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Determination of botanical composition and rangeland status of Yedigöller Region (Erzurum/Türkiye)

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Abstract

This study investigated the botanical composition, soil cover, and quality of rangeland located in the Yedigöller region of İspir district, Erzurum province, Türkiye, in 2020. The Loop method was employed to determine these parameters. A total of 44 taxa were identified in the study area, with *Asteraceae* (13 taxa), *Poaceae* (8 taxa), and *Lamiaceae* (4 taxa) being the most dominant families. The overall soil cover was determined to be 70.29%. *Poaceae* species accounted for 40.38% of the vegetation cover, followed by *Fabaceae* (3.55%) and other families (56.07%). The rangeland quality was assessed as "Poor" with a quality index of 2.17. These findings indicate that the rangeland in the study area is of low quality and requires improvement measures.

Keywords: Erzurum, botanical composition, Loop method, rangeland quality degree

Yedigöller bölgesinin (Erzurum/Türkiye) botanik kompozisyonu ve mera durumunun belirlenmesi

Özet

Bu çalışma, Türkiye'nin Erzurum ili, İspir ilçesi, Yedigöller bölgesinde yer alan bir mera alanının 2020 yılında botanik kompozisyonu, toprağı kaplama oranı ve kalitesini incelemiştir. Bu parametreleri belirlemek için Lup yöntemi kullanılmıştır. Çalışma alanında toplam 44 takson belirlenmiş olup, bunlardan en baskın familyalar *Asteraceae* (13 takson), *Poaceae* (8 takson) ve *Lamiaceae* (4 takson)'dır. Toplam toprağı kaplama oranı %70,29 olarak belirlenmiştir. Bitki örtüsü içerisinde *Poaceae* türleri %40,38, *Fabaceae* %3,55 ve diğer familyalar %56,07 oranında yer almaktadır. Mera kalitesi 2,17 kalite derecesi ile "Zayıf" olarak değerlendirilmiştir. Bu bulgular, çalışma alanındaki meranın düşük kalitede olduğunu ve iyileştirme önlemlerine ihtiyaç duyduğunu göstermektedir.

Anahtar Kelimeler: Erzurum, botanik kompozisyon, Lup yöntemi, mera kalite derecesi

Introduction

Türkiye is divided into three phytogeographic regions in terms of flora: Mediterranean in the South and West, Euro-Siberian in the North, and Irano-Turanian in Eastern and Central Anatolia (Akdeniz 2009). According to recent studies, there are approximately 12,000 plant taxa in Türkiye and endemism is high.

Rangelands, meet the nutritional needs of animals, and also have important benefits such as creating gene resources and biodiversity and protecting against erosion (Carlier et al. 2005; Babalık and Kılınç 2021). Rangelands meet 68% of the protein and 62% of the starch of the nutrients consumed by our country's livestock in a year (Babalık and Sarıkaya 2015).

Due to the early and excessive grazing and the lack of maintenance and improvement processes in Türkiye's rangelands for many years, the fresh forage yield of rangelands has decreased and the vegetation cover has deteriorated to a great extent (Yavuz and Sürmen 2016; Sürmen and Kara 2018; Dursun et al. 2023). The quality and yield of grasses obtained from rangelands have decreased. These rangelands should be improved to grow more nutritious and more productive forage to meet the feed needed by animals. To increase the yield values of rangelands, studies should first be carried out to determine the plant composition of that region and then to increase the yield. Vegetation surveys and measurements in rangelands are applied to obtain information about the qualitative and especially quantitative characteristics of rangelands in regions with unknown vegetation (Türk et al. 2003).

This research investigates the rangeland vegetation within the Yedigöller region of İspir district, Erzurum province. The Yedigöller region was selected for this study due to its unique ecological characteristics, including its diverse topography, elevation gradients, and proximity to various water bodies. These factors contribute to a wide range of plant species and communities, making it an ideal location to explore rangeland vegetation dynamics. The study aims to assess the area's rangeland health by analyzing four key factors: vegetation cover rate, botanical composition (identifying species families and species), rangeland quality, and overall rangeland state classification. This method offers a thorough comprehension of the ecological composition and grazing capacity of the rangelands.

Materıal and Method

Study Area: In 2020, researchers conducted this study in the Yedigöller region, located in the İspir district of Erzurum province, Türkiye. The Yedigöller region sits at an average elevation of 2750 meters above sea level (40° 37′ 25.5″ N, 40° 54′ 22.4″ E) and is roughly 39 kilometres away from the district centre. Figures 1 and 2 depict the study area's location and photographs taken within the region, respectively. The meteorological data for the study area (Erzurum) in 2020 revealed a total precipitation of 295.6 mm, an average temperature of 5.6 °C, and an average relative humidity of 67% (Anonymous, 2021).

Method

In this study, rangeland vegetation was examined in July 2020 when the vegetation reached the climax stage. Plant samples were collected from the field and processed following herbarium protocols outlined by Erik et al. (1996). Three replicates for each plant species were collected, dried, mounted on herbarium sheets, and deposited at the Recep Tayyip Erdoğan University Pazar Vocational School herbarium. Identification of plant specimens was achieved using the reference floras "Flora of Türkiye and the Aegean Islands" (Davis 1965-1985, Davis et al. 1988, Güner et al. 2000). Taxonomic nomenclature followed Güner et al. (2012), with additional verification of names against the Euro+Med Plant Base (2020) database. This study assessed the rangeland's vegetation characteristics using the Loop method (Koç and Çakal 2004; Ok and Çaçan 2023). A 20 meter Loop line was established, with 100 Loop values measured at 20-centimeter intervals. The plant species

intercepted by each Loop were recorded on the measurement scale. Additionally, plant samples encountered within each Loop were collected for complete identification.

This study assessed botanical composition using a line Loop method with 5 main lines, each containing 10 sub-lines. The approach followed established principles (Tosun 1968). The area

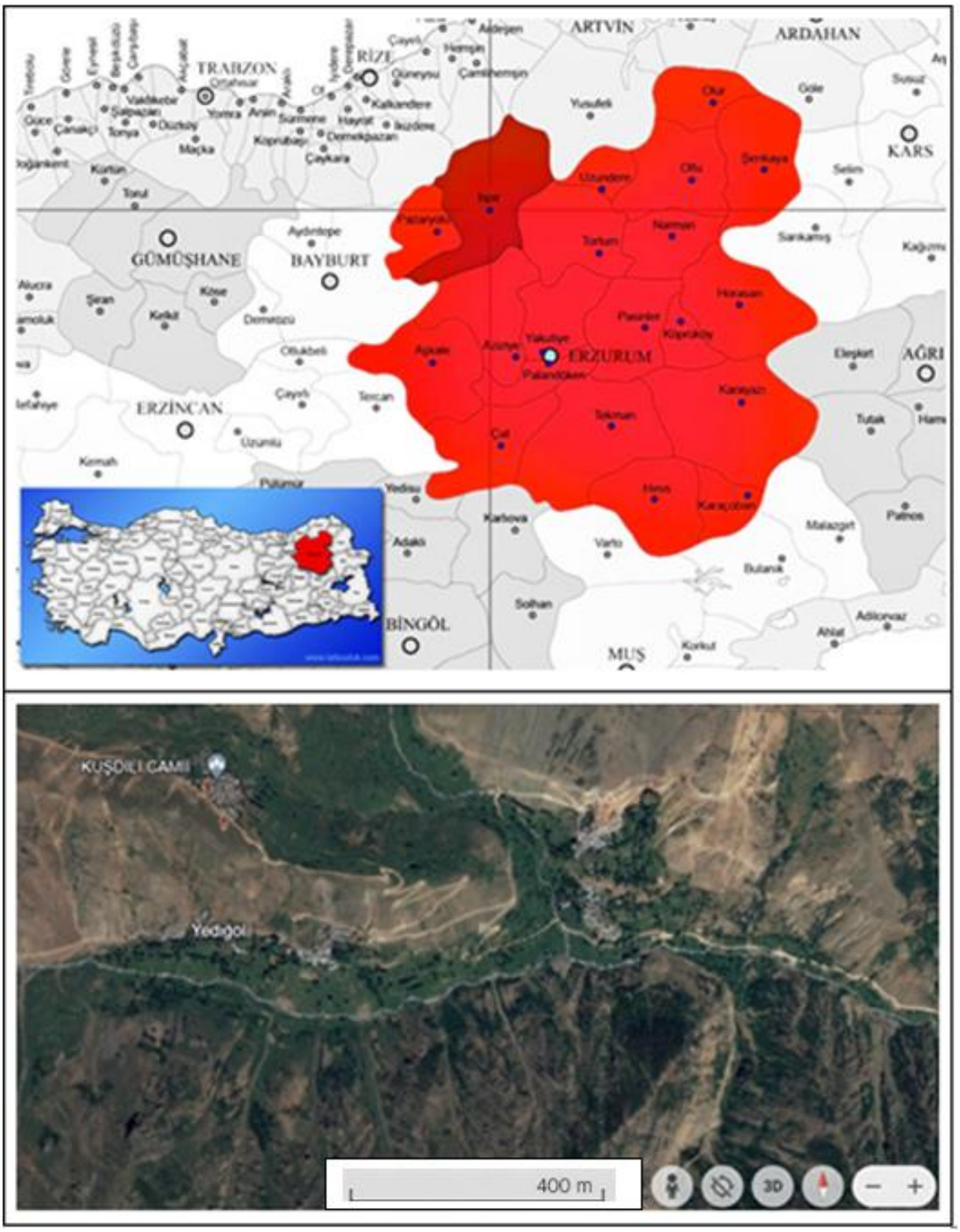

Figure 1. Location of the study area (Google Earth)

Figure 2. Some photos were taken from the study area

covered by vegetation was calculated as the ratio of the loop area occupied by vegetation to the total loop area (Gökkuş et al. 1993). Individual plant species within the composition were assigned scores between -1 and 10 based on their forage potential using criteria from previous studies (Gökkuş et al. 1993; Bakoğlu 1999; Anonymous 2008). The final rangeland quality score was determined by multiplying these scores by their respective proportions in the composition and and then summing the values for all plant taxa. Rangeland status was then categorized based on a pre-defined scale (De Vries et al. 1951) with values ranging from 0.0-10.0, where higher scores indicated better quality (Very Poor: 0.0-2.0; Poor: 2.1-4.0; Medium: 4.1-6.0; Good: 6.1-8.0; Very Good: 8.1-10.0).

Result and Discussion

The list of plants identified in the study area, their families, ratio of soil cover with plant and ratio of botanical composition and rangeland degrees are given in Table 1 and the soil cover and botanical composition ratios of the families are given in Figure 3.

Table 1. Families, taxa, value numbers, soil cover and botanical composition ratios, rangeland quality degrees of the plants found in the rangelands of Yedigöller region (İspir/Erzurum).

	Family	**Taxon**	**VN**	**SCR**	**BCR**	**RQD**
	POACEAE					
1	*Poaceae*	*Dactylis glomerata* L. subsp. *glomerata*	7	2.34	3.74	0.262
2	*Poaceae*	*Festuca woronowii* Hack. *subsp. woronowii*	2	9.37	7.09	0.142
3	*Poaceae*	*Koeleria macrantha* (Ledeb.) Schult.	6	3.75	6.77	0.406
4	*Poaceae*	*Nardus stricta* L.	3	8.43	18.18	0.545
5	*Poaceae*	*Phleum alpinum* L.	4	1.41	1.06	0.042
6	*Poaceae*	*Poa alpina* L. subsp. *fallax* F. Herm.	5	0.94	0.71	0.036
7	*Poaceae*	*Poa longifolia* Trin.	8	2.34	1.77	0.142
8	*Poaceae*	*Poa nemoralis* L.	8	0.94	1.06	0.085
		Total		**29.52**	**40.38**	**1.66**
	FABACEAE					
1	*Fabaceae*	*Astragalus bicolor* Lam. subsp. *bicolor*	3	2.81	2.13	0.064
2	*Fabaceae*	*Trifolium ambiguum* M.Bieb.	7	1.87	1.42	0.099
		Total		**4.69**	**3.55**	**0.16**
	OTHER FAMILIES					
1	*Asteraceae*	*Achillea millefolium* L. subsp. *millefolium*	1	0.47	0.35	0.004
2	*Asteraceae*	*Erigeron caucasicus* Steven subsp. *venustus* (Botsch.) Grierson	1	0.47	0.35	0.004
3	*Asteraceae*	*Gnaphalium sylvaticum* L.	1	0.47	0.35	0.004
4	*Asteraceae*	*Helichrysum graveolens* (M.Bieb.) Sweet	0	0.94	0.71	0.000
5	*Asteraceae*	*Helichrysum plicatum* DC. subsp. *polyphyllum* (Ledeb.) P.H.Davis & Kupicha	0	0.47	0.35	0.000
6	*Asteraceae*	*Pilosella cymosa* (L.) F.W.Schultz & Sch.Bip.	0	0.47	0.35	0.000
7	*Asteraceae*	**Psephellus appendicigerus* (K.Koch) Wagenitz	0	0.94	1.36	0.000
8	*Asteraceae*	*Scorzonera cana* (C.A.Mey.) Griseb. var. *alpina* (Boiss.) D.F.Chamb.	7	0.47	1.01	0.071
9	*Asteraceae*	*Solidago virgaurea* L.	0	0.47	0.35	0.000
10	*Asteraceae*	*Tanacetum balsamitoides* Sch.Bip.	2	0.94	0.71	0.014
11	*Asteraceae*	*Tripleurospermum caucasicum* (Willd.) Hayek	1	0.47	0.35	0.004
12	*Asteraceae*	*Tripleurospermum melanolepis* (Boiss. & Buhse) Pobed.	1	0.47	0.35	0.004
13	*Asteraceae*	*Tripleurospermum oreades* (Boiss.) *Rech.f.* var. *oreades*	1	0.47	0.35	0.004
14	*Campanulaceae*	*Campanula aucheri* A.DC.	0	1.41	1.06	0.000
15	*Campanulaceae*	*Campanula glomerata* L.	0	0.47	0.35	0.000
16	*Caprifoliaceae*	*Cephalaria gigantea* (Ledeb.) Bobrov	5	0.94	1.36	0.068
17	*Caryophyllaceae*	*Cerastium longifolium* Willd.	6	0.47	0.35	0.021
18	*Caryophyllaceae*	*Dianthus liboschitzianus* Ser.	2	0.47	0.35	0.007
19	*Caryophyllaceae*	*Minuartia circassica* (Albow) Woronow	1	1.41	1.06	0.011

20	*Caryophyllaceae*	*Minuartia verna* (L.) Hiern subsp. *verna*	1	0.47	0.35	0.004
21	*Crassulaceae*	*Sempervivum armenum* Boiss. & A.Huet subsp. *armenum*	0	0.47	0.35	0.000
22	*Hypericaceae*	*Hypericum armenum* Jaub. & Spach subsp. *armenum*	0	0.94	0.71	0.000
23	*Lamiaceae*	*Marrubium astracanicum* Jacq. subsp. *astracanicum*	0	0.94	1.36	0.000
24	*Lamiaceae*	*Nepeta racemosa* Lam.	0	0.94	1.36	0.000
25	*Lamiaceae*	*Stachys macrantha* (K.Koch) Stearn	2	0.94	0.71	0.014
26	*Lamiaceae*	*Thymus longicaulis* C.Presl subsp. *longicaulis*	3	3.75	2.84	0.085
27	*Plantaginaceae*	**Veronica gentianoides* Vahl subsp. *gentianoides* var. *alpina* A.Öztürk & M.A.Fisch.	1	0.47	0.71	0.007
28	*Polygonaceae*	*Rumex acetosella* L.	0	0.47	0.35	0.000
29	*Polygonaceae*	*Rumex angustifolius* Campd. subsp. *angustifolius*	0	0.47	0.35	0.000
30	*Rosaceae*	*Alchemilla heterophylla* Rothm.	0	0.94	0.71	0.000
31	*Rosaceae*	*Filipendula ulmaria* (L.) Maxim. subsp. *ulmaria*	3	0.47	0.35	0.011
32	*Rosaceae*	*Sibbaldia parviflora* Willd. var. *parviflora*	1	1.41	1.06	0.011
33	*Rubiaceae*	*Asperula gracilis* C.A.Mey.	1	0.47	0.35	0.004
34	*Scrophulariaceae*	**Verbascum armenum* Boiss. & Kotschy ex Boiss. var. *armenum*	0	10.31	33.04	0.000
		Total		**36.08**	**56.07**	**0.347**
		GENERAL TOTAL		**70.29**	**100.00**	**2.170**

*: Endemic, VN: Value Number, SCR: Soil Cover Ratio, BCR: Botanical Composition Ratio, RQD: Rangeland Quality Degree.

Table 1 shows that the total plant coverage rate of the rangeland was 70.29%, *Poaceae* 29.52%, *Fabaceae* 4.69% and other families 36.08%. The botanical composition ratios of *Poaceae, Fabaceae* and other families were determined as 40.38%, 3.55% and 56.07%, respectively. The rangeland quality grade was 2.17 and the condition of the rangeland was determined as "Poor". *Nardus stricta* (18.18%) from *Poaeceae*, *Astragalus bicolor* subsp. *bicolor* (2.13%) from *Fabaceae* and *Verbascum armenum* var. *armenum* (33.04%) from other families were the first taxa in the botanical composition of the rangeland.

A total of 44 taxa, 8 in *Poaceae*, 2 in *Fabaceae* and 34 in other families, were identified in the rangeland. The number of taxa in other families were: *Asteraceae* (13), *Campanulaceae* (2), *Caprifoliaceae* (1), *Caryophyllaceae* (4), *Crassulaceae* (1), *Hypericaceae* (1), *Lamiaceae* (4), *Plantaginaceae* (1), *Polygonaceae* (2), *Rosaceae* (3), *Rubiaceae* (1), *Scrophulariaceae* (1). *Psephellus appendicigerus*, *Veronica gentianoides* subsp. *gentianoides* var. *alpina* and *Verbascum armenum* var. *armenum* taxa are endemic.

The relatively high number of taxa observed in this rangeland can be attributed to several factors. Firstly, the diverse topography and microclimates within the area support a variety of plant species. Secondly, the presence of pollinators, such as bees and butterflies, facilitates the reproduction and spread of plants. Thirdly, the rangeland's proximity to other plant communities may allow for the dispersal of seeds and genetic material. Further research on these factors could provide valuable insights into the mechanisms underlying the plant diversity in this region.

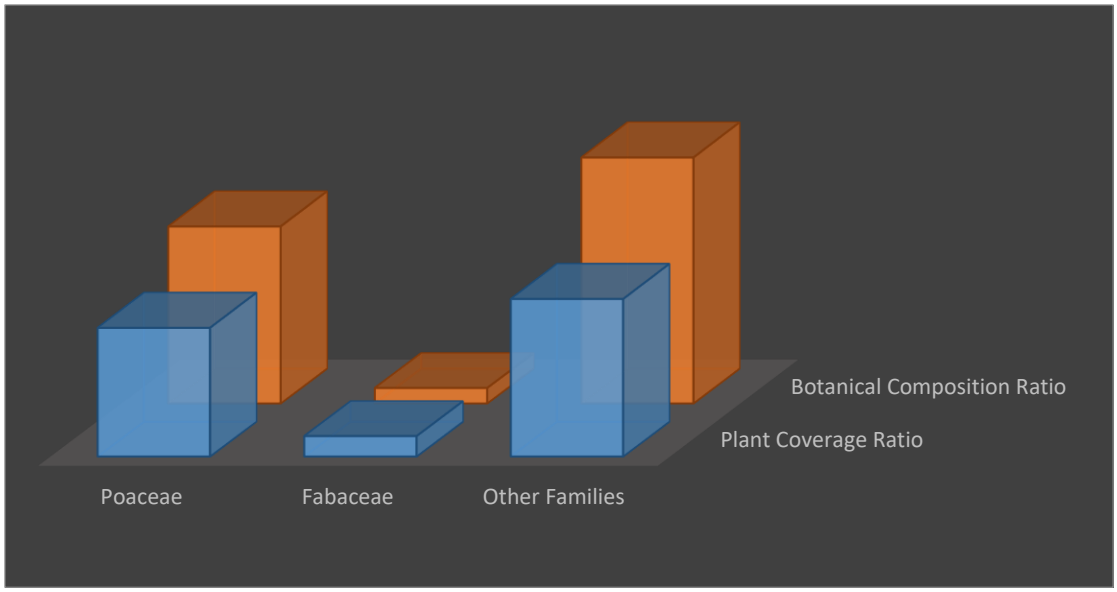

Figure 3: Plant Coverage and Botanical Composition Ratios of Families (%)

Considering the studies on botanical composition and rangeland condition; Fayetörbay (2007) conducted a study in rangeland sections with different altitudes in Erzurum Palandöken and found that the ratios of grasses, legumes and other families in botanical composition were 56.28%, 10.47% and 33.31%, respectively, and the coverage ratio of rangeland to soil was 39% and the rangeland condition was moderate; Babalık and Sarıkaya (2015) in Zengi rangeland (Isparta) found that the botanical composition of the rangeland was 63.51% grasses 16.39% legumes and 20.10% other families; in the study conducted by Bilgin and Özalp (2016), the botanical composition of the rangeland consisted of 46.19% of grasses, 14.36% of legumes and 39.45% of other families; Çaçan and Başbağ (2016) reported that 68.19% of the rangeland was covered with plants in the rangelands of Yelesen-Dikme villages (Bingöl) and the botanical composition was composed of 17.39% of grasses, 21.09% of legumes and 61.52% of other families; İspirli et al. (2016) conducted a study in the natural rangelands of 12 villages of Taşköprü district of Kastamonu province and found that the average vegetated area ratio was 83.34%, 1 of the rangelands was "Good", 5 of them were " Fair" and 6 of them were "Poor" rangelands; Uzun et al. (2016) found that the average vegetated area ratio of the rangelands of 15 villages of the central district of Bartın province was 93.57%, 1 of the rangelands was classified as "Very good", 1 as "Good", 6 as "Fair" and 7 as "Poor" rangeland condition; Babalık and Ercan (2018) reported that the area covered with vegetation in the study area of Karaören village (Eskişehir) was 51.2%, and the botanical composition of the rangeland was 44% grasses, 23% legumes and 33% other families; Sürmen and Kara (2018) found that the proportion of grasses, legumes and other families in the botanical composition by weight was 37.09%, 4.24% and 58.67%, respectively, in the study conducted in rangelands at different slopes in Aydın province; Çınar et al. (2019) conducted a study in the rangelands of Tufanbeyli district (Adana) and found that the average proportion of grasses, legumes and other family plants in the area covered with plants was 36.9%, 22.0% and 41.1%, respectively, the rangeland quality degrees ranged between 2.40-3.92 and the condition class of the rangelands was poor; Çatal et al. (2019), in his study conducted in Ovit plateau (Rize), found that the soil cover rate was 63.4%, the proportion of grasses in botanical composition was 39.35%, the proportion of legumes was 6.61% and the proportion of other families was 54.04% and the condition of the rangeland was very poor with a rangeland quality degree of 1.976; Bakoglu et al. (2021) in 2020 in the high altitude rangelands of the Anzer region (Rize), the

botanical composition is dominated by grasses (*Poaceae*) with a significant presence of other plant families and a total of 45 taxa and 72% soil cover, and the rangeland quality was classified as "Very Poor" (grade 1.95). Similarly, Baykal et al. (2021) found a diverse plant community (39 taxa, 20 families) on the Legiş plateau rangelands (Rize). Here, *Poaceae* made up a smaller portion (12.90%) compared to legumes (*Fabaceae*, 28.24%). With a total soil cover of 78.92%, this rangeland was rated as "Poor" (degree 2.63).

There are similarities and differences between the findings obtained from the research and the findings of the researchers mentioned above. It is believed that the variations result from various meteorological and soil conditions, as well as from varying grazing intensities and vegetation structures.

Conclusion

A survey of the Yedigöller region (İspir/Erzurum) identified a total of 44 plant taxa. Eight belonged to the *Poaceae* family, two to *Fabaceae*, and the remaining 34 were spread across various families. *Asteraceae* had the most diverse representation within these other families (13 taxa), followed by *Lamiaceae* (4), *Caryophyllaceae* (4), and *Rosaceae* (3). Interestingly, *Nardus stricta* (18.18%) from *Poaceae, Astragalus bicolor* subsp. *bicolor* (2.13%) from *Fabaceae,* and *Verbascum armenum* var. *armenum* (33.04%) from other families were the dominant plant species. Overall plant cover in the rangeland was 70.29%, with *Poaceae, Fabaceae,* and other families rates of botanical composition 40.38%, 3.55%, and 56.07% respectively. The rangeland quality index score of 2.17 indicates a 'Poor' grazing quality. In conclusion, this study reveals that rangelands in the Yedigöller region are facing a significant problem. By taking measures such as improving rangeland management practices, increasing plant diversity, spreading nutrient-rich species and reducing grazing pressure, the quality of rangelands can be improved and the sustainability of livestock activities in the region can be ensured.

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