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Evaluation and Determination of Rangeland Vegetation in Kayseri Province

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Abstract

Rangelands are basically one of the main feed resources for livestock. They are also important for watershed functions, biodiversity, and recreation. It is necessary to be known rangelands current status for their improvement and management. For this reason vegetation survey was conducted on the rangelands of Kayseri Province in year 2009. A modified wheel point method with loop was used for vegetation survey in the 60 representative survey sites of rangelands in Kayseri province. The results of this survey indicated that vegetation cover was detected as 57.85 %. The cover rates of decreasers and increasers in botanical composition were 12.62 % and 19.98 %, respectively. The numbers of sites determined as good, fair, and poor conditions were 1, 29, and 30, respectively. The 59 sites of total sites were identified as fair and poor in condition based on the rangeland condition classes. On the other hand, 26 sites were found as risky and 28 sites as unhealthy in health categories. These results show that rangelands are in fast degradation trend which should be immediately stopped and reversed to the original situation with available rehabilitation techniques for the improvement of rangelands.

Keywords: Rangeland condition, health, management, improvement.

Kayseri İli Mera Vejetasyonunun Belirlenmesi ve Değerlendirilmesi

Öz

Meralar hayvan varlığımızın temel beslenme kaynaklarından biridir. Buna ilaveten meralar, su kaynağı olmaları, biyoçeşitliliğe sahip bulunmaları ve rekreasyon alanı olarak değerlendirilmeleri açısından önemlidir. Mera alanlarının ıslahı ve yönetimi için mevcut durumun belirlenmesi gereklidir. Bu nedenle Kayseri ili mera alanlarında 2009 yılında vejetasyon etüt çalışmaları yapılmıştır. İlin tüm meralarını temsil edecek 60 durak belirlenmiş ve lup ile modifiye edilmiş bir tekerlek nokta yöntemiyle vejetasyon etüdü yapılmıştır. Araştırma sonucunda bitkiyle kaplı alan % 57.85 bulunmuştur. Azalıcı ve çoğalıcı bitki türleri oranları sırayla % 12.62 ve % 19.98 olarak saptanmıştır. İncelenen mera alanlarından iyi, orta ve zayıf durumda olanlar sırayla 1, 29 ve 30 adet olarak tespit edilmiştir. Vejetasyon etüdü yapılan toplam 60 mera durağından 59 tanesinin mera durumu orta ve zayıf, biri iyi olarak belirlenmiştir. Diğer taraftan mera sağlığı açısından yapılan sınıflamada 26 durak riskli ve 28 durak sorunlu olarak tespit edilmiştir. Bu sonuçlar ildeki meraların hızlı bozulma sürecinde olduğunu göstermekte olup bu süreç acilen durdurulmalı ve uygun mera yönetimi ve ıslahı çalışmaları ile orijinal yapısına döndürülmelidir.

Anahtar Kelimeler: Mera durumu, sağlığı, yönetimi ve ıslahı

Introduction

Rangelands are benefited by human for multiple use as food, fiber, water, recreation, and wildlife (Holechek et al. 2004). They are considered significant for environmental aspects and must be maintained in the context of ecosystem management.

Rangeland vegetation and related environmental factors are primarily observed to identify range condition and trend. This process explains in a detailed information on historical use, present potential, and future possibilities of rangelands.

The Central Anatolia Region consists of 33.3% (TÜİK 2001) of total rangeland area which is 14.6 mil. ha (TÜİK 2012). Because of the rapid development in agricultural mechanization, the rangeland areas were converted to croplands and cultivated since 1950's, thereby rangelands in total area has been declined by 40% for last 50 years. This situation caused to break down the balance between livestock and rangelands because of increased animal numbers and declined

rangeland area. The rangelands, main feed resources for animals, were used as early and heavy grazing in the long term. As a result unfortunately their quantity and quality were drastically reduced (Büyükburç 1983).

Plant species with good quality and hay yield are important for rangelands of the Central Anatolia Region. Their existence and influence in the rangeland vegetation were also considered as an important factor on the determination of the rangeland condition and health. Following species were identified in the past studies; *Festuca ovina* (Bakır 1970; Özmen, 1977; Uluocak,1977), *Andropogon gryllus, Hedysarum varium* (Bakır 1970; Tokluoğlu 1979), *Thymus squarrosus,* (Bakır 1970; Özmen 1977; Tokluoğlu 1979), *Artemisia fragrans* (Özmen 1977; Tokluoğlu 1979), *Medicago sativa* (Bakır 1970; Uluocak 1977). In addition, other important species for the region were also found such as *Poa bulbosa* var*. vivipara, Bromus erectus, Onobrychis armena, Cynodon dactylon, Stipa lagascae, Teucrium polium, Globularia orientalis* (Bakır 1970), and *Agrostis* sp*., Bromus erectus, Stipa pennata, Convolvulus compactus, Noaea spinosissima* (Özmen 1977). Moreover, plant species as *Kochia prostate* (Tokluoğlu 1979), and *Trifolium arvense, T. campestre, T. repens, Onobrychis sativa, O. alba, O. tenuifolia, Koelaria cristata, Agropyron intermedium, A. elongatum, A. trichophorum*, *Phleum pratense, P. phloides, P. exaratum*, *Dactylis glomerata, D. hispanica* (Uluocak 1977) were specified in the vegetation of rangelands*.*

Botanical composition, climatic data and environmental features should be determined for description of the study area (Bakır 1969). After the evaluation of present data is identified rangeland condition (excellent, good, fair, poor) and health (healthy, risky and unhealthy) (Bakır 1969; Koç et al. 2003). In addition to the carrying capacity should be also calculated by rangeland hay yield, grazing period, rangeland area, and daily animal consumption. Based on above mentioned information, proper grazing system should be easily determined and implemented for various status levels of rangelands.

Vegetation surveys were performed in the 9 provinces of the Central Anatolia Region between 2007 and 2011 year. Both provinces, as namely Ankara and Çankırı**,** were found similar status for range condition and health in a fair and at risky, respectively (Ünal et al. 2012a; Ünal et al. 2012b). Furthermore, the percentages of vegetation cover and bare ground in Ankara and Çankırı were obtained at the same study to be as 60.55% and 39.45%; 65.19% and 34.81%, respectively. These vegetation surveys showed that the cover rates of decreasers and increasers in the provinces of Ankara and Çankırı were quantified ranging from 10.24% to 25.71% and from 14.72% to 24.80%, respectively. These vegetation communities consisted of the 287 and 327 species in rangelands of Ankara and Çankırı, respectively. Decresear species were found in both provinces such as *Agropyron cristatum, Bromus tomentellus, Dactylis glomerata, Elymus repens, Koeleria cristata, Lotus aegaeus, L. corniculatus, O. armena, O. oxyodonta, Trifolium pretense,*and *Vicia cracca.* These incresears as *Cynodon dactylon, Plantago lanceolata, P. bulbosa, Stipa holosericea,* and *Teucrium polium* were also existed in two locations*.* Other increasers such as *Hordeum bulbosum, Poa alpine, Dorycnium pentaphyllum, Ebenus hirsuta, Hedysarum cappadocicum* were also encountered in vegetation of Ankara province.

The objective of this study was to identify the condition and the health of rangelands which were based on plant species in vegetation community of the sixty different sites. Other purpose was to outline the proper management for rangeland improvement in this province.

Material and Method

Study area description

The study area, Kayseri province, is located at the plateau of the Central Anatolia Region with latitudes of 37^{o} 45' – 39^{o} 13' N , and longitudes of 34^{o} 56' – 36^{o} 59' E (Figure 1). The altitudes of the sampling sites range from 1080 m to 2264 m. The slopes of the studied sites vary across the province. Long term annual mean precipitation is 397 mm, it was 487mm in the survey year (2009) (Anonymous 2009a). Long term average temperature is 10.2 ^{o}C but the recorded average temperature was 10.8 ^{o}C in the survey year. The coldest month is January with mean temperature of -1 ^{o}C. The warmest months are July and August with mean temperature of 22.0^{o}C (Figure 2). The long term average relative humidity is about 59.0% but it was below the long-term average in the survey year as 57.4%.

Soil depths in the study area are in general very shallow. The soil texture of sites

ranges from clay to clay – loam. The soil is neutral (pH 6.73) and slightly alkaline (pH 8.45), a wide range variation of lime content (0.0 – 36.55%), very low phosphorus amount (0.1- 6.9 kg/da), rich potassium content (22-497 kg/da), low and fair organic matter content (0.0– 3.3%) (Anonymous, 2009b).

The vegetation survey was conducted with a modified wheel point method (Koç and Çakal 2004) at the representative 60 sites of Kayseri province. Two transect lines with 100 m long were made at each site. The 200 reading points having 0.50 m intervals were recorded along each transects. Plant samples were properly collected and dried up for making herbarium. They all were identified according to related flora books of Davis 1965-1985, Davis et al. 1988, Güner et al. 2000. In addition, habitat factors (altitude, aspect, slope) and impact of rangeland use (grazing intensity) with soil features and erosion influence were noted down for each sample sites. The cover percentages of plant species, bare ground and stoniness on rangeland were determined. The rangeland condition (only cover of decreasers and increasers used) were categorized as excellent, good, fair, poor and the rangeland health were also classified as healthy, at risky, and unhealthy based on the basal cover of rangeland vegetation (Koç et al. 2003).

Rangeland and meadow areas are 690.028 ha. The total livestock is 218.000 animal unit (AU) (Anonymous 2009c). Carrying capacity (CC) of total rangeland area in Kayseri province is 138.081 AU. Livestock number is much more 58.0% than CC of Kayseri rangelands. Hay need of livestock of the province is 994 625 tons per year, but production of rangeland and meadow is only 310.682 tons (31.24% of total requirement).

Results and Discussions

General assessment (Rangelands condition and health)

The Province rangeland condition was determined and categorized into fair class (having the total values of decreasers and increasers as 26.23%) based on plant species (Table 1). The percentages of decreasers, increasers, and invaders in botanical composition were 12.62%, 19.98%, and 68.91% respectively. A value of the increasers used for range condition is also 14.46%.

The province rangeland health was identified in a risky category having the percentages of plant cover and bare ground as 57.85% and 42.15%, respectively (Table 1).

Ankara and Çankırı provinces had similar status for range condition and health, in a fair and at risky, respectively (Ünal et al. 2012a; Ünal et al. 2012b). Heavy grazing may naturally result in current unfavorable status of regional rangelands.

Rangeland health

Rangeland health values of the study sites were given in Table 2. The percentages of vegetation cover and bare ground were found as 83.42%, 16.58%; 62.33%, 37.67% and 48.21%, 51.79% at healthy (6 sites), risky (26 sites), and unhealthy (28 sites) of the health classes, respectively. In the same table, the 54 sites of total 60 sites were the poor health classes as risky and unhealthy. This status wasn't sustainable for maintain and improvement of present rangeland. It means rangeland degradation process continues fast.

Similarly, in Ankara and Çankırı provinces, the percentages of vegetation cover and bare ground were obtained to be as 77.75% and 22.25%; 79.04% and 20.96%; 63.77% and 36.23%; 64.52% and 35.48%; 49.30% and 50.70%; 46.23% and 53.77% at healthy, risky, and unhealthy of the health classes, respectively (Ünal et al. 2012a; Ünal et al. 2012b).

These data showed that three province rangelands have similar declining trend on range health. It means that rangeland health and implementing management also resemble each other for regional provinces.

Healthy rangeland class had the highest vegetation cover with 83.42% (Table 2). The lowest and the highest values of botanical composition in the same consecutive classes for these three health classes as healthy, risky, and unhealthy were determined as 75.25%, 100.00%; 56.75%, 70.50% and 32.00%, 55.50%, respectively.

Rangeland Condition

The condition data of survey sites is given in Table 3. The vegetation survey results showed that the three different classes of rangeland conditions were found as good (one site, KYS049), fair (29 sites), and poor (30 sites) in the province of Kayseri. The total number of fair and poor sites conditions was 59 (Table 3).

The only one site out of the 60 sites was in a good rangeland condition and its decreasers cover was found as 70.25% in botanical composition, but it had no increaser plant species. The percent value of invader species was 29.75% in the site KYS049.

Good management practices should be used for this site to benefit optimum level and to maintain its current status. The cover rates of decreasers and increasers in the sites of good rangeland condition of Ankara and Çankırı provinces were quantified as 43.09% and 32.87%; 49.36% and 13.33%, respectively (Ünal et al. 2012a; Ünal et al. 2012b).

The 29 sites of total 60 survey sites were in a fair class having the percentages of decreasers and increasers in botanical composition of 15.82% and 27.08%, respectively (Table 3). When decreaser species percent reduced; conversely, increaser species cover expanded on vegetation cover. The cover rates of decreasers and increasers in Ankara and Çankırı fair rangeland conditions were quantified as 15.13% and 28.91%; 15.19% and 25.33%, respectively (Ünal et al. 2012a; Ünal et al. 2012b). Invader species also led to increase and dramatically reached to 57.64%. These data became indicators of a wide range variation in two main species groups. Animals prefer to feed first palatable plants (decrasers and increasers) latter to eat less palatable species. Some factors such as environmental aspects; various topography, rangeland distance to village and management history cause to lead diverse use levels on rangeland vegetation. Various grazing intensity such as light, moderate, and heavy grazing differently influences species on plant community of rangeland sites.

The 30 sites in a poor class of rangeland condition have the percentage of decreasers and increasers on botanical composition of 7.16% and 12.88%, respectively (Table 3). In this poor class, both decreasers and increasers rates under herbivores were the lowest to the other classes’. The cover rates of decreasers and increasers in Ankara and Çankırı poor range conditions were measured as 4.21% and 22.66%; 3.13% and 27.13%, respectively (Ünal et al. 2012a; Ünal et al. 2012b). Decreasers cover value of poor condition in Kayseri province was higher than those values in other provinces, but increasers data was too lower than Ankara and Çankırı’s. Invaders rate in the poor categorize in this study was 81.11% which was the highest rate in the all three classes (Table 3). In the poor sites, the impact of grazing highly influences plant species of good quality (such as decreasers and increasers) and remarkably occurs scattered small patches of plant species through rangelands.

Plant species

There were 263 species that could refer to an indicator for a wide range diversity of vegetation community composition. Ankara and Çankırı provinces consisted of the 287 and 327 species in rangeland vegetation communities, respectively (Ünal et al. 2012a; Ünal et al. 2012b). These data refer that high richness in plant species exists in regional vegetation community.

The percentages of decreasers, increasers and invaders on botanical composition were given in Table 4 and Table 5. In this survey, decreaser grasses include the following species: *Agropyron cristatum, Agrostis stolonifera, Bromus tomentellus, Chrysopogon gryllus (Andropogon gryllus), Elymus hispidus, Koeleria cristata, Phleum montanum* and *Poa pratensis.* Following decresears were encountered in Ankara and Çankırı provinces such as *Agropyron cristatum, Bromus tomentellus, Dactylis glomerata, Elymus repens, Koeleria cristata, Lotus aegaeus, L. corniculatus, O. armena, O. oxyodonta, Trifolium pretense,*and *Vicia cracca.* (Ünal et al. 2012a; Ünal et al. 2012b). Increaser grasses were found as *Briza media, Cynodon dactylon, Ebenus laguroides, Festuca callieri, Festuca valesiaca, Hordeum bulbosum, Poa alpina, Poa bulbosa, Puccinellia koeieana* and *Stipa holosericea*.

The following plant species existed in the earlier studies through The Central Anatolian Region: *Andropogon gryllus,* (Bakır 1970; Tokluoğlu 1979) and *Festuca ovina= F. valesiaca, F.callieri* (Bakır 1970; Özmen 1977; Uluocak 1977; Ünal et al. 2010; Ünal et al. 2011).

Major important species for this region such as *Poa bulbosa* var.*vivipara, Cynodon dactylon,* (Bakır 1970), *Koelaria cristata, Agropyron* (*A. intermedium, A. elongatum, A. trichophorum*) were found in the previous work and this study.

Decreaser legume species such as *Medicago sativa, Onobrychis occulta* and *O. oxyodonta* were identified in the field survey of this study. Increaser forage legumes such as

Hedysarum cappadocicum Hedysarum pestalozzae and *Hedysarum varium* were also determined.

The same plant species were encountered in the past surveys and this study such as *Hedysarum varium* (Bakır 1970; Tokluoğlu 1979), *Medicago sativa* (Bakır 1970; Uluocak 1977), *Onobrychis armena* (Bakır 1970; Ünal et al. 2010) and *Onobrychis sativa, O. alba, O. tenuifolia* (Uluocak 1977) that are all considered potentially to be most important to be rehabilitated and over-seeded for region vegetation community.

These incresears as *Cynodon dactylon, Plantago lanceolata, Poa bulbosa, Stipa holosericea,* and *Teucrium polium* also occurred in Ankara and Çankırı provinces (Ünal et al. 2012a; Ünal et al. 2012b). Other increasers such as *Hordeum bulbosum, Poa alpine, Dorycnium pentaphyllum, Ebenus hirsuta, Hedysarum cappadocicum* also seemed in vegetation of Ankara province (Ünal et al. 2012a).

Some invader species in the study areas were *Alyssum desertorum, A. pateri, Taeniatherum caput-medusae, Eryngium campestre, Euphorbia macroclada, Noaea mucronata, Phlomis armeniaca*, *Potentilla recta, Salvia cryptantha, Scabiosa argentea, Teucrium chamaedrys, Thymus sipyleus*, *Vicia ervilia*, *Ziziphora capitata.*

Dominant plant species at the native steppe vegetation as *Thymus squarrosus,* (Bakır 1970; Özmen 1977; Tokluoğlu 1979; Ünal et al. 2010; Ünal et al. 2011), *Artemisia fragrans* (Özmen 1977; Tokluoğlu 1979; Ünal et al. 2010; Ünal et al. 2011) have synonyms with *Artemisia santonicum* and *Thymus sipyleus* existing in this survey.

Conclusions

Range condition and health classes were determined as fair, and risky. The rangelands of Kayseri Province were in a good condition at 1 site, fair condition at 29 sites, and poor condition at 30 sites. The status of total 59 sites, consisting of fair and poor sites, is an indicator of mismanagement of rangelands. As a result, rangelands have been degraded and this unfavorable process has been fast continued.

Good or sound management and suitable improvement techniques should be immediately implemented for these rangelands. The various recommended techniques should also be put into practice for three category levels as follows.

For good condition category, a proper grazing system having six months periods may be implemented firstly. Grazing period and carrying capacity must be considered carefully. Fertilization is recommended as 50 kg of nitrogen and phosphorous per hectare for sustainable hay yield and quality of rangelands (Büyükburç 1999).

For fair condition category, available management techniques and rehabilitation may be run together. Rangeland management should be designed with based on grazing period and carrying capacity. In addition, restoration activities such as fertilization (50 kg N+ 50 kg P_2O_5 per ha, Büyükburç 1999), over-seeding and weed control should be carried out. During this period, it is necessary to produce much more herbage production by cultivation of forage crops to meet livestock requirement.

All rehabilitation activities should be minutely planned for poor condition. At the beginning of rangeland restoration, grazing must be stopped for certain resting time as two and three years. Over-seeding and weed control should be applied together and correctly managed during this period. As vegetation cover and desired plant species rate reach to a satisfactory level, sustainable management and rehabilitation strategies should be immediately applied on these sites.

Vegetation and its changes with spatial and temporal variability should be monitored over time for novel implements and improvements in the future.

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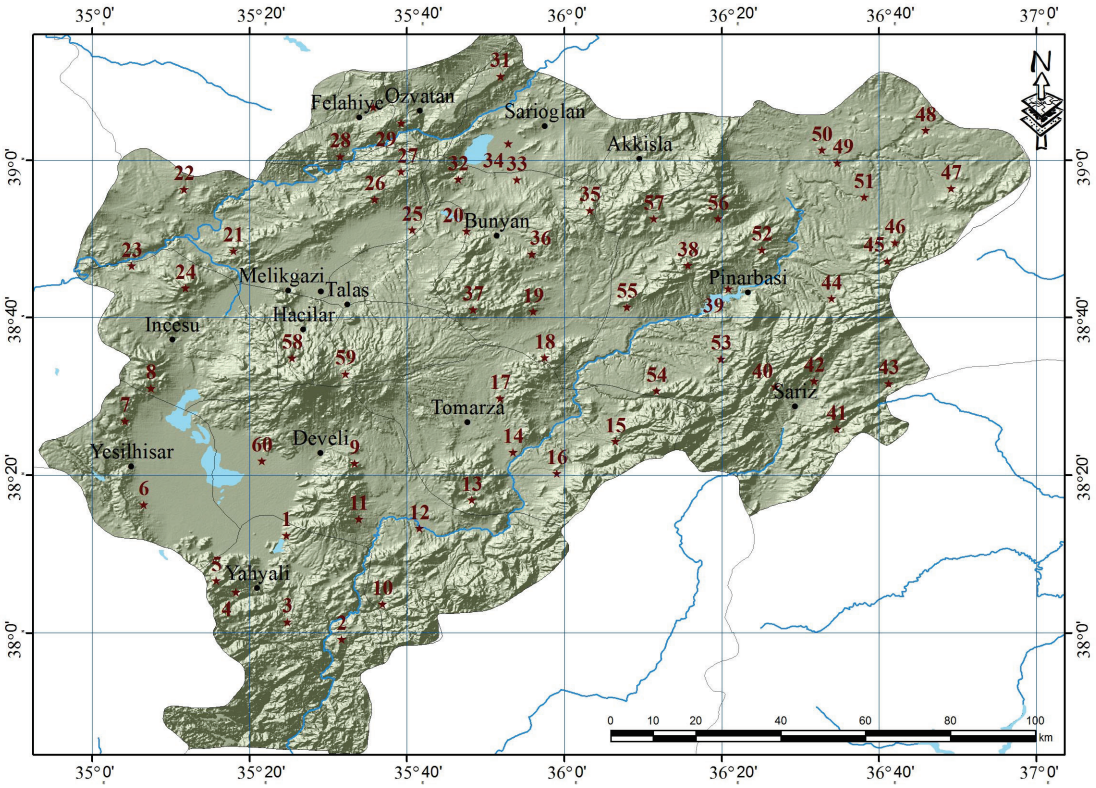

Figure 1. Study sites in the province of Kayseri

Şekil 1. Kayseri ilindeki çalışma yapılan duraklar

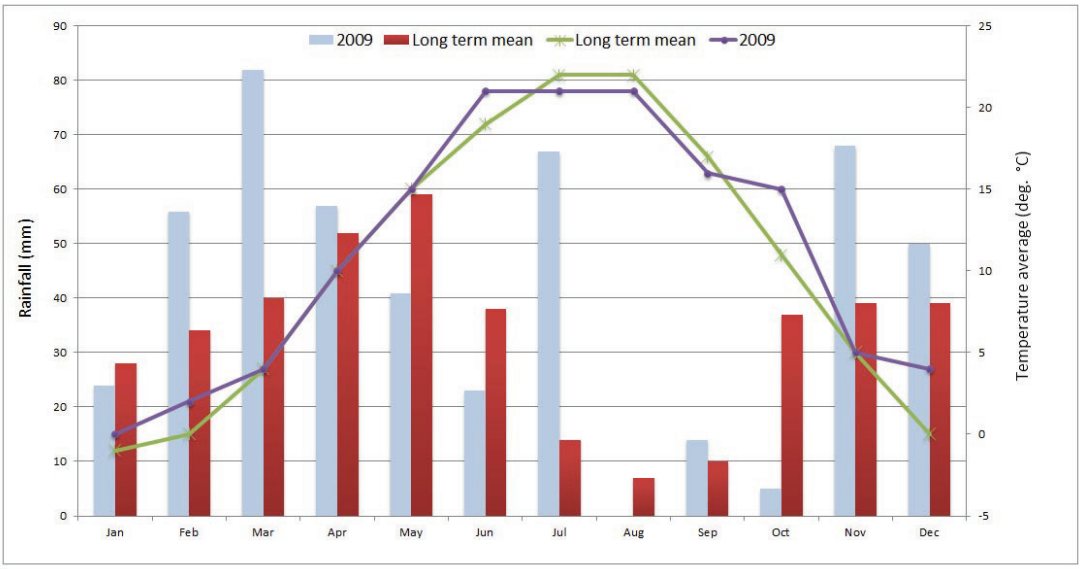

Figure 2. Monthly temperature and precipitation data of Kayseri province

Şekil 2. Kayseri ilinin aylık sıcaklık ve yağış değerleri

Table 1. Vegetation cover, bare ground and rangeland health values (%)
Çizelge 1. Bitkiyle kaplı alan, çıplak alan ve mera sağlık değerleri

	VC	BG	D	IC	IV	IURC	SURC
Minimum	32.00	0.00	0.41	1.10	23.00	0.00	1.44
Maximum	100.00	68.00	70.25	77.00	98.56	35.00	70.25
Average	57.85	42.15	12.62	19.98	68.91	14.46	26.23
SE	12.22	12.22	10.91	15.28	16.96	7.80	12.73
CV (%)	21.12	28.98	86.49	76.48	24.61	53.97	48.53

Explanation

CA Vegetation cover / *Bitkiyle kaplı alan*
BG Bare Ground / *Çıplak Alan*
D Decreasers / *Azalıcılar*
IC Increasers / *Çoğalıcılar*
IV Invaders / *İstilacılar*
IURC Increasers Used for Range Condition / *Mera Durumunun Tespitinde Kullanılan Çoğalıcı Türler*
SURC Species Used for Range Condition / *Mera Durumunun Tespitinde Kullanılan Bitki Türleri*
SE Standart error / *Standart hata*
CV (%) Coefficient Variation / *Değişim Katsayısı*

Table 2. Vegetation cover, bare ground and rangeland health values
Çizelge 2. Bitkiyle kaplı alan, çıplak alan ve mera sağlık değerleri

Health values or health classes	Site numbers	Descriptive statistics	Vegetation cover (%)	Bare ground (%)
Healthy	6	Minimum	75.25	0.00
		Maximum	100.00	24.75
		Average	83.42	16.58
		SE	9.50	9.50
		CV (%)	11.39	57.29
Risky	26	Minimum	56.75	29.50
		Maximum	70.50	43.25
		Average	62.33	37.67
		SE	4.06	4.06
		CV (%)	6.52	10.79
Unhealthy	28	Minimum	32.00	44.50
		Maximum	55.50	68.00
		Average	48.21	51.79
		SE	5.75	5.75
		CV (%)	11.92	11.10

Table 3. Rangeland conditions of sites and the percentages of decreasers, increasers and invaders on vegetation cover
Çizelge 3. Durakların mera durumları ve bitkiyle kaplı alan içerisindeki azalıcı, çoğalıcı ve istilacıların yüzdeleri

Rangeland condition	Site numbers	Descriptive statistics	D *	IC	IV	IURC	SURC
Good	1 (KYS049)	Minimum	-	-	-	-	-
		Maximum	-	-	-	-	-
		Average	70.25	.	29.75	0.00	70.25
		SE	-	-	-	-	-
		CV (%)	-	-	-	-	-
Fair	29	Minimum	2.66	8.47	23.00	8.47	26.50
		Maximum	29.41	77.00	73.28	35.00	49.41
		Average	15.82	27.08	57.64	19.57	34.85
		SE	7.16	15.44	11.65	5.12	5.89
		CV (%)	45.22	57.02	20.22	26.18	16.89
Poor	30	Minimum	0.41	1.10	58.18	0.00	1.44
		Maximum	21.09	41.01	98.56	20.51	25.78
		Average	7.16	12.88	81.11	10.00	16.44
		SE	5.38	11.51	10.96	6.68	7.48
		CV (%)	75.14	89.38	13.52	66.81	45.51

* Explanation was given in Table 1.

Table 4. Decreaser and increaser plant species on the rangeland vegetation
Çizelge 4. Mera vejetasyonu içerisindeki azalıcı ve çoğalıcı bitki türleri

Decreasers	Increasers
Grasses	**Grasses**
Agropyron cristatum	*Briza media*
Agrostis stolonifera	*Cynodon dactylon*
Bromus tomentellus	*Hordeum bulbosum*
Chrysopogon gryllus	*Festuca callieri*
Elymus hispidus	*Festuca valesiaca*
Koeleria cristata	*Poa alpina*
Phleum montanum	*Poa bulbosa*
Poa pratensis	*Puccinellia koeieana*
	Stipa holosericea
Legumes	
Medicago sativa	**Legumes**
Onobrychis armena	*Ebenus laguroides*
Onobrychis occulta	*Hedysarum cappadocicum*
Onobrychis oxyodonta	*Hedysarum pestalozzae*
Trifolium pannonicum	*Hedysarum varium*
Trifolium pratense	
	Others
Other	*Plantago holosteum*
Sanguisorba minor	*Plantago lanceolata*
	Teucrium polium

Table 5. Invader plant species on rangeland vegetation
Çizelge 5. Mera vejetasyonu içerisindeki istilacı bitki türleri

Anthemis tinctoria	*Echinaria capitata*	*Noaea mucronata*
Anthemis wiedemanniana	*Ephedra major*	*Nonea pulla*
Arabidopsis thaliana	*Erodium cicutarium*	*Onobrychis cornuta*
Arenaria ledebouriana	*Eryngium campestre*	*Onosma taurica*
Arenaria serpyllifolia	*Erysimum crassipes*	*Orchis palustris*
Aristolochia maurorum	*Erysimum echinellum*	*Paracaryum racemosum*
Artemisia santonicum	*Erysimum thyrsoideum*	*Paronychia kurdica*
Asperula nitida	*Euphorbia cheiradenia*	*Pedicularis comosa*
Asphodeline taurica	*Euphorbia macroclada*	*Petrosimonia nigdeensis*
Astragalus acicularis	*Falcaria vulgaris*	*Phlomis armeniaca*
Astragalus albertshoferi	*Filago pyramidata*	*Phlomis linearis*
Astragalus angustifolius	*Fumana aciphylla*	*Phlomis pungens*
Astragalus chthonocephalus	*Fumana procumbens*	*Phragmites australis*
Astragalus condensatus	*Galium incanum*	*Picnomon acarna*
Astragalus densifolius	*Galium verum*	*Pilosella hoppeana*
Astragalus hirsutus	*Genista albida*	*Pimpinella tragium*
Astragalus karamasicus	*Genista aucheri*	*Polygala pruinosa*
Astragalus kochakii	*Geranium tuberosum*	*Polygala supina*
Astragalus lineatus	*Glaux maritima*	*Potentilla polyschista*
Astragalus lydius	*Globularia orientalis*	*Potentilla recta*
Astragalus mesogitanus	*Globularia trichosantha*	*Potentilla reptans*
Astragalus microcephalus	*Gundelia orientalis*	*Prangos meliocarpoides*
Astragalus pinetorum	*Gundelia tournefortii*	*Pterocephalus plumosus*
Astragalus plumosus	*Haplophyllum telephioides*	*Quercus pubescens*
Astragalus spruneri	*Helianthemum canum*	*Ranunculus arvensis*
Astragalus stenosemius	*Helianthemum ledifolium*	*Ranunculus damescenus*
Astragalus wiedemannianus	*Helianthemum nummularium*	*Rhagadiolus angulosus*
Asyneuma limonifolium	*Helianthemum salicifolium*	*Rochelia disperma*
Berberis crataegina	*Helichrysum arenarium*	*Salsola crassa*
Briza minor	*Helichrysum plicatum*	*Salvia caespitosa*
Bromus japonicus	*Herniaria glabra*	*Salvia cryptantha*
Bromus sterilis	*Herniaria incana*	*Salvia frigida*
Bromus tectorum	*Hypericum hyssopifolium*	*Salvia hypargeia*
Bungea trifida	*Hypericum scabrum*	*Salvia multicaulis*
Carduus pycnocephalus	*Jasminum fruticans*	*Saponaria viscosa*
Carex atrata	*Juniperus oxycedrus*	*Scabiosa argentea*
Centaurea carduiformis	*Lappula barbata*	*Scariola viminea*
Centaurea depressa	*Leontodon asperrimus*	*Scorzonera elata*
Centaurea pichleri	*Lepidium cartilagineum*	*Scorzonera hieraciifolia*
Centaurea triumfettii	*Limonium iconicum*	*Scutellaria orientalis*

Table 5. continues
Çizelge 5' in devamı

Centaurea urvillei	*Linaria corifolia*	*Sedum album*
Centaurea virgata	*Linum nodiflorum*	*Senecio vernalis*
Ceratocephalus falcatus	*Logfia arvensis*	*Silene otites*
Chardinia orientalis	*Marrubium astracanicum*	*Stachys annua*
Cirsium arvense	*Marrubium globosum*	*Stachys lavandulifolia*
Cirsium lappaceum	*Marrubium parviflorum*	*Teucrium chamaedrys*
Clypeola jonthlaspi	*Matthiola longipetala*	*Thesium billardieri*
Conringia perfoliata	*Medicago lupulina*	*Thlaspi perfoliatum*
Convolvulus assyricus	*Medicago rigidula*	*Thymus leucotrichus*
Convolvulus holosericeus	*Minuartia anatolica*	*Thymus migricus*
Cotoneaster nummularius	*Minuartia hamata*	*Thymus sipyleus*
Cousinia stapfiana	*Minuartia hybrida*	*Trachynia distachya*
Crataegus monogyna	*Minuartia leucocephala*	*Triglochin palustre*
Crepis sancta	*Minuartia montanra*	*Trigonella caerulea*
Cruciata taurica	*Moltkia coerulea*	*Trigonella crassipes*
Crupina crupinastrum	*Muscari neglectum*	*Trigonella filipes*
Daphne gnidioides		*Trigonella fischeriana*
Dianthus zonatus		*Trigonella monantha*

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