Comparison of Grazed and Protected Mountain Steppe Rangeland in Ulukışla, Turkey

TUNCAY TUKEL

Abstract

A typical steppe range having a semiarid climate at an altitude of about 1,350 m was studied to determine the yield potential of an area protected from grazing for a 30-year period representing about 36,690 ha rangeland. This study area has a class VII capability and was compared with a public grazing area on the immediate vicinity. Total ground cover, composition, and dry forage yields were significantly decreased on the continuously grazed public ranges. Two grasses (*Festuca ovina* and *Poa bulbosa* var. *vivipara*), one shrub (*Salvia cryptantha*) and a forb species (*Asphodeline isthmocarpa*) were the main plants causing the difference in the ground cover. The grazed and ungrazed ranges did not differ significantly in infiltration rate. However, the southerly aspect of the protected range had a higher infiltration rate than the other aspects.

Very little has been done to determine the production potential and to describe the truly protected mountain steppe range vegetation in Turkey. Most of the steppe rangelands in Turkey are either under very heavy and uncontrolled grazing pressure for a long time or under cultivation for growing cereal crops.

Although there have been several notable studies on Turkish rangelands (Uslu 1959, Çetik 1965, Alinoglu 1969, Erkun 1971 and 1972, Özmen 1977 and Tosun et al. 1977), they were primarily conducted on overgrazed public rangelands representing only the current grazed status, not the true potential that can be expected from the ranges. Most of these studies are unavailable to the interested American readers. Two articles however have been published in the *Journal of Range Management* concerning the general grazing potential of Turkey (Cornelius 1962, and Pringle and Cornelius 1968).

The main purpose of this study was to determine the floristic composition and the potential production capabilities of a typical steppe range protected from grazing for 30 years, compared to a nearby continuously and heavily grazed public range located in Ulukışla, Turkey.

Study Area

This study was conducted on the rolling hills of Ulukışla, a county of Nigde Province of Turkey. The study area has a semiarid climate at an elevation of about 1,350 m. Average annual precipitation is 362 mm. Of this total, 39% occurs during the growing season of March, April, and May; precipitation in winter is usually in the form of snow and accounts for 34% of the total. A small amount of all precipitation (64 mm on the average) makes possible regrowth of vegetation following summer dormancy. Most rainfall in the spring comes from high intensity thunderstorms. Annual precipitation is highly variable and drought is common, especially during the summer season in July, August, and September. The frost-free period is approximately 175 days, depending on the rainfall distribution.

There has not been a detailed geological survey of the study area; however, a general purpose geological map of Turkey places this

area into the tertiary period with parent materials composed of Andezite, Spilite, and Porphyrite (Anonymous 1961). The study area is classified as class VII having shallow rocky soils highly eroded with steep slopes. The class of soils represents a total of 36,690 ha rangelands in the region.

Soils in the upper profiles of the protected rangelands investigated were usually sandy-clay-loams or clay-loams, and loams in the lower portion of the profiles. An exception was the Northwest aspect, which was low throughout the profile. The soils of the grazed lands, however, were mostly clay and clay-loam types. Soil color varied from dark brown, dark grayish brown, brown to reddish brown in the upper but were olive-gray in the lower layer indicating a complex type of parent material with andezite and serpentine.

Methods

Four different aspects in both the protected and the grazed areas were selected to represent the soil moisture gradient in the study area. At each location, 8 permanent 20-m long transect lines were established. Vegetative cover, composition and frequency data were obtained by using a loop with a 2-cm radius. Measurements were taken at 20-cm intervals to provide 100 loop readings on each transect line. Forage yields were obtained by cutting the plants at ground level in randomly thrown 0.1-m² quadrats; 20 quadrats were clipped at each location. Crude protein content of the dried forage was determined by the micro-kjeldahl method utilizing standard laboratory procedures as developed by (Kaçar 1972). Vegetative data were analyzed by multiple discriminant analysis procedures explained by (Öztük et al. 1978). Soil infiltration rate was measured by a double ring infiltrometer, 25 cm tall with an inner radius of 10 cm and the outer of 16 cm. Disappearance of the water column in the inner ring was recorded every 5 minutes over a 45-minute period, replicated 4 times at each location.

Vegetative cover, composition, frequency, and the yield data were obtained at the beginning of grazing period in 1980, and at the end of the grazing seasons both in 1979 and 1980.

Results and Discussion

Vegetative Cover, Frequency and Botanical Composition

Total ground cover, frequency, and plant community composition of the grazed and ungrazed ranges are shown in Table 1. Two shrub species, *Salvia cryptantha* and *Thymus squarrosus*, dominated the continuously grazed ranges, and 2 grasses, *Festuca ovina* and *Poa bulbosa* var. *vivipara*, dominated the protected rangelands. These results revealed that the good quality forage grasses were replaced by the less palatable shrub species in the continuously grazed ranges. These results also indicate that the secondary succession is still taking place in the rangelands protected since 1949. It may be expected that 3 other grass species, namely *Koeleria cristata*, *Stipa lagacea* and *Bromus tomentellus* would also be increasing under protection in the future. These findings support the more or less similar results of the other research workers (Bakir 1970a and 1970b, Johnston et al. 1971, Erkun 1972, Uluocak 1974, Lanford and Buel 1979, and Özmen 1977).

Author is a faculty member, College of Agriculture, University of Çukurova, Adana, Turkey.

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Table 1. Vegetative cover, frequency and botanical composition of the grazed and ungrazed rangelands.

Plant species	Total ground cover(%)		Frequency (%)		Botanical composition (%)	
	Grazed	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed
<i>Festuca ovina</i>	+	7.4	3.0	43.2	1.7	23.0
<i>Poa bulbosa</i> var. <i>vivipara</i>	0.6	4.8	5.1	32.6	3.5	15.3
<i>Thymus squarrosus</i>	2.4	4.3	16.7	26.1	14.0	14.1
<i>Poa bulbosa</i>	+	2.2	3.4	20.0	1.53	7.0
<i>Stipa lagacea</i>	0.6	1.7	6.2	13.75	3.5	5.3
<i>Bromus tomentellus</i>	+	1.6	3.6	15.1	2.0	5.3
<i>Anthemis cretica</i>	0.6	1.4	5.4	12.4	2.9	4.7
<i>Salvia criptantha</i>	5.9	1.0	34.3	10.4	28.2	3.4
<i>Koeleria cristata</i>	+	0.9	2.5	7.3	1.8	2.8
<i>Artemisia fragrans</i>	+	0.9	1.5	7.0	1.0	2.7
<i>Onobrychis oxydonta</i>	+	0.5	0.7	4.3	+	1.2
<i>Xeranthemum squarrosus</i>	0.8	+	7.6	+	+	1.2
<i>Alyssum condensatum</i>	0.6	+	6.0	1.6	3.0	0.6
<i>Ventenata macra</i>	0.5	+	4.4	1.1	3.2	+
<i>Bromus squarrosus</i>	0.5	+	4.6	4.0	2.3	1.4

+ indicates the values less than 0.5%.

Forage Yield

The forage yields of the grazed rangelands were significantly less than that of the ungrazed ranges in both early and late summer seasons. Dried forage in the grazed areas in early season was about half that in the ungrazed areas. In the late summer, this production difference was not as large as in the early summer season. These lesser yields of dried forage on the grazed rangelands result from heavy and continuous past grazing of the public lands, confirming the findings of Schmutz et al. (1967) and Brown and Schuster (1969).

The most interesting fact concerning the dried forage yields of the investigated rangelands was that the yield differences in the grazed areas for both early and late summers (53.5 kg/da and 52.7 kg/da, respectively) were negligible. This lack of difference was, of course, another indication of the heavy and uncontrolled grazing indiscriminately taking place in the common grazing lands of Ulukışla in both seasons. This heavy grazing would not allow the more palatable grasses to be regrown during the grazing period. Whereas dried forage yield differences was appreciable in the ungrazed areas for both seasons (109.6 kg/da and 83.2 kg/da, respectively). This difference may be explained on the basis that annual grass species such as *Poa bulbosa* and *Poa bulbosa* var. *vivipara* have good growth in the early summer but mature and die later in the season.

Key Plants

Four species, *Poa bulbosa* var. *vivipara*, *Festuca ovina*, *Bromus tomentellus* and *Poa bulbosa* consistently decrease under grazing. Two species, *Salvia criptantha* and *Asphodeline isthmocarpa* increase under heavy and uncontrolled grazing. Therefore, a practical suggestion for range managers is that the overpopulations of *Salvia criptantha* and *Asphodeline isthmocarpa* indicate that resting such rangelands is necessary to allow palatable grasses such as *Festuca ovina*, *Poa bulbosa* var. *vivipara*, *Bromus tomentellus* and *Poa bulbosa* to increase.

Crude Protein

Crude protein percentages of the forage on both grazed and protected ranges were higher in the early summer than in the late summer (Fig. 1). However, crude protein of the grazed ranges in both early and late summer, although not statistically tested, was slightly more than that of the protected ranges. This was probably because the heavily grazed range had more fresh regrowth and less dry matter than the protected ranges. Thus, protected ranges, due to greater total production will have more crude protein than the grazed areas. This result supports the findings of Demarchi (1973).

Fig. 1. Crude protein percentages of the grazed and protected ranges during two different grazing periods and on our different aspects.

Infiltration Rate

Infiltration rates of the grazed and protected ranges are shown in Table 2. Some interesting relations were found between the ranges

Table 2. Infiltration rates (cm/hr) on different aspects of grazed and protected ranges at the end of 45 minutes.

Aspects	Protected ranges	Grazed ranges
South	33.6 a*	27.6 a
Southwest	14.7 b	21.9 a
West	17.4 b	19.20 a
Northwest	16.2 b	19.5 a
X	20.5	22.1

*Means having the same letter are not statistically significant ($p \leq 0.05$)

and among different aspects. Although the mean infiltration rate of the grazed ranges (22.1) cm/hr was slightly higher than that of the protected ranges (20.5 cm/hr), the difference was not statistically significant. These results are contradictory to Brown and Schuster (1969). Infiltration sampling, was during the summer period when soils of the grazed ranges were very dry with more soil cracking than on the protected ranges.

There was a significant difference between the infiltration rates of aspects in the protected area. The highest rate, 33.6 cm/hr, was observed in the south-facing aspect. Although similar differences occurred on the grazed range, they were not significant statistically. This finding suggest that heavy grazing on public ranges was nullifying the aridity differences between northerly and southerly aspects.

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