosus	+1	+1	11	+1	11	+1	+1	+1	+1	+1	+1	+1	.	+1	+1	.	+1	88	V
T	Veronica chamaepitys	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	.	.	+1	.	+1	+1	76	IV
T	Phleum exaratum	21	.	+1	11	+1	.	21	+1	11	.	11	+1	+1	+1	.	.	.	65	IV
H	Poa bulbosa f. vivipara	+1	+1	+1	+1	+1	+1	.	+1	.	+1	.	+1	+1	12	.	.	.	65	IV
T	Minuartia mesogitana subsp. lydia	+1	+1	+1	+1	11	.	.	11	11	+1	.	.	.	+1	11	.	.	59	III
H	Anthemis tinctoria var. pallida	+1	.	.	+1	.	11	+1	+1	+1	.	.	.	+1	.	+1	+1	+1	59	III
T	Myosotis collina	+1	+1	+1	+1	+1	+1	.	.	+1	.	.	+1	.	+1	.	+1	.	59	III
H	Hypericum origanifolium	.	+1	.	+1	.	+1	.	+1	.	+1	.	+1	.	+1	+1	+1	.	53	III
T	Alyssum desertorum var. desertorum	+1	+1	.	+1	+1	+1	+1	+1	.	.	.	.	.	+1	.	.	+1	53	III
T	Vulpia ciliata	11	+1	+1	.	+1	+1	+1	.	.	.	+1	.	.	.	+1	.	.	47	III
G	Allium flavum	+1	+1	+1	+1	.	.	+1	+1	.	+1	.	.	+1	.	.	.	.	47	III
H	Dactylis glomerata	+1	.	.	+1	.	+1	.	+1	+1	+1	+1	+1	.	.	.	.	.	47	III
T	Elymus caput-medusae	+1	.	.	+1	.	.	+1	.	+1	.	+1	.	+1	+1	+1	.	.	47	III
H	Festuca ovina	+1	+1	.	+1	.	.	+1	.	+1	+1	+1	.	.	.	.	.	.	41	III
H	Teucrium chamaedrys subsp. chamaedrys	+1	.	+1	+1	.	+1	+1	.	+1	.	.	+1	.	.	.	.	.	41	III
H	Verbascum lasianthum	+1	.	+1	.	.	+1	+1	.	+1	.	+1	.	.	+1	.	.	.	41	III
T	Psilurus incurvus	.	+1	+1	22	.	.	.	11	.	+1	.	+1	.	.	.	.	.	35	II
T	Festuca lachenalii	+1	.	.	.	+1	.	.	+1	.	+1	.	.	11	.	11	.	.	35	II
T	Herniaria glabra	.	+1	+1	+1	+1	.	.	.	.	.	.	+1	.	+1	.	.	.	35	II
T	Briza spicata	.	+1	.	.	+1	.	.	.	+1	+1	.	.	.	.	+1	+1	.	35	II
T	Scabiosa rotata	.	.	+1	+1	.	.	+1	.	.	+1	.	.	+1	.	+1	.	.	35	II
T	Veronica dillenii	+1	+1	.	.	+1	.	.	.	+1	.	+1	.	.	.	.	.	.	29	II
H	Erysimum smyrnaeum	.	.	.	.	.	+1	+1	+1	.	.	+1	.	+1	.	.	.	.	29	II
H	Koeleria cristata	+1	.	.	.	.	.	+1	+1	.	+1	+1	.	.	.	.	.	.	29	II
Ch	Thymus tosevii	12	+1	.	.	.	.	.	.	.	+1	.	12	.	.	.	.	.	24	II
H	Minuartia hirsuta subsp. falcata	.	+1	+1	.	.	.	.	.	.	.	.	+1	.	+1	.	.	.	24	II
H	Galium lucidum	.	.	.	.	.	11	+1	.	.	.	+1	.	+1	.	.	.	.	24	II
H	Anthemis cretica subsp. anatolica	.	+1	+1	.	.	.	.	.	.	.	.	+1	.	.	.	.	+1	24	II
T	Valerianella coronata	+1	.	.	+1	.	+1	.	.	+1	.	.	.	.	.	.	.	.	24	II
Ch	Teucrium polium	.	+1	+1	.	.	.	.	.	.	.	.	+1	.	.	.	+1	.	24	II
H	Bromus tomentellus	.	+1	.	.	+1	.	+1	.	.	.	.	+1	.	.	.	.	.	24	II
T	Papaver dubium	.	.	.	.	+1	.	.	.	.	.	.	.	+1	.	.	+1	+1	24	II
H	Alyssum pateri subsp. pateri	.	.	.	.	+1	.	.	.	.	.	.	.	+1	.	+1	+1	.	24	II
T	Turgenia latifolia	.	.	+1	.	.	+1	.	+1	.	.	+1	.	.	.	.	.	.	24	II
T	Trifolium arvense var. arvense	+1	.	.	+1	.	+1	.	.	.	.	.	.	.	.	.	.	.	18	I
H	Campanula lyrata	.	.	.	.	.	.	.	+1	.	.	+1	.	.	.	+1	.	.	18	I
T	Lithospermum apulum	.	.	.	.	.	+1	.	.	.	+1	.	.	+1	.	.	.	.	18	I
T	Picnomon acarna	.	.	.	.	+1	.	.	.	+1	+1	.	.	.	.	.	.	.	18	I
T	Myosotis micrantha	+1	+1	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	18	I

In all 17 quadrats were laid in this community and 100 species recorded (Table 4.). The percentage of life forms of the species in the community is as follows:

Therophytes	(T):	52
Hemicryptophytes	(H):	33
Chamaephytes	(Ch):	9
Nanophanerophytes	(Pn):	4
Geophytes	(G):	2

As is apparent from the table too, more than half of the species (52 %) of the community are annuals.

2–*POPULUS TREMULA L. COMMUNITY*

This community also develops in the study area after the heavy destruction of *Pinus nigra subsp. pallasiana.* The *Populus tremula* community is found in the form of patchs between 1300 1450 m. altitude, on the continuously wet and cool northern slopes dominated blocky rocks and is covered with snow for a longer time.

The mean percentage of water content during the months of April, May June and July were found to give some information about the soil water in the soils of *Cistus laurifolius* and *Populus tremula* communities, and the results are given in Table 5.

Table 5. Percentage water content of the soils suppording cistus laurifolus (C.l.) and Populustremula (P.t.) communities.

	Water content (%)					
	April		May		June-July	
Soil depth (cm)	C.l.	P.t.	C.l.	P.t.	C.l.	P.t.
0–20	9.32	14.36	16.66	22.85	7.32	13.82
20–40	12.48	12.76	16.91	15.78	10.87	11.81
40–60	10.88	13.46	15.54	15.91	11.64	11.45

The soils of this plant community have A horizon rich in organic matter (3.31–8.61 %), sandy-loam and is distributed in deeper soils as compared to others with 5–10 cm thick raw humus cover lying on the soil surface. The available percentage water content being 5.35–15.95, and pH 7.2–7.6, the soils being non $CaCO_3$ (Table 6,7).

As in clear from the table, soils of *Cistus laurifolius* community have low water content in general as compared to the soils of *Populus tremula* community and soils lying below 20 cm. depth are richer in moisture content than upper soil layers. This ratio is inverse in the soils of *Populus tremula* community. This difference in the water content is due to of longer duration of snow cover on the soils of *Populus tremula* community. It occurs on cool and shady north exposed of the area with rich in organic matter.

The percentage cover of *Populus tremula* community in the study area varies between 70–90. The community, as on the northwestern slope of Melik top, shows two vertical layers in the areas with heavy destruction. The first is a 1–2 m. tall shrub layer dominated by *Populus tremula*. The second layer is formed by herbs with an average height of 20–30 cm. and their covers are rather low. In the areas where *Populus tremula* is less disturbed and three vertical layers are found in the commu nity. First layer is of small trees with an average height of 4–5- m. and other two layers are the same as mentioned above i.e; shrub layer and herbaceous layer.

The *Populus tremula*, after which the community is named, has a rhizome with a dense root system which fixes it to the soil firmly. This root system is rather superficial and the upper soil is rich in moisture and organic matter. In the areas with high cover values of *Populus tremula*, even the passage through plant cover is very diffucult.

Other species found in the tree and shrub layer of *Populus tremula* community are: *Cistus laurifolius*, *Colutea cilicica*, *Quercus cerris* and *Pinus nigra subsp. pallasiana*. The probable characteristic species of the community are: *Populus tremula*, *Chamaecytisus*

TABLE 6. PHYSICAL ANALYSIS OF THE SOILS SPPORTING POPULUS TREMULA L. COMMUNITY

No	Depth cm.	CaCO %	Sand %	Silt %	Clay %	Texture	Saturation %	Field capacity (water %, 1/3 Atm.)	Wilting point (water %, 15 Atm.)	Available water for the plant %
3 a	0–10	—	65.35	22.66	11.99	Sandy Loam	43.85	14.16	7.05	7.11
3 b	15–50	—	73.59	10.30	16.11	”	36.63	12.20	6.85	5.35
5 a	0–10	—	68.50	15.80	15.70	”	66.19	23.20	7.25	15.95
5 b	15–60	—	69.47	14.42	16.11	”	48.11	21.15	6.85	14.30
6 a	0–10	—	77.71	4.12	18.17	”	48.84	17.25	6.50	10.75
6 b	15–50	—	73.59	14.42	11.99	”	41.14	14.50	6.80	7.70
7 a	0–15	—	76.65	15.49	7.86	”	54.40	20.60	7.40	13.20
7 b	20–60	—	77.71	12.36	9.93	”	40.04	16.40	7.15	9.25

TABLE 7. CHEMICAL ANALYSIS OF THE SOILS SUPPORTING POPULUS TREMULA L. COMMUNİTY

No	Depth cm	pH	Conductivity Mmhos/cm.	Organic matter %	Carbon %	N %	Water soluble cations meq/lt			Exchangeable cations meq/100 gr			C.E.C. meq/100 gr.	Useful P ppm.
							Na	K	Ca+Mg	Na	K	Ca+Mg		
3 a	0–10	7.3	0.120	3.31	1.919	0.165	0.595	0.095	0.695	1.32	0.42	12.90	14.00	12.41
3 b	15–50	7.2	0.133	0.87	0.504	0.043	0.578	0.022	0.750	1.10	0.35	8.90	10.35	9.14
5 a	0–10	7.3	0.187	8.61	4.994	0.448	0.438	0.032	1.352	1.78	0.38	14.92	17.08	16.61
5 b	15–60	7.3	0.073	1.38	0.800	0.071	0.291	0.039	0.419	0.90	0.25	11.85	13.00	9.28
6 a	0–10	7.6	0.234	3.76	2.180	0.191	0.514	0.082	1.620	1.28	0.32	9.80	11.40	12.21
6 b	15–50	7.3	0.081	0.99	0.574	0.044	0.321	0.019	0.576	1.07	0.35	10.08	11.50	10.50
7 a	0–15	7.4	0.212	6.75	3.915	0.340	0.398	0.086	1.729	1.42	0.38	14.12	15.92	15.05
7 b	20–60	7.4	0.161	0.88	0.510	0.047	0.573	0.038	1.008	1.06	0.34	9.34	10.74	9.91

TABLE 8. POPULUS TREMULA L. COMMUNITY

Life form																	
	No. of quadrat	9	26	25	10	21	52	20	49	23	22	51	28	27	53	24	
	Area m²	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	
	Altitude m	1400	1400	1390	1410	1430	1360	1440	1310	1440	1450	1340	1390	1400	1370	1430	
	Exposition	NW	N	NE	NW	N	N	NW	NW	NE	N	NE	N	NW	N	NE	
	Inclination %	25	40	15	30	20	45	35	40	20	35	40	40	35	40	30	
	Main rock	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	
	Coverage %	90	90	90	90	70	90	80	85	75	90	90	70	85	90	90	
	Height of the trees and shrubs m	1.5	3	2	1.5	5	4	5	2	3	4	2	1.5	2	4	2.5	
	Cover of the trees and shrubs %	90	85	80	75	70	85	80	80	75	90	85	70	80	80	90	
	Height of the herbs cm	30	30	35	40	30	35	30	30	25	30	25	20	25	25	30	
	Cover of the herbs %	20	20	25	40	20	20	15	20	25	15	25	15	20	20	10	
Pn	Cistus laurifolius	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	.	+1	+1	87 V
Pn	Colutea cilicica	11	+1	+1	+1	.	.	.	+1	.	+1	.	.	.	.	.	40 II
	The cahracteristic species of the higher communities:																
Pn	Quercus cerris	+1	+1	+1	11	+1	+1	+1	+1	.	.	.	+1	+1	+1	+1	80 IV
Pp	Pinus nigra subsp. pallasiana	+1	.	.	.	.	+1	.	11	+1	.	.	11	+1	+1	+1	53 III
	Probable characteristic species of the community:																
Pp	Populus tremula	54	54	54	44	44	54	54	54	44	54	54	43	54	54	54	100 V
Ch	Chamaecytisus hirsutus	+1	12	12	+1	12	22	12	22	12	+1	23	12	22	23	22	100 V
H	Poa nemoralis	22	22	11	22	11	11	11	11	11	11	+1	11	+1	11	+1	100 V
H	Erysimum smyrnaeum	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	100 V
H	Silene compacta	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	93 V
T	Galium peplidifolium	.	11	+1	+1	+1	+1	+1	11	+1	+1	11	11	+1	.	.	80 IV
H	Saponaria glutinosa	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	.	.	+1	+1	80 IV
H	Arabis sagittata	+1	+1	.	+1	+1	11	+1	+1	+1	.	+1	.	+1	.	+1	73 IV
H	Silene italica	+1	+1	.	+1	+1	.	+1	+1	.	+1	+1	.	+1	+1	.	67 IV
H	Verbascum splendidum	.	+1	.	+1	+1	+1	+1	.	+1	+1	+1	.	+1	.	+1	67 IV
T	Petrorhagia alpina subsp. olympica	+1	+1	.	+1	+1	+1	+1	+1	.	.	.	.	+1	+1	.	60 III
H	Anthemis tinctoria var. tinctoria	.	11	+1	+1	+1	.	+1	+1	+1	+1	.	.	.	.	.	53 III
T	Galium aparine	+1	+1	.	+1	.	.	.	.	+1	+1	11	.	.	+1	+1	53 III
G	Cephalenthera rubra	+1	.	+1	.	+1	.	.	.	+1	+1	+1	.	.	.	+1	47 III
H	Fibigia eriocarpa	+1	.	.	+1	+1	+1	.	.	.	.	+1	.	.	.	.	47 III
H	Arabis caucasica subsp. caucasica	.	.	.	+1	+1	.	+1	.	.	+1	.	+1	+1	+1	.	47 III
	COMPANIONS																
T	Myosotis collina	+1	+1	+1	.	11	+1	+1	+1	11	+1	+1	11	+1	+1	+1	93 V
H	Anthemis tinctoria var. pallida	+1	+1	+1	.	+1	+1	11	11	+1	+1	+1	11	.	+1	+1	87 V
H	Campanula lyrata	.	11	+1	+1	+1	11	+1	11	+1	+1	.	+1	+1	+1	.	80 IV
T	Veronica chamaepitys	.	+1	+1	.	.	+1	+1	+1	+1	.	.	+1	+1	+1	+1	67 IV
H	Poa bulbosa f. vivipara	+1	+1	+1	.	+1	.	+1	+1	.	.	.	+1	+1	+1	.	60 III
T	Acinos rotundifolius	+1	.	+1	.	+1	+1	+1	.	+1	+1	+1	.	.	+1	.	60 III
T	Festuca lachenalii	+1	.	+1	+1	.	.	.	+1	+1	.	.	+1	+1	.	+1	53 III
H	Hypericum perforatum	+1	11	+1	+1	+1	.	.	.	.	.	.	.	.	+1	+1	40 II
T	Bromus sterilis	+1	.	11	+1	.	.	.	.	+1	.	+1	.	.	.	+1	40 II
H	Hypericum origanifolium	.	+1	+1	.	.	+1	.	.	+1	.	+1	+1	.	.	.	40 II
T	Bromus aquarrosus var. squarrosus	+1	.	+1	+1	.	+1	.	.	+1	.	.	.	.	.	.	40 II
H	Stachys orientalis	+1	11	.	+1	.	+1	.	.	+1	.	.	.	.	.	.	40 II
T	Bromus tectorum	+1	.	+1	.	+1	+1	.	.	.	.	.	11	.	.	.	33 II
H	Turritis laxa	.	.	.	.	.	.	+1	+1	.	.	.	.	.	+1	.	33 II
T	Veronica dilenii	.	+1	.	.	.	+1	.	+1	.	.	+1	.	+1	+1	.	33 II
T	Fumaria cillicica	.	+1	.	.	+1	+1	.	.	.	.	.	+1	+1	.	.	33 II
H	Vicia cracca var. stenophylla	+1	+1	.	22	.	.	.	.	.	.	+1	+1	.	.	.	33 II
H	Trifolium medium var. medium	+1	+1	.	11	.	.	.	.	.	+1	.	.	.	.	.	27 II
H	Alyssum murale subsp. murale var. murale.	+1	.	.	.	.	.	.	+1	.	11	.	.	.	.	.	27 II
H	Linaria genistifolia subsp. genistifolia	.	.	+1	.	.	.	+1	.	.	.	+1	+1	.	.	.	27 II
T	Thlaspi violascens	.	+1	.	.	.	.	.	.	.	.	+1	.	+1	.	.	27 II
H	Coronilla varia subsp. varia	+1	.	+1	+1	.	.	.	.	+1	+1	.	.	.	+1	.	27 II
H	Anthemis cretica subsp. anatolica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20 I
H	Dactylis glomerata	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	20 I
H	Teucrium chamaedrys subsp. chamaedrys	.	.	+1	.	.	.	.	.	.	+1	.	+1	.	.	.	20 I
G	Allium flavum	.	+1	.	.	+1	.	.	.	.	.	.	.	.	.	.	20 I
T	Minuartia mesogitana subsp. lydia	+1	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	20 I
T	Logfia arvensis	.	.	.	.	.	.	11	+1	.	.	.	+1	.	.	.	20 I

hirsutus, *Poa nemoralis*, *Erysimum smyrnaeum*, *Silene compacta*, *Galium peplidifolium*, *Saponaria glutinosa*, *Arabis sagittata*, *Silene italica*, *Verbascum splendidum*, *Petrorhagia alpina*, *subsp. olympica*, *Anthemis tinctoria var. tinctoria*, *Galium aparine*, *Cephalanthera rubra*, *Fibigia eriocarpa* and *Arabis caucasica subsp. caucasica*. The important companion species with higher frequency are: *Myosotis collina*, *Anthemis tinctoria var. pallida*, *Campanula lyrata*, *Veronica chamaepitys*, *Poa bulbosa f. vivipara*, *Acinos rotundifolius* and *Festuca lachenalii*. The species with double frequency occurred in the community are as follows: *Potentilla recta*, *Galium lucidum*, *Verbascum flavidum*, *Arabidopsis thaliana*, *Torilis ucranica*, *Calamintha vulgaris*, *Geum urbanum*, *Silene vulgaris*, *Lamium purpureum*, *Luzula forsteri*.

The species with single frequency occurred in the community are as follows: *Rosa canina*, *Rhamnus petiolaris*, *Arabis nova*, *Alyssum strigosum*, *Alyssum desertorum var. desertorum*, *Herniaria glabra*, *Valerianella coronata*, *Taraxacum buttleri*, *Papaver dubium*, *Chrysopogon gryllus*, *Moenchia mantica subsp. mantica*, *Tragopogon pratensis subsp*, *orientalis*, *Malabaila secacul*, *Veronica triphyllos*, *Carex vulpina*, *Epilobium lanceolatum*, *Scrophularia scopolii var. scopolii*, *Asperula involucrata*, *Huetia cynapioides subsp. macrocarpa*, *Galium coronatum*, *Alliaria petiolata*, *Sedum sempervivoides*, *Milium vernale*.

In 15 quadrats laid in *Populus tremula* community, 82 species have been found (Table 8.). The percentage of life forms of the species found in the community is given below:

Hemicryptophytes	(H):	52.44
Therophytes	(T):	32.93
Nanophanerophytes	(Pn):	6.10
Microphanerophytes	(Pp):	3.66
Geophytes	(G):	3.66
Chamaephytes	(Ch):	1.22

3– ARTEMISIA CAMPESTRIS L. COMMUNITY

Artemisia campestris community is found between 1400–1500 m. altitudes, in high plateous with deep sandy-loam soils. This

community also is present in patchs and covers an area of approxi mately two hectares. It is not frequent in the study area. The majority of the species in the *Artemisia campestris* community are characteristic of steppes being annual therophytes. The *Artemisia campestris* community is separated from the *Cistus laurifolius* community in the study area by a definite boundry. Geomorphology and soil structure play an important role in this separation. It is present on slightly inclined or non-inclined plains above 1350 m, relatively dry, deep and sandy-loam soils which possess a firm structure as comparet to the soils supporting *Cistus laurifolius* community. The aeration is poor in this soils and *Artemisia campestris* roots extend up to a depth of 20 cm. being widely spread in the surface layer.

The soils of the community have a A horizon with enough of organic matter (2.84–6.65 %), available water being (10.25–16.00 %), non-calcareous and a pH of 7.1–7.2 (Table 9).

The *Artemisia campestris*, after which the community is named is a 30-50 cm tall perennial herb. The total coverage of the community is 80–90 % whereas that of *Artemisia campestris* is 60–70 %. The height of the two layers in the community varies between 30–50 cm and 10–15 cm. The first layer is dominated by *Artemisia campestris* and second one is an under layer covering the soil in the form of a carpet.

No shrub occurs in the *Artemisia campestris* community. The probable characteristic species of the community are: *Artemisa campestris*, *Arenaria serpyllifolia*, *Trifolium campestre*, *Herniaria incana*, *Apera spica-venti*, *Taraxacum spec.*, *Phlomis armeniaca*, *Trifolium retusum*, *Astragalus squalidus*, *Galium cf, pedemontanum*, *Rumex acetosella*, *Scleranthus annuus*, *Silene lydia*, *Helianthemum ledifolium var. lasiocarpum* and *Erodium cicutarium subsp. cicutarium*. The important companions with higher frequency are: *Veronica chamaepitys*, *Poa bulbosa f. vivipara*, *Bromus tectorum*, *Trifolium arvense var. arvense*, *Alyssum desertorum var. desertorum*, *Logfia arvensis*, *Phleum exaratum*, *Festuca ovina*, *Vulpia ciliata*, *Myosotis collina* and *Potentilla recta* The species with double frequency occurred in the community are as follows: *Bromus squarrosus var. squarrosus*, *Teucrium chamaedrys subsp.*

TABLE 9. PHYSICAL AND CHEMICAL ANALYSIS OF THE SOILS SUPPORTING ARTEMISIA CAMPESTRIS L. COMMUNITY

No	Depth cm.	CaCO %	Sand %	Silt %	Clay %	Texture	Saturation %	Field capacity (water %, 1/3 Atm.)	Wilting point (water % 15 Atm.)	Available water for the plant %
8	0–20	—	71.53	18.54	9.93	Sandy loam	60.25	22.20	6.20	16.00
9 a	0–15	—	85.95	6.19	7.86	Loamy sand	36.32	16.10	5.85	10.25
9 b	20–60	—	77.71	10.30	11.99	Sandy loam	41.48	17.00	5.75	11.25

No	Depth cm.	pH	Conductivity Mmhos/cm.	Organic matter %	Carbon %	N %	Water soluble cations meq/It			Exchangeable cations med/100 gr			C.E.C meq/100 gr.	Useful P ppm
							Na	K	Ca+Mg	Na	K	Ca+Mg		
8	0–20	7.1	0.078	6.65	3.857	0.329	0.203	0.057	0.490	1.62	0.48	14.18	16.28	10.00
9 a	0–15	7.1	0.069	2.84	1.647	0.142	0.196	0.041	0.403	0.98	0.32	11.28	13.58	8.65
9 b	20–60	7.2	0.081	0.93	0.539	0.045	0.260	0.073	0.510	0.94	0.35	11.56	12.85	8.26

chamaedrys, *Veronica dillenii*, *Valerianella coronata*, *Pilosella hoppeana subsp. lydia Globularia trichosantha*, *Crepis sancta*, *Telephium imperati subsp. orientale*, *Hypecoum imberbe*. The species with single frequency occurred in the community are as follows: *Hypericum origanifolium*, *Bromus tomentellus*, *Lithospermum apulum*, *Trifolium pannonicum subsp. elongatum*, *Leontodon asperrimus*, *Centaurea virgata*, *Marrubium globosum*, *Medicago sativa subsp. sativa Capsella bursa-pastoris*, *Silene marschallii*, *Trifolium caudatum*, *Onobrychis oxyodontha*, *Alyssum strigosum*, *Medicago rigidula*.

In the 10 quadrats laid in this community, 65 species were identified (Table 10.). The percentage of life forms of the species in this community is as follows:

Therophytes	(T):	51.56
Hemicryptophytes	(H):	42.19
Chamaephytes	(Ch):	6.25

More than half the species in this community (51.56 %) are annuals.

4–*HYPERICUM HETEROPHYLUM VENT. COMMUNITY*

This community is found in the study area between 1450-1550 m altitude, on south facing slopes, where trickling water sources are present and block shaped main rocks are apparent on the surface. They are distributed as patchs and prefer the rock crevices which in general are more wet than other places. In short, the habitat of this community in the study area is eroded places with shallow soil cover, rocks, well exposed to sun, cool and wet places.

There are no horizons in the soils of *Hypericum heterophyllum* community. Skeletal percentage being 43–50, organic matter 1.13–4.5 %, pH 7.0–7.2 and soils are non-calcareous (Table 11).

Hypericum heterophyllum is a subshrub chamaephyte, 30–40 cm tall, with a spreading branches from base and generally flowers in the begining of July. *Hypericum heterophyllum* community occupies the minimum possible place in the study area being

TABLE 10. ARTEMISIA CAMPESTRIS L. COMMUNITY

Life from												Frequency %	Frequency class
	No. of quadrat	32	30	31	29	33	36	35	34	37	38		
	Area m	50	50	50	50	50	50	50	50	50	50		
	Altidude m²	1410	1410	1420	1410	1420	1450	1440	1415	1440	1450		
	Exposition	S	NE	N	E	E	—	NE	E	—	—		
	Inclination %	3	3	3	3	2	—	3	2	—	—		
	Main rock	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.	Ands.		
	Coverage %	90	90	95	90	85	80	90	90	90	80		
	Mean height of the plants cm	30	35	35	35	30	30	35	35	30	30		
	PROBABLE CHARACTERISTIC SPECIES OF THE COMMUNITY												
H	Artemisia campestris	43	43	43	44	43	33	43	44	44	43	100	V
T	Arenaria serpyllioflia	+1	11	11	11	11	11	11	+1	+1	11	100	V
T	Trifolium campestre	11	.	+1	+1	11	11	+1	+1	+1	+1	90	V
H	Herniaria incana	+1	+1	+1	.	+1	+1	+1	+1	+1	+1	90	V
T	Apera spica-venti	11	11	11	+1	11	+1	+1	.	11	.	80	IV
	Taraxacum spec	+1	+1	+1	.	+1	11	+1	11	12	.	80	IV
H	Phlomis armeniaca	+1	11	11	+1	+1	+1	.	.	+1	+1	80	IV
T	Trifolium retusum	.	11	+1	11	.	+1	11	+1	+1	+1	80	IV
H	Astragalus squalidus	+1	+1	11	+1	11	+1	+1	+1	.	.	80	IV
T	Galium cf. pedemontanum	+1	+1	.	+1	+1	+1	+1	.	+1	+1	80	IV
H	Rumex acetosella	+1	.	+1	+1	+1	+1	+1	+1	+1	.	80	IV
T	Scleranthus annuus	+1	11	+1	+1	+1	.	+1	.	.	.	60	III
T	Silene lydia	.	+1	+1	.	.	+1	+1	.	+1	+1	60	III
T	Heliantheum ledifolium var. lasiocarpum	+1	+1	+1	+1	+1	.	.	.	.	.	50	III
T	Erodium cicutarim subsp. cicutarium	.	+1	+1	+1	+1	.	.	+1	.	.	50	III
	COMPANIONS												
T	Veronica chamaepitys	+1	+1	+1	+1	+1	11	+1	+1	11	11	100	V
H	Poa bulbosa f. vivipara	21	21	21	21	21	21	21	21	21	.	90	V
T	Bromus tectorum	+1	+1	11	+1	.	+1	+1	+1	+1	+1	90	V
T	Trifolium arvense var. arvense	+1	.	+1	+1	+1	+1	+1	+1	+1	+1	90	V
T	Alyssum desertorum var. desertorum	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	90	V
T	Logfia arvensis	+1	+1	+1	+1	+1	+1	+1	.	.	+1	80	IV
T	Phleum exaratum	+1	+1	.	.	.	11	+1	+1	11	11	70	IV
H	Festuca ovina	12	+1	+1	+1	+1	+1	.	+1	.	.	70	IV
T	Vulpia ciliata	11	+1	+1	+1	+1	+1	.	+1	.	.	70	IV
T	Myosotis collina	.	+1	+1	+1	+1	.	+1	.	+1	+1	70	IV
H	Potentilla recta	+1	.	+1	+1	+1	+1	.	+1	.	.	60	III
T	Herniaria glabra	+1	11	11	11	.	.	.	11	.	.	50	III
T	Festuca lachenalii	.	+1	+1	+1	+1	+1	.	.	.	.	50	III
T	Minuartia mesogitana subsp. lydia	+1	+1	.	+1	.	+1	+1	.	.	.	50	III
Ch	Teucrium polium	+1	+1	+1	+1	.	.	.	.	+1	.	50	III
T	Galium floribundum	+1	.	.	.	.	+1	+1	.	.	+1	40	II
H	Verbascum lasianthum	.	+1	+1	.	.	.	.	+1	+1	.	40	II
T	Papaver argemone	.	+1	+1	+1	.	.	+1	.	.	.	40	II
T	Ziziphora taurica	.	.	.	.	+1	+1	.	.	.	+1	30	II
T	Psilurus incurvus	.	.	.	.	.	.	+1	.	+1	+1	30	II
Ch	Thymus zygioides	+1	.	+1	.	+1	.	.	.	.	.	30	II
H	Stipa barbata	+1	.	.	.	.	.	.	.	+1	+1	30	II
H	Scabiosa argentea	+1	+1	.	.	+1	.	.	.	.	.	30	II
Ch	Euphorbia myrsinites	.	.	+1	.	.	+1	.	.	.	+1	30	II
H	Centaurea triumfettii	+1	+1	.	.	.	.	.	+1	.	.	30	II
H	Achillea biebersteinii	.	+1	.	+1	.	.	+1	.	.	.	30	II
H	Teucrium orientale var. glabrescens	+1	.	.	.	+1	.	.	+1	.	.	30	II

TABLE 11. PHYSICAL AND CHEMICAL ANALYSIS OF THE SOILS SUPPORTING HYPERICUM HETEROPHYLLUM VENT. COMMUNITY

No	Dephy cm.	CaCO %	Sand %	Silt %	Clay %	Texture	Saturation %	Field capacity (water %, 1/3 Atm.)	Wilting point (water %, 15 Atm.)	Availamble water for the plant %
11	0–20	—	67.41	14.42	18.17	Sandy loam	42.45	15.00	4.95	10.05
12	0–30	—	65.35	20.60	14.05	Sandy loam	53.35	20.01	5.00	15.01

No	Depth cm.	pH	Conductivity m. Mmhos/cm.	Organic matter %	Carbon %	Na %	Water soluble cation meq/lt			Exchangeable cations meq/100 gr.			C.E.C. meq/100 gr.	Useful P ppm.
							Na	K	Ca+Mg	Na	K	Ca+Mg		
11	0–20	7.0	0.085	1.13	0.655	0.058	0.191	0.039	0.670	1.00	0.36	9.90	11.26	9.21
12	0–30	7.2	0.093	3.45	2.001	0.172	0.197	0.053	0.703	1.06	0.22	13.00	14.28	12.28

distributed in approximately an area of one hectare. General cover varies between 50–75 % and majority of this is composed of *Hypericum heterophyllum*. The community has two vertical layers. First one is shrub and subshrub layer being 30–50 cm tall and second layer is of herbs with a poor cover and height of 10–15 cm.

Juniperus oxycedrus subsp. oxycedrus and *Cistus laurifolius* are the companion shrubs of the community. The probable characteristic species of the community are: *Hypericum heterophyllum*, *Minuartia hirsuta subsp. falcata. Ornithogalum tenuifolium* and *Tanacetum armenum*. In moisture places following plant species occur such as: *Juncus capitatus*, *Aira elegans*, *Juncus bufonius*, *Sedum confertiflorum* and *Ventenata dubia*. The important companions with high frequency are: *Minuartia mesogitana subsp. lydia*, *Logfia arvensis*, *Myosotis collina*, *Poa bulbosa f. vivipara*, *Fistuca ovina*, *Galium floribundum*, *Ziziphora taurica*, *Acinos rotundifolius*, *Trifolium arvense var. arvense*, *Vulpia ciliata*, *Allium flavum* and *Agrostis pisidica*. The species with single frequency occurred in the community are as follows: *Galium cf. pedemontanum*, *Bromus tectorum*, *Phleum exaratum*, *Teucrium chamaedrys subsp. chamaedrys*, *Thymus tosevii*, *Rumex acetosella*, *Arabis caucasica subsp. caucasica*, *Briza spicata*, *Asperula stricta*, *Papaver dubium*, *Campanula lyrata*, *Verbascum flavidum*, *Globularia trichosantha*, *Dianthus lydus*, *Caucalis platycarpos*, *Fritillaria armena*, *Ranunculus illyricus subsp. illyricus*, *Anagallis arvensis*, *Muscari racemosum*, *Fumana aciphylla*, *Valeriana tuberosa*, *Agrostis stolonifera*.

In the six quadrats laid in the *Hypericum heterophyllum* community 65 species were observed (Table 12.). The percentage of life forms of the species in the community is as follows and more than half of the members are therohytes.

Therophytes	(T):	52.31
Hemicryptophytes	(H):	24.62
Chamaephytes	(Ch):	10.77
Geophytes	(G):	9.22
Nanophanerophytes	(Pn):	3.04

TABLE 12. HYPERRICUM HETEROPHYLLUM VENT. COMMUNITY

Life from								Frequency %	Frequency class
	No. of quadrat	41	5	42	40	43	66		
	Area m²	50	50	50	50	50	50		
	Altitude m.	1560	1520	1510	1550	1480	1540		
	Exposition	SE	SW	SE	SE	S	SE		
	Inclination %	30	35	20	30	40	30		
	Main rock	Ands.	Anns.	Ands.	Ands.	Ands.	Ands.		
	Coverage %	60	50	75	70	60	50		
	Mean height of the plants cm.	40	40	35	40	35	35		
	SHRUBS								
Pn	Juniperus oxycedrus subsp. oxycedrus	+1	+1	.	+1	+1	+1	83	V
Pn	Cictus laurifolius	+1	+1	.	.	+1	.	50	III
	HERBS								
	PROBABLE CHARACTERISTIC SPECIES OF THE COMMUNITY:								
Ch	Hypericum heterophyllum	33	33	43	33	33	33	100	V
H	Minuartia hirsuta subsp. falcata	11	+1	11	11	11	+1	100	V
G	Ornithogalum tenuifolium	+1	+1	11	11	.	+1	83	V
Ch	Tanacetum armenum	11	.	+1	11	.	+1	67	IV
	THE SPECIES OF MOISTURE PLACES:								
T	Juncus capitatus	11	+1	11	11	11	+1	100	V
T	Aira elegans	+1	+1	+1	+1	+1	+1	100	V
T	Juncus bufonius	+1	.	12	12	12	+1	83	V
T	Sedum confertiflorum	+1	12	12	.	+1	+1	83	V
T	Ventenata dubia	+1	.	+1	+1	.	+1	67	IV
	COMPANIONS:								
T	Minuartia mesogitana subsp. lydia	11	+1	11	11	11	+1	100	V
T	Logfia arvensis	+1	+1	+1	+1	+1	+1	100	V
T	Myosotis collina	+1	+1	+1	+1	.	+1	83	V
H	Poa bulbosa f. vivipara	+1	.	+1	+1	+1	+1	83	V
H	Festuca ovina	+1	+1	+1	+1	+1	.	83	V
T	Galium floribundum	+1	+1	+1	.	+1	.	67	IV
T	Ziziphora taurica	+1	+1	.	+1	.	+1	67	IV
T	Acinos rotundifolius	+1	+1	+1	.	+1	.	67	IV
T	Trifolium arvense var. arvense	+1	+1	+1	+1	.	.	67	IV
T	Vulpia ciliata	.	+1	+1	.	+1	+1	67	IV
G	Allium flavum	+1	.	+1	+1	+1	.	67	IV
T	Agrostic pisidica	.	+1	.	+1	+1	+1	67	IV
H	Bromus tomentellus	.	+1	.	.	12	+1	50	III
G	Scorzonera pseudolanata	+1	.	11	+1	.	.	50	III
T	Sedum pallidum var. pallidum	+1	+1	.	.	+1	.	50	III
T	Bromus squarrosus var. squarrosus	+1	+1	+1	.	.	.	50	III
H	Koeleria cristata	+1	.	.	+1	.	+1	50	III
T	Linaria simplex	+1	.	.	+1	.	.	33	II
T	Arabis nova	.	+1	+1	.	.	.	33	II
T	Psilurus incurvus	+1	.	.	+1	.	.	33	II
T	Holosteum umbellatum subsp. glutino.	+1	.	.	.	+1	.	33	II
T	Alyssum strigosum	+1	.	.	+1	.	.	33	II
T	Trifolium campestre	.	.	+1	+1	.	.	33	II
T	Elymus caput-medusae	.	+1	.	.	.	+1	33	II
T	Valerianella coronata	+1	.	+1	.	.	.	33	II
H	Stipa barbata	+1	.	+1	.	.	.	33	II
H	Alyssum pateri subsp. pateri	+1	+1	.	.	.	.	33	II
T	Aegilops ovata	+1	.	.	.	+1	.	33	II
T	Sideritis montana	.	+1	.	.	.	+1	33	II
H	Centaurea urvillei subsp. stepposa	+1	+1	.	.	.	.	33	II
T	Veronica arvensis	.	.	+1	+1	.	.	33	II
Ch	Sedum album	.	.	.	.	+1	+1	33	II

VI–EVALUATION OF THE STUDY AREA FROM THE POINT OF ITS MANAGEMENT IN FUTURE

The following suggestions could be put forward for the best evaluation of the study area as a whole in future.

A major part of Turkey lying outside North Anatolian region is subjected to drought every year, to a little or great extent. The plantation work in the dry areas in particular need a special attention and patience.

The destruction of the *Pinus nigra subsp. pallasiana* community in the study area has destroyed the ecological balance of the area and resulted in a loss of the habitat of this community. This destruction has first of all changed the physical and chemical properties of the non-calcareous brown forest soils and through erosion has resulted in the loss of the surface layer in the A horizon, which is rich in humus and controls to some extent the water budget and temperature of the soils. The result is that soil drought has increased more in this area which were passing a long dry period of four months before. As such, for the plantation work to be carried out in the region the problem of drought should be considered first in this connection.

Today the species used for the plantation of this area is *Pinus nigra subsp. pallasiana*. The seedlings of this young *Black-pine*, used for plantation, need a good maintenance for a long period till they get established. As a result of this, for the development of the seedlings, these should be watered during the dry periods. If there is no possibility for watering, following measures can be suggested.

In order to prevent the water loss through evaporation, the bases of seedlings should be covered by a nylon cover. A cover of flat stones or pebbles at the top of seedling dicks shall serve the same purpose. Alongwith this the plant cover will prevent surface erosion and evaporation. With this method, soils can be kept cool and organic matter content will also increase. The plantation zone should be prevented from cutting and grazing. In order to prevent erosion through safeguarding the plant cover, the area can be surrounded by a barbed wire.

The growth behaviour of *Black pines* is successfully going ahead on the cool and wet north slopes of Kara top, where plantation has been carried out for the first time in this area. The texture of the soils of this slope is sandy-loam and sandy-clayeyloam, with enough available water (11.85–14.00 %). Alongwith this due to the occurence of a few such characteristic places in the plantation area the same percentage of success can not be expected everywhere. The areas protected in the north facing slopes of the Kara top the surface cover of the herbs is well developed and cover percentage and frequencies of the species like *Agropyron intermedium*, *Festuca ovina*, *Thymus tosevii*, *Koeleria cristata*, *Coronilla varia subsp. varia* and *Dactylis glometara* is quite high. It is necessary to secure a dominance of the herbs in the other plantation zones for the above purpose. The naturally growing species of the Kara top plantation area, where *Pinus nigra subsp, pallasiana* has been used, is *Quercus cerris*, and the latter is in competition with it. It will be useful to decrease the density of *Quercus cerris* in the area for the success of *Pinus nigra subsp, pallasina.*

The west slopes of Armutlu deprression and Gülbek top which preserve the forest soil in the study area; cutting through will be harmful because it spoils the ecological balance. A proper conservation of these areas will allow for the better growth of the *Black pine* cover.

In the areas with shallow surface layers of soil where *Black pine* plantation is not successful. We believe that, for the soil conservation, *Quercus cerris* plantation should be tried. Only after this step, plantation of *Black pine* could be started. The environmental needs of *Cedrus libani* are quide different (16) as such, its plantation may not give a good results in this area for the time being.

The agricultural plants grown in the study area are *Poppy*, *Wheat* and *Barley*. Alongwith this, attention should be paid towards the cultivation of horticultural plants. On the slopes with higher percentage of sand *Vine* should be cultivated where as in the plains where watering will be possible *Cherry*, *Apple* and *Pear* plants shall prove successful.

The northern slopes of Eğerli Dağ and southern slopes of Bey Dağ can be protected and conserved as pastures.

VII–DISCUSSION AND CONCLUSION

The investigations carried out have shown that sometime back the climax vegetation type in the study area was *Pinus nigra subsp. pallasiana*. This community lying on the eastern frontiers of Mediterranean climate has resulted in the formation of *Cistus laurifolius* and *Populus tremula* communities after its destruction by biotic factors like severe cutting and fire. In general *Cistus laurifolius* community occupies the hot and dry areas while *Populus tremula* community occupies cool and wet sites of the area.

The climax vegetation type of the area i.e., *Pinus nigra subsp. pallasiana* community is mixed up with shrubs like *Quercus cerris*, *Cistus laurifolius* and *Populus tremula*, which were present there before. If the factors resulting in the procedure of regression had been less effective, the layer of small trees of *Quercus cerris* would be expected in the area after the *Pinus nigra subsp. pallasiana* community. *Quercus cerris* has a frequency of 87–100 % in the communities of *Cistus laurifolius* and *Populus tremula* and because of its being less resistant to biotic factors causing sudden destruction, pyrophyte species like *Cistus laurifolius* and *Populus tremula* which are more resistant to cutting or are less destructed, have got distributed in short time. Alongwith this, if the existing plant cover is protected from the effect of biotic factors, *Quercus cerris* may dominate the area once again. This view of ours is fully supported by the existence of a subclimax *Quercus cerris* cummunity in the surrounding areas.

Akman (1974), and Çetik (1974) have shown *Quercus pubescens* as a subclimax while discussing the plant dynamism of *Pinus nigra subsp. pallasiana climax* community from the point of view of regressive procedure holds true for the transitory areas which are dominated by the Mediterranean climate, like our study area.

Since *Pinus nigra subsp. pallasiana* climax vegetation is met with only to a little extent in the study area, it has not been recognized as a community and characteristic species have not been mentioned. As a result of this, some of the probable characteristic species of the four communities; recognized on the basis of preferential constant-dominant species; could belong to the *Pinus nigra subsp. pallasiana* community. In particular the expectation of the *Silene italica* as probable characteristic species of *Populus tremula* community; which is closely related to the forest habitat; can be cited as an example in this connection.

Communities like *Cistus laurifolius*, *Populus tremula*, *Artemisia campestris* and *Hypericum heterophyllum* have been recognized in the study area and in all cases *Poa bulbosa f. vivipara* and Myosotis collina species have shown a high frequency. After these less frequent species like *Acinos rotundifolius*, *Logfia arvensis* and *Veronica chamaepi tys* follow the list.

Cistus laurifolius community has been recognized for the first time in Ayaş mountains of the Central Anatolian region by Akman and Ketenoğlu (1976). It is a shrub formation peresent in the form of a transition between steppe and forest vegetation. The *Cistus laurifolius* community recognized by us resembles the one recognized by Akman and Ketenoğlu (1976) in Ayaş mountains în the constant species (frequency 50 % and above) to the degree of 26 percent. The ratio of resemblence in the floristic composition is 19 percent.

Populus tremula community has been recognized for the first time by Erik (1975) in the Karagöl surroundings of Central Anatolian region. It has been recognized in Işık mountain as well by Akman (1976). *Populus tremula* community recognized by us resembles that of Karagöl and Işık mountain; according to the constant species; to the degree of 14 and 18 percent respectively. According to the floristic composition the resemblence is up to the ratio of 12 percent with those recognized in Karagöl and up to 20 percent with those recognized in Işık mountain.

Hypericum heterophyllum community has been recognized by Akman and Ketenoğlu (1976) for the first time in Ayaş mounta-

ins. The *Hypericum heterophyllum* community recognized by us resembles the Ayaş mountains constant species to the degree of 11 percent and floristic composition to the degree of 18 percent. *Hypericum heterophyllum* community in the Central Anatolia is found on andesite main rock of volcanic origin, surface soils having loamy texture.

The *Artemisia campestris* community has been recognized by us for the first time in the study area and it lies between 1400 1500 m. altitude on deep sandy-loam soils of plains.

The constant species found among the community members are those which are adapted to a greater extent to the habitat of the community. As such, a commparison of the communities according to the constant species will give more good results. Because, the possibilities for the presence of the species with less frequency in the several communities lying under particular climatic conditions depends on a chance. Alongwith this, the ratio of comparison between the same communities has never gone up beyon 26 percent. The reasons for the non-parallelity can be discussed as follows:

a) Local habitat differences, inspite of the development of the same communities in the same type of habitats.

b) The communities of small trees and trees are still developing and structure of the community is channing with this.

The 314 different species collected from the study area from the floristic point of view and presented in the form of a list along with their life forms. The species of *Verbascum afyonense Hub-Mor*, out of those collected from the area; is a new to the flora.

VIII–LIST OF THE SPECIES COLLECTED FROM THE STUDY AREA

BETULACEAE	Period of survival	Life form
Corylus avellana L.	Perennial	P.
BORAGINACEAE		
Anchusa hybrida Ten.	Biennial	H.
Anchusa leptophylla ER. et S. var. pallidiflora Hub. -Mor.	Perennial	H.
Lithospermum apulum (L.) Vahl.	Annal	T.
Lithospermum incrassatum Guss.	"	T.
Myosotis alpestris F. W. Schmidt	Perennial	H.
Myosotis collina Hoffm.	Annual	T.
Myosotis lithospermifolia (Willd.) Hornem.	Perennial	H.
Myosotis micrantha Pall.	Annual	T.
Onosma heterophylla Griseb.	Perennial	H.
CAMPANULACEAE		
Asyneuma limonifolium (L.) Janch.	Perennial	H.
Campanula lyrata Lam.	Biennial	H.
Specularia pentagonia L.	Annual	T.
CARYOPHYLLACEAE		
Arenaria ledebouriana Fenzl	Perennial	H.
Arenaria serpyllifolia L.	Annual	T.
Bolanthus minuartioides (Jaub. et Spach.) Hub.–Mor.	Perennial	H.
Dianthus erinaceus Boiss. var. alpinus.	"	Ch.
Dianthus lydus Boiss	"	H.
Dianthus zonatus Fenzl var. zonatus	"	H.
Holosteum umbellatum L. var. glutinosum (Bieb.) Gay.	Annual	T.
Holosteum umbellatum L. var. umbellatum.	"	T.
Minuartia hirsuta (Bieb.) Hand-Mazz subsp. falcata (Gris.) Mattf.	Perennial	H.
Minuartia mesogitana (Boiss.) Hand. –Mazz. subsp. lydia (Boiss.) McNeill	Annual	T.
Moenchia mantica (L.) Bartl. subsp. caerulea (Boiss.) Clapham	Annual	T.
Moenchia mantica (L.) Bartl. subsp. mantica.	"	T.

Petrorhagia alpina (Habl.) Ball. et Heywood subsp. olympica (Boiss.) Ball. et Heywood	Annual	T.
Saponaria glutinosa Bieb.	Biennial	H.
Silene cappadocica Boiss. etHeldr.	Perennial	H.
Silene compacta Fischer	Biennial	H.
Silene italica (L.) Pers.	Perennial	H.
Silene lydia Boiss..	Annual	T.
Silene marschallii C.A. Meyer	Perennial	H.
Silene supina Bieb. subsp. pru inosa (Boiss.) Chowdh.	"	H.
Silene vulgaris (Moench) Garcke var. vulgaris.	"	H.
Stellaria media (L.) Vill. subsp. media.	Annual	T.
Telephium imperati L. subsp. orientale (Boiss.) Nyman	Perenial	H.
CISTACEAE		
Cistus laurifolius L.	"	P.
Fumana aciphylla Boiss.	"	Ch.
Helianthemum ledifolium (L.) Miller var. lasiocarpum (Willk.) Bornm.	Annual	T.
COMPOSITAE		
Achillea biebersteinii Afan.	Perennial	H.
Achillea setacea Waldst. et Kit.	"	H.
Anthemis aciphylla Bois. var. aciphylla.	"	H.
Antamis cretica L. subsp. anatolica (Boiss.) Grierson	"	H.
Anthemis tincoria L. var. pallida DC.	"	H.
Anthemis tinctoria L. var. tintoria.	"	H.
Anthemis wiedemanniana Fisch. et Mey.	Annual	T.
Artemisia campestris L.	Perennial	H.
Carduus nutans L.	Biennial	H.
Centaurea cyanus L.	Annual	T.
Centaurea depressa Bieb	"	T.
Centaurea solstitialis L. subsp. solstitialis	"	T.
Centaurea triumfettii All.	Perennial	H.
Centaurea urvillei DC. subsp. stepposa Wagen.	Perennial	H.
Centaurea virgata Lam.	"	H.
Chondrilla juncea L.	"	H.
Cirsium sintenisii Freyn	Biennial	H.

Cnicus benedictus L.	Annual	T.
Crepis foetida L. subsp. rhoeadifolia (Bieb.) Celak	”	T.
Crepis sancta (L.) Babc.	Annual	T.
Helichrysum plicatum DC. subsp. plicatum.	Perennial	H.
Inula montbretiana DC.	”	H.
Leontodon asperrimus (Willd.) J. Ball	”	H.
Logfia arvensis (L.) Holub	Annual	T.
Picnomon acarna (L.) Cass.	”	T.
Pilosella auriculoides (A.F.Lang) Sell et West	Perennial	H.
Pilosella hoppeana (Schultes) C.H.et F.W. Schultz subsp. lydia (Bornm. et Zahn) Sell et West	”	H.
Scorzonera cana (C.A.Meyer) Hoffm.	”	H.
Scorzonera eriophora DC.	”	H.
Scorzonera pseudolanata Grossh.	”	G.
Senecio pseudo-orientalis Schiskin	”	H.
Senecio vernalis Waldst. et Kit.	Annual	T.
Tanacetum armenum (DC.) Schultz	Perennial	Ch.
Tanacetum cilicium (Boiss.) Grierson	”	H.
Taraxacum buttleri van Soest	”	H.
Tragopogon longirostris Bisch.	Biennial	H.
Tragopogon pratensis L. subsp. orientalis.	Perennial	H.
Xanthium spinosum L.	Annual	T.
Xeranthemum annuum L.	”	T.
CRASSULACEAE		
Sedum acre L.	Perennial	Ch.
Sedum album L.	”	Ch.
Sedum confertiflorum Boiss.	Annual	T.
Sedum pallidum Bieb. var. pallidum.	”	T.
Sedum sempervivoides Bieb.	Biennial	H.
CRUCIFERAE		
Aethionema arabicum (L.) Andrz. ex DC.	Annual	T.
Aethionema cordatum (Desf.) Boiss.	Perennial	Ch.
Alliaria petiolata (Bieb.) Cav. et Grande	Biennial	H.
Alyssum desertorum Stapf. var. desertorum.	Annual	T.
Alyssum minutum Schlecht. ex DC.	”	T.
Aylssum murale Waldst. et Kit. subsp. murale. var. murale.	Perennial	H.

Alyssum pateri Nyar. subsp. pateri.	"	H.
Alyssum strigosum Banks et Sol.	Annual	T.
Arabidopsis thaliana (L.) Heynhold	"	T.
Arabis caucasica Willd. subsp. caucasica.	Perennial	H.
Arabis nova Vill.	Annual	T.
Arabis sagittata (Bertol). DC.	Biennial	H.
Capsella bursa-pastoris (L.) Medik.	Annual	T.
Cardaria draba (L.) Desv. subs. chalepensis (L.) O.E. Schulz	Perennial	H.
Clypeola jont hlaspi L.	Annual	T.
Erophila verna (L.) Chevall. subsp. spathulata (Lang.) Walters	"	T.
Erophila verna (L.) Chevall. subsp. verna.	"	T.
Erysimum smyrnaeum Boiss. et Bal.	Biennial	H.
Fibigia eriocarpa (DC.) Boiss.	Perennial	H.
Sisymbrium altissimum L.	Annual	T.
Thlaspi arvense L.	"	T.
Thlaspi violascens Boiss.	"	T.
Turritis glabra L.	"	T.
Turritis laxa (Sibth. et Sm.) Hayek	Biennial	H.
CUPRESSACEAE		
Juniperus excelsa Bieb.	Perennial	P.
Juniperus foetidissima Willd.	"	P.
Juniperus oxycedrus L. subsp. oxycedrus.	"	P.
CYPERACEAE		
Carex coriogyne Nelmes	"	G.
DIPSACACEAE		
Scabiosa argentea L.	"	H.
Scabiosa rotata Bieb.	Annual	T.
EUPHORBIACEAE		
Euphorbia falcata L.	Annual	T.
Euphorbia myrsinites L.	Perennial	Ch.
Euphorbia segueriana Necker. subsp. niciciana	"	H.

FAGACEAE		
Quercus aegilops L.	"	P.
Quercus cerris L.	"	P.
Quercus infectoria Oliv.	"	P.
GENTIANACEAE		
Erythreae centaurium Pers.	Biennial	H.
Erythreae linarifolia Pers.	Annual	T.
GERANIACEAE		
Erodium cicutarium (L.) L'Herit. subsp. cicutarium.	Annual	T.
Erodium hoefftianum C.A. Meyer	"	T.
Geranium macrostylum Boiss.	Perennial	G.
Geranium pyrenaicum Burm. fil.	"	H.
GLOBULARIACEAE		
Globularia trichosantha Fisch. et Mey.	Perennial	Ch.
GRAMINEAE		
Aegilops ovata L.	Annual	T.
Agropyron divaricatum Boiss. et Bal.	Perennial	H.
Agropyron intermedium (Host) P. Beauv.	"	H.
Agrostis pisidica Boiss.	Annual	T.
Agrostis stolonifera L.	Perennial	H.
Aire elegans Willd.	Annual	T.
Alopecurus arundinaceus Poir.	Perennial	H.
Andropogon gryllus L.	"	H.
Apera spica-venti (L.) P. Beauv.	"	H.
Briza spicata Sibth. et Sm.	Annual	T.
Bromus scoparius L.	"	T.
Bromus squarrosus L. var. squarrosus.	"	T.
Bromus sterilis L.	"	T.
Bromus tectorum L.	"	T.
Bromus tomentellus Boiss.	Perennial	H.
Dactylis glomerata L.	Perennial	H.
Elymus caput-medusae Forsk.	Annual	T.
Festuca lachenalii (Gml.) Spenner	"	T.
Festuca ovina L.	Perennial	H.

Hordeum bulbosum L.	"	G.
Koeleria cristata L.	"	H.
Melica ciliata L.	"	H.
Milium vernale Bieb.	Annual	T.
Nephelochloa orientalis Boiss	"	T.
Phleum exaratum Gris.	"	T.
Phleum pratense L.	Perensial	H.
Poa bulbosa L. f. vivipara Koel.	"	H.
Poa nemoralis L.	"	H.
Psilurus incurvus (Gouan) Schinz et Thellung	Annual	T.
Secale montanum Guss.	Perennial	H.
Stipa barbata Desf.	"	H.
Ventenata dubia (Leers.) Cost. et Dur.	Annual	T.
Vulpia ciliata Link.	"	T.
GUTTIFERAE		
Hypericum heterophyllum Vent.	Perennial	Ch.
Hypericum origanifolium Willd.	"	H.
Hypericum perforatum L.	"	H.
IRIDACEAE		
Crocus chrysanthus Herb.	"	G.
Iris schatti.	"	G.
JUNCACEAE		
Juncus bufonius L.	Annual	T.
Juncus capitatus L.	"	T.
Luzula forsteri (Sm.) Dc.	Perennial	H.
LABIATAE		
Acinos rotundifolius Pers.	Annual	T.
Calamintha vulgaris (L.) Druce.	Perenial	H.
Lamium amplexicaule L.	Annual	T.
Lamium purpureum L.	"	T.
Lamium striatum Sibth. et Sm.	Perennial	H.
Marrubium globosum Montbr. et Auch.	"	H.
Nepeta tmolea Boiss.	"	H.
Phlomis armeniaca Willd.	"	H.

Prunella laciniata L.	"	H.
Salvia frigidia Boiss.	"	H.
Salvia grandiflora Ettling	"	Ch.
Sideritis lanata L.	Annual	T.
Sideritis montana L.	"	T.
Stachys orientalis Vahl	Perennial	H.
Teucrium chamaedrys L. subsp. chamaedrys.	"	H.
Teucrium orientale L. var. glabrescens Hausskn.	"	H.
Teucrium polium L.	"	Ch.
Thymus tosevii Vel.	"	Ch.
Thymus zygioides Gris.	"	Ch.
Ziziphora taurica M.B.	Annual	T.
LEGUMINOSAE		
Astragalus lydius Boiss.	Perennial	Ch.
Astragalus squalidus Boiss. et Noe	"	H.
Astragalus stereocalyx Bornm.	"	H.
Astragalus vulnerariae DC.	"	H.
Chamaecytisus hirsutus (L.) Link	"	Ch.
Colutea cilicica Boiss. et Bal.	"	P.
Coronilla varia L. subsp. varia.	"	H.
Dorycnium graecum (L.) Ser.	"	H.
Lathyrus digitatus (Bieb.) Fiori	"	H.
Lathyrus incouspicuus L.	Annual	T.
Lathyrus laxiflorus (Desf.) O. Kuntze subsp. laxiflorus.	Perennial	H.
Lotus corniculatus L. var. alpinus Ser.	"	H.
Medicago rigidula (L.) All.	Annual	T.
Medicago sativa L. subsp. sativa.	Perennial	H.
Onobrychis oxyodontha Boiss.	"	H.
Pisum sativum L. subsp. elatius (Bieb.) Aschers. etGraebn.	Annual	T.
Trifolium arvense L. var. arvense	"	T.
Trifolium alpestre L.	Perennial	H.
Trifolium campestre Schreb.	Annual	T.
Trifolium caudatum Boiss.	Perennial	H.
Trifolium medium L. var. medium	"	H.
Trifolium pannonicum Jacq. subsp. elongatum (Willd.) Zoh.	"	H.

Trifolium repens L. var. giganteum Lag.-Foss	"	H.
Trifolium retusum L.	Annual	T.
Trifolium speciosum Willd.	"	T.
Trifolium striatum L.	"	T.
Vicia cracca L. subsp. stenophylla Vel.	Perennial	H.
Vicia lathyroides L.	Annual	T.
Vicia sativa L.	"	T.
Vicia sativa L. subsp. nigra (L.) Ehrh.	"	T.
LILIACEAE		
Allium flavum L.	Perennial	G.
Allium sphaerocephalum L.	"	G.
Colchicum ancyrensis B.L. Burtt	"	G.
Colchicum decaisnei Boiss.	"	G.
Fritillaria armena Boiss.	"	G.
Gagea anisanthos C. Koch	"	G.
Gagea arvensis Pers.	"	G.
Merendera attica Boiss. et Sprun.	"	G.
Muscari comosum (L.) Mill.	"	G.
Muscari racemosum (L.) Mill.	"	G.
Ornithogalum fimbriatum Willd.	"	G.
Ornithogalum nutans L.	"	G.
Ornithogalum oligophyllum Clarke	"	G.
Ornithogalum tenuifolium Guss.	"	G.
Scilla bifolia L.	"	G.
LINACEAE		
Linum austriacum L. subsp. austriacum.	"	H.
OLEACEAE		
Jasminum fruticans L.	"	P.
ONAGRACEAE		
Epilobium lanceolatum Seb. et Mauri	Perennial	G.
ORCHIDACEAE		
Cephalanthera rubra (L.) L.C. Rich.	"	G.
Orchis romana Seb. et Mauri	"	G.

PAPAVERACEAE		
Fumaria asepala Boisss.	Annual	T.
Fumaria cilicica Hausskn.	”	T.
Fumaria parviflora Lam.	”	T.
Hypecoum imberbe Sibth. et Sm.	”	T.
Papaver apokrinomenon Fedde	Perennial	H.
Papaver argemone L.	Annual	T.
Papaver dubium L.	”	T.
Papaver somniferum L.	”	T.
PINACEAE		
Pinus nigra Arn. subsp. pallasiana (Lamb.) Holmboe	Perennial	P.
PLANTAGINACEAE		
Plantago lanceolata L.	Perennial	H.
POLYGONACEAE		
Rumex acetosella L.	Perennial	H.
PRIMULACEAE		
Anagallis arvensis L.	Annual	T.
RANUNCULACEAE		
Ceratocephalus testiculatus (Crantz) Roth	”	T.
Ranunculus arvensis L.	”	T.
Ranunculus gracilis Clarke	Perennial	H.
Ranunculus illyricus L. subsp. illyricus.	”	H.
Ranunculus isthmicus Boiss.	”	H.
Ranunculus reuterianus Boiss.	”	H.
RHAMNACEAE		
Rhamnus petiolaris Boiss.	”	P.
ROSACEAE		
Amygdalus communis L.	”	P.
Cotoneaster nummularia Fisch. et Mey.	”	P.
Crataegus bornmuelleri Zabel	Perennial	P.
Crataegus monogyna Jacq. subsp. monogyna.	”	P.

Crataegus orientalis Pallas ex Bieb. var. orientalis.	"	P.
Geum urbanum L.	"	H.
Potentilla recta L.	"	H.
Prunus divaricata Ledeb. subsp. divaricata.	"	P.
Pyrus elaeagnifolia Pallas subsp. elaeagnifolia	"	P.
Rosa canina L.	"	P.
Sanguisorba minor Scop.	"	H.
Sorbus umbellata (Desf.) Fritsch var. umbellata.	"	P.
RUBIACEAE		
Asperula involucrata Berggr. er Wahl.	"	H.
Asperula stricta Boiss.	"	Ch.
Galium aparine L.	Annual	T.
Galium coronatum Sibth. et Sm.	Perennial	H.
Galium floribundum Sibth. et Sm.	Annual	T.
Galium lucidum Koch.	Perennial	H.
Galium cf. pedemontanum All.	Annual	T.
Galium peplidifolium Boiss.	"	T.
Galium orientale Boiss.	Perennial	Ch.
Galium verum L.	"	H.
SALICACEAE		
Populus tremula L.	"	P.
SCRPOHULARIACEAE		
Linaria genistifolia (L) Mill. subsp. dalmatica (L.) Maire et Petitmengin	"	H.
Linaria genistifolia (L.) Mill. subsp. genistifolia.	"	H.
Linaria simplex (Willd.) DC.	Annul	T.
Scrophularia scopolii Hoppe var. scopolii.	Perennial	H.
Verbascum afyonense Hub.-Mor.	Biennial	H.
Verbascum flavidum (Boiss.) Freyn et Bornm.	Biennial	H.
Verbascum insulare Boiss. et Heldr.	"	H.
Verbascum lasianthum Boiss.	"	H.
Verbascum splendidum Boiss.	"	H.
Veronica arvensis L.	Annual	T.
Veronica chamaedrys L.	Perennial	H.

Veronica chamaepitys Gris	Annual	T.
Veronica dillenii Crantz	"	T.
Veronica hederifolia L. subsp. triloba (Opiz) Celak	"	T.
Veronica multifida L.	Perennial	H.
Veronica triphyllos L.	Annual	T.
UMBELLIFERAE		
Anthriscus nemorosa (Bieb.) Sprengel	Perennial	G.
Caucalis platycarpos L.	Annual	T.
Eryngium campestre L.	Perennial	H.
Ferulago aucheri Boiss.	"	G.
Huetia cynapioides (Guss.) P.W. Ball subsp macrocarpa (Boiss. et Spruner) P.W. Ball	"	G.
Malabaila secacul Banks et Sol.	"	H.
Peucedanum depauperatum Boiss. et Bal.	"	H.
Pimpinella tragium Vill. subsp. polyclada (Boiss. et Heldr.) Tutin	"	H.
Torilis ucranica Sprengel	Annual	T.
Turgenia latifolia (L.) Hoffm.	"	T.
VALERIANACEAE		
Valeriana tuberosa L.	Perennial	G.
Valerianella coronata (L.) DC.	Annual	T.
VIOLACEAE		
Viola occulta Lehm	Annual	T.
Viola parvula Tineo	"	T.
Viola sieheana Becker	Perennial	H.

Abbreviations:

P: Phanerophyte

Ch: Chamaephyte

H: Hemicryptophyte

G: Geophyte

T: Therophyte

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ÖZET

Bu fitososyolojik ve fitoekolojik araştırma 1975, 1976 yıllarında, Afyon iline bağlı Köroğlubeli ve Bayat bucağı arasındaki basık arazide yapılmıştır.

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Ankara Üniversitesi Basımevi. Ankara – 1979