PHYTOSOCIOLOGICAL STUDIES ON THE STEPPE COMMUNITIES OF NATURAL PASTURES IN ŞANLIURFA, UPPER MESOPOTAMIA, TURKEY

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Abstract. This phytosociological study was carried out in the steppe of Fatik Mountains in Sanliurfa, between the years 2002-2005. At the end of this study, it was underlined that the dominant vegetation type was steppe in the region and different steppe associations were determined. These were also; *Festuco callieri–Teucrietum poliae* ass. nova, *Astragalo strictifolii–Salvietum sclarea* ass. nova, *Phlomido bruguieri–Thymbretum spicatae* ass. nova, *Asphodelo aestivum–Teucrietum poliae* ass. nova, *Cynodo dactyloni–Bromoetum danthoniae* ass. nova, and *Prosopo farctae–Avenetum erianthae* ass. nova. During the floristic surveys, 153 taxa belonging to 26 families and 107 genera were identified. *Poaceae* with 31 taxa (20.3%), *Asteraceae* with 24 taxa (15.7%), *Fabaceae* with 22 (14.4%), and *Apiaceae* with 13 taxa (8.5%) were the richest families.
Keywords: *steppe vegetation, grazing, ecosystems, characteristic species, association*

Introduction

Turkey is located at the intersection of two important gene centers namely the Mediterranean and Near East and has the ninth highest biodiversity among terrestrial countries. Natural species of most cereals cultivated for human consumption grow on steppe ecosystems (Ture and Bocuk, 2007).

Fatik Mountain, located at the southwestern part of Şanlıurfa, was selected as the research area since it has a peculiar steppe vegetation and has been paid less attention so far as "Adıgüzel and Aytac, 2001" mentioned earlier. The studied area is in the C7 square according to grid system adopted by Davis (1988). Phytogeographically located in the Irano–Turanian Floristic Region, extending between the longitudes of 37.2 North and 37.3 and between the latitudes of 38.6 and 38.7 East (Anonymous, 1995).

The central, eastern and southeastern parts of Turkey belong phytogeographically to the Irano–Turanian region (Zohary, 1973). The Irano–Turanian region is separated into two parts the West and the East Irano–Turanian subregions. There are three provinces in Turkey belonging to the West Irano–Turanian subregion namely; Central Anatolian, Irano–Anatolian and the Mesopotamian provinces. According to this classification, Southeast Anatolia is located in the Mesopotamian province of the West Irano–Turanian subregion (Zohary, 1973).

According to Flora of Davis (Davis 1965-1985; Davis et al.; 1988; Güner et al., 2000) some researchers among them Kotschy, Sintenis, Davis, and Zohary have visited and

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gathered plant specimens from Şanlıurfa by Baytop (2003). Some floristic and taxonomic studies were carried out in and around Southeast Anatolia (Kaynak and Ketenoğlu, 1980; Malyer, 1981-1983; Kaynak, 1987-1989a, b; Yıldırımlı, 1992-1994; Yıldız and Aktoklu, 1996; Ertekin and Saya, 1997; Ertekin, 2002; Adıgüzel and Aytac, 2001; Aslan and Turkmen, 2001-2003; Turkmen et al., 2002; Akan et al., 2005; Aydoğdu and Akan, 2005). But there has been no vegetational research data except for a study carried out by Zohary (1973). In addition, Southeast Anatolia is one of the most little known or unknown regions of Turkey (Davis, 1965-1985; Çırpıcı, 1987; Donner, 1990).

In the region, the natural areas are used as pastures like in all arid countries. Artificial pasture culture has not been demanded yet. It has been stated that it contains wheat, beans in pastures in arid regions and includes drought-resistant different vegetation types and other herbaceous plants such as Savanne, Praerie, Steppe, Maguis, Phyrgana. (Gençkan, 1983). This understanding and using of pastures are applied in Şanlıurfa on large scale, like in the most of regions of Turkey. In this region the open places which are out of using, belong to state, like slopes, stony, rocky places, stream beds, hills etc. (Çullu et al., 2002). Şanlıurfa is one of little researched region in Turkey (Aslan, 2015). It has 724.529 ha of area. 263.507 ha of this area is used as natural pastures. In the region, the pastures have the poorest plant cover (10-15%) in Turkey. 0.82 ha of area is divided for each cow. In the past years there have been significant changes in the diversity of plants in this area due to random overgrazing and in some years fires (steppe fires) due to the abundance of animals. But, when the pastures of the region are taken into consideration it is necessary to divide 4 ha area for each cow. This shows that the pastures are used five times excessively. Excessive and irregular using have caused succession and degradation. The primary vegetation has transformed to secondary vegetation and converting towards semi-desert ecosytem (Atamov et al., 2004).

The characteristic vegetation type is steppe in this region (Atamov et al., 2004). The threat factors are excessive grazing and transforming of natural pastures to agricultural areas. Because of increased industrial activities, urbanization, tourism activities, creating new agricultural areas, mining activities, using agricultural methods and overgrazing, the natural structures of steppe ecosystems have been getting destroyed (Ture and Bocuk, 2007). 74 taxa are under threat and of these 10 taxa on Karacadağ, 13 taxa in Ceylanpınar are endemic (Özhatay et al., 2003; Aslan, 2018). In Şanlıurfa, the steppe vegetation is dominant because of ecological, geographical and antropogenic factors. Usually, animals eat legumes, grasses and similar crops, which are fresh and delicious for a period of one year. However, the perennial shrub, smelly and prickly plants are not preferred.

Under effects of topographic and edafic factors, different steppe vegetation types are found in the region. In this steppe, wheats are dominant and different plants can be found, which have life forms like geophytes, camephytes, cryptophytes, hemicryptohytes and terophytes. In some districts, some remains of forest and rare old trees are found. In addition, the efemeres which grow rapidly and complete their life cycles in short time after spring and autumn rains are present in the vegetation.

The constant plants are perennial herbs, shrubs and trees that are seen rarely (Atamov et al., 2007). But, the efemeres are found and affect quality of fodder plants and yields positively.

In the region, watery agriculture has been made for years. Agricultural method applied to irrigation in semi-arid and arid regions depending on the characteristics of the plant sown or to obtain higher yields. Since these areas are not natural areas, weed yield

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is considerably reduced due to the excess number of animals. Holophytic areas have risen 394%. The agriculture of wheat and cotton have been stopped in some places because of salinity and these areas have been used as pastures for the last 15 years (Çullu et al., 2002).

Materials and methods

The city Şanlıurfa in Southeast of Anatolia is between 37° 49' 12" – 40° 10' 00" East meridian and 36° 41' 28" – 37° 55' 50" North parallel. In Şanlıurfa the uneven areas are at percentage of 60.4%, mountains 22%, plains 16.3% and plateaus 1.3%. Harran plain, covering the study area, is one of the most important agricultural areas of Turkey and located between 36°47' and 39°15' east longitude and 36°40' and 37°41' north latitude within the borders of the province of Şanlıurfa in Southeastern Anatolian region. The most important plains are named Harran, Suruç, Viranşehir, stayed on south part of Şanlıurfa. Ceylanpınar plain are stayed on southwest. In addition, Halfeti, Hilvan and Bozova plains have large areas. The average altitude is 375 m. The lowest plain is Harran plain. Viranşehir plain is at east, Suruç plain is at west of Harran plain. It is 141 535 ha (Anonymous, 1995) (*Figs. 1, 2* and *3*).

Floristic and phytosociologic research studies were carried out between the years 2000-2005 at Karacadağ, Tektek, Fatik, Kaşmer, Nemrut, Kalecik mountains and Direkli Hills where are used as natural pastures. Regular geobotanical trips were organized. Plant specimens were collected and preserved according to the herbarium techniques. These were identified with the help of "Flora of Turkey and the East Aegean Islands" (Davis, 1965-1985, 1988; Güner et al., 2000) and other relevant publications (Akman et al., 2001) as well as the flora of Syria, Iraq and Iran. In addition, the plants of Birecik Dam lake area and halophytic plants in Akçakale were gathered and classified (Ertekin and Saya, 1997; Ertekin, 2002; Adıgüzel and Aytac, 2001; Aslan, 2002; Aslan and Türkmen, 2001-2003; Kaya, 2002; Atamov et al., 2004; Akan et al., 2005; Aydın, 2003; Aydoğdu and Akan, 2005; Ayalp, 2005; Atamov et al., 2005).

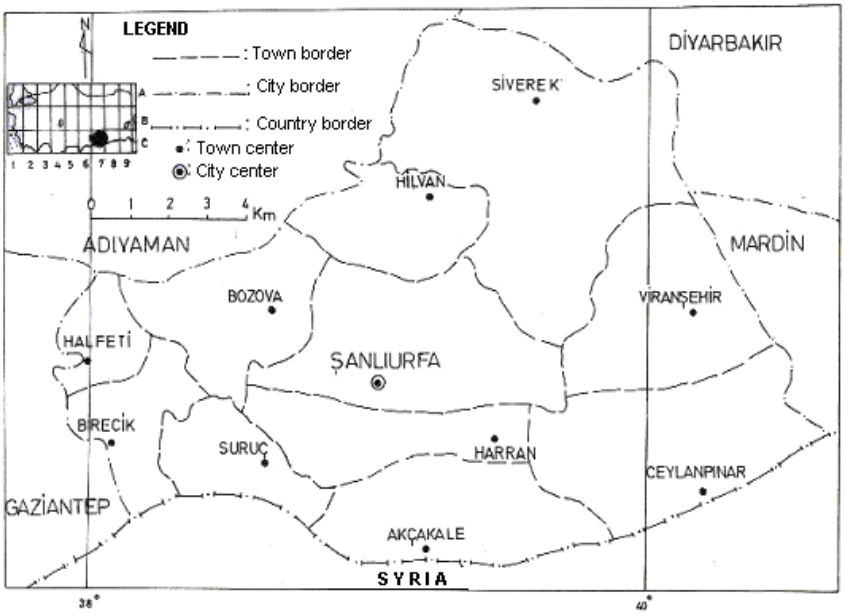

Figure 1. *Location of the study area in Turkey*

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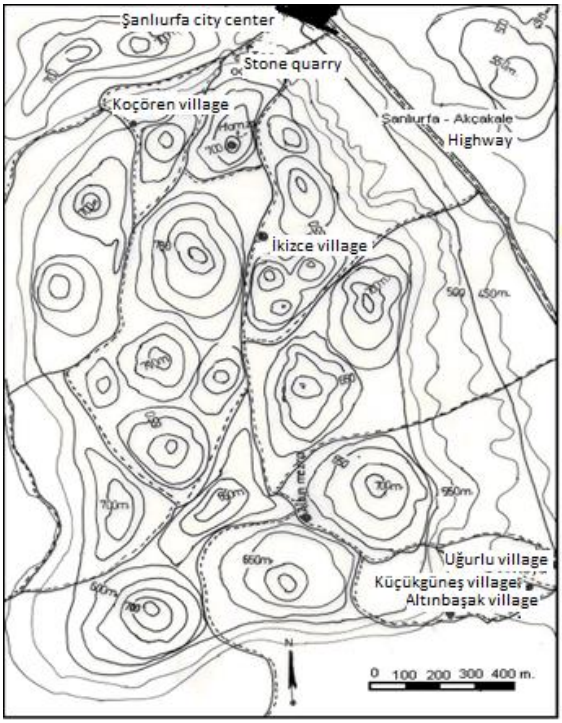

Figure 2. *The map of Fatik Mountains*

Figure 3. *A photo of the research area*

Braun-Blanquet's (1964) method was used for the naming of phytosociological plant groups. Plants were sampled twice a month during certain vegetation periods and plant samples were taken to identify the plants and examine the necessary materials.) These plants have been protected in the Herbarium of Harran University. The climatic data were taken from the Sanliurfa Meteorology Station and has been evaluated according to these data. Approximately 500 g. soil samples were taken from 5 cm under the soil in the research areas in spring, summer and autumn. The soil samples were dried naturally and analysis of them were made by the Ministry of Agriculture and the Rural Affairs General Directorate of Rural Services Sanliurfa Research Institute.

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Results and discussion

As it is seen in *Figure 4* and *Table 1*, the climate in Şanlıurfa is arid from June to October in a long period. In this period, most annual plants die. Only perennial herbs, shrubs and trees are alive. Semiarid Mediterranean climate occurs in research area. According to Emberger the precipitation–temperature coefficient (Q) is 42.94 (Akman, 1990). Annual mean temperature is 18.7 °C. The maximum mean temperature (M) is 46.8 °C, in July. The minimum mean temperature (m) is -6.8 °C, in February. Annual rainfall is about 457.8 mm (Anonymous, 2001) and the seasonal precipitation regime is winter, spring, autumn and summer. This is the first variant of the East Mediterranean precipitation regime. The ombrothermic diagram shows dry and rainy periods (*Fig. 4*).

Table 1. *The bioclimate and fall regime of Sanliurfa*

Altitude (m)	P (mm)	M (°C)	M (°C)	Q	PE	S	Fall regime	Bioclimate
547	457.8	46.8	-6.8	42.94	7.2	0.18	W.Sp.A.Su	Semi-arid, cold in winter

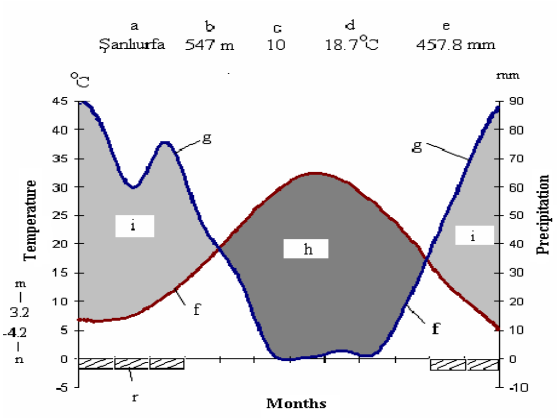

Figure 4. *The climatic diagram of Şanlıurfa.* ***a:*** *Meteorology station;* ***b:*** *The elevation of the Meteorology station (m);* ***c:*** *The year of temperature and precipitation;* ***d:*** *The mean annual temperature (°C);* ***e:*** *The mean annual precipitation (mm);* ***f:*** *The curved line of temperature;* ***g:*** *The curved line of precipitation;* ***h:*** *Arid season;* ***i:*** *Humid season;* ***m:*** *The least mean temperature of the most cold month (°C);* ***n:*** *Absolute minimum temperature (°C);* ***r:*** *Probable frosty month*

In the different plant associations in the steppe vegetation, the avarage productivity changes between 1.0-7.0 kg m^{-2}. Excessive aridity and temperature have caused decreasing productivity and quality of fodder plants in pastures. From the end of autumn to the middle of spring, the efemeres grow and these plants increase the quality and productivity of fodders by 2-3 times. At the end, yield of natural pastures, number of fodder plant species and their populations have been reduced day to day because of excessive and unconscious grazing, migration, negative habitat conditions like aridity and temperature. The plants which have prickle, etheric oils, latex, poison, bitter and fluff have spread out. Excessive grazing has caused the transforming of the primary steppe to secondary and then semi-desert to desert vegetation.

In most of the places in this area, the covering degree of the flora is 40-50%. And this is the characteristic property of half-desert and desert type associations. The flora

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has generally made up of a single layer and the average height of the grass covering is 10-20 cm.

On the contrary, the number of plants which are not eaten by animals have been increased. Thus, the primary steppe vegetation has been transformed to secondary and it is seen that the succession has been transformed to semi-desert conditions.

Immigration is widespread in this region and emigrants migrate from East Anatolia to use pastures for grazing. Thousands of sheep destroy the all immature and senile groups of plants. The yield of pastures has been decreased. This situation has caused transforming from steppe to desertation.

In the flora of Şanlıurfa, 71 families, 798 taxa belonging to 342 genera have been determined (Atamov et al., 2004). 135 of these plants were monocotyledonaes, 663 were dicotyledonaes.

The number of plants belonging to *Poaceae* family were more than others in spite of having less species (56) than *Fabaceae* (101). The dominant taxa which spread out in naturel pastures were as follows: *Bromus japonicus* Thunb. subsp. *japonicus, B. squarrosus* L., *B. sterilis* L., *B. tectorum* L., *Avena sterilis* L. subsp. *sterilis, Aegilops triuncialis* L. subsp. *triuncialis, A. neglecta* Req. ex Bertol, *Festuca callieri* (Hackel ex St. – Yves) F. Markgraf subsp. *callieri, Hordeum murinum* L. *subsp. glaucum* (Steudel) Tzvelev.

Some plants belonging to *Fabaceae,* have fodder quality. Most of them are used as fodders. These were as follows; *Astragalus onobrychis* L., *A. aleppicus* Boiss., *A. immarginatus* Labm., *A. dactylocarpus* Boiss., *Medicago rigidula* (L.) var. *rigidula, Onobrychis caput-galli* (L.) Lam. *O. crista-galli* (L.) Lam. *O. galegifolia* Boiss. *O. kotschyana* Fenzl. *Trifolium scabrum* L., *T. speciosum* Willd., *T. dasyurum C.* Presl, *T. angustifolium L.* var *intermedium, T. boisseri* Guss. ex Boiss., *T. meironense* Zoh., *T. campestre* Schreb., *Trigonella monspeliaca* L., *T. mesopotamica* Hub. Mor., *Vicia mollis* Boiss., *Coronilla orientalis* Miller var. *orientalis, C. scorpioides* (L.) Koch, *Hedysarum varium* Willd.

In the research area, 153 taxa belonging to 26 families and 107 genera were identified. *Poaceae* with 31 taxa (20.3%), *Asteraceae* with 24 taxa (15.7%), *Fabaceae* with 22 (14.4%), and *Apiaceae* with 13 taxa (8.5%) were the richest families.

Braun-Blanquet's (1964) method was used for the naming of phytosociological plant groups.

32 sample parcels were evaluated and 6 new associations and their upper categories are as follows:

Astragalo–Bromotea Quezel 1973

Astragalo–Bromotalia Quezel 1973

Agropyro–Stachyon Quezel 1973

1. *Festuco callieri–Teucrietum poliae* ass. ova

Onobrychido armenae–Thymetalia leucostomi Akman, Ketenoglu Quezel 1984

2. *Astragalo strictifolii–Salvietum sclarea* ass. nova
3. *Phlomido bruguieri–Thymbretum spicatae* ass. nova
4. *Asphodelo aestivum–Teucrietum poliae* ass. nova
5. *Cynodo dactyloni–Bromoetum danthoniae* ass. nova
6. *Prosopo farctae–Avenetum erianthae* ass. nova

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Festuco callieri–Teucrietum poliae ass. nova

There were no trees and shrubs in its structure. Only grass layer was present and covering was 40-80%. The length was between 10 and 35 cm (*Table 2*).

Festuco callieri–Teucrietum poliae association was spreading out where the calcereous main rock, gravelled and small pit areas. According to chemical and physical properties of soils where the association was spreading out homogenous, pH was between 7.0 and 7.71, the rate of lime ($CaCO_3$) was 3.8%, phosphorus (P_2O_5) was 5.2-5.3 kg dec^{-1}; potassium (K_2O) was 118.8-308.8 kg dec^{-1} and organic component was 2.17-2.48% (*Table 3*).

Table 2. *Festuco callieri–Teucrietum poliumae ass. nova. Thypus: Sample Parcel 62*

Sample parcel No	**12**	**23**	**34**	**35**	**37**	**41**	**42**	**46**	**48**	**50**	Frequency
Square size (m^2)	50	50	50	50	50	50	50	50	50	50	
Altitude (m)	500	478	530	540	570	510	515	530	535	550	
Gradient (%)	20	30	30	35	30	25	30	35	30	25	
Direction	N	NW	NW	N	N	N	N	N	N	NW	
Length of cover (cm)	10	25	20	17	20	22	20	25	25	20	
Number of species	21	21	20	16	17	18	18	15	16	17	
Cover (%)	60	55	55	60	65	65	60	60	60	65	
Characteristic species of Association											
Festuca callieri	22	22	+2	+2	+1	22	22	33	22	11	V
Teucrium polium	–	22	+1	11	11	1	33	33	+1	11	IV
Trifolium tomentosum	+2	+2	+1	+2	+2	.	.	.	.	.	III
Characteristic species of Allians *Festuca–Teucrion*											
Phleum phleoides	+1	+2	+2	+2	.	.	.	+2	+2	+2	III
Phlomis bruguieri	+2	+2	+2	+2	+2	+2	+2	+1	.	.	III
Eryngium creticum	+1	+2	+2	.	.	+2	+1	.	.	.	II
Characteristic species of Ordo *Daphno–Festucetalia*											
Thymbra spicata var. *spicata*	22	22	22	11	11	+2	+2	+2	.	.	III
Lolium rigidum	+2	+2	.	.	.	+2	+1	+1	+1	+1	II
Hordeum murinum subsp. *glaucum*	+2	.	.	+2	+2	+2	+2	+2	+2	.	III
Characteristic species of Classis *Daphno–Festucetea*											
Salvia sclarea	.	.	.	+2	+2	+2	+2	+2	+2	+1	II
Teucrium polium	+2	+1	+2	+2	+2	.	.	.	.	.	II
Scutellaria tomentosa	+2	+1	+2	.	.	.	.	.	+2	+2	II
Aegilops cylindirica	+2	+2	+1	+1	+1	+1	+1	.	.	.	II
Participants											
Allium flavum subsp. *tauricum* var. *tauricum*	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	III
Avena sterilis subsp. *sterilis*	+1	+1	.	.	.	+2	+2	+2	+2	+1	II
Euphorbia denticulata	+1	+1	+1	+1	+1	.	.	.	.	+1	I
Tordylium syriacum	.	.	.	.	.	+1	+2	+2	+2	+1	I
Erodium cicutarium subsp. *cicutarium*	+1	+1	+1	.	.	.	.	.	.	.	I
Cichorium glandulosum	.	.	.	.	+1	+1	+2	+2	.	.	I
Crepis reuterana subsp. *reuterana*	.	.	.	.	.	.	.	+1	+1	+1	I
Gagea luteoides	.	+1	.	.	.	.	.	.	.	.	I

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Thlaspi perfoliatum	+1	+1	+1	+1	.	.	.	.	.	.	I
Muscari comosum	.	.	.	.	.	.	+1	+1	+1	.	I
Scandix pecten–veneris	+1	.	.	.	.	.	+1	.	.	+1	I
Lappula barbata	.	.	.	.	+1	.	.	.	.	.	I
Cynosurus echinatus	.	+1	.	.	.	.	.	.	.	.	I
Torilis tenella	+1	+1	.	.	.	.	.	.	+1	.	I
Hypecoum imberbe	.	.	+1	.	.	.	.	.	.	+1	I
Senecio vulgaris	.	.	.	.	.	+1	.	.	.	.	I
Anthemis haussknechtii	.	.	.	.	+1	+1	+1	.	.	+1	I
Gypsophila antari	+1	+2	+2	+2	.	.	.	+1	.	.	II
Medicago minima var. *minima*	+1	+1	+2	+2	+2	.	.	.	+2	+2	II
Echinops microcephalus	.	.	+1	.	.	.	.	.	.	.	I
Centaurea solstitialis subsp. *solstitialis*	+1	.	.	.	.	.	.	.	.	.	I
Hypecoum pendulum	.	.	.	.	.	.	.	.	+1	+1	I
Torilis leptophylla	.	.	+2	+1	+1	+1	+1	.	.	.	I

Table 3. *Chemical characteristics of the soil of the research area*

Location	Deepth (cm)	Saturation with water (%)	Total salt (%)	pH	$CaCO_3$ (%)	P_2O_5	K_2O	Organic mass (%)
Ugurlu Village	0-20	77	0.071	7.70	3.8	5.3	118.8	2.48
Kocoren Village	0-20	77	0.060	7.71	3.8	5.2	308.8	2.17
Ikizce Village	0-20	68	0.073	7.28	2.6	4.9	179.2	1.44
Altun Village	0-20	66	0.098	7.42	6.8	4.5	108	2.35

The characteristic species of the association were *Festuca callieri* subsp. *callieri*, *Teucrium polium*. Each species are the elements of Irano–Turanian phytogeographic region.

Classis: *Daphno–Festucetea* Quezel 1964

Ordo: *Daphno–Festucetalia* Quezel1964

Alliance: *Festuca–Teucrion* ass. nova

Asphodelo aestivi–Teucrietum poliae ass. nova

The characteristic species of the association were *Asphodelus aestivus* and *Teucrium polium*. This association was at the north part of the Fatik Mountains and at the environs of Stone quarry. 10 sample areas were used. The gradient was 35-40%, The length was between 600 and 700 m (*Table 4*).

Table 4. *Asphodelo aestivi–Teucrietum poliae ass. nova. Thypus: Sample Parsel 63*

Sample parcel No	60	61	62	67	70	73	77	79	81	82	
Square size (m^2)	50	50	50	50	50	50	50	50	50	50	Frequency
Altitude (m)	531	535	500	510	515	520	530	505	500	517	
Gradient (%)	30	20	25	25	30	30	35	30	35	35	
Direction	W	W	W	W	NW	NW	NW	NW	NW	W	

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Length of cover (cm)	20	25	20	20	25	15	20	25	20	30	
Number of species	14	13	11	8	12	13	13	10	11	11	
Cover (%)	55	50	45	55	50	55	60	50	40	45	
Characteristic species of Association											
Astragalus strictifolius	11	+2	+2	11	11	12	22	22	22	+2	V
Teucrium polium	+2	22	22	22	11	.	.	11	+2	+2	VI
Asphodelus aestivus	12	33	33	.	.	+2	+2	.	.	.	III
Characteristic species of Allians *Agropyro–Stachyon*											
Euphorbia denticulata	+1	.	+1	.	+1	.	+2	+2	+2	.	III
Centaurea solstitialis subsp. *solstitialis*	.	+2	.	.	+2	+2	.	.	.	+1	II
Bromus japonicus subsp. *japonicus*	+1	+2	.	.	33	+1	+2	+1	.	.	III
Characteristic species of Ordo *Astragalo–Bromotalia*											
Astragalus lamarckii	11	+2	+2	22	22	11	11	11	+2	+2	IV
Bromus danthoniae	+2	+2	+1	+1	.	.	.	+1	+1	+2	III
Scutellaria tomentosa	+1	+1	.	.	.	.	+2	+1	+1	+1	II
Characteristic species of Classis *Astragalo–Bromotea*											
Arrhenatherum kotschyi	+2	+2	.	.	+2	+2	.	.	+1	11	II
Phlomis kurdica	+2	.	.	+2	+1	+1	.	+1	.	.	II
Gypsophila antari	+1	.	+1	.	.	.	+1	.	.	.	I
Stipa holosericea	.	.	.	+1	+2	+2	+2	+2	.	.	II
Participants											
Poa bulbosa	+1	+1	+2	+2	+	+1	+2	+2	+2	+2	II
Trifolium speciosum	.	.	+2	.	+2	+2	+1	.	.	+2	II
Torilis arvensis	+1	+1	+1	.	.	.	.	+1	+2	+1	II
Anthemis haussknechtii	+1	+1	+1	.	.	.	+1	.	.	.	I
Lolium rigidum	.	.	.	+1	+1	+2	+2	.	+2	.	I
Capparis spinosa	.	.	.	.	.	+1	+1	.	.	.	I
Convolvulus arvensis	.	.	.	.	+1	+2	.	.	.	.	I

The association contain one layer composed of grass and average length was between 20 and 30 cm. The plant cover was changing between 40 and 60%.

Classis: *Astragalo–Bromotea* Quezel 1973

Ordo: *Astragalo–Bromotalia* Quezel 1973

Alliance: *Agropyro–Stachyon* Quezel 1973

This association was spreading out on the calcereous main rock, and gravelled and small pit areas. According to chemical and physical properties of soils, pH was: 7.28-7.71, the rate of lime ($CaCO_3$) was 3.8%, phosphorus (P_2O_5) was 5.2 kg/dec.; potassium (K_2O) was 118.8 kg/dec. and organic component was 2.48%. (*Table 3*). The yield of pasture was low, between 0.5 and 1.0 ha^{-1}, because of excessive grazing. 20 taxa were determined.

Cynodo dactyloni–Brometum danthoniae ass. nova

The characteristic species of the association were *Cynodon dactylon* and *Bromus danthoni*. It was defined in stream beds and depressed places on the southwest of İkizce village at Fatik mountains. The gradient was low (5-10%), and the altitude was between

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600 and 700 m. 10 sample parcels were used. This association composed of only grass layer and the average length was between 10 and 20 cm., covering was 60–65% and taxon number was poor (between 7 and 13) (*Table 5*).

Classis: *Astragalo–Bromotea* Quezel 1973

Ordo: *Astragalo–Bromotalia* Quezel 1973

Alliance: *Agropyro–Stachyon* Quezel 1973

This association was spread out at red-brown soils. According to chemical and physical properties of soils; pH was: 7.42, the rate of lime ($CaCO_3$) was 6.8%, phosphorus (P_2O_5) was 4.5 kg dec^{-1}; potassium (K_2O) was 108.0 kg dec^{-1}. and organic component was found as 2.35% (*Table 3*). The yield of pasture was 1.0 ha^{-1}

The association Cynodo datyloni–Brometum danthoniae is composed of 27 taxa Table 5).

Table 5. *Cynodo dactyloni–Bromoetum danthoniae ass. nova. Thypus: Sample Parcel 64*

Sample parcel No	******	**63**	**64**	**69**	**71**	**74**	**75**	**76**	**78**	**80**	Frequency
Square size (m^2)	50	50	50	50	50	50	50	50	50	50	
Altitude (m)	470	485	480	485	490	485	480	458	500	505	
Gradient (%)	10	20	25	15	20	25	15	20	25	20	
Direction	NE	NE	NE	NE	NE	N	N	N	NE	NE	
Length of cover (cm)	15	15	10	10	15	15	10	15	10	20	
Number of species	13	13	13	12	13	8	12	12	7	10	
Cover (%)	65	60	65	65	60	60	65	55	55	65	
Characteristic species of Association											
Cynodon dactylon	.	+2	22	33	33	22	23	23	+2	+2	V
Bromus danthoniae	+1	+2	+1	+2	+2	11	11	22	11	12	IV
Bromus japonicus	+2	+1	+2	11	11	11	+2	.	.	.	III
Characteristic species of Allians *Agropyro–Stachyon*											
Avena eriantha	+1	+1	+1	+2	+2	+2	+2	.	.	.	III
Eryngium creticum	+1	.	+1	.	+1	.	.	+1	+1	+1	II
Cichorium glandulosum	.	.	.	+1	.	.	.	+1	.	+1	I
Characteristic species of Ordo *Astragalo–Bromotalia*											
Astragalus lamarckii	.	.	+2	+1	+1	+2	+2	+2	+2	+2	III
Bromus rubens	+2	+2	+2	.	.	.	+1	+1	.	.	II
Euphorbia characias subsp. *wullfenii*	.	.	.	+1	+1	+1	.	.	.	.	I
Characteristic species of Classis *Astragalo–Bromotea*											
Aegilops cylindirica	+2	+2	.	.	.	.	.	+1	+2	.	II
Hordeum bulbosum	.	.	+1	+2	+2	.	.	.	.	+2	I
Ziziphora capitata	+1	+1	+1	+2	.	.	.	.	.	.	I
Scrophularia canina subsp. *bicolor*	+1	+1	.	.	.	.	+1	.	.	.	I
Participants											
Scandix pecten–veneris	.	.	.	+1	+1	+1	+2	+2	+2	+2	III
Verbascum kotschyi	.	+1	+1	.	.	.	.	.	.	+1	I
Centaurea consanguinea	.	.	+1	.	.	.	+1	+1	+1	.	I
Veronica beccabunga subsp. *beccabunga*	+1	+1	.	.	+1	.	.	.	.	.	I
Ranunculus arvensis	11	+1	+2	+2	+2	+1	.	.	.	.	II
Secale sylvestris	.	.	.	.	.	.	+1	+1	+1	.	I

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Allium flavum subsp. *tauricum* var. *tauricum*	+1	+1	.	.	.	.	.	.	.	+1	I
Senecio vulgaris	.	.	.	.	.	.	+1	+1	.	.	I
Crepis reuterana subsp. *reuterana*	+1	.	.	.	+1	.	.	.	.	+1	I
Trifolium tomentosum	.	.	.	.	.	.	.	.	+1	.	I
Hypecoum pendulum	.	.	.	+1	+2	+2	.	.	.	.	I
Avena sterilis subsp. *sterilis*	+1	+1	.	.	.	.	.	.	.	+1	I
Hypericum capitatum var. capitatum	.	.	.	.	.	.	+1	.	.	.	I

Phlomido bruguieri–Thymbretum spicatae ass. nova

Phlomis bruguieri and *Thymbra spicata* subsp. *Spicata* were the characteristic species of this association. It was spread out on the south part of the Fatik mountain, between Ikizce village and Altun mezra village. The gradient was 15-30% and the altitude was between 610 and 850 m (*Table 6*).

The association contained only one layer like the others, grass layer. The average length was 12-25 cm and rate of covering was 50-60% (*Table 6*).

Classis: *Astragalo–Bromotea* Quezel 1973

Ordo: *Onobrychido armenae–Thymetalia leucostomi* Akman, Ketenoğlu Quezel 1984

Alliance: *Phlomido armeniaceae–Astragalion microcephali* Akman, Ketenoğlu Quezel 1986

It was spreading out at red-brown soils. According to chemical and physical properties of soils, pH was: 7.70, the rate of lime ($CaCO_3$) was 3.8%, phosphorus (P_2O_5) was 5.3 kg dec^{-1}; potassium (K_2O) was 118.8 kg dec^{-1} and organic component was found as 2.48% (*Table 3*). The yield of pasture was 1.0-1.5 ha^{-1} 29 taxa were determined from this association (*Table 6*).

Table 6. *Phlomido bruguieri–Thymbretum spicatae ass. nova Thypus: Sample Parcel 17*

Sample parcel No	**10**	**13**	**14**	**15**	**17**	**19**	**21**	**22**	**28**	**30**	**33**	**65**	**66**	
Square size (m^2)	50	50	50	50	50	50	50	50	50	50	50	50	50	
Altitude (m)	610	605	707	710	715	720	725	810	815	750	820	822	815	
Gradient (%)	20	15	25	20	25	35	30	20	20	25	30	30	30	
Direction	SE	S	S	S	S	SE	SE	SE	SE	SE	SE	SE	S	Frequency
Length of cover (cm)	25	20	20	25	20	20	25	20	25	20	20	20	25	
Number of species	12	12	10	11	15	9	9	9	12	7	9	9	7	
Cover (%)	50	55	55	60	60	60	65	55	55	50	50	60	55	
Characteristic species of Association														
Phlomis bruguieri	+2	+2	22	22	11	11	22	22	11	+2	+2	+2	+1	V
Thymbra spicata	+2	+2	+2	+1	+1	11	11	11	+2	+2	+1	+1	+2	IV
Characteristic species of Allians *Phlomido armeniaceae–Astragalion microcephali*														
Hordeum murinum subsp. *glaucum*	+2	+2	22	22	11	11	11	+1	+2	+2	22	11	11	IV
Phleum phleoides	+1	+2	+2	+2	+2	.	.	.	.	.	+2	.	.	III
Teucrium parviflorum	+2	.	.	.	+2	.	.	.	+2	.	.	.	.	II
Euphorbia characias subsp. *wullfenii*	.	.	.	.	.	.	+2	+2	.	.	+2	.	.	I

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Characteristic species of Ordo *Onobrychido armenae–Thymetalia leucostomi*														
Onobrychis caput-galli	+2	+2	+1	+2	+2	+2	+2	+2	+2	.	.	+2	+2	IV
Bromus scoparius	.	+2	+2	+2	+1	+1	+1	+1	+1	+2	+2	+1	.	III
Medicago rigidula	+1	+1	.	.	.	.	.	.	+1	+1	.	.	.	I
Characteristic species of Classis *Astragalo–Bromotea*														
Bromus japonicus	.	+2	+2	+2	+1	+1	+1	+2	+2	+2	+2	+2	+2	III
Satureja hortensis	+1	+1	+1	+2	+2	+2	.	.	.	.	.	.	+2	II
Scabiosa calocephala	+1	+1	+1	+2	+2	.	.	.	.	.	+2	.	.	II
Participants														
Hypecoum imberbe	.	.	.	.	+1	.	.	.	.	.	.	.	.	I
Torilis tenella	.	.	.	.	.	.	+1	.	.	.	.	.	.	I
Xanthium strumarium subsp. *strumarium*	.	.	.	.	.	.	.	+1	.	.	.	+1	.	I
Cynosurus echinatus	+1	.	.	.	.	+1	.	.	.	.	.	.	.	I
Eremopyrum bonaepartis subsp. *bonaepartis*	.	+1	.	.	+1	.	.	.	.	.	.	.	.	I
Urginea maritima	.	.	.	.	.	.	.	.	.		+1	.	.	I
Secale sylvestris	.	.	.	.	.	.	.	.	.	.	.	+1	.	I
Gagea luteoides	+2	.	.	.	.	.	.	.	.	.	.	.	.	I
Trfolium stellatum	.	.	.	.	+1	.	.	.	.	.	.	.	.	I
Crepis reuterana subsp. *reuterana*	.	.	.	.	.	.	+1	.	.	.	.	.	.	I
Sedum caespitosum	.	.	+1	.	.	.	.	.	.	.	.	.	+1	I
Echinops microcephalus	.	.	.	.	+1	.	.	+1	+1	.	.	.	.	I
Eryngium creticum	+1	.	.	+1	.	.	.	.	+1	.		.	.	I
Capsella bursa-pastoris	.	.	.	.	.	+1	.	.	.	+1	.	.	.	I
Thlaspi perfoliatum	+1	+1	.	+1	.	.	.	.	.	.	.	.	.	I
Velezia rigida	.	.	.	.	.	.	.	.	.	.	+1	.	.	I

Prosopo farctae–Avenetum erianthae ass. nova

The characteristic species were *Prosopis farcta*, *Avena eriantha* and *Bromus scoparius*. It was determined from the Northwest of Küçük Güneş, Aşağı Güneş and Yukarı Güneş villages of Fatik Mountain at 450-500 m altitudes.

The association composed of only grass layer except *Prosopis farcta,* the average length was between 15 and 30 cm and the covering was between 50 and 65%. The number of taxon was between 12 and 18 (*Table 7*).

Classis: *Astragalo–Bromotea* Quezel 1973

Ordo: *Astragalo–Bromotalia* Quezel 1973

Alliance: *Prosopo–Bromuon* ass. nova

This association was spreading out at red-brown soils. According to chemical and physical properties of soils, pH was: 7.28, the rate of lime ($CaCO_3$) was 2.6%, phosphorus (P_2O_5) was 4.9 kg dec^{-1}; potassium (K_2O) was 179.2 kg dec^{-1} and organic component was measured as 1.44% (*Table 3*). The yield of pasture was 1.0-1.5 ha^{-1} 26 taxa were determined (*Table 7*).

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Table 7. *Prosopio farctae–Avenetum erianthae ass. nova Thypus: Sample Parcel 9*

Sample parcel No	**2**	**5**	**6**	**8**	**9**	**11**	**12**	**16**	**18**	**20**	**25**	**26**	**27**	Frequency
Square size (m^2)	50	50	50	50	50	50	50	50	50	50	50	50	50	
Altitude (m)	450	455	460	470	475	480	485	490	495	500	505	510	515	
Gradient (%)	10	15	10	10	10	10	15	15	15	10	10	10	15	
Direction	E	E	E	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	
Length of cover (cm)	25	20	20	25	30	15	15	25	15	15	25	25	20	
Number of species	18	13	12	13	13	12	12	13	13	12	13	13	14	
Cover (%)	55	50	55	50	50	45	50	60	55	50	45	50	50	
Characteristic species of Association														
Prosopis farcta	+2	+2	33	33	22	22	11	11	11	22	22	33	33	V
Bromus scoparius	+1	+1	+2	.	.	22	22	+2	+2	+1	+1	+2	22	IV
Avena eriantha	+2	+2	22	22	22	+2	+2	+2	+2	+2	+2	.	+1	IV
*Characteristic species of Allians Prosopo–Bromuon****														
Phlomis bruguieri	+2	+2	+2	+2	+2	+1	+1	+2	+2	+2	+2	+2	+2	III
Hordeum murinum subsp. *glaucum*	+1	+1	+2	+2	11	11	11	11	11	+1	+1	.	.	III
Salvia sclarea	+1	.	.	.	+1	+1	+1	+2	+2	+2	+2	.	.	II
Characteristic species of Ordo *Astragalo–Bromotalia*														
Astragalus lamarckii	+1	+2	+2	+2	+2	+2	+2	+2	.	.	+2	.	.	II
Bromus japonicus	+1	+1	11	+2	+1	.	.	.	+1	+2	.	+1	12	II
Juncus articulatum	+1	+1	+1	22	22	22	22	.	.	.	11	11	.	III
Characteristic species of Classis *Astragalo–Bromotea*														
Phleum phleoides	+2	+2	+2	+2	+1	+1	+1	+2	+2	+1	+1	+1	+1	II
Phlomis bruguieri	+2	+2	.	.	+2	+2	.	.	+2	+2	+2	.	.	II
Cichorium glandulosum	+1	.	+1	+1	.	.	.	+1	+1	+1	.	.	.	I
Participants														
Althea officinalis	+1	+1	+1	+1	+1	.	+2	+2	+2	.	.	.	.	II
Verbascum kotschyi	.	.	.	+1	+2	+2	+1	+1	+1	.	.	+1	+1	II
Linum pubescens subsp. *pubescens*	+1	.	.	+1	.	.	.	.	.	.	+1	.	.	I
Euphorbia szovitsii var. *szovitsii*	.	.	.	.	.	.	.	.	+1	+1	+1	.	.	I
Eryngium campestre	.	+1	+1	.	.	.	.	.	.	.	.	.	+1	I
Hypericum capitatum var. *capitatum*	+1	.	.	.	.	.	.	+1	.	.	.	+1	.	I
Trifolium tomentosum	.	.	.	.	+1	.	.	.	.	.	.	+1	.	I
Hordeum bulbosum	.	.	.	.	.	.	+1	.	.	.	.	.	+1	I
Aegilops cylindirica	.	.	.	+1	.	+1	.	.	.	.	.	+1	.	I
Torilis arvensis	.	.	.	.	.	.	.	.	.	+1	.	.	.	I
Carduus pycnocephalus subsp. *albidus*	+1	.	.	.	.	.	.	.	.	.	+1	.	+1	I
Anthemis haussknechtii	.	+1	.	.	.	.	.	.	.	.	.	+1	+1	I
Erodium cicutarium subsp. *cicutarium*	+1	.	.	.	.	.	.	.	.	.	.	+1	+1	I
Lappula barbata	.	.	+1	.	.	.	.	+1	.	.	.	+1	+1	I
Secale sylvestre	.	.	.	+1	.	.	.	.	.	.	.	.	+1	I

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Astragalo strictifolii–Salvietum sclarea ass. nova

Astragalus strictifolius var. *strictifolius* and *Salvia sclarea* were the characteristic taxa of this association. It was determined between Fatik and Ikizce villages at northeast direction. The altitude was 600-750 m and the gradient was between 20 and 35%. The association composed of only grass layer except *Astragalus strictifolius* var. *strictifolius*. The average length was between 20 and 25 cm and the covering was between 50 and 65%. The number of taxon was between 10 and 18 (*Table 8*).

Classis: *Astragalo–Bromote* Quezel 1973

Ordo: *Astragalo–Bromotalia* Quezel 1973

Alliance: *Agropyro–Stachyon* Quezel 1973

This association was spreading out at the red-brown soils on the arid stone. According to chemical and physical properties of soils, pH was: 7.42, the rate of lime ($CaCO_3$) was 6.8%, phosphorus (P_2O_5) was 4.5 kg dec^{-1}; potassium (K_2O) was 108.0 kg dec^{-1} and organic component was measured as 2.35% (*Table 3*). The yield of dry grass was between 300 and 400 g m^{-2} 35 taxa were determined (*Table 8*).

Table 8. *Astragalo strictifolii–Salvietum sclarea ass. nova Thypus: Sample Parcel 36*

Sample parcel No	**1**	**3**	**4**	**36**	**38**	**44**	**45**	**47**	**49**	**51**	**52**	**54**	**58**	Frequency
Altitude (m)	50	50	50	50	50	50	50	50	50	50	50	50	50	
Gradient (%)	510	520	530	540	550	555	557	560	565	567	570	571	572	
Direction	30	35	20	20	25	30	30	35	35	30	35	30	25	
Length of cover (cm)	SE	SE	SE	S	S	S	SW	SW	SW	S	S	S	S	
Number of species	25	20	20	25	30	35	35	30	30	25	30	25	25	
Cover (%)	13	12	15	16	16	13	13	9	12	10	15	12	12	
Altitude (m)	50	55	55	60	65	60	60	55	55	60	60	60	50	
Characteristic species of Association														
Astragalus strictifolius var. *strictifolius*	12	12	22	+1	+1	22	+1	+2	22	22	22	11	11	IV
Salvia sclarea	12	.	12	11	+1	+1	+2	+2	11	22	+2	+2	11	IV
Characteristic species of *Allians Agropyro Stachyon*														
Thymbra spicata	.	.	+2	22	33	+2	+2	+2	+2	22	22	11	11	IV
Phlomis kurdica	+2	+2	+2	+2	+2	.	.	.	.	.	+2	+2	.	III
Euphorbia characias subsp. *wullfenii*	.	.	+2	+2	+2	+2	+2	.	.	.	.	.	+2	II
Stipa holosericea	.	.	.	.	.	.	.	.	+2	+2	+2	.	.	II
Characteristic species of Ordo *Astragalo–Bromotalia*														
Festuca callieri subsp. *callieri*	+2	+2	+2	+2	+2	+2	.	.	.	.	.	.	.	II
Astragalus lamarckii	22	+2	+2	22	22	.	.	.	22	11	11	22	11	IV
Phlomis ssp.	+2	+2	+2	.	.	.	+2	+2	+2	.	+2	.	.	III
Characteristic species of Classis *Astragalo–Bromotea*														
Eryngium creticum	.	.	+2	+2	+2	+2	+2	.	.	+2	+2	.	+2	III
Teucrium polium	+2	+2	.	.	+2	+2	+2	+2	.	.	.	.	.	II
Trifolium speciosum	.	.	.	+2	+2	+2	.	.	.	.	+2	+2	+2	II
Ranunculus arvensis	+2	.	+2	.	.	.	+1	+1	+1	+1	.	.	.	I

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	Participants													
Eminium rauwolffii var. *rauwolffii*	+2	+2	+2	+2	+2	+2	+2	+1	+1	+1	.	.	+2	III
Muscari comosum	+2	+2	+2	.	.	.	.	.	.	+1	+1	+1	.	II
Gagea luteoides	+2	+2	+2	+1	+2	+2	+2	.	.	.	.	+1	+1	III
Erodium cicutarium subsp. *cicutarium*	.	.	.	.	+1	+2	.	.	+1	+1	+1	.	.	I
Achillea vermicularis	.	.	.	.	.	.	.	+2	.	.	.	.	.	I
Eryngium campestre	.	.	.	+1	+2	+2	+1	.	.	.	.	.	.	I
Capsella bursa-pastoris	.	.	.	.	.	.	.	.	.	.	+1	+1	+1	I
Avena sterilis subsp. *sterilis*	+2	+1	+1	+2	+1	.	.	.	+2	.	.	.	.	I
Echinaria capitata	+1	+1	.	.	.	.	.	.	.	.	.	+1	+1	I
Althea officinalis	.	.	.	+2	.	.	+1	.	.	.	.	.	+2	I
Veronica beccabunga subsp. *beccabunga*	.	+1	.	.	.	.	.	.	.	.	+1	+1	+1	I
Vulpia persica	.	.	.	.	.	+1	+1	.	.	.	.	.	.	I
Bromus japonicus	.	.	.	+1	.	.	.	.	+1	+1	+1	.	.	I
Eremopyrum bonaepartis subsp. *bonaepartis*	.	.	.	.	.	.	+2	.	.	.	+2	.	.	I
Convolvulus arvensis	.	.	+2	.	.	.	.	.	.	.	.	.	+1	I
Cichorium glandulosum	.	.	.	.	.	+1	.	.	.	.	.	.		I
Linum pubescens	.	.	.	+1	.	.	.	+1	+1	.	.	.		I
Aegilops cylindirica	+2	.	.	.	+2	.	.	.	.	.	.	.	.	I
Xanthium strumarium subsp. *strumarium*	.	+1	.	.	.	.	.	+1	.	.	+1	.	.	I

Conclusion

In the region, due to excessive and uncontrolled grazing, steppe vegetation has turned into secondary vegetation rather than semi-desert and desert-type vegetation. Therefore, these areas should be controlled and over-grazing should be prevented. In natural pastures, the value of the forage plant and the most suitable pasture capacity should be determined. The productivity of pastures is related to the composition of plant species and habitat factors (Braun-Blanquet, 1964). Morphological structures and ecological habitat forms are one of the most important subjects that should be studied in pasture research projects.

First, the quality and quantity of a pasture should be examined. In the region, plant sociological characteristics of the dominant steppe vegetation change during the seasons. The efemers change the productivity and quality of the pastures. In pastures, forage crops have been reduced due to overgrazing, others spread if inedible to animals. These areas have been abandoned for agriculture and have become barren due to overgrazing. In the future research of these areas, controlled pasture stocking should be carried out together with controlled irrigation for the formation of productive pastures, and even pasture forage crops suitable for barren areas should be selected and trials should be conducted in the area. National and regional pasture management plans should continue to be implemented effectively, sustainable productivity must be ensured and these areas should be put back into service of Turkish livestock.

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