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A Preliminary Study on Grazing Pattern of Sheep Transhumance in Turkey

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ARTICLE INFO	ABSTRACT
Research Article	Grazing activities of indigenous sheep breed of the Turkish breed *Karakaş* and *Koçeri* which were transhumance flocks were investigated in a typical unimproved mountainous pasture in the East of Turkey. Data were collected from two different flocks on main daily activities (grazing, resting, moving or standing) every fifteen minutes. The characteristics of the pastures around the routes were assessed according to CORINE Land Cover classification system. Standing was a residual activity in both study paths. The animals concentrated their activity mostly on grazing while resting and moving occurred in specific times during the whole grazing period. Once the animals were heading back to their main settlement areas to be milked, grazing activity have been increased. Further studies on grazing behavior and changes in land cover will help to adjust the management strategies to the available natural resources.

Türkiye'de Konar Göçer Koyun Sürülerinde Otlama Davranışları Üzerine Ön Araştırma

MAKALE BİLGİSİ	ÖZ
Araştırma Makalesi	Konar göçer sürülerinden olan Karakaş ve Koçeri yerli koyun ırklarının otlama aktiviteleri Doğu Anadolu bölgesinin gelişmemiş dağlık mera alanında araştırılmıştır. Her 15 dakikada bir temel günlük aktiviteler (otlama, dinlenme, hareket etme veya ayakta kalma) konusundaki veriler iki farklı sürüden toplanmıştır. Otlama güzergahı çevresindeki meraların özellikleri CORINE Arazi örtüsü sınıflandırma sistemine göre değerlendirilmiştir. Hareket etmek her iki ırkta da sürekli bir faaliyet olarak gözlemlenmiş, hayvanlar, aktivitelerini çoğunlukla otlatma üzerine yoğunlaştırırken, dinlenme ve hareket etme tüm otlatma süresi boyunca belirli zamanlarda gözlemlenmiştir. Hayvanlar sağılmak üzere ana yerleşim alanlarına geri dönerken otlatma etkinliğinin arttığı saptanmıştır. Otlatma davranışları üzerine daha fazla çalışma yapılarak arazi örtüsündeki değişikliklerin saptanması ile otlatma yönetim stratejileri belirlenebilir. Elde edilen sonuçlar mevcut doğal kaynakların düzenlenmesinde yardımcı olacaktır.

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Introduction

Grazing is the most important daily activity that ruminant livestock undertake. The ability to detect and understand the grazing patterns of free-ranging livestock is critical for monitoring the weight gain of individual animals, managing available biomass within the landscape (Delagarde and Lamberton, 2015; Ueda et al., 2011) and taking crucial decisions regarding to natural grassland management and conservation. Mountainous pastures, which located up to 600 m, are characterized by a rough topography and great variability of plant communities and herbage cover (Aldezabal et al., 1999). Their flora composed mainly by perennial grasses and glass-like plants as well as of some forbs and shrubs. They are grazed seasonally, from mid- spring to autumn, while they are covered by snow during winter (Sarlis, 1998). Grazed pastures represent a specific, but synthetic ecological system with crucial dependent variables such as nutrition and environmental controls influencing the dominant plant and animal species (Squires, 1975). In recent years, it has been increasingly realized that grazing of sheep considerably contributes to a sustainable management of agricultural areas and to landscape preservation (Brüne and Stumpf, 2004; Fischer et al., 2007).

Rangelands (dominated by dry grasslands and grass/shrublands) cover 22.9 million ha in Turkey (Koc et al., 2015) and seasonal grazing have been historically the way of livestock production. These grasslands are still critically important to livestock production, an activity which contributes to 12% of the agricultural output in Turkey, accomplished in small-scale farms in which domestic breeds with low productivity but high adaptation to the harsh environmental conditions are managed (FAO, 2016). However, as a result of the implementation of poor agricultural policies, such as convention of rangeland to cropland and failure to prevent the encroachment of urbanization (Sayar et al., 2015). According to Sabanci, (2012), the rangeland area have been decreased by approximately 37 million hectares between 1950s and 2000s. The existing sheep production systems in Turkey are based on traditional grazing of communal grasslands that provides free herbage for animals during 6 months in a year which has been a traditional way of production since hundreds of years in Turkey-still surviving, yet with many challenges and constrains. Anatolian highlands have been exposed to systematic grazing over the last ten thousand years by a high degree of variability in degree of mobility, land use and animal preferences and herd management strategies (Hammer and Arbuckle, 2017). On the other hand, the system also provides numerous ecological and social contributions. Since grasslands in the mountains are the only free feed available areas-they are very attractive for farmers for minimum input production and thus high in economic returns. However, high stocking rates cause extensive degradation of grasslands, threating sustainability and vigour of the forages in these pastures if wrongly managed.

Turkey has around 31 million sheep (FAO, 2016) and majority of them are still linked to seasonal transhumance production systems. Those sheep flocks have been adopted since millennia to the unique pastoral areas and landscapes with conservation value which prevail in the Eastern (sheep transhumance) and Mediterranean region (goat transhumance) of Turkey. There are scarce studies which have tackled transhumant sheep grazing patterns in relation with landscape characteristics in a given moment in these rangelands. There are different systems adapted to several regions, yet no studies have been conducted on their grazing patterns under natural conditions. This paper aimed to describe the nocturnal grazing behaviour of sheep flocks' during summer period in the Eastern of Turkey. Assessing their grazing behaviour within a specific landscape context is a key aspect to develop appropriate management systems which maximize animal performances while controlling environmental impact.

Materials and Methods

Study Site

The study was conducted in Erzurum and Ağrı provinces in East Anatolia, Turkey (Figure 3) during the year 2017 on Koçeri and Karakaş local breeds (Figure 1, Figure 2).

Figure 1 *Koçeri* breed in unimproved mountain pasture of Ağrı province

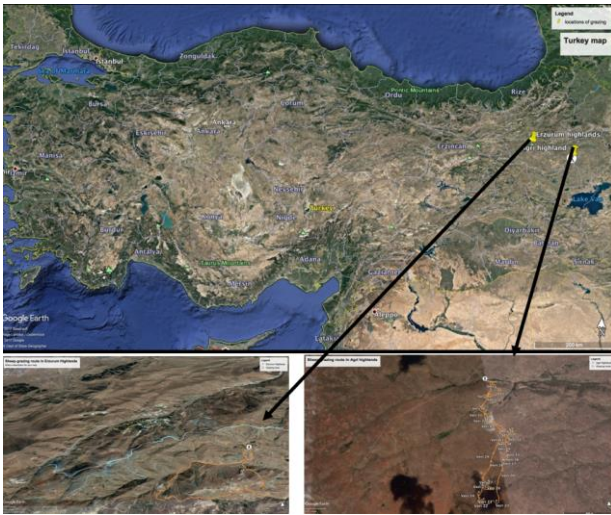Figure 2 *Karakaş* breed in Erzurum mountain pastures

Figure 3 Location of study sites in Turkey

(a)

(b)

Figure 4a Karakaş sheep in Erzurum highland, 4b Koçeri sheep in Ağrı highlands

The pastures in the mountain elevating from 1975-2062 m in Ağrı and 2503-2810 m in Erzurum. The climate of the whole area is continental with long winters and cold limiting dormant-season grazing to south-facing slopes. According to the meteorological station at nearest, the mean annual temperature was recorded 16.6°C and the total regional annual precipitation ranged between 400 mm and 650 mm, and it intensifies from autumn through spring. Vegetation cover is dominated by cool-season grasses that are dormant during the summer, especially in August and early September. The mountain steppe has a dense coverage of short grasses, mainly sheep fescue and some legumes.

The composition of Ağrı Tutak Döşkaya pasture was composed of; *Medicago spp., Onobrychis sativa, Dactylis glomerata, Koeleria cristata, Agropyron spp., Festuca ovina, Astragalus spp., Poa bulbosa, Bromus tectorum, Astragalus spp., Achillaa millefolium, Eryngium campestre, Centaurea kilaea, Saponaria officinalis* and *Anthemis* (Anonim, 2017). The botanical composition of Erzurum pastures determined as; *Ori ganum onites, Melitotus Officinalis, Onorbrychis sp., Poa Pratensis, Lotus corniculatus, Pona pila, Dactylis glomerata L. Astragalus membran aceus, Verbascum Thapsus* (Anonim, 2017a).

GIS Route

The routes of the flock were recorded via Wikiloc®2017 and transferred to Google Earth. The land cover surrounding each pastureland (25 km radius) was analyzed according to CORINE Land Cover classification (Büttner et al., 2012) and a vector based geographic information system, ArcGis 10.3 (ESRI, 1996).

Sampling and Experimental Analysis

Data were recorded in the summer settlement areas of transhumants in the eastern highlands of Turkey. Two transhumant flocks were followed on foot in order to record daily grazing routes and patterns of Koçeri (Fig 4b) and Karakaş (Fig 4a) breeds in August 2017. Karakaş and Koçeri are indigenous multipurpose fat tail Turkish breeds.

Average flock size for both flocks were approximately 400 ewes. 20-23 ewes of each flock were randomly selected and marked during data recording. Grazing activities of 20 to 23 sheep of each flock were observed every 15 minutes by 2 trained observers in each location equipped with hand chronometers and cameras and the number of animals which were grazing, walking, standing and resting activities were recorded in every 15 min. Grazing in the eastern pastures are performed mainly at night due to belief that cooler temperatures are more suitable for grazing according to the local shepherds. Therefore observations were made from 19.00 pm to 8.15 am as normal grazing practice. Grazing activities were recorded as grazing time (grazing or browsing while walking or standing), resting (simply sitting for rest), moving (simply walking, running) and standing (simply standing doing nothing). Grazing patterns were recorded five consecutive days in each location. The shepherds were interviewed before and after the routes in order to gather information about their management strategies. The shepherds made two breaks (one before mid-night and one after midnight - for eating and resting) in each location. During these breaks flocks stay close to each other and rest as well. Head lamps were used by the observers in order the record the behaviours yet in a certain distance in order to not interfere their natural grazing patterns. The average distances covered by the flocks during their daily routes were recorded as 6.3 and 8.4 km in Ağrı and Erzurum, respectively. Maximum and minimum altitudes were reached at 2062 m and 1975 m in Ağrı and at 2801 m and 2503 m in Erzurum, respectively. Chi square test were used in order to test the dependency between the variables.

Results and Discussions

With the movement of the herds, more moving activities observed than grazing. Grazing activity started after 1-2 hours of walking for both herds. Grazing was the main activity (55.4%) followed by moving (18.5%) during each observation in both study sites, while resting and standing were recorded only in 10-13.8% of the sheep in each occasion. Shepherds stopped twice to rest and most of the animals lie down during those two periods in both areas. Majority of the animals intensified grazing after midnight (00.30 am), more intensified around 5.30 am. The grazing activity intensified in three periods along the night in Erzurum although 5:45 am onwards most of the animals focused on this activity. The moving activity increased in several periods during night and some of them with a decrease in grazing. The resting frequency fluctuated and increased in two occasions whereas it was a minority activity by the end of the routes (Figure 5, Figure 6). The standing activity was inconsistent with a little peak between 21:15 pm and 21:30 pm (Figure 5).

Grazing intensified during early day time in Ağrı (Table 3). Similarly, Loridas et al., 2011 found higher grazing time of sheep in the highlands. With regards to the night grazing or grazing in the cool hours, there is an agreement with Shinde et al., 1997 that ruminants tend to avoid grazing during the hot hours of the day and thus reducing their daily grazing time. Resting had two peaks between 20:45 pm-21:30 pm and 2:30 am and 2:45 am. The standing activity was scarce with no remarkable peaks (Figure 6).

The flocks moved across a landscape dominated by natural grasslands (especially in Erzurum) followed by sparsely vegetated areas in both areas. Nevertheless, the relevance of other land covers was variable in each case (Table 1). Regarding Ağrı path, the main land covers (agglutinating around 75% of all surfaces) natural grasslands, sparsely vegetated areas, arable land and salines. As for Erzurum path, landscape is dominated by natural grassland, sparsely vegetated areas and transitional woodland-scrubland. Forests were more abundant in the Erzurum surroundings (6%).

Land use devoted to agriculture and arable land cover a wider surface in Ağrı than in Erzurum mountains. These marginal territories offer limited options but enough for small ruminants which had lower nutritional requirements. An alternative production systems such as livestock grazing of bigger species like cattle or horses could be unfeasible (García et al., 2013).
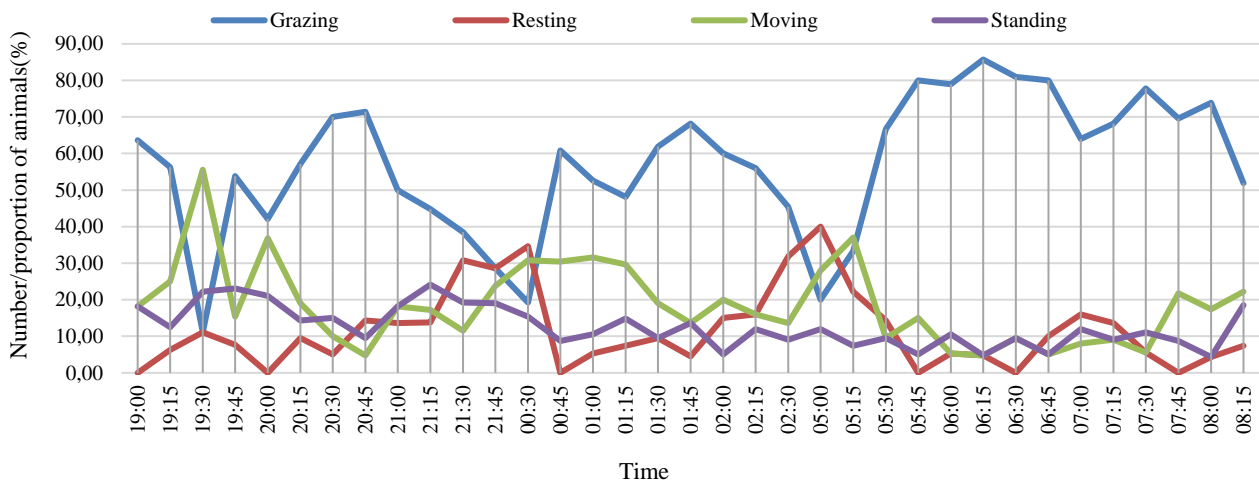

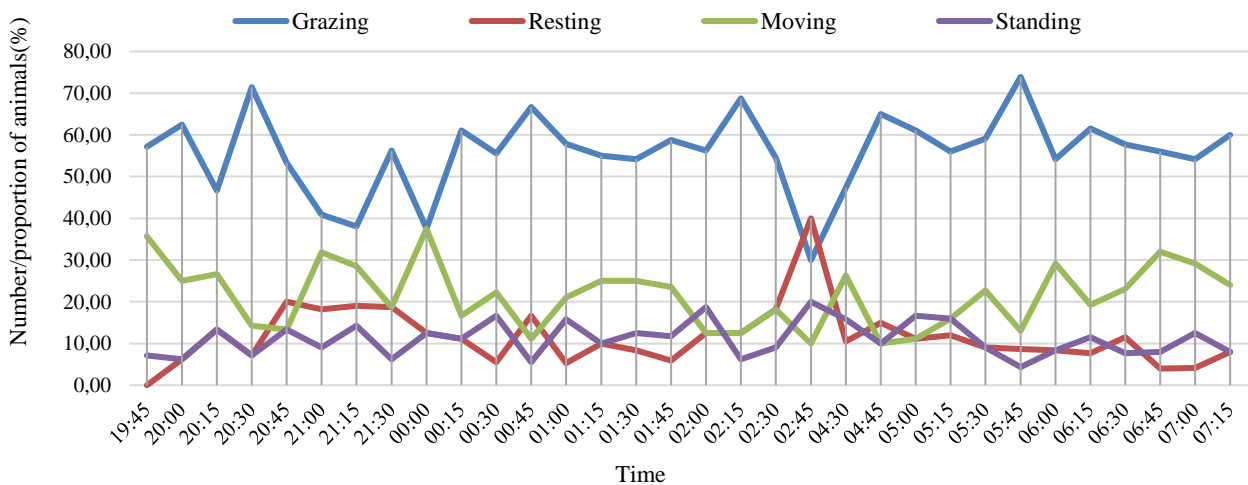Figure 5 Daily variation of grazing patterns in Erzurum

Figure 6. Daily variation of grazing patterns in Ağrı

Table 1 Percentage of main land-cover categories for both studied paths according to the CORINE land cover information.

List	CORINE Land Cover (25 km radius)	Ağrı	Erzurum
1	Discontinuous urban fabric	0.15	0.16
2	Construction sites	0.00	0.01
3	Non-irrigated arable land	18.96	1.59
4	Permanently irrigated land	0.85	0.86
5	Complex cultivation patterns	2.36	3.98
6	Agriculture land with significant natural vegetation	9.69	7.77
7	Broad-leaved forest	0.00	1.76
8	Coniferous forest	0.00	3.52
9	Mixed Forest	0.00	0.86
10	Sparsely vegetated areas	19.64	22.04
11	Transitional woodland-scrub	0.32	11.89
12	Pastures	1.12	0.00
13	Natural grassland	21.06	41.71
14	Beaches, dunes, sands	0.38	0.00
15	Bare rocks	3.8	3.51
16	Inland marshes	0.1	0.34
17	Saline	17.18	0.00
18	Water courses and bodies	4.39	0.00

Table 2 Variation of grazing patterns in Erzurum highlands

Pattern	Time			Total
	19:45 – 21:30	00:00 – 02:45	04:30 – 07:15	
Grazing (number of animals/%)	10 (47.6)	12 (52.2)	14 (66.7)	36 (55.4)
Resting (number of animals/%)	3 (14.3)	3 (13)	2 (9.5)	8 (12.3)
Moving (number of animals/%)	4 (19)	5 (21.7)	3 (14.3)	12 (18.5)
Standing (number of animals/%)	4 (19)	3 (13)	2 (9.5)	9 (13.8)
Total	21 (100)	23 (100)	21 (100)	65 (100)

χ^2: 2.004   P=0.919

Table 3 Variation of grazing patterns in Ağrı highlands

Pattern	Time			Total
	19:45– 21:30	00:00– 02:45	04:30– 07:15	
Grazing (number of animals/%)	9 (52.9)	10 (52.6)	14 (60.9)	33 (55.9)
Resting (number of animals/%)	2 (11.8)	3 (15.8)	2 (8.7)	7 (11.9)
Moving (number of animals/%)	4 (23.5)	4 (21.1)	5 (21.7)	13 (22)
Standing (number of animals/%)	2 (11.8)	2 (10.5)	2 (8.7)	6 (10.2)
Total	17 (100)	19 (100)	23 (100)	59 (100)

χ^2: 0.726   P=0.994

Conclusions

It is concluded that sheep spent more grazing time and less resting and standing during the whole grazing period. Standing was a residual activity in both study paths. Once animals were heading back to tents to be milked, their grazing activity increased. Further observations together with studies focused on diet selection and animal performances in other periods are needed to detect any seasonal/daily changes in grazing patterns. Those aspects will be useful to adjust the management techniques to a more-efficient use of the natural resources. A deeper analysis on the changes of the land cover along time will help to evaluate the potential of these transhumant activities in the future.

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