# The comparison of botanical composition and the condition and health class of different rangeland sites in forest ecosystem

Emre ÇOMAKLI[1] M. Kerim GÜLLAP[2,*] mkgullap@atuni.edu.tr, Tuğba ÇOMAKLI[3]

Adnan BİLGİLİ[3]

[1] Atatürk University Environmental Problems Research Center, Erzurum, Turkey

[2] Department of Field Crops, Faculty of Agriculture, University of Atatürk, Erzurum, Turkey

[3]Eastern Anatolia Forestry Research Institute Directorate, Erzurum, Turkey

Çomaklı E, Güllap MK, Çomaklı T, Bilgili A. The comparison of botanical composition and the condition and health class of different rangeland sites in forest ecosystem. Turkish Journal of Agriculture and Forestry. doi: 10.3906/tar-2011-95

**Abstract:** In this study conducted in Erzurum Province's Oltu District Kırdağı Location during 2015, 2016 and 2017 concerning the above forest, forest interior and forest edge rangeland sites, the botanical composition of rangeland sites, canopy coverage rate, rangeland condition scores, and comparison of the condition of rangeland and the health class were emphasized. According to the results, although the grass and legume rations in the forest edge rangeland was lower, the others families' ratio was higher than that of the other sites. Hence, it was determined that the ratio of canopy coverage rate was higher in the forest top rangeland site compared to other sites. Consequently, the health class of the rangeland is in the risky class in the forest edge site. Rangeland status class, which is a comparison of vegetation for climax, was found to be weak in this site. As a result, these values clearly indicate that the forest edge rangeland was seriously damaged compared to the other sites.

**Keywords:** Botanical composition, forest, grazing, rangeland health class

## 1. Introduction

Forest rangelands are multi-functional and rich potential feed sources for livestock including grasses, legumes, broad-leaved plants, and shrubbery. When grazing is debated in these sites, considerations such as tree species and age, foreign herbaceous plants and prevalent shrub species, type, age and number of animals in the field, climate and topographical structure of the field must be taken into account (Lawrence and Hardesty, 1992; Koc et al., 2014; Alp et al., 2016; Bilgili, 2016; Kaskoniene et al., 2020). Animal grazing in forest areas has many advantages, both in terms of animal products and forest products. Although trees provide a good shading for animals, and in this way, forage

plants that mature later here become more nutritious for animals, on the other hand, grazing animals may make a beneficial contribution to the growth and efficiency of trees by making the forest more sparse.

Grazing in rangelands is common in many parts of the world, for example, 15% of alpine in Europe (Mayer et al., 2006) and 75% of US states have been used for grazing in this way for more than 200 years (Wray, 1998). Under the supervision and control of our Ministry of Forestry and Water Affairs, there is a total of 1 554 338 hectares of graze land, of these lands, 278 915 hectares of this area are registered as forest interior, 717 976 hectares are as forest top and 557 447 hectares are as forest edge rangelands (Anonymous, 1968; Tekeli and Mengül, 1991; Avcıoğlu et al., 1996). The population of people living and earning a living in these areas is about 7.1 million (Anonymous, 2012) and some of the very low-income forest villagers are involved in forestry activities. The province of Erzurum, which is situated particularly in the North-East Anatolia area, is one of the most important places where the population density living in or around the forest is the highest and where rangeland-focused animal breeding is carried out.

Forest interior and forest edge rangelands, which are situated at higher altitudes than low altitude rangelands, are both more efficient and an alternative feed supply for animals, since they are less exposed to early spring and late autumn grazing (Bilgili and Koç, 2020). However, by using forest graze land areas and other real grazing areas, we need to be very vigilant about certain problems, both in terms of use and benefit from them. Since overgrazing on forest rangeland causes nutrient reduction, intensified erosion, soil compression, and acidification on the one side, and also poses severe harm to the soil's biological activity. (Belsky and Blumenthal, 1997; Barnes et al., 1998). Thus, with the growing burden of grazing as a result of misuse, the situation can result against the tasty

species in the rangeland. As proven by the findings of several studies performed in the Eastern Anatolian Region (Koç, 1995; Erkovan, 2000; Güllap, 2010; Severoğlu, 2018), it has been decided that intense and early grazing raises the rate of undesirable species in the botanical composition. As a result, the decrease in the ratio of species that contribute positively to the rangeland condition in the composition has deteriorated the rangeland condition and a decline in their health status was observed due to the gap in rangeland (Comakli et al., 2008).

Research carried out concerning the forest gap rangelands is relatively less compared to other rangeland sites. This research aims to assess the botanical composition and condition of rangeland and health class of the forest interior, forest edges, and forest top rangelands of the Erzurum Province, Oltu District, Kırdağı Location, as a basis for future studies and to guide applications.

## 2. Material and methods

The research was conducted between 2015-2017 in rangeland areas of the same direction (northwest) and same slope (5%) in the Kırdağı Zone located within the Oltu Forest Management Directorate of the Oltu District of Erzurum Province. The area where the research was performed was split into three separate groups: Forest top, forest interior, and forest edge. The first rangeland site has an altitude of 2370 m at the forest top, an altitude of 1930 m at the forest interior, and an altitude of 1830 m at the forest edge.

A total of 92 plant species were found in the examined rangeland sites; of the grass species, the *Dactylis glomerata* and *Festuca ovina*, of legume species, the *Astragalus sp*. and *Trifolium montanum* have been recorded while from other families the *Thymus parviflorus* and *Xanthium strumarium* recorded as common species.

According to data collected from the Oltu Meteorology Station, which is the nearest meteorological station to the area where the research is performed, the precipitation amount is 390.5 mm based on the mean score of long years, with the highest precipitation in May (61.2 mm) and the lowest precipitation in January (17.3 mm). The amount of precipitation observed in the first year of the research was higher than in the previous years. The average total temperature and relative humidity recorded during the research years and long years are 10.8, 9.9, 10.7 and 9.8 $^{0}$C and 52.8%, 52.7%, 47.9%, and 59.8% respectively. When the temperature values were analyzed, it was observed that the third year of the research was warmer than the long years and the second year average, while the temperature was almost the same as the first year. The highest temperature values were reported in August every three years in which the study was performed. In terms of relative humidity, there was no substantial variation from the average of long years during the experiment years, except for the third year of the research (Figure 1).

Considering the principles stated by Soil Survey Laboratory Staff (2017) in the soil samples taken from different rangeland sites where the study was conducted, the forest top, forest interior, and forest edge soil characteristics can be stated as follows. Soil structure classes are clayey-loamy, loamy, and sandy-clayey-loamy respectively. The aggregate stabilities are recorded as 81.3%, 61.7%, and 58.5% respectively, while the pH values are 7.87, 7.76 and 7.36, the electrical conductivity (EC) values are 0.17, 0.08 and 0.07 dS / m, the organic matter values are 4.05%, 2.36% and 1.31%, and finally the amount of phosphorus useful for to the plants was recorded as 14.9, 21.3 and 23.3 kg ha$^{-1}$ respectively.

While determining the botanical composition of the forest interior, forest edge, and forest top rangeland vegetations, transect measurements were performed by using the method

stated by Gökkuş et al. (2001), 7 lines were chosen from each rangeland site of the research area, and 10 transect lines were measured on each line. A vegetation study was conducted at the end of the blooming cycle of the dominant species and the ratios of the species of the botanical composition are determined by proportioning the values of the plant species to the total number of plants (Gökkuş et al., 2001). Again, utilizing field measurements, the health and condition class of rangeland concerning all three rangeland sites is calculated using the methods set out by Koc et al. (2003).

## 3. Results and discussion

The ratio of grasses in the botanical composition of the different rangeland sites of the forest where the study was conducted showed a 5% difference in terms of significance (Table 1). The ratio of grasses that varies between 20.72% and 36.05% among forest rangeland sites was determined as 29.05% at forest top, 36.05% at forest interior, and 20.72% at the forest edge. Although the ratio of grasses in the rangeland sites examined did not vary by year the interaction of site x year was not considered to be statistically significant.

The ratio of legumes, which has an average share of 15.34% in vegetation, was lower at forest interior (12.05%) and forest edge (11.69%) sites when compared to forest top sites (22.29%) (Table 1). There was no statistically significant difference between the years in terms of legume ratio and the site x year interaction.

The ratio of plants of other families in botanical composition among forest rangeland sitesvaried between 48.70% and 67.59% and this difference was significant at the 5% level (Table 1). The data show us that there is no significant difference between years and the site x year interaction in terms of the ratio of other families in different rangeland sites of the forest.

The canopy covarage rate (CCR) varied between 35.51% and 52.56% among rangeland sites. Forest top rangeland sites had the highest rate of CCR with 52.56%, while forest edge rangeland sites had the lowest rate of canopy coverage rate with 35.51%. The rate of canopy coverage rate, which is 44.89% on average, did not indicate a significant variation every year and similarly concerning site x year interaction (Table 2).

While the rangeland condition score (RCS) was 37.81 at the forest top, it was 42.30 at the forest interior, and 23.90 at the forest edge, and as a conclusion, this difference was very significant in statistical terms. The rangeland status score did not indicate a substantial difference between the forest rangelands over the years, and likewise, the site x year interaction was also found to be not significant. According to the rangeland status score and health values obtained in the study, it was noted that forest top and forest interior sites are in the healthy-medium rangeland health and condition class, while the forest edge site is in the risky-weak class range in terms of the condition and health of the rangeland.

In addition to grazing (Sankey, 2007; Škornik et al., 2010; Severoğlu, 2018), ecological differences (Güllap, 2010; Çomaklı et al., 2012; Türk et al., 2015) are likely to be effective on the change in the botanical composition of the examined forest sites. However, in our research, while the forest edge rangeland site had a lower proportion of grass than the other sites, the forest top and the forest interior rangeland sites had a higher proportion of grass. This difference between the rangeland sites could have been exacerbated by the lower altitude of the forest edge rangeland site compared to other sites of the rangeland and as well as because of the earlier start of grazing in this area and the increased grazing pressure. It is also likely that the ratio of grasses, which are in the first place among the desired plants in rangeland, will decline. Indeed, in similar studies, it has been noted that heavy and early grazing harms the vegetation (Holechek and Pieper, 1992;

Gökkuş and Koç, 2001; Güllap, 2010; Koç and İleri, 2016) and the rate of grasses has decreased significantly (Fırıncıoglu et al., 2007; Chartier et al., 2009). Besides, according to the data collected, it has been observed that the forest interior rangeland site has a larger percentage of grass than the other sites, and this could be since the *Dactylis glomerata* plant which is resistant to shade is more abundant in this area. Because the *Dactylis glomerata* that grows in high altitude rangelands (Can and Ayan, 2017) is highly resistant to drought, shade, grazing, and mowing and is widely used in the improvement of rangelands (Açıkgöz, 2001; Manga et al., 2002).

Since most of the legumes and forage crops with high crude protein content are consumed by animals, the plants of this family may exhibit less resistance to grazing (Sternberg et al., 2000; Tamartash et al., 2007*;* Erkovan et al., 2016). For this cause, the forest edge rangeland site, which is subjected to intense grazing of animals as in the research area, is projected to have a lower legume ratio relative to the forest top and the forest interior. While at the same time, in many studies (Bakoğlu, 1999; Rose et al., 2012), we can see the statement that there will be a decrease in the rate of legumes with increasing grazing pressure. Also, based on the data we collected, it has been found that the forest top rangeland has a higher rate of legumes relative to other rangeland sites, and this can be clarified by the explanation that grazing in this area cannot be carried out during the critical spring season due to the higher altitude of this area and that the plants have the chance to recover in this site. Because rangeland plants are extremely vulnerable to grazing during the spring and autumn critical grazing seasons in meadows and rangelands, and the vegetation is heavily affected by grazing during this time (Bakır, 1987; Altın et al., 2001; Ercan, 2018).

With the intensity of grazing, the distribution of the species may occur in the rangeland vegetation, which may be against the tasty species (Short and Woolfolk, 1956; Koc et al., 2008; Güllap, 2010; Severoglu and Gullap, 2020; Surmen and Kara, 2018) and thus an increase in the rate of plant species that are not desired by animals can be seen (Allred et al., 2012; Bremm et al., 2016; Erkovan et al., 2016). Indeed, the forest edge rangeland subjected to intense grazing pressure in the research area had a higher proportion of other families than other rangeland sites.

The main philosophy of the evaluation of health classes is based on the rate of basal area of vegetation. If the basal vegetation cover rate is greater than 40%, there is no risk of erosion, if the basal cover rate is below 30-40%, a risky situation would appear because the vegetation cannot retain the soil adequately, and since the soil cover rate is below 30%, the water erosion (Marshall, 1973) will take place, so that, it is an approach focused on the evaluation of the state of rangeland as problematic (Koç et al., 2003). For this reason, while the forest edge rangeland site is in the risky class due to the grazing practices that take place when the plants are sensitive, the forest top and forest interior rangeland sites that are not exposed to grazing during the sensitive period are recorded in the healthy class. Indeed, in similar studies (Koç, 1995; Hoffman and Ashwell, 2001; Vetter et al., 2006; Gür and Altın, 2015), it has been argued that the rate of soil cover, which is an essential factor for the rangeland health class, has decreased as a result of improper grazing.

The state of the rangeland (Wroe et al., 1998), articulated as a comparison of the plant species present in the botanical composition by the climatic climax, appears to worsen as a result of heavy grazing. In this study, while the forest edge rangeland site is classified in the weak class, forest top and forest interior rangeland sites are in the medium class.

Since the intensive grazing in the forest edge of the rangeland caused the plants favored by the animals to vanish from the vegetation and the invasive species that the animals avoid to graze it became dominant in sites that became sparse due to this absence. This study is in parallel with many studies (Erkovan, 2000; Tamartash et al., 2007; Yavuz and Surmen 2016) stating that there would be deviations from climax vegetation due to overgrazing conditions.

Similarity index values of pasture sites changed from 46.90% to 101.26%. The lowest similarity index rate (46.90%) was determined between the sites of forest top pasture and forest edge pasture while the highest similarity index rate (101.26%) was determined between forest top pasture site and forest interior pasture site. Although the similarity index rate between the forest top pasture site and forest edge pasture site was below 50%, between forest top pasture site and forest interior pasture site was higher than 50% similarity. Similarity index values were calculated based on the current plant species composition of the pasture sites and species similarities or differences of the in pasture sites revealed the similarity index between sites.

## 4. Conclusion

As a result, when the forest top, the forest edge, and the forest interior rangeland sites are evaluated in terms of the above-mentioned characteristics, it has been determined that the forest edge is damaged due to misuse of the rangelands and has weak quality in terms of rangeland assessment criteria compared to other sites, and we can attribute this result to early and overcapacity grazing practices. With aiming to prevent these negative effects, especially in these areas and the ones with similar characteristics, future measures such as determining the dates for starting and leaving grazing according to scientific principles, deciding carrying capacity correctly, making detailed management plans for forest

rangeland, and supporting the high-quality roughage production of forest villagers to prevent grazing can be very useful.

Acknowledgements

This study was supported by the General Directorate of Forestry within the scope of the projects of the Eastern Anatolia Forestry Research Institute. Project No: 01.6906 / 2015-2017.

## References

Açıkgöz E (2001). Yem Bitkileri. Uludağ Üniversitesi Güçlendirme Vakfı Yayınları (in Turkısh).

Allred BW, Fuhlendorf SD, Smeins FE, Taylor CA (2012). Herbivore species and grazing intensity regulate community composition and an encroaching woody plant in semi-arid rangeland. Basic and Applied Ecology 13 (2): 149-158.

Alp S, Ercisli S, Dogan H, Temim E, Leto A et al. (2016). Chemical composition and antioxidant activity *Ziziphora clinopodioides* ecotypes from Turkey. Romanian Biotechnological Letters 21: 11298-11303.

Altın M, Gökkuş A, Koç A (2011). Çayır ve Mera Yönetimi. Tarım ve Köy İşleri Bakanlığı, Tarımsal Üretim ve Geliştirme Genel Müdürlüğü Yayınları (in Turkısh).

Anonim (1968). Orman Genel Müdürlüğü Mera Envanteri. T.C. Tarım Bakanlığı, Orman Genel Müdürlüğü (in Turkısh).

Anonim (2012). Tarım Verileri. Türkiye İstatistik Kurumu (in Turkısh).

Avcıoğlu R, Tung T, Akbari N, Özel N (1996). Seferihisar Yöresi Orman içi ve Orman Kenarı Doğal Meralarının Islahı Olanakları Üzerinde Ön Araştırmalar. Orman Bakanlığı, Ege Ormancılık Araştırma Enstitüsü Müdürlüğü (in Turkısh).

Bakır Ö (1987). Çayır-Mera Amenajmanı. Ankara Üniversitesi Ziraat Fakültesi Yayınları (in Turkısh).

Bakoğlu A (1999). Otlatılan ve Korunan İki Farklı Mera Kesiminin Bazı Toprak ve Bitki Örtüsü Özelliklerinin Karsılastırılması. Atatürk Üniversitesi, Erzurum, Türkiye (in Turkısh).

Barnes BV, Zak DR, Denton SR, Spurr SH (1998). Forest Ecology, Fourth Edition. John Wiley and Sons, New York.

Belsky AJ, Blumenthal DM (1997). Effects of Livestock Grazing on Stand Dynamics and Soils in Upland Forests of the Interior West. Conservation Biology 11 (2): 315-327.

Bremm C, Carvalho PC, Fonseca L, Amaral GA, Mezzalira JC et al. (2016). Diet switching by mammalian herbivores in response to exotic grass invasion. PloS ONE 11 (2): 1-16.

Bilgili, A (2016). Kuzeydoğu Anadolu Bölgesinde (Oltu, Erzurum) Sarıçam (*Pinus sylvestris* L.) ağaçlandırma alanlarında sığır otlatmanın etkileri. Atatürk Üniversitesi, Erzurum, Türkiye (in Turkısh).

Bilgili A, Koç A. (2020). Determination of Some Vegetation Characteristics in Forest Gap Rangelands of Sarıkamış. Atatürk Üniversitesi Ziraat Fakültesi Dergisi 51 (1): 88-96 (in Turkish).

Can M, Ayan İ (2017). Some Feature and Yield Changes Depending on Growth Periods on Cocksfoot (Dactylis glomerata L.) Populations. Doğa Bilimleri Dergisi 20 (2): 160-166 (in Turkish).

Chartier MP, Rostogno CM, Roig FA (2009). Soil erosion rates in rangelands of northeastern Potagonia: A dendrogeomorphological analysis using exposed shrubroots. Geomorphology 106 (3-4): 334-351.

Comakli B, Dasci M, Koc A (2008). The effects of traditional grazing practices on upland (yayla) rangeland vegetation and forage quality. Turkish Journal of Agriculture and Forestry 32 (4): 259-265.

Çomaklı B, Öner T, Daşçı, M (2012). Changing of the vegetation on rangeland sites with different using history. Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi 2 (2): 75-82 (in Turkısh).

Ercan A (2018). Determination of range condition and vegetation properties of the Karaören Village rangeland of Seyitgazi district in Eskisehir province. Süleyman Demirel University, Isparta, Turkey (in Turkısh).

Erkovan Hİ (2000). Çiğdemlik Köyü (Bayburt) Mera Vejetasyonları Mevcut Durumu. Atatürk Universitesi. Erzurum, Türkiye (in Turkısh).

Erkovan Ş, Güllap MK, Erkovan Hİ, Koç A (2016). Rangeland health and ecological site classification of the rangeland with grazed different type animals. Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi 25 (2): 174-178 (in Turkısh).

Fırıncıoglu HK, Seefeldt SS, Sahin B (2007). The effect of long-term grazing exclosures on range plants in Central Anatolia Region of Turkey. Environmental Management 39 (3): 326-337.

Gökkuş A, Koç A (2001). Mera ve Çayır Yönetimi. Atatürk Üniversitesi Ziraat Fakültesi Yayınları (in Turkısh).

Güllap MK (2010). Kargapazarı Dağında (Erzurum) farklı otlatma sistemi uygulamalarının mera bitki örtüsüne etkisi. Atatürk Universitesi, Erzurum, Türkiye (in Turkısh).

Gür M, Altın M (2015). Some features of floristik composition of diffrent using history of natural pastures in Thrace Region. Anadolu Tarım Bilimleri Dergisi 30 (1): 60-67 (in Turkısh).

Hoffman T, Ashwell A (2001). Nature divided: land degradation in South Africa. University of Cape Town Press.

Holechek JL, Pieper RD (1992). Estimation of stocking rate on New Mexico rangelands, Journal of Soil and Water Conservation 47: 116–119.

Kaskoniene V, Bimbiraite-Surviliene K, Kaskonas P, Tiso N, Cesoniene L et al. (2020). Changes in the biochemical compounds of *Vaccinium myrtillus, Vaccinium vitis-idaea*, and forest litter collected from various forest types. Turkish Journal of Agriculture and Forestry 44: 557-566.

Koç A (1995). Topoğrafya ile Toprak Nem ve Sıcaklığının Mera Bitki Örtülerinin Bazı Özelliklerine Etkileri Atatürk Universitesi, Erzurum, Türkiye (in Turkısh).

Koç A, Gökkuş A, Altın M (2003). Comparison of the World-Widely Used Methods in Definition of Range Condition and a Suggestion for Turkey. 5. Tarla Bitkileri Kongresi, 13-17 Ekim 2003, Diyarbakır, Türkiye, s. 36-42 (in Turkısh).

Koç A, Erkovan Hİ, Serin Y (2008). Changes in vegetation and soil properties under semi-nomadic animal raising areas in highlands, rangelands of Turkey. Current World Environment 3 (1): 15-20.

Koc A, Schacht WA, Erkovan HI (2014). The History and Current Direction of Rangeland Management in Turkey. Rangelands 37 (1): 39-46.

Koç A, İleri O (2016). Comparison of cattle and sheep grazed sub-irrigated rangelands vegetation in Eskişehir Plain. Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi 25 (2): 179-184 (in Turkısh).

Lawrence JH, Hardesty LH (1992). Mapping the territory: agroforestry awareness among Washington state land managers. Agroforestry Systems 19 (1): 27–36.

Manga İ, Acar Z, Ayan İ (2002). Buğdaygil Yem Bitkileri. Ondokuz Mayıs Üniversitesi Ziraat Fakültesi Yayınları (in Turkısh).

Marshall JK (1973). Drought, land use and soil erosion. In: JV, Lovett (editor). In the Environmental,Economic and Social Significance of Drought, Sydney, pp. 55-77.

Mayer AL, Kauppi P, Tikka PM, Angelstam P (2006). Conservation implications of exporting domestic wood harvest to neighboring countries. Environmental Science & Policy 9 (3): 228-236.

Oztas T, Koc A, Comakli B (2003). Changes in vegetation and soil properties along a slope on overgrazed and eroded rangelands. Journal of Arid Environments 55 (1): 93-100.

Sankey TT (2007). Woody-herbaceous-livestock species interaction. Annals of Arid Zone 46: 1–28.

Severoğlu S (2018). Eğime Bağlı Olarak Mera Bitki Örtüsünün Değişimi. Atatürk Üniversitesi, Erzurum, Türkiye (in Turkish).

Gullap M, Severoglu S (2020). Effects of animal grazing on favorable forage yield and quality of rangelands with different slope. Turkish Journal of Field Crops 25 (2): 168-173.

Short LR, Woolfolk EJ (1956). Plant vigour as acretion of range condition. Journal of Range Management 9: 66-69.

Škornik S, Vidrih M, Kaligarič M (2010). The effect of grazing pressure on species richness, composition and productivity in North Adriatic Karst rangelands. Plant Biosystems 144 (2): 355–364.

Soil Science Division Staff. 2017. Soil survey manual. Washington, D.C.

Sternberg M, Gutman M, Perevolotsky A, Ungar ED, Kigel J (2000). Vegetation response to grazing management in a Mediterranean herbaceous community: a functional group approach. Journal of Applied Ecology 37 (2): 224-237.

Sürmen M, Kara E (2018). Yield and quality characteristics of rangelands which have different slopes in Aydın ecological conditions. Derim 35 (1): 67-72 (in Turkısh).

Tamartash R, Jalilvand H, Tatian MR (2007). Effects of Grazing on Chemical Soil Properties and Vegetation Cover (Case Study: Kojour Rangelands, Noushahr, Islamic Republic of Iran). Pakistan Journal of Biological Sciences 10: 4391-4398.

Tekeli S, Mengül Z (1991). Orman içi merada topoğrafyanın botanik kompozisyona ve verim üzerine etkisi. Türkiye II. Çayır-Mera ve Yembitkileri Kongresi 28-31 Mayıs 1991; İzmir, Türkiye, s. 139-149 (in Turkısh).

Türk M, Albayrak S, Bozkurt Y (2015). The effects of grazing on botanical composition in different artificial pastures. Süleyman Demirel Üniversitesi Ziraat Fakültesi Dergisi 10 (1):27-34 (in Turkısh).

Vetter S, Goqwana WM, Bond WJ, Trollope WW (2006). Effects of land tenure, geology and topography on vegetation and soils of two grassland types in South Africa. African Journal of Range and Forage Science 23 (1): 13–27.

Wray PH (1998). Grazing Iowa's Woodlands. Forestry Extension Notes F-350. Ames, Iowa: Iowa State University.

Wroe RA, Smoliak S, Adams BW, Willims WD, Anderson ML (1988). Guide to range condition and stocking rates for Alberta Grasslands. Alberta Forestry, Lands and Wildlife Public Lands Division.

Yavuz T, Surmen M (2016). Vegetation features of alpine and subalpine rangelands in Eastern Black Sea region 59: 474-477.

**Table 1.** The botanical composition of different rangeland sites of the forest [(1)].

| Rangeland Sites | Botanical Composition (%) | | |
|---|---|---|---|
| | **Grasses** | **Legumes** | **The Other Families** |
| Forest top | 29.05 a | 22.29 A | 48.70 b |
| Forest interior | 36.05 a | 12.05 B | 51.92 b |
| Forest edge | 20.72 b | 11.69 B | 67.59 a |
| **Mean** | **28.60** | **15.34** | **56.06** |
| 2015 | 29.87 | 14.93 | 55.21 |
| 2016 | 27.49 | 14.78 | 57.73 |
| 2017 | 28.46 | 16.32 | 55.28 |
| **Mean** | **28.60** | **15.34** | **56.06** |
| Site | * | ** | * |
| Year | ns | ns | ns |
| Site x Year | ns | ns | ns |

[1]Values followed by small and capital in a column shows significant differences at P <0.05 and P <0.01 levels, respectively, using Duncan's multiple range test.
[ns]No statistical difference at P <0.05 and P<0.01, * Statistical difference at P< 0.05, ** Statistical difference at P <0.01.

**Table 2** The condition of rangeland and the health class of different rangeland segments of the forest [(1)].

| Rangeland Sites | CCR (%) | RCS | The health and condition class of rangeland |
|---|---|---|---|
| Forest top | 52.56 a | 37.81 A | healthy-medium |
| Forest interior | 46.60 a | 42.30 A | healthy-medium |
| Forest edge | 35.51 b | 23.90 B | risky-weak |
| **Mean** | **44.89** | **34.67** | |
| 2015 | 43.60 | 29.53 | healthy-medium |
| 2016 | 43.33 | 40.71 | healthy-medium |
| 2017 | 47.73 | 33.77 | healthy-medium |
| **Mean** | **44.89** | **34.67** | |
| Site | * | ** | - |
| Year | ns | ns | - |
| Site x Year | ns | ns | - |

[1]Values followed by small and capital in a column shows significant differences at P <0.05 and P <0.01 levels, respectively, using Duncan's multiple range test.
[ns]No statistical difference at P <0.05 and P<0.01, * Statistical difference at P< 0.05, ** Statistical difference at P <0.01.
CCR: Canopy covarage rate.
RCS: Rangeland condition score.

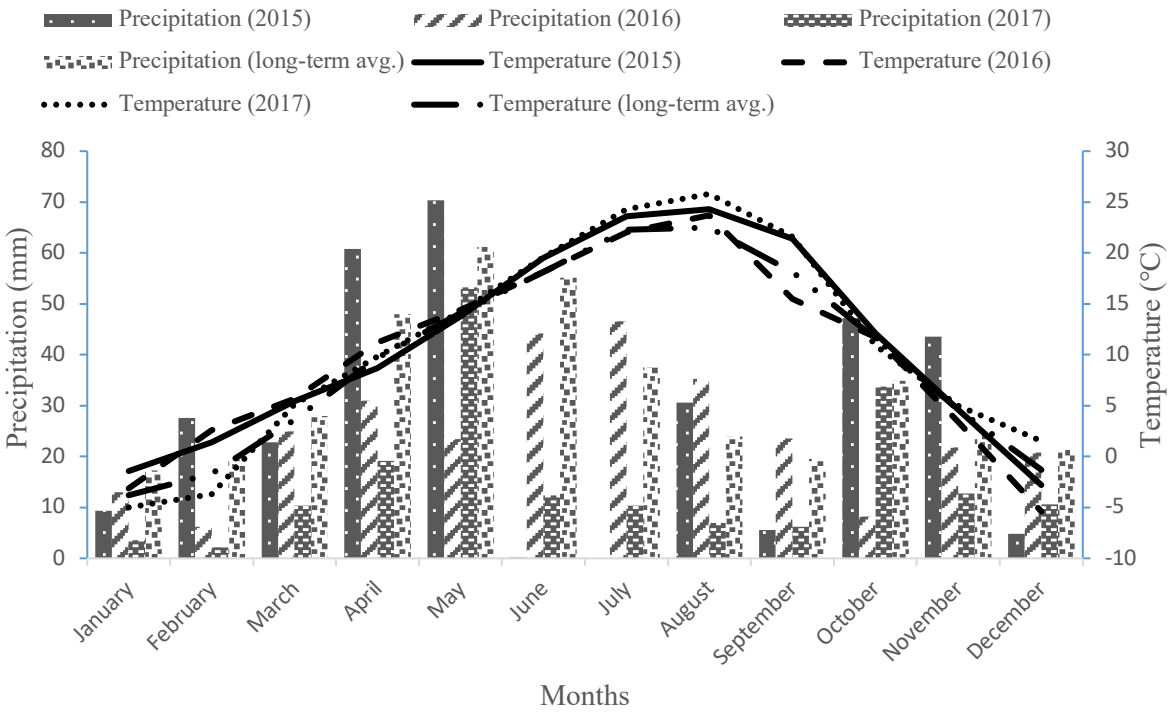


**Figure 1.** Climate information for many years in the field of research