

THE EFFECT OF FOREST GRAZING PLANNING ON FOREST ECOLOGY AND CARRYING CAPACITY: A CASE STUDY OF MEDITERRANEAN REGION IN TURKEY

KAŞIKÇI D.^{1*} ARMAĞAN M.E.¹, TÜRKOĞLU T.² AND TOLUNAY A.³

¹Department of Animal Science, Faculty of Agricultural Sciences and Technologies, Isparta University of Applied Sciences, Isparta, Turkey

²Department of Forestry, Koycegiz Vocational School, Mugla Sitki Kocman University, Mugla, Turkey

³Department of Forest Engineering, Faculty of Forestry, Isparta University of Applied Sciences, 32260 Isparta, Turkey

*Corresponding author's email: duyguince@isparta.edu.tr; phone: +90-246-211-8584; fax: +90-246-211-8696

Abstract

Mediterranean region of Turkey has mountainous and hilly topography that is ecologically suitable for goat grazing. However most of the time goat producers do not consider the carrying capacity of the shrublands and overgrazing or undergrazing occur. Since overgrazing or undergrazing affect the ecology of the shrublands, the purpose of the study was to compare the grazing plan prepared by Isparta Sütçüler Forest Administration Office for determining the herb and dry substance yield, the best month of the year for grazing and the optimum number of goats per grazing hectare. According to scientific studies, 4 goats can be grazed per year annually on free grazing ranges with 100% canopy coverage. Accordingly, 3 different parcels were determined at regions in settlements where grazing is allowed thereby the canopy coverages of kermes oak were tried to be calculated for the grazing areas. Based on these ratios, the optimum number of goats that can be grazed at these areas was determined. According to the acquired data, while the number of goats that can be grazed on an area of 57.605 ha was calculated as 81.453, this was put forth in the grazing management plan prepared by the Forest Administration as 57.605 goats. This corresponds to 23,848 fewer goats in comparison with the optimum number indicated in the study. It was observed when the grazing plan was compared with the data acquired in the study that the grazing areas in the village are sufficient for the current number of goats, however it was determined in our study that the current grazing areas can be sufficient for greater number of goats.

Key words: Hair Goats, Kermes Oak, Grazing Plan, Forest.

Introduction

It is observed that there is a rapid decrease in the number of sheep and goats in Turkey since 2008. The reasons for this decrease were in general the implementation of wrong livestock policies, insufficient support, the fact that producers are disorganized as well as the marketing of live animals and animal products at continuously decreasing prices. It can be stated that these factors have in general been effective in the decrease of goat breeding in our country. The damage inflicted on forests by hair goats is thought as the main reason for the decrease in hair goat breeding which is considered profitable among stock breeding activities since they can be bred in very difficult conditions and since they can yield products by feeding on shrubland and scrubs which no other animal can consume (Ertuğrul *et al.*, 2010; Yılmaz *et al.*, 2010). Even though it is also known by forest workers that they are beneficial for the forests, the numbers of migrant goat breeders as well as those of goats and their breeders have decreased over time due to the oppression and monetary fines inflicted on them. However, it has now been accepted by a law as a result of the cooperation by the Ministry of Food Agriculture and Livestock and the Ministry of Environment and Forestry with support from Sheep and Goat Breeders' Association of Turkey which started accelerating sheep and goat breeding in recent years that hair goats are an important part of forests and that forests are important as grazing areas for use in goat breeding (Tolunay & Ayhan, 2010; Kamalak *et al.*, 2010; Papachristou *et al.*, 2005). However, goats should be considered as an indispensable part of the forest and also as a significant source of income acquired from the forests. It should be kept in mind that Akçakesme (*Phillyrea latifolia*), Kermes oak

(*Quercus coccifera* L.), Thyme (*Thymus* spp.), Sage (*Salvia* spp.), Thorny burnet (*Sarcopoterium spinosum*), Rosemary (*Rosmarinum* spp.) and Tragacanth species (*Astragalus* spp.) are frequently observed in Mediterranean climate shrublands (Yılmaz, 1996; Ainalis & Tsiouvaras., 2004). It should also be noted that forests are also grazing areas. The fact that the "Action Plan for Reducing the Damages Inflicted by Goats" prepared by the Ministry of Environment and Forestry in 2008 has not taken into consideration the areas where hair goats are raised naturally resulted in insufficiencies of the grazing areas determined according to the plan (Forest Management (Anon.), 2007; Kutlu *et al.*, 2003; Tolunay *et al.*, 2009).

Heitschmidt & Stuth (1991) stated that grazing animals are ecological factors and a part of ecosystem. Verdú *et al.*, (2000) reported that sheep and goat grazing was very important for stability of biodiversity in Mediterranean ecosystem.

There were *Quercus Coccifera* (Kermes oak), *Styrax officinalis* (Bead tree) and *Juniperus oxycedrus* (Prickly Juniper) in the study area which make up the majority in the Mediterranean vegetation of high basins (Dönmez, 2014). The hair goat breeding areas in Europe are located within the borders where certain tree and shrub species considered among Mediterranean scrub vegetation are distributed. It has been determined that Kermes oak (*Quercus coccifera* L.) and Holm oak (*Quercus ilex* L.) species the leaves of which are preferred by hair goats can be found frequently in these areas (Aldezabal & Garin 2000; Ainalis *et al.*, 2006; Tolunay *et al.*, 2014; Tolunay *et al.*, 2009; Tasligil & Sahin, 2010).

The purpose of this study was to determine how the grazing plan prepared by the province of Isparta, district of Sütçüler, Forest Administration Directorate is applied by the members of "Isparta Sheep and Goat Breeders Association" as well as the optimum number of animals that can be grazed on unit area and the type of shrubland in these areas. Thus, the effectiveness of the grazing plan at the field will be discussed along with its positive and negative aspects.

Materials and Method

Study area: Sütçüler region located in Western Mediterranean region of Turkey is located between 37°59'26,8"- 37°25'44,4" northern latitudes and 30°53'13,7"- 31°21'33,0" Eastern longitudes. The elevations vary between 250 to 2500.

There are two watersheds in Sütçüler region. Thus there are two types of climate in the region. The climate in the region is a transition among Aegean, Mediterranean and Mid-Anatolian climates. In general, Mid-Anatolian climate is more prominent because average precipitation is lower than Mediterranean region and average annual

temperature is closer to the Mid-Anatolian region's values. Summers are hot and dry whereas winters are cold and rainy. In summer day and night temperature difference is high. When the meteorological data of the Sütçüler region is examined it is observed that July is the hottest month (average temperature of 23.9°C), and February is the coldest month (average temperature of 3,3°C). Average annual temperature is 13.03°C.

November and December are the months that have highest precipitation whereas July and August are the driest months. Average annual precipitation is 914.7 mm (Anon., 2019).

Location: Sütçüler District is located within the borders of the Isparta province in northern Mediterranean Region. It is surrounded by Mount Anamas to the north, Mount Dedeğöl to the east, Mount Sarp to the south, Mount Dulup and Mount Kızıldağ to the west and has a naturally steep morphological structure. The annual average temperature is 13,03°C according to Sütçüler District meteorological station data. Figure 1 shows the location of Sütçüler District, part of the Isparta province on the map (Anon., 2019).

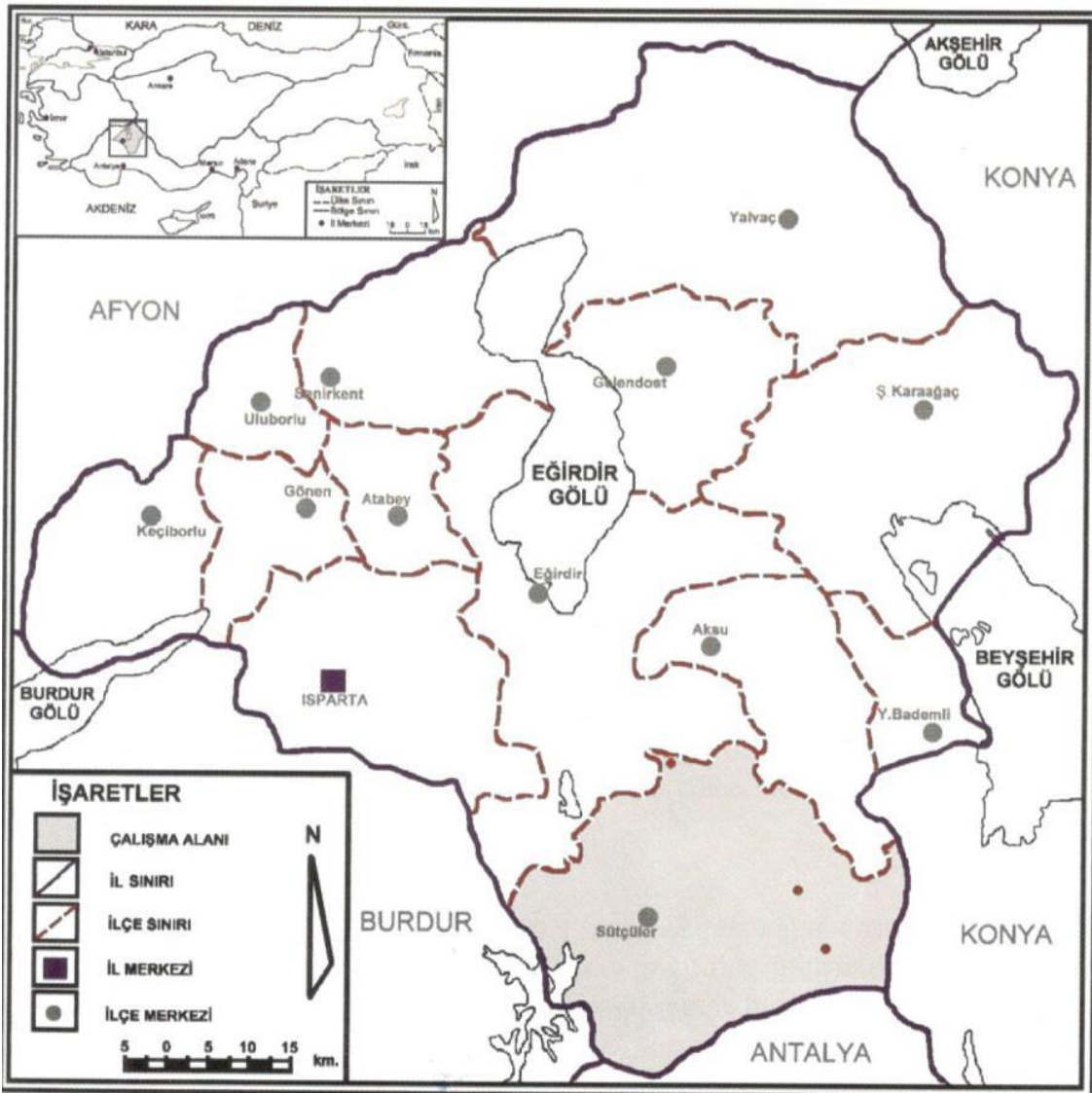


Fig. 1. Location of Sütçüler District Part of the Isparta Province.

Geomorphological structure: Sütçüler district contains 14% of the Isparta province with an area of about 128 800 hectares. It is one of the largest districts of Isparta with regard to its area. It has an average elevation ranging between 250 to 2500 m. It is in a completely mountainous region in between the southwest, northeast and southeast of the Western Taurus Mountain Range. Due to the characteristics of its physical environment, flat lands are very scarce in the Sütçüler district due to the wide and rugged terrain that changes in very short distances.

The aim of this study is to determine how the grazing plan prepared by the Regional Directorate of Sütçüler Forest Management is applied by the breeders and to determine the optimal number of animals grazing in the unit area. Thus, the effectiveness and positive and negative aspects of the grazing plan will be discussed.

Table 1 shows the field inventory for the settlements where goat breeding activities are carried out, forbidden grazing zones and the number of goats allowed for grazing according to the grazing plan.

While 37.007,1 of the general area in the grazing plan included in the project by the Forest Administration Directorate Office and 31.897,2 hectares of the forest area were included in the grazing plan, an area of 5.109,9 hectares (fields, settlement areas and water areas) have not been included in the plan. While grazing has been forbidden on 3158,2 ha forest area according to the grazing plan, it is allowed on 30119,8 hectares of forest area. It has been indicated in the plan that only 2 hair goats can be allowed to graze on 1 ha of forest area and that the number of animals that can be grazed in each village is in accordance with this number. It has been allowed in the grazing plan to graze 57.605 goats in 11 settlements annually. Table 1 presents the grazing plan data for which a project has been developed by the Forest Administration (Table 2). Figure 2 shows the grazing regions of the Sütçüler Forest Administration Directorate.

Average grazing capacity of Kermes oak shrubland areas: The live weight of an adult hair goat raised in the conditions of Turkey varies between 40-50 kg. Goats consume dry substances equivalent to about 3-4% of their body weights during 1 day. The live weight was assumed

as 50 kg in the present study for determining the hair goat grazing capacity per unit kermes oak area and it was estimated that they will consume dry substance equivalent to about 4% of this weight (Gorgulu, 2002). Dry substance yields for kermes oak fields with different canopy coverage and mixture rates are presented in Table 3.

The values in Table 1 were used for calculating the grazing capacity per unit kermes oak area (1 ha) and the number of hair goats that can be grazed on this area. The number of hair goats that can be fed by 1 ha area covered 100% by Kermes oaks varies between 1-5 subject to the vegetation period. The numbers of hair goats that can be grazed on unit area differ based on the canopy coverage ratio of kermes oaks and the dry substance amount acquired at different periods (Çürek & Özen, 2010; Tolunay *et al.*, 2018; Kaşıkçı *et al.*, 2019).

Field measurement and data collection: The study was carried out on areas on free grazing areas allowed in accordance with the grazing plan prepared by the Sütçüler Forest Administration Directorate Head Office by taking into consideration the borders between the district center and 11 settlements. The aforementioned study areas cover the hair goat grazing area in 47 farms. The study areas were selected from areas with the Mediterranean shrubs as the primary shrublands. Three random study parcels as A, B and C (3 parcels x 100 m² = 300 m²) were taken into consideration on areas where hair goat grazing is allowed with 10 m x 10 m = 100 m² random parcels in each village separately. The canopy coverage ratios of the shrublands in each parcel was measured after which the average of these measurements was calculated thereby determining the canopy coverage ratio for the study area (Fig. 3) (Tolunay *et al.*, 2014).

Table 2. Sütçüler forest administration directorate field use areas.

Free area (red region)	30119,8 ha
Forbidden area (yellow region)	3158,2 ha
Unplanned area (purple region)	5295,1 ha

Table 1. Field inventory and the forbidden-permitted grazing forest areas plan.

No.	Settlements	Total village land ha	Unplanned areas ha	Total forest land ha	Forest lands		Number of goat allowed grazing
					Forbidden grazing area ha	Allowed grazing arear ha	
1.	Bekirağalar	753,1	147,6	605,6	69,2	536,4	1.073
2.	Beydili	10.096,6	378,5	9.718,1	346,1	9.372	18.744
3.	Boğazköy	753,8	194,2	559,6	248,5	311	622
4.	Çobanisa	6259,7	1067,0	5.192,7	299,0	4.893,7	9.788
5.	Hacıahmetler	2867,0	418,2	2.448,8	416,6	2.032,2	4.065
6.	Hacıaliler	1882,5	262,8	1.619,8	589,3	1.030,5	2.061
7.	Pınarköy	1848,1	428,7	1.419,4	147,8	1.271,6	2.544
8.	Sarayköy	1826,3	185,2	1.641,2	17,9	1.623,3	3.245
9.	Sarımehmetler	5721,2	631,7	5.089,5	689,6	4.399,9	8.800
10.	Merkez	3504,5	1042,3	2.462,2	203,7	2.258,5	4.517
11.	Yeniköy	1494,2	353,8	1.140,4	67,6	1.072,8	2.146
Total		37.007,1	5.109,9	31.897,2	3.095,4	28.801,8	57.605

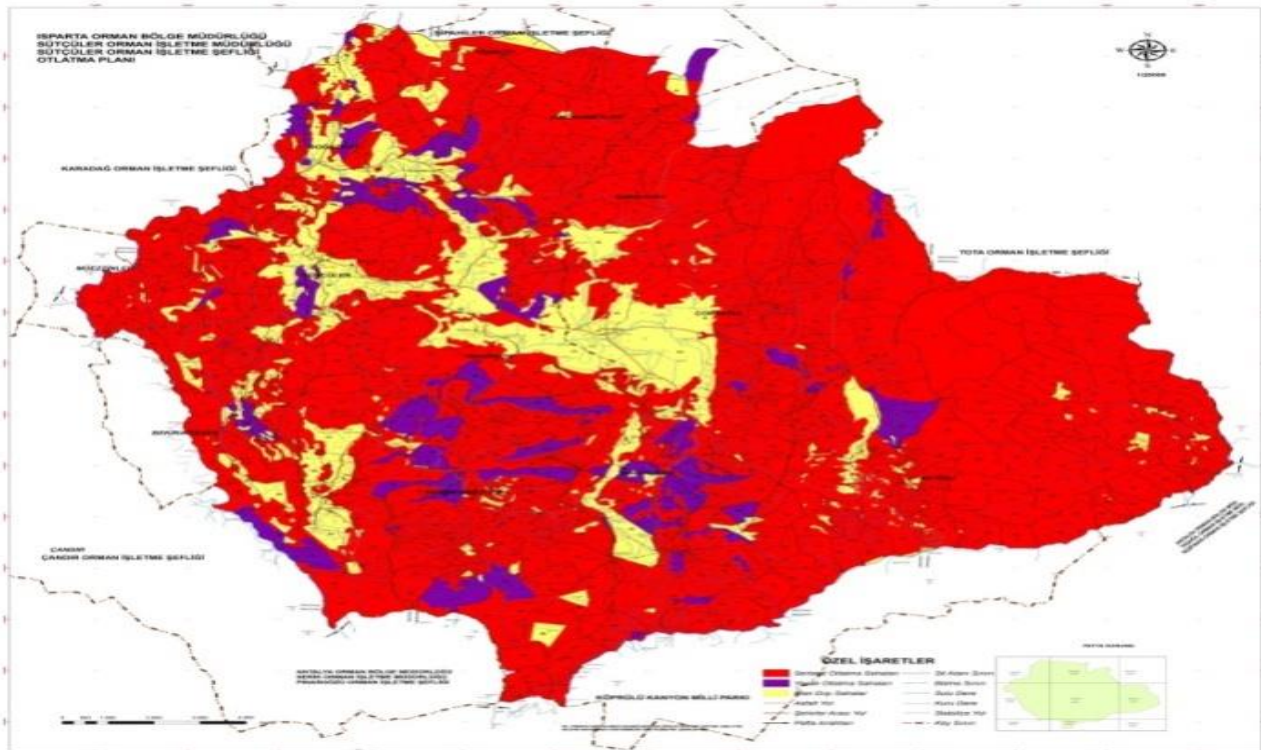


Fig. 2. Sütçüler forest administration directorate grazing plan.

Table 3. Dry substance yields for kermes oak fields with varying canopy coverage ratios subject to the vegetation period¹.

Vegetation period	Canopy ratios ²				
	% 10 kg ha ⁻¹	% 30 kg ha ⁻¹	% 50 kg ha ⁻¹	% 70 kg ha ⁻¹	% 100 kg ha ⁻¹
April	77.2	131.6	386.0	540.4	772.0
May	191.1	573.3	955.5	1337.7	1911.3
June	309.3	927.9	1546.5	2165.1	3093.3
July	361.0	1083.0	1805.0	2527.0	3610.0
August	364.9	1094.7	1824.5	2554.3	3649.3
September	368.9	1106.7	1844.5	2582.3	3689.4

¹The numbers are based on the leaf and shoot data grown in one vegetation period

²Canopy Coverage Ratio: The ratio at which Kermes oaks cover the field/soil



Fig. 3. Measuring the coverage area of the plant cover using the Quadrat method.

The parcels were divided into areas of 100 m² using the Grid method. The quadrat with dimensions of 1m² in the divided areas of A, B, C was projected randomly and the canopy coverage ratio in the parcel was obtained. The measured areas were calculated as percentages. Table 5 presents the ratios measured at 3 different areas in Sütçüler settlements and the average of these ratios. The study was carried out on 3 parcels since the study results were acquired in 3 repetitions. The study was carried out in late May when the shrubland vegetation completed its seasonal growth.

Canopy coverage ratios (%) acquired as a result of the measurements at the study areas and the field sizes (ha) were used for determining the canopy coverage ratios for the shrubland. These coverage ratios were used for calculating the optimum number of goats that can be grazed on 1 ha area and the optimum number of animals that can be fed annually by the forests where villagers have been allowed to graze their stock. A very strong and positive relationship was determined in another study between the growth performances of hair goats and vegetation coverage and feed mass ($p < 0,05$). It was determined that high grazing capacity has an adverse impact on the growth performance of kids since it also affects feed availability. Accordingly, availability of feed in grazing plans and grazing capacity are important aspects that should be taken into consideration for ensuring sustainable goat breeding (Türkoğlu *et al.*, 2016).

Results and Discussion

Goat breeding farms and goat population of the region: The goat breeding farms determined in the settlements located in the study areas of the Forest Administration Directorate Sütçüler Office have been numbered in the study. Data on the numbers of goats in these farms were acquired from Isparta Sheep and Goat Breeders' Association Office and the total number of goats in the settlements were determined. Table 4 presents the names of the goat breeding farms, the names of the settlements where goat breeding activities are carried out,

the numbers of goats of these breeders, the total grazing area (ha) in the settlements and the total number of goats in the village.

It can be observed upon examining Tables that the grazing capacity is insufficient in one village when the current number of goats in the settlements is taken into consideration as 57.605 and that there is a potential to feed 71,678 goats. As an example, the free grazing area determined for the Bekirağalar Village by the Forest Administration is 536,4 ha and the maximum number of hair goats that can be grazed is 1.073. The goat population in the village is 713. The canopy coverage ratios measured at A, B and C parcels in the district of Elmalı Gedik located within the borders of the village were 80%, 90% and 70% respectively. The average for the canopy coverages measured in the parcels is 80%. Based on the canopy coverage ratios, the number of goats that can be grazed on 1 ha of land in 1 year in areas where grazing is allowed is 3,4. According to the results of our measurements, the optimum number of goats that can be grazed in areas where grazing is permitted is 1.824. Based on this result, the optimum number of goats is 751 greater than the maximum number of goats allowed by the Forest Administration. The results are similar for all the other settlements.

It was observed as a result of the study that the coverage ratios of the kermes oak areas in the settlements vary between 60 to 90 %. The number of hair goats that can be grazed optimally per village was calculated by taking into consideration the coverage ratios of shrubland and presented in Table 6 as the number of goats that can be grazed in 1 ha area in 1 year.

It is considered logical to use the numbers for June in Table 6 for our country since grazing generally starts during the month of June in kermes oak covered areas in countries neighboring the Mediterranean Region. Because, it was determined as a result of phenological observations that the shoot growth and leaf development in kermes oaks in the study region take place in April, whereas the flowering and pollination take place in May. Since grazing during these periods is harmful for the growth and development of kermes oaks, the green leaf and shoot yields obtained are low (Tolunay *et al.*, 2009).

Table 4. Goat breeding farms and goat population.

Farms	Settlements	Goat population	Grazing area (ha)	Total goat number
1, 2, 3, 4	Bekirağalar	172,122,210,209	536,4	713
5, 6, 7	Çobanisa	177, 87, 134	4893,7	398
8, 9	Pınarköy	127, 149	1271,6	276
10, 11, 12, 13, 14, 15, 16, 17, 18, 19	Sarımehmetler	103, 190, 76, 201, 130, 282, 154, 78, 152, 108	4399,9	1474
20, 21, 22, 23, 24	Merkez	391, 233, 338, 51, 196	2258,5	1209
25, 26	Sarayköy	375, 372	1623,3	747
27, 28	Boğazköy	105, 139	311	244
29	Hacıahmetler	233	2032,2	233
30, 31	Yeniköy	55, 92	1072,8	147
32	Hacıaliler	77	1030,5	77

Table 5. Canopy coverage ratios measured at the shrubberies in the settlements.

No.	Settlements	A	B	C	Mean
1.	Bekirağalar	80%	90%	70%	80%
2.	Çobanisa	70%	80%	60%	70%
3.	Pınarköy	65%	75%	70%	70%
4.	Sarımehmetler	50%	60%	70%	60%
5.	Merkez	60%	80%	70%	70%
6.	Sarayköy	95%	85%	90%	90%
7.	Boğazköy	90%	50%	80%	70%
8.	Hacıahmetler	60%	70%	50%	60%
9.	Yeniköy	60%	65%	55%	60%
10.	Hacıaliler	85%	65%	60%	70%
11.	Beydili	55%	65%	60%	60%

Table 6. Number of hair goats that can be grazed in unit area subject to different coverage ratios (Tolunay *et al.*, 2009).

Vegetation period	Coverage ratios ¹				
	% 10 ha year ⁻¹	% 30 ha year ⁻¹	% 50 ha year ⁻¹	% 70 ha year ⁻¹	% 100 ha year ⁻¹
April	0.10	0.18	0.52	0.74	1.05
May	0.26	0.78	1.32	1.83	2.61
June	0.42	1.27	2.11	2.96	4.23
July	0.49	1.48	2.47	3.46	4.95
August	0.50	1.49	2.49	3.49	4.99
September	0.51	1.51	2.52	3.53	5.05

Increase in green leaf and shoot yield stops during periods after May, leaves become harder and shoots lignify due to summer aridness. Hence, the number of hair goats that 1 ha of kermes oak with complete canopy coverage (100%) is 4 per year (Tolunay *et al.*, 2009; Kaşıkçı *et al.*, 2019).

While the number of goats that can be grazed on an area of 57,605 ha has been calculated as 81,453 according to the table, this number was put forth in the grazing administration plan prepared by the forestry administration as 57.605 goats. This result is 23,848 goats less in comparison with the optimum number determined in the study. The total goat population of about 15 million decreased down to 6 million in 2008 due to the action plans for decreasing or even eliminating the goat potential in areas where they can harm the forests due to the forestry policies that are in effect in Turkey (Kaymakçı & Engindeniz. 2010). However, projects such as “Directorate of Forest and Village Relations” (OR-KÖY) were carried out contrary to all these developments thereby taking positive steps to support the forest settlements. Moreover, a regulation was prepared in 2011 that encompasses the grazing plans with new forestry policies thereby providing new grazing areas that will support stockbreeding (Table 7).

Table 7. The optimum number of hair goats that can be grazed in the settlements in the study area and deviations from these numbers.

No.	Settlements	Allowed grazing areas ha	Coverage ratio %	Grazing capacity ha	Optimum goat number	Available goat capacity	Goat capacity		Grazing plan capacity	
							Below current capacity	Above current capacity	Below goat	Above goat
1.	Bekirağalar	536,4	80	3,4	1,824	713	-1,111	1,073	-360	—
2.	Beydili	9372	70	3	28,116	3,446	-24,670	18,744	-15,298	—
3.	Boğazköy	311	70	3	933	244	-689	622	-378	—
4.	Çobanisa	4893,7	60	2,5	12,235	1,209	-11,026	9,788	-8,579	—
5.	Hacıahmetler	2032,2	70	3	6,097	233	-5,864	4,065	-3,832	—
6.	Hacıaliler	1030,5	70	3	3,090	77	-3,013	1,030	-953	—
7.	Pınarköy	1271,6	70	3	3,815	276	-3,539	2,544	-2,268	—
8.	Sarayköy	1623,3	90	3,8	4,059	747	-3,312	3,245	-2,498	—
9.	Sarımehmetler	4399,9	60	2,5	11,000	1474	-9,526	8,800	-7,326	—
10.	Merkez	2258,5	70	3	6,776	1209	-5,567	4,517	-3,308	—
11.	Yeniköy	1072,8	60	2,5	2,682	147	-2,535	2,146	-1,999	—
Total		28801,8			81,453	5,518	-71,678	57,605	-48,03	

These results indicate that the Forest Administration has reduced the grazing capacity of kermes oak areas. It was determined in a similar study as a result of the evaluation of the results related with the general characteristics of goat breeding farm that grazing is the most important problem of goat breeders and that it is required to develop a solution in cooperation with the Forest Administration (Tolunay *et al.*, 2014). Goat breeders have been subjected to fines with a ratio of 21% in the first study area and 45% in forest resource areas due to unauthorized grazing. An important finding of the present study is that goat breeders make certain violations with regard to sustainable forest resources management due to the grazing issue they are faced with. Hence, the cooperation between goat breeders and Forest Administration should be increased in order to solve this issue. It was determined that the interventions made by goat breeders in the Sütçüler district to prevent trees in the forests to be damaged during grazing decrease with increasing age, that the education level has decreased as well as the years of experience in this profession (Türkoğlu *et al.*, 2016; Kaşıkçı *et al.*, 2019).

Conclusion and Suggestions

The effectiveness of grazing plans in implementation is examined with regard to the Sütçüler example. Based on the study results, it was calculated that the grazing capacities in the grazing plans can be sufficient for a greater number of goats than the total goat population in the region. Studies on the effectiveness of grazing plans put forth that grazing capacities are evaluated only with regard to the species and numbers of the animals when preparing the plans but that the amount of plants suited for grazing have not been taken into consideration (Coşgun, 2014). It should be taken into consideration based on this neglected finding that the goats in the region will benefit less from grazing since the amount of herbage in areas with low plant density will be low and that more animals than the grazing capacity may be grazed in areas where plant density is high. Geographical formations that have shaped the region resulted in a rugged structure in the region. This has shaped the Mediterranean vegetation hosting different shrubberies at different elevations. One of the cases where the rugged structure has been effective is the small amount of land suitable for agriculture in the region thereby forcing the locals to revert to animal breeding. Goats that can move comfortably on the rugged terrain and consume the thorny shrubland in the region have become one of the fundamental products of the animal breeding activities carried out in the region. Young labor migrated from the settlements to the cities as industrialization became more dominant in city centers. Lack of young labor in settlements that can continue animal breeding activities and the inability of the elderly population in the settlements to carry out animal breeding activities are among the negative consequences of this event. As a result, old breeders are forced to decrease their number of animals or to quit animal breeding completely if they have to.

It was calculated that 81,453 goats can graze in the grazing areas of the district center and 11 settlements included in the study area within the borders of the Sütçüler Farm Administration Directorate Office. The current total number of goats at the Center and the Settlements is 5,518. It was calculated that 71,658 goats can be grazed in addition to the current number of goats. The average number of goats per farm in our study area was 100. When the grazing area sufficient for an additional goat population of 71,658 is considered, it means that there is additional work opportunity for about 717 more families who can earn a living by breeding goats or that there is enough grazing area for an additional 71,658 goats. Since Verdú *et al.*, (2000) reported that sheep and goat grazing was very important for stability of biodiversity in Mediterranean ecosystem, it is important to match the goat number and productivity of the shrubland. In this research it is shown that there is undergrazing and possible results of undergrazing on ecology should be observed.

Goat breeding farm can be determined in the free grazing areas of locations at the centers, districts and settlements inside the authorized area of Isparta Provincial Forestry Directorate where grazing capacity is not sufficient and where there will be excess grazing. Afterwards, the areas to be determined by the Sütçüler Forest Administration Head Office can be rented for free grazing and thereby the areas with a goat population below the grazing capacity can be used.

Solution suggestions in the short and long run for the forest settlements in our study area can be listed as below; The problems experienced by goat breeding farm in the settlements should be determined and tangible support should be received from the related institutions as soon as possible. Goat breeders or shepherds who arrange the grazing of goats should continue grazing activities by taking into consideration the best possible times at which goats can benefit from grazing as well as the most efficient grazing areas in accordance with the framework put forth by grazing administrations. Information should be provided based on proofs as to how excessive grazing can harm the vegetation of the region. The positive impacts of a balanced grazing plan on the goat breeding in the region as well as the shrubland vegetation should also be explained to breeders based on proofs. Urban development support should be provided taking into consideration the education levels of breeders. Positive and fastest methods should be preferred for animal production. Forest villagers should benefit from social security rights more effectively. Recent supports by the Ministry of Food and Forestry including Young Farmers Projects and Small Ruminant Subsidies have made significant contributions to breeding. Similar subsidies will pave the way for an increase in breeding. Animal markets with easy transportation options should be established in our study region and it should be ensured that sellers and buyers come to these markets which have structures that will enable their accommodation. It should be kept in mind that economy will in turn improve dramatically. Forest villagers should be incorporated in the production by way of projects carried out with cooperatives and unions enabling them to have access to

equipment required for processing animal products thereby carrying out production activities for animal based products. A new field of employment will be created in the chain from slaughtering to processing, packaging and delivery to consumers thereby providing a positive space to the forest villagers who have been pushed to the background.

Acknowledgments

This study was supported by the Turkish Scientific and Technical Research Council of Turkey (TUBITAK) (Project No: 117O549). The authors extend their gratitude to the TUBITAK.

References

- Ainalis A.B. and C.N. Tsiouvaras. 2004. Forage production of woody fodder species and herbaceous vegetation in a silvopastoral system in Northern Greece, *Agroforest. Sys.*, 42: 1-11.
- Ainalis, A.B., C.N. Tsiouvaras and A.S. Nastis. 2006. Effect of summer grazing on forage quality of woody and herbaceous species in a silvopastoral system in Northern Greece. *J. Arid Environ.*, 67: 90-99.
- Aldezabal, A. and I. Garin. 2000. Browsing preference of feral goats (*Capra hircus* L.) in a Mediterranean mountain scrubland. *J. Arid Environ.*, 44: 133-142.
- Anonymous. 2007. Orman Genel Müdürlüğü. Forest Management Administration documents.
- Anonymous. 2019. Ortalama Ekstrem ve Yağış Değerleri Bülteni, Ankara: Devlet Meteoroloji İşleri Genel Müdürlüğü Yayını.
- Coşgun, U. 2014. Ormanların yönetiminde otlatma planlarının yeri ve önemi, II. Ulusal Akdeniz Orman ve Çevre Sempozyumu, 22-24 Ekim 2014. 637-649.
- Çürek, M. and N. Özen. 2010. Keçi meralarında bulunan bazı maki türlerinin otlatma mevsimi boyunca yem değerlerinin saptanması. *Ulusal Keçicilik Kongresi*. 24-26 Haziran, Çanakkale. 324-328.
- Dönmez, Y. 2014. Türkiye Bitki Coğrafyası Çalışmaları. *Coğrafya Dergisi*, 29: 1-27.
- Ertuğrul, M., T. Savaş, G. Dellal, T. Taşkın, M. Koyuncu, F. Cengiz, B. Dağ, S. Koncagül and E. Pehlivan. 2010. Türkiye Küçükbaş Hayvancılığının İyileştirilmesi. Türkiye Ziraat Mühendisliği VII. *Teknik Kongresi Bildiriler*, 11-15 Ocak, Ankara, 667-685.
- Görgülü, M. 2002. Büyük ve Küçükbaş Hayvan Besleme, Çukurova Üniversitesi Ziraat Fakültesi Yayınları, 1. Basım, Adana-Türkiye, Ss: 285.
- Heitsch Mid R.K. and I.W. Stuth. 1991. *Grazing Management: An Ecological Perspective*, Timber Press, Portland, Oregon.
- Kamalak, A., O. Canbolat, O. Ozay and S. Akbas. 2010. Nutritive value of Oak (*Quercus* spp.) Leaves, *Small Rumin. Res.*, 53: 161-165.
- Kaşıkcı, D., T. Türkoğlu, S. Bekiroğlu, M. Özmiş and A. Tolunay. 2019. The comparative analysis on the overview of hair goat breedings to sustainable forest resources management, *App. Eco. & Environ. Res.*, 17: 7027-7042.
- Kaymakçı, M. and S. Engindeniz. 2010. Türkiye’de Keçi Yetiştiriciliği: Sorunlar ve Çözümler, Ulusal Keçicilik Kongresi, 24-26 Haziran 2010, Çanakkale, 1-25.
- Kutlu, H.R., A. Gül and M. Görgülü. 2003. Türkiye Hayvancılığı; Hedef 2023 – Sorunlar, Çözüm Yolları ve Politika Arayışları, Erişim tarihi: 12 Mart 2016.
- Papachristou, T.G., L. Dziba and E. Provenza. 2005. Foraging ecology of goats and sheep on wooded rangelands. *Small Rumin. Res.*, 59: 141-156.
- Tasligil, N. and G. Sahin. 2010. Türkiye’de Keçi yetiştiriciliğinin coğrafi dağılımı (Geographical Distribution of Goat Breeding in Turkey). – Ulusal Keçicilik Kongresi (*National Congress on Goat Cultivation*, 24-26 June, Çanakkale, Turkey).
- Tolunay, A. and V. Ayhan. 2010. Türkiye’de Kıl Keçisi yetiştiriciliğinde orman kaynaklarından yararlanmada mevcut durum, darboğazlar ve çözüm önerileri. Ulusal Keçicilik Kongresi, 24-26 Haziran, Çanakkale, 92-96.
- Tolunay, A., D. Ince, I. Daskiran, T. Turkoglu and M. Ozmis. 2018. Role of goat breeding in reducing rural poverty in the Western Mediterranean region of Turkey. – 1st International Symposium on Silvopastoral Systems and Nomadic Societies in Mediterranean Countries, 22-24 October 2018, Isparta, Turkey
- Tolunay, A., E. Adıyaman, A. Akyol, D. Ince, T. Türkoğlu and V. Ayhan. 2014. An investigation on forage yield capacity of Kermes Oak (*Quercus coccifera* L.) and grazing planning of Mediterranean maquis scrublands for traditional goat farming. 9: 1-9, <http://dx.doi.org/10.1155/2014/398479>
- Tolunay, A., V. Ayhan, D. Ince and A. Akyol. 2009. Traditional usage of Kermes oak (*Quercus coccifera* L.) and Pure Hair Goat (*Capra hircus* L.) in a silvopastoral system on Davras Mountain in Anatolia: Constraints, Problems and Possibilities, *J. Anim. & Vet. Adv.*, 8(8): 1520-1526.
- Türkoğlu, T., S. Bekiroğlu and A. Tolunay. 2016. Effect of stocking rate on forage availability and growth performance of goat kids in Mediterranean Kermes Oak shrublands. *Kastamonu Uni.Orman Fakültesi Dergisi*, 16: 269-279. http://dx.doi.org/10.15666/aeer/1703_70277042
- Verdú, J.R., M.B. Crespo and E. Galante. 2000. Conservation strategy of a nature reserve in Mediterranean ecosystems: The effects of protection from grazing on biodiversity. *Biol. & Conserv.*, 9: 17707-1721.
- Yılmaz, K.T. 1996. Akdeniz Doğal Bitki Örtüsü. Çukurova Üni. Ziraat Fak. Genel Yayın, 141. Adana
- Yılmaz, M., H.E. Bardakçioğlu, T. Taşkın and O. Karaca. 2010. Türkiye’de göçer keçi yetiştiriciliğinin mevcut durumu ve geleceği: Muğla-Yatağan örneği. *Ulusal Keçicilik Kongresi Çağrılı Bildirisi*, 24-26 Haziran 2010 Çanakkale, 135-141.

(Received for publication 4 September 2018)