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Research Paper

Comparison of rangeland vegetation study methods

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Abstract: This study was conducted in the natural rangeland of the Ataturk University, Erzurum, Türkiye. The aim of the study was to determine the differences appearing in the use of different vegetation measurement methods (i.e. loop, transect, wheel point (WP) and modified wheel point (MWP). It was also aimed to determine the optimum number of sample for each method, and to improve the arrangements to compare the data from different methods on the same vegetation. The data were collected from 60 lines. Regression formulas were generated regarding canopy coverage ratios. In all methods, it was observed that grass family made up of an important part of the whole vegetation while the *Festuca ovina* was dominant specie. Other families and legumes followed in diminishing order. The difference between the methods was found to be statistically significant (p<0,01). In all methods the dominant specie had the contagious distribution. It was found that 55-30, 55-35, 55-25 and 50-45 samples should be collected for loop, transect, WP and MWP methods respectively in order to determine the condition of the dominant specie in the vegetation with the deviation of 5 and 10 per cent. Rangeland quality degree was found to be 3,45; 4,44; 3,49 and 3,08 for loop, transect, WP and MWP methods respectively. Study area was evaluated to be in fair range condition for transect method while it was in poor condition for the rest.

Keywords: rangeland vegetation, Türkiye

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Introduction

Having functions to prevent erosion by wind and runoff along with their feed supply for an important part of the animal kingdom, grasslands are important natural resources for the nations. For better use of these resources, it is required to avoid applications possibly affecting specie composition (i.e. over fertilization, seeding etc) as much as heavy and intimely grazings.

The need and necessity for measuring the various quantitaive characteristics of the grassland vegetations and statistical analysis of the data have brought about the problem of determination of optimum sample size. Different methods were developed to measure the characteristics of the grassland vegetations. However, there hasn't been any method developed on which most of the researchers agreed regarding accuracy and easiness. Since characteristics to be measured and the priorities are different, methods vary according to objectives and ecologies.

In previous grassland vegetation studies conducted in Türkiye transect and loop methods were commonly used. In a study by Bakır (1970a) loop, transect and point frame methods were compared. However, the gap emerged in comparison of the results from different methods has not been covered. The aim of this study to set forth the differences from the applications of different methods (loop, transect, wheeled point and modified wheeled point) on the same vegetation and to determine the optimum sample size to be studied for each method as long as developing the settings to compare the data from different methods.

MATERIAL and METHOD

Material

This study was conducted in a grassland part located in Atatürk University campus in 2002.

Method

In this study, loop, transect, wheel-point (WP) and modified wheel-point (MWP) methods to be used to determine the some quantitative characteristics of the rangeland vegetations were compared. Transect Method of Canfield (1941) and Loop Method of Parker (1951) are based on the principles of plant existence in spaces of 1 cm^2 and 3,14 cm^2 respectively and determination of the specie of the plant found.

Wheel-point method (WP) explained by Griffin (1989) is based on a rimless wheel apparatus with a radius in about 1 m. It is rolled throughout the measurement line on its spokes in the study area by the aid of a handle attached to it. Two opposite spokes are tapered and the ends of the rest are covered with rubber buffers to make rolling easier over the ground. This method works with the principle of determination of botanical composition considering the most common specie in an area with a radius of 5 cm in the points where tapered spokes touch the ground.

Modified wheel-point method (MWP) was developed with the view that WP would be inefficient in plant cover ratio in the areas exposed to erosion. In this method, instead of data recording area of 5 cm radius in data recording points of the spokes, an area of 3.14 cm^2 was proposed as in loop method. For that reason, rings with an area of 3.14 cm^2 were attached to the recording spokes. The difference between this method and loop is the recording intervals throughout a line, 1 m in the first and 20 cm in the latter. If necessary, zigzag is possible in MWP. Also, MWP makes it possible to extend the distribution of the sample in study area because of wider recording intervals so, it is possible to reduce the error due to heterogeneity.

In previous vegetation studies conducted in the region were reported optimum sample sizes varying between 25-55 lines (Tosun 1968; Koç 1991). For that reason, in each method considered it was decided to employ 60 lines of samples. Each line is composed of 100 sampling units. Study sampling started in early July when dominant species bloom and continued till late July. Subjects such as botanical composition, soil coverage ratio, grassland quality degree and class were considered in evaluation of the data.

In order to perform the statistical analysis of the samples from the vegetation it is required to know the sample distributions. For that reason, mean, variance and distribution coefficient (DC) were calculated and the latter was tested with t-test to determine the type of specie distributions. DC is indifferent from 1 in poisson distribution while it is greater than 1 in contagious distribution (Gökkuş *et al,* 2000). Consequently, in determination of the type of sample distributions for the plant species it was accepted that distribution was contagious if $t_{calculated} > t_{list}$ or it was poisson if $t_{calculated} < t_{list}$

The formula developed by Fisser & Van Dyne (1966) was adopted in evaluation of the species having Poisson distribution after the square root transformation of the data to make it close to normal distribution (Tosun 1968, Gökkuş *et al*. 1995). Since in poisson distributions with a

mean less than 10, square root transformation gives better results after adding 0,5 to all records obtained from counting or measurement (Greig-Smith 1983), optimum sample sizes were calculated according to this application.

Especially, the plants having tuft, stolon and short rizoms have contagious distribution (Gökkuş *et al.* 2000). In determination of the optimum sample size for contagious distributions, oscillation curve method, proposed by Greig-Smith (1983), was employed. This method is based on the determination of deviations from the mean at a given significance level (10 or 5%) through graphs. On the other hand, grassland quality and condition were determined according to the method proposed by De Vries *et al* (1951).

FINDINGS and DISCUSSIONS

Dominant species in the grassland vegetation were determined to be *Festuca ovina, Koeleria cristata, Agropyron intermedium, Bromus tomentellus, Medicago varia* and *Artemisia spicigera.* All dominant species had contagious distribution except *Koeleria cristata, Bromus tomentallus and Artemisia spicigera. Koeleria cristata* had poisson distribution in loop and MWP as the last two had poisson distribution in MWP.

Even though number of samples to be collected varies between 2 and 60 for dominant species in field study they usually fall between 25 and 55. This difference appeared between the species is related to the dispersion of the species on the field. Since the species having contagious distribution shows heterogeneity on the ground the number of samples to be collected increases. Similar findings were reported by Tosun (1968) and Bakır (1970b). Optimum number of samples for *Festuca ovina, Koeleria cristata and Bromus tomentallus* at significance level of 5% were determined to be 55-60 in loop and transect methods, 50 in WP and 45-55 in MWP as they were 25-35 in loop method, 35-55 in transect, 25-30 in WP and 45-55 in MWP at significance level of 10%. This result suggests that the more the species show homogenous distribution on the field the less number of samples to be collected. Similar results were also reported by Bakır (1970b) and Kendir (1995).

According to the results, regarding a deviation of 10% in vegetation studies using loop method, transect, WP and MWP methods 50±5; 55±5; 30±5 and 50±5 lines of samples respectively seem to be sufficient.

Grassland quality degree was determined to be 3,45; 4,44; 3,49 and 3,08 for the loop, transect, and MWP methods respectively. According to this, grassland condition class was fair for transect method as was it poor for the other methods.

Considering the results together it was concluded that transect method had no alternative in small areas while all methods could be used in wider areas. On the other hand, in standardization of soil cover ratio, formulas developed in this study for the grasslands in which tufted plants are dominat could be used.

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