DETERMINATION OF THE CERTAIN VEGETATION CHARACTERISTICS OF KIZILOVA FOREST PASTURE LOCATED IN THE SOUTH OF TURKEY

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Abstract. Forest pastures are an important resource for Mediterranean countries, providing cheap forage and a reservoir of biodiversity. A case study was conducted of the Kizilova forest pasture (Sutculer) in the Isparta district of Southern Turkey in 2014-2016. The aim of the study is to determine the plant species, plant-covered area, botanical compositions, aboveground biomass, belowground biomass, pasture condition and grazing capacity in a pasture. Vegetation sampling was conducted in spring and autumn (2014-2016). "Line intercept" and "quadrat" methods were used in order to determine the pasture flora of the case study area. The finding was that 106 plant taxa belonged to 23 families, out of which 26 taxa of Asteraceae were determined, while 13 and 11 taxa were determined in Lamiaceae and in Poaceae, respectively. The plant-covered area was found to be nearly 57.7%. The botanical composition of pastures' taxa is approximately 46.5% Poaceae, 31.2% Fabaceae and 22.3% of other families. The aboveground and belowground biomass productions were calculated as 414.2 kg/da and 745.2 kg/da, respectively. The results indicated that the grazing capacity for an area was on average 153.4 animal units and the average sufficient pasture area per animal unit was 1.3 ha. The case study area of pasture condition was determined as moderate.
Keywords: *above-ground biomass, plant-covered area, botanical composition, grazing capacity, Turkey*

Introduction

Natural vegetation is extremely important for any region. It is a natural structure created by the conditions of that region to protect the soil and the water and to be the nutrition and source of life. Meadow and pasture vegetation, an important part of the natural vegetation cover, hold particular importance as the areas of feed supply that forms the basis of animal production.

A large part of the earth is covered by meadow and pasture areas. These vast areas are resources that are irreplaceable in terms of obtaining animal products, which are the most important source of nutrition for the world's population.

Meadow and pasture areas constitute 18.8% of the total land area of our country and 37% of the total agricultural land. Meadow and pasture areas were 37.9 million hectares in the 1950s in Turkey, but have dropped to 14.6 million hectares today (Altin et al., 2011). In Turkey, the proportion of areas for planting forage crops within field lands is 11.7% (TSI, 2013). Therefore, meadow and pasture areas are crucial sources of animal feed production. A total of 30% of the hay needed by animals is covered by meadows and pastures, which constitutes about one-fifth of the total area of Turkey (Gokkus, 1994; TSI, 2013). Meadows and pastures supply 68% of the nutrients consumed by our country's animals in a year as crude protein and 62% of them as starch value (Okatan

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and Yuksek, 1997). These figures confirm that meadows and pastures are the main sources of animal nutrition (Erkun, 1999).

The natural pastures in our country are found in highly elevated and rough lands in general. A total of 90% of them are located on grade 6 and 7 lands (Aydin and Uzun, 2002). The hay yield of the pastures in Turkey is about 70 kg/da, which correspond to one-third of the world average (Babalik and Fakir, 2017). Most of the plants that make up the yields of these pastures consist of shrubs and weeds, which animals cannot consume.

The fact that Turkey's natural pastures are in a bad condition today not only adversely affects the stock farming and therefore the country's economy, but also leads to the destruction of land and water resources. As a matter of fact, due to misapplications such as early- and over-grazing, a large proportion of the pastures have lost their natural vegetation cover, and the erosion problem has reached dangerous dimensions. Moreover, grazing in pastures at a density of about 2-3 times higher than the capacities of the pastures has caused a reduction in their productivity (Koc et al., 1994). In order to solve these problems, it is necessary that pastures that are in poor condition be improved immediately in order to produce abundant and good quality forage again. However, the first condition of success in the process of improvement, which aims to enhance any material and its usefulness, is to fully understand the material to be improved. Therefore, various features of pastures in different ecological regions of our country should be studied.

Vegetation analysis aims to quantitatively express the vegetative characteristics of plants in terms of quality and quantity. Although vegetation analysis studies are not very common in our country, plant taxonomy and phytosociology studies have been carried out to determine which plant species exist in pastures. The main purpose of pastures should also be to allow grazing in addition to the protection of soil and water. Thus, the vegetation studies to be carried out in the pastures include the studies to reveal the yield and quality of pasture forage for management (Gokbulak, 2006).

Using vegetation analysis, it is possible to obtain data on information such as the pasture condition, its progress in a positive or negative direction, its grazing intensity in the past, its forage value and effectiveness in terms of grazing, its soil and water conservation characteristics (Gokbulak, 2003), its aesthetic value, the determination of its grazing capacity, and the determination of the effects of drought on vegetation. Moreover, information can be obtained on the dominant plant species and the amount of forage in pastures (Gokbulak, 2006). Indeed, many research studies on this subject have been based on the determination of the floristic composition and ecological characteristics in natural pastures and on the determination of the yield and grazing capacities of pastures.

In Isparta, the total of meadow and pasture areas is 81.719 ha, and 81% of these areas are located on grade 7 lands (Anonymous, 2006). As is the case in our country, the cause of the reduction in the yields of the Isparta pastures is early- and over-grazing. For this reason, some of the pastures have become unable to meet the forage needs of animals (Babalik, 2007).

This study aimed to examine various vegetation features of Kizilova, a forest pasture located in the Sutculer district of Isparta province and to reveal the current situation. The collected data will become the basis for range improvement studies to be carried out in the region and to provide the necessary information about the natural pasture vegetation. Therefore, the study aimed to identify the regional ecological characteristics

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that would shed light on the plant species in the Kizilova forest pasture, the extent to which pasture plants cover the soil, the botanical composition, the yield of the pasture, the belowground biomass, the grazing capacity and improvement studies. Moreover, in this study, an attempt was made to reveal what kind of changes would take place based on the protection measures to be taken in the pastures and to determine the benefits that could be achieved by relieving the pressure on forest pastures in the region, where stock farming depended to a great extent on pasture grazing.

Material and Method

Material

Kizilova forest pasture (37º36'06"N - 31º03'52"E), with an area of approximately 200 hectares located within the boundaries of Sutculer district of Isparta province, was selected as the research material (*Fig. 1*). The pasture area has an average elevation of 1410 meters. It has a general north-west aspect and an average slope of 2% (*Fig. 2*). It is 92 km from the center of Isparta province.

Kizilova pasture is a type of forest pasture, and the dominant tree species in the forest areas around the pasture area consist of Greek juniper (*Juniperus excelsa* Bieb.) and Turkey oak (*Quercus cerris* L.). Indeed, these two species of trees, especially Greek junipers, hold significant potential for forage in these forest areas, since they do not cover areas very densely in the stands they create.

The research area is located in the transition zone between the Mediterranean climate and the continental climate, and represents the upland zone behind the Mediterranean. According to long-term climate data (1950-2015), the average annual temperature in Sutculer is 12.9°C, and the amount of total annual precipitation is 777.5 mm (TMS, 2016). According to the climate diagram drawn using the Walter method (Walter, 1958), a dry season prevails in the region from the middle of April to the end of October (*Fig. 3*).

Kizilova forest pasture area defined in the study as the material used continuously for grazing. The research area is located at the C3 cell according to the grid system used in the Flora of Turkey by Davis (1965-1988).

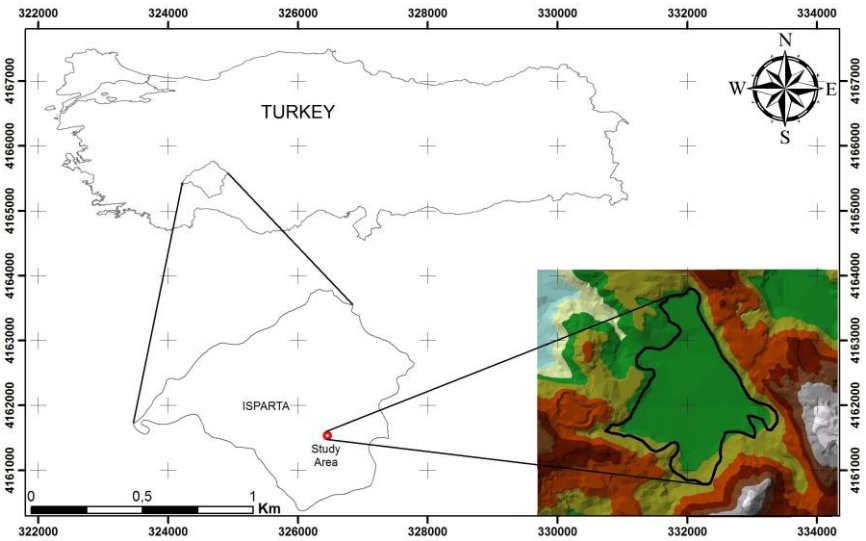

Figure 1. *Study area*

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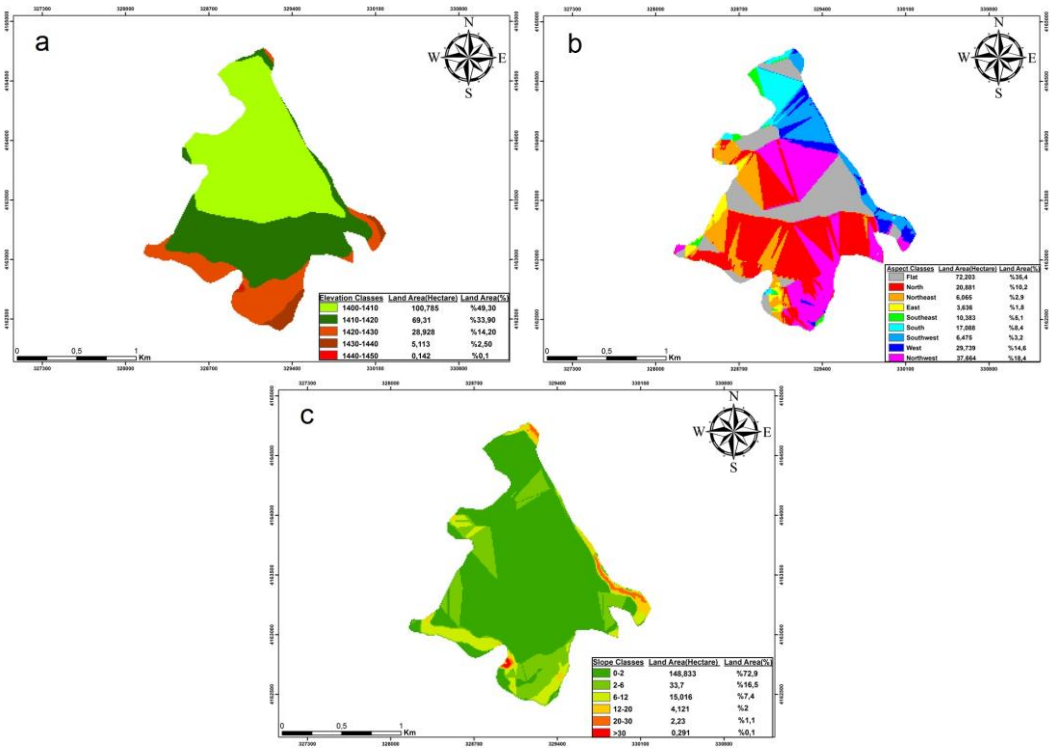

Figure 2. *Elevation (a), aspect (b) and slope (c) maps*

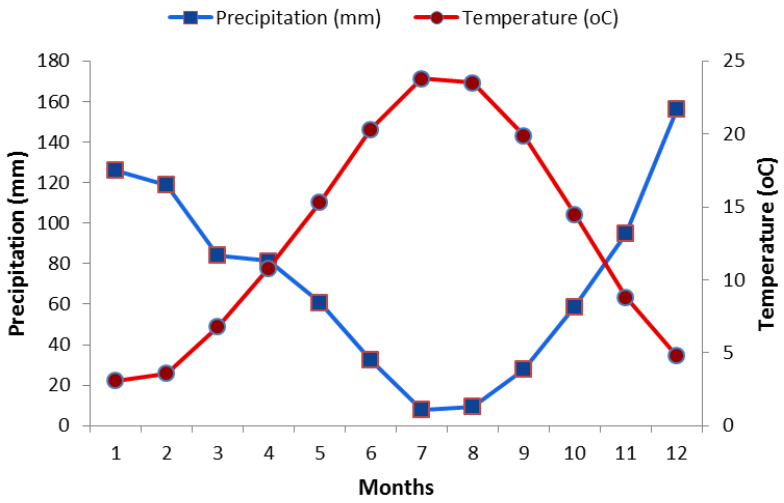

Figure 3. *Climate diagram*

Method

In order to identify the characteristics of the pasture vegetation in the research area, 10 experimental plots, each measuring 10×5 m^2, were created and surrounded with barbed wire (*Fig. 4*). Experimental plots were selected and positioned on a topographical map with a scale of 1:25000 using actual land-use maps, and GIS technology. These experimental plots were randomly distributed to the pasture area,

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considering also the variations in the vegetation structure, aspect and altitude. In the measurements carried out in those plots that were closed to grazing, the methods of line intercept (transect) (Babalik, 2004; Dalle et al., 2006; Godinez-Alvarez et al., 2009; Palta and Genc Lermi, 2018) and quadrat (Stohlgren et al., 1995; Wale et al., 2012; Cacan and Kokten, 2014; Babalik and Sarikaya, 2015; Ozgur et al., 2017), which are some of the methods for determining the quantitative characteristics of pasture vegetation, were utilized. The vegetation measurements were carried out in the second half of June and September during both trial years.

Figure 4. *A view from the experimental plots*

In this study, the following vegetation characteristics of the pasture were determined: plant-covered area, botanical composition, above-ground biomass, belowground biomass, pasture condition and grazing capacity. The line intercept method was used to determine the plant-covered area in pasture (Bilgen and Ozyigit, 2005; Oztas et al., 2003). As per the method, the plant-covered area was calculated by proportioning the intercept areas of plants in the line to the total intercept area (Etchberger and Krausman, 1997). Similarly, the line intercept method was used for determining the botanical composition. For this reason, the plant species were split into three groups: poaceae, fabaceae and other families. Their botanical composition ratio was determined based on the plant-covered area. Above-ground biomass was determined using the quadrat method, and frames of 1x1 m^2 were used for this purpose. During measurements, the plant material was mown from the soil surface from a height of about 3 cm at the study areas. The mown material was dried in the laboratory at 70^{o}C for 24 hours in the oven. Then they were weighed and the results were calculated in kg/da. The plants were taken for the quadrat measurement for determining the belowground biomass. Then, the remaining roots were taken without harming them, with 20 cm of active roots as a basis (Ozgur et al., 2017). The pasture condition was determined according to the values of plant-covered areas in the pasture.

In addition, 50 disturbed and undisturbed soil samples were taken, with five samples from each of the experimental plots in the research area in June 2015. Texture classes,

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organic matter quantities, electrical conductivities, lime amounts, bulk density, pH values and macro plant nutritional elements of these samples were determined in the laboratory. In order to determine soil properties, samples were collected from experimental plots within a depth of 0-20 cm. Soil samples were oven-dried at 105ºC, grounded and passed through a 2-mm sieve and each sample was weighed and analyzed. In this context, the particle size distribution of the soil was determined based on the Bouyoucos hydrometer method (Bouyoucos, 1962). The soil texture was defined based on the international particle size distribution classes (Gulcur, 1974). The concentration of soil organic matter was determined by wet combustion described in the Walkley-Black method (Nelson and Sommer, 1996). The electrical conductivity (EC) in 1:5 soil/water suspension was determined by the EC meter (Rhoades, 1982). Amounts of lime were determined by the pressure calcimeter method (Loeppert and Suarez, 1996). Bulk density was determined by the core method (Blake and Hartge, 1986). The pH level was identified in 1:2.5 soil/water suspension by the pH meter (Rowell, 1994; Kantarci, 2000). Macro plant nutritional elements of the soil samples were measured using a Shimadsu 6600 atomic absorption equipment (Gulcur, 1974).

Statistical methods (the variance analysis and the Duncan multiple comparison test) were used to evaluate the data obtained as a result of the measurements carried out in the field and the analyses done in the laboratory. Significance or insignificance of the differences between findings were also revealed. SPSS 20.0 package program was used to evaluate the obtained data (SPSS Inc., 2011).

Results and Discussion

Based on the analyses of the soil samples taken from the 10 experimental plots that were created in the pasture area, it was found that the pasture area soil was composed of 43% clay, 34% sand and 23% dust, classifying the soil as a texture type of “Clay Soil”. The amount of organic matter was moderate, at 3.78%. The average amount of lime was 1.55%, the electrical conductivity was 46.64 μs/cm, the bulk density was 1.263 g/cm^3 and the amount of nitrogen was 0.229%. The soil reaction was neutral with a pH of 6.6. Regarding the macro nutritional elements of the soil samples, no evidence was found to restrict the plant development to a severe extent. The dispersion ratio of the soil samples was determined to be 24.6%. In this respect, the pasture soil was susceptible to erosion in general.

The average plant-covered area (PCA) value of the pasture area was determined to be 57.65%. Plant-covered area values (Bakoglu and Koc, 2002), which have quite an important influence on the protection of soil against erosion, showed differences according to the plots of measurements (*Fig. 5*).

According to the results of the variance analysis, there was a significant difference between the plots in terms of the plant-covered area at a level of .1% (F=27.133). Some ecological and topographical features (soil properties, aspect, altitude, etc.) are thought to be factors in the occurrence of these differences.

Based on the result of the t test carried out in terms of the plant-covered area according to seasons, there was no significant difference between the seasons (t=6.535). However, it was found that the plant-covered area measured in the summer season (60.00%) was higher than the plant-covered area measured in the fall season (55.30%) (*Fig. 6*).

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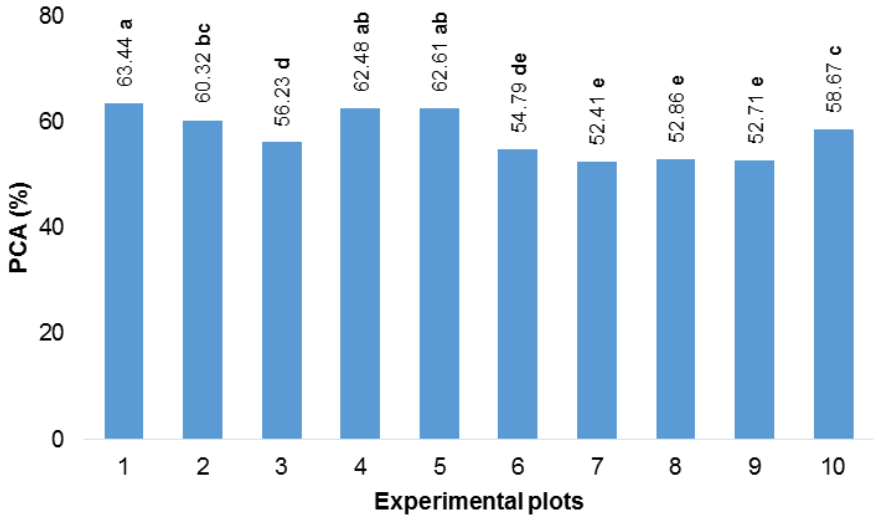

Figure 5. *Plant covered area according to the plots*

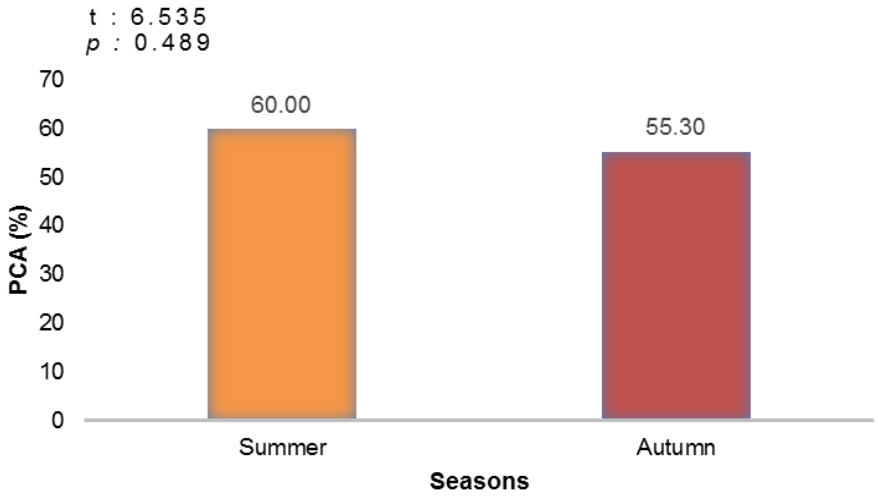

Figure 6. *Plant covered area according to seasons*

According to the PCA in the pasture, in terms of botanical composition, the rates of Poaceae, Fabaceae, and the other families were 46.47%, 31.17%, and 22.36%, respectively. The Poaceae family showed the highest rate of involvement in the botanical composition in the pasture area, followed by the Fabaceae family and the other families (*Fig. 7*). Gur and Sen (2016) found similar results in their studies.

In general, the amount of the above-ground biomass (AGB) was 414.2 kg/da in Kizilova pasture. During the summer measurements in June, the above-ground biomass was 451.2 kg/da, which was reduced to 377.2 kg/da during the fall measurements in September.

Based on the variance analysis results regarding the amount of above-ground biomass in the plots, there was a statistically significant difference between the plots ($F=23.379$) ($p<.001$) (*Fig. 8*).

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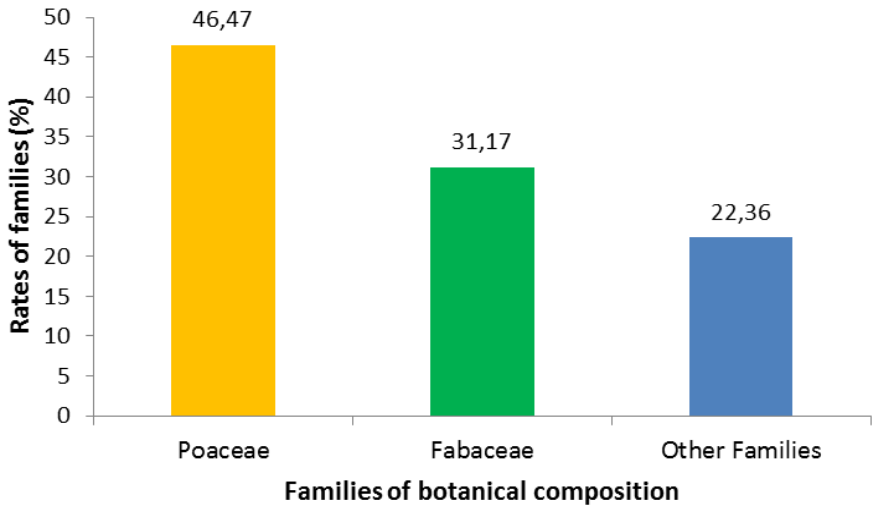

Figure 7. *The rate of the families in the botanical composition*

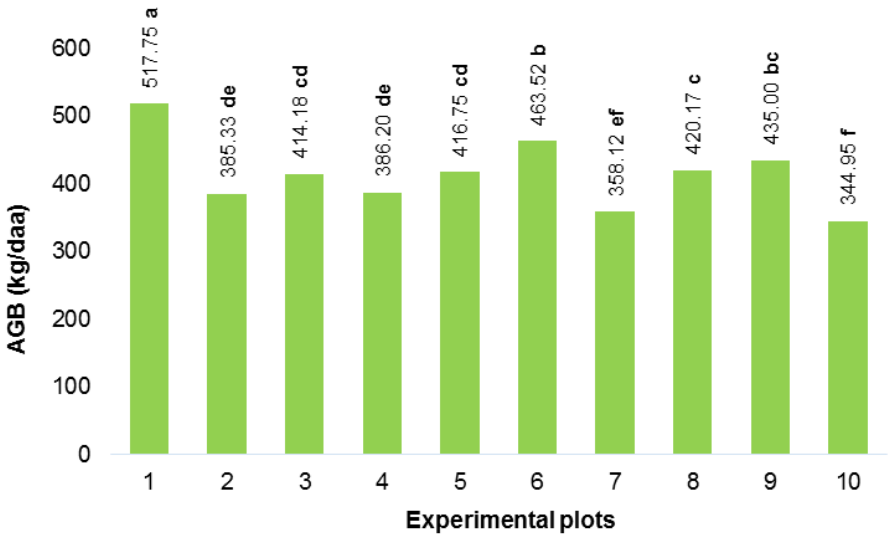

Figure 8. *Above-ground biomass according to the plots*

There was no significant difference between the seasons based on the t-test (t=9.438) in terms of the amount of the above-ground biomass. The amount of above-ground biomass measured in summer season was 451.20 kg/da and the fall season was 377.20 kg/da (*Table 1*).

Table 1. *Families distribution of the above-ground biomass according to seasons*

Measurement time	Summer	Fall	Average
Above-ground biomass (kg/da)	451.2	377.2	414.2
Poaceae	208.35	171.1	189.7
Fabaceae	139.7	113.2	126.5
Other families	103.15	92.9	98.0

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Regarding the amount of above-ground biomass according to seasons, a decrease was observed in the fall compared to the summer in all three families (*Table 1*). The factor was that precipitation during September and October was less than that during the spring months, and the higher temperature in the pasture area caused the amount of the above-ground biomass to be lower in autumn than in summer. In addition, plants lost components such as branches and leaves in the autumn.

In general, the amount of belowground biomass (BGB) was 745.2 kg/da in Kizilova pasture. During the measurements in June, the belowground biomass was 808.1 kg/da, which was reduced to 682.3 kg/da during the fall measurements in September.

According to the results of the variance analysis of the belowground biomass according to the plots (*Fig. 9*), there was a significant difference between the plots ($F=71.981$) ($p<.001$).

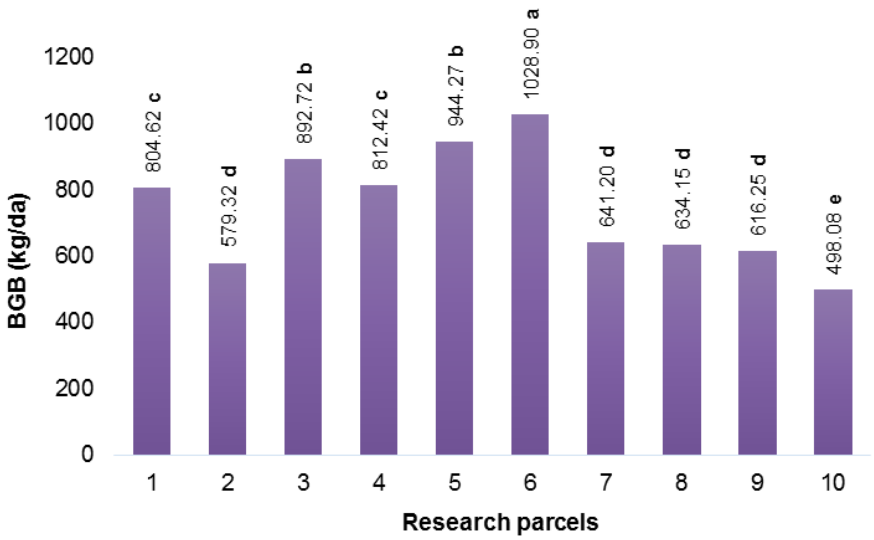

Figure 9. *Belowground biomass according to the plots*

There was no significant difference between the seasons based on the t test ($t=4.946$) in terms of the amount of the belowground biomass. The amount of belowground biomass measured in summer season was 808.11 kg/da and the fall season was 682.28 kg/da.

The quality level of the pasture in the study area was identified as 4.11, and the pasture condition was "moderate." However, the quality level of the pasture was very close to poor. This situation is caused as a result of the botanical composition. As Gillen et al. (1991) found, the pressure of overgrazing and poor use results in great damage to the vegetation cover, which naturally leads to a decrease in the quality of the pasture.

Based on the vegetation observations, approximately 170 days between the beginning of grazing (mid-May) and the end of grazing (early November) were determined as the "grazing period" for Kizilova pasture.

The grazing capacity of Kizilova forest pasture was determined to be 153.4 animal units, the unit area grazing capacity was 0.8 animal units, and the pasture size needed for 1 animal unit was determined to be 1.3 ha.

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Conclusion and Recommendations

This study was carried out in the Kizilova forest pasture of the Sutculer district of Isparta province to identify the condition of our pastures. The plant-covered area in the research area was 57.65%. A total of 106 plant taxa belonging to 23 families were identified. Families with the most taxa were identified as the Asteraceae, Lamiaceae and Poaceae families, respectively. The botanical composition of the pasture area was 46.47% Poaceae, 31.17% Fabaceae and 22.36% other families. Moreover, the average above-ground biomass was determined as 414.2 kg/da and the belowground biomass as 745.2 kg/da. Based on this, the grazing capacity of the pasture area was determined to be 153.4 animal units, while the pasture area needed for 1 animal unit was calculated as 1.3 ha.

The following suggestions can be made based on the results obtained in this study. Firstly, overgrazing takes place almost all year round in the pasture area. Stray horse flocks play a significant role in overgrazing. Another important problem is early grazing. This has damaged the pasture at an extreme level and caused considerable decline in vegetation quality. There are various signs of erosion in the pasture area. Nevertheless, no factors that would limit plant development at a significant level in the physical and chemical properties of soil samples were found. In this case, it may be possible to restore the pastures to the desired level and to prevent erosion by establishing certain protective measures.

Among the 106 plant taxa in the pasture, 85 were of families other than Poaceae and Fabaceae forage crops. These families consist of plants that are not preferred by animals. In order to increase the proportion of Poaceae and Fabaceae forage crops in the botanical composition, the grazing should be carefully planned, and the grazing capacity must be observed during grazing season.

In order to sustain pastures, they must be used in accordance with the grazing capacity. In addition, both villagers and shepherds should be trained, and villagers should be encouraged to plant forage crops in agriculture areas outside pastures. However, it would be possible to improve the quality of the pasture condition from the “moderate” level to the “good” level by ensuring that animals graze uniformly and by using methods such as fertilization. Moreover, the excessive size of horse flocks that graze in a haphazard manner must be addressed. These are all necessary in order to improve and sustain the pasture area in order to reap optimum benefits.

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REFERENCES

[1] Altin, M., Gokkus, A., Koc, A. (2011): Meadow and pasture management. – Ministry of Agriculture and Rural Affairs, General Directorate of Agricultural Production and Development Volume 1, 331p., Ankara.

[2] Anonymous (2006): Isparta environmental status report. – Isparta Governorship, Provincial Directorate of Environment and Forestry 450p., Isparta.

[3] Aydin, I., Uzun, F. (2002): Meadow-Range Management and Breeding. – Ondokuz Mayis University Faculty of Agriculture Textbooks No: 9, 313p., Samsun.

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/1701_521532

[4] Babalik, A. A. (2004): Surface cover measurement methods in meadows and ranges. – Suleyman Demirel Faculty of Forestry Journal A(1): 50-72, Isparta.
[5] Babalik, A. A. (2007): A research on determination of plant covered area and grazing capacity on the Davraz mountain Kozagaci highland range. – Suleyman Demirel University, J. Fac. For. A(1): 12-19, Isparta.
[6] Babalik, A. A., Sarıkaya, H. (2015): A research on the hay yield and botanical composition of the Zengi rangeland in Isparta. – Turkish Journal of Forestry 16(2): 96-101.
[7] Babalik, A. A., Fakir, H. (2017): Comparison of vegetation properties on the protected and grazed rangeland areas: the case of Kocapinar rangeland. – Journal of Forestry 18(3): 207-211.
[8] Bakoglu, A., Koc, A. (2002): The comparison of some soil and plant of characteristic in grazed and protected range sites: I. Comparison of plant cover characteristic. – Firat University Journal of Science and Engineering 14(1): 37-47.
[9] Bilgen, M., Ozyigit, Y. (2005): Determination of vegetation characteristics of some rangelands in Korkuteli and Elmali. – Akdeniz University Journal of Agricultural Faculty 18(2): 261-266.
[10] Blake, G. R., Hartge, K. H. (1986): Bulk Density and Particle Density. – In: Klute, A. (ed.) Methods of Soil Analysis. SSSA Book Series: 5, Madison, 363-381.
[11] Bouyoucos, G. J. (1962): Hydrometer method improved for making particle size analyses of soils. – Agronomy Journal, 54(5): 464-465.
[12] Cacan, E., Kokten, K. (2014): Research on the yield herbage and grazing capacity of a range in Cicekyayla village, central district Bingol. – Turkish Journal of Agricultural and Natural Sciences Special Issue (2): 1727-1733.
[13] Dalle, G., Maass, B. L., Isselstein, J. (2006): Rangeland condition and trend in the semi-arid Borana lowlands, southern Oromia, Ethiopia. – African Journal of Range and Forage Science 23(1): 49-58.
[14] Davis, P. H. (1965-1988): Flora of Turkey and The East Aegean Islands. – University Press, Edinburgh, Vol.: 1-10.
[15] Erkun, V. (1999): The importance and historical development of grassland-rangelands: rangeland pasture law practice handbook. – Ministry of Agriculture and Rural Affairs General Directorate of Agricultural Research and Policies, Ankara.
[16] Etchberger, R. C., Krausman, P. R. (1997): Evaluation of Five Methods for Measuring Desert Vegetation Source. – Wildlife Society Bulletin 25(3): 604-609.
[17] Gillen, R. L., Mccollum, F. T., Hodges, M. E., Brumer, J. E., Tate, K. W. (1991): Plant community responses to short duration grazing in Tallgrass prairie. – Journal of Range Management 44: 124-128.
[18] Godinez-Alvarez, H., Herrick, J. E., Mattocks, M., Toledo, D., Van Zee, J. (2009): Comparison of three vegetation monitoring methods their relative utility for ecological assessment and monitoring. – Ecological Indicators 9: 1001-1008.
[19] Gokbulak, F. (2003): Selected physical properties of heavily trampled soils livestock trails. – Journal of the Faculty of Forestry Istanbul University, Series: A, 53(1): 39-40.
[20] Gokbulak, F. (2006): Vegetation analysis methods. – Lecture Notes of Master Degree, Istanbul University Graduate School of Applied and Natural Sciences, 98p., İstanbul.
[21] Gokkus, A. (1994): The place and importance of grassland-rangelands and forage plants in roughage production of Turkey. – Ataturk University Journal of Agriculture Faculty 25: 250-261., Erzurum.
[22] Gulcur, F. (1974): Physical and chemical soil analysis methods. – Istanbul University Faculty of Forestry Publications, No: 201, Istanbul, Turkey.
[23] Gür, M., Şen, C. (2016): Some characteristics of legume and grass species determined in a natural rangeland of Thrace region. – Journal of Tekirdag Agricultural Faculty 13(1): 61-69.

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/1701_521532

[24] Kantarci, M. D. (2000): Soil science. – Istanbul University Faculty of Forestry Publications, No: 462, Istanbul, Turkey.
[25] Koc, A., Gokkus, A., Serin, Y. (1994): Situation of Turkey's grassland- rangelands and the importance for erosion. – Journey of Ecology Environment 13: 36-41.
[26] Loeppert, R. H., Suarez, D. L. (1996): Carbonate and Gypsum. – In: Sparks, D. L., Page, A. L., Helmke, P. A., Loeppert, R. H. (eds.) Methods of Soil Analysis Part 3 – Chemical Methods. SSSA Book Ser. 5.3. SSSA, ASA, Madison, WI. p. 437-474.
[27] Nelson, D. W., Sommer, L. E. (1996): Total carbon, organic carbon and organic matter. – In: Sparks, D. L., Page, A. L., Helmke, P. A., Loeppert, R. H. (eds.) Methods of Soil Analysis Part 3 – Chemical Methods. SSSA Book Ser. 5.3. SSSA, ASA, Madison, WI. p. 961-1010.
[28] Okatan, A., Yuksek, T. (1997): Studies on growing of sainfoin excessive grazed grassland parcel (*Onobrychis viciifolia* Scop.) and yield potential. – Turkey 2. Field Crops Congress, Ondokuz Mayis University Faculty of Agriculture, 22-25 September 1997, 492-498., Samsun.
[29] Ozgur, F., Karagul, R., Ozcan, M. (2017): Changes in plant composition and forage production in relation to elevations in the rangelands of Alanya province. – Journal of Forestry 13(1): 18-27.
[30] 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: 93-100.
[31] Palta, S., Genc Lermi, A. (2018): Comparison of some characteristics of protected and non-protected natural rangelands: a case study of Bartın. – Academic Research Book on Agriculture, Forestry and Aquaculture, Forest Engineering Studies. ISBN: 978-605-288-401-0, Gece Kitapligi, Bizim Buro Matbaa, Issue: 37-55, Ankara.
[32] Rhoades, J. D. (1982): Soluble Salts. – In: Page, A. L. (ed.) Methods of Soil Analysis. Part 2: Chemical and Microbiological Properties, pp. 149-157. SSSA, Madison, USA.
[33] Rowell, D. L. (1994): Soil science: Methods and applications. – Longman Scientific and Technical, Singapore.
[34] Stohlgren, T. J., Falkner, M. B., Schell, L. D. (1995): A modified-whittaker nested vegetation sampling method. – Vegetatio 117: 113-121.
[35] SPSS Inc. (2011): IBM SPSS Statistics 20 Core System User's Guide. – Chicago, IL, USA.
[36] TMS (2016): Isparta province Sutculer district climate datas. – Ministry of Forestry and Water Affairs, Turkish State Meteorological Service, Ankara.
[37] TSI (2013): Agricultural statistics. – T. R. Premiership Turkish Statistical Institute. www.tuik.gov.tr Accessed in June 2016.
[38] Wale, H. A., Bekele, T., Dalle, G. (2012): Floristic diversity, regeneration status, and vegetation structure of woodlands in Metema area, Amhara National Regional State, Northwestern Ethiopia. – Journal of Forestry Research 23(3): 391-398.
[39] Walter, H. (1958): Climadiagram used essentially to detect of drought times. – Journal of the Faculty of Forestry Istanbul University, Series: B, Volume: 8, Issue: 2, Istanbul. Translator: Selman Uslu.

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