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The Use of Goat Grazing for Prevention of Forest Fires in the West Mediterranean Region of Turkey

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Abstract. In this study, the effects of goat grazing on reducing forest fires are investigated. For this purpose, trial areas were taken in 3 provinces (Antalya, Isparta and Burdur) within the study area which has rough terrain and scrubland. As a result of grazing goat flock in these areas, the amount of flammable material removed per unit area was calculated under 4 different intensities: weak grazing (70-100% of the total available aboveground biomass), medium grazing (70-40%), heavy grazing (40%-10%) and no grazing in the study area.

The amount of flammable material removed by goat grazing in study areas where grazing is allowed in the state forests is annually -756,500 tons in Antalya Province, -304,000 tons in Isparta Province, -198,000 tons in Burdur Province and totally -1,258,500 tons in entire study area. Thus, goats remove the amount of flammable material from the Western Mediterranean Forests at the rate of 61%.

Weak grazing (70-100%) in grazing classes cannot reduce the amount of flammable material. The grazing intensities that should be used to reduce the forest fire hazard are in medium grazing (70-40%) and heavy grazing (40-10%). The most suitable grazing period to preventing forest fires is the period between April 15 and June 15. Considering the presence of different forest vegetation in the study area, these grazing periods can be extended to 15 days earlier or 15 days later. Finally, the 3-month period between April 1 and June 30 is the most effective period of grazing for the prevention of forest fires.

Keywords. Forests, goat breeding, grazing, forest protection, fire prevention, Turkey.

L'utilisation du pâturage des chèvres pour la prévention des incendies de forêt dans la région de la Méditerranée occidentale en Turquie

Résumé. *Dans cette étude, les effets du pâturage des chèvres sur la réduction des incendies de forêt sont étudiés. A cet effet, des zones d'essai ont été prises dans 3 provinces (Antalya, Isparta et Burdur) au sein de la zone d'étude qui a un terrain accidenté et de la garrigue. En raison du pâturage du troupeau de chèvres dans ces zones, la quantité de matière inflammable enlevée par unité de surface a été calculée sous 4 intensités différentes : pâturage faible (70-100 % de la biomasse aérienne disponible totale), pâturage moyen (70-40 %) , pâturage intensif (40 à 10 %) et aucun pâturage dans la zone d'étude.*

La quantité de matières inflammables enlevées par le pâturage des chèvres dans les zones d'étude où le pâturage est autorisé dans les forêts domaniales est de -756 500 tonnes dans la province d'Antalya, de -304 000 tonnes dans la province d'Isparta, de -198 000 tonnes dans la province de Burdur et de -1 258 500 tonnes dans l'ensemble de l'étude. Région. Ainsi, les chèvres enlèvent la quantité de matières inflammables des forêts de la Méditerranée occidentale au taux de 61%.

Un pâturage faible (70-100 %) dans les classes de pâturage ne peut pas réduire la quantité de matières inflammables. Les intensités de pâturage qui devraient être utilisées pour réduire le risque d'incendie de forêt sont en pâturage moyen (70-40%) et en pâturage intensif (40-10%). La période de pâturage la plus appropriée pour prévenir les feux de forêt est la période entre le 15 avril et le 15 juin. Compte tenu de la présence de différentes végétations forestières dans la zone d'étude, ces périodes de pâturage peuvent être prolongées jusqu'à 15 jours plus tôt ou 15 jours plus tard. Enfin, la période de 3 mois entre le 1er avril et le 30 juin est la période de pâturage la plus efficace pour la prévention des feux de forêt.

Mots-clés. *Forêts, élevage caprin, pâturage, protection des forêts, prévention des incendies, Turquie.*

I - Introduction

Turkey is a country with a land holding of 78,000,644 hectares of which 28.6% is represented by forests. Forest fires have an important place among the factors that threaten forests (GDF, 2018).
The Mediterranean climate prevails in the south of the country, and due to the characteristics of this climate type, the region where forest fires are most common is the Mediterranean Region. Summer drought, which is among the characteristics of the Mediterranean climate, is the most important factor that prepares the ground for the outbreak of forest fires. In the period of summer drought, herbaceous plants dry up after seed maturation. On the other hand, as a result of the accumulation of leaves and availability of branches of trees, and shrubs, dry material ready to burn can easily in both forest and agricultural areas. In short, the reason why forest fires are high both in area and in numbers, especially in the Mediterranean Region, is the presence of dry grass and woody material suitable for burning during the summer drought period. Today, the General Directorate of Forestry spends a large amount of money on forest fire prevention as well as on extinguishing forest fires. However, it is possible to prevent the forest fires by making the goats eat the grass and leaves in the forest areas (Ortaş, 2010).
Contemporary forest fires management approach, besides fire extinguishing activities, aims to actively intervene in the forest for two main purposes: reducing the risk of forest fire (e.g., by controlled burning, by cutting vegetation, etc.) and restoring forest health (Mutch et al., 1993).
Animal grazing in forests is the process of reducing the amount of flammable material to reduce the risk of forest fires (Yılmaz, 2016).
With this regard, goats have important functions in preventing forest fires. Every year, thousands of kilometers of fire safety lanes and roads are established in order to keep forest fires in small areas and prevent their spread. The paths opened by the goats serve as a natural fire safety road and path. It is expensive and difficult for human beings to open and establish these paths. By doing this, goats contribute to the prevention of fires (Kaşıkçi et all., 2020).
If the goats are grazed in an area with mature trees, they do not harm the forest that benefits from them. Because they clear all the flammable material around the adult trees. Thus, the elements that increase the risk of fire spreading are eliminated. When a fire breaks out, the flames cannot spread as there is no plant residue left in the ground land. Thus, the fire in the area with mature trees cannot spread. As a matter of fact, the United States of America (USA) effectively uses goats in the fight against forest fires. In the USA, goats are deliberately grazed in forest areas (Lovreglio et.all, 2014).
In this study, it was investigated how to benefit from goats in reducing forest fires. For this purpose, trial areas were taken in three provinces within the study area and the following aspects determined: (i) the amount of flammable material removed per unit area as a result of the grazing of goat flock in these areas, and (ii) the most suitable grazing periods that can be done without damaging the forests.

II - Material and method

In this study, it was investigated how to benefit from small ruminants in reducing forest fires. For this purpose, experimental areas were taken in three provinces (Isparta, Burdur and Antalya), and the amount of combustible material removed per unit area as a result of grazing goat flocks in these areas was determined. In addition, the most suitable grazing periods that can be done without damaging the forests were determined.

Field studies can be selected based on the knowledge about the characteristics of the universe and according to the purpose of the research, this type of sampling is called purposive sampling. In purposive sampling, samples can be taken from places that are thought to represent the universe and are a typical example of the universe (Dasdemir, 2016). Purposeful sampling method was used in the selection and determination of the trial areas in this study.
Grazing classes were determined by considering the % of the total available aboveground biomass. Accordingly, the coverage rate of vegetation in the “no grazing” is 100%, “weak grazing” is between 100%-70%, “medium grazing” is between 70% and 40%, and “heavy grazing” is between 40%-10%.
Accordingly, measurements were made by taking 12 random trial areas (10 m x 10 m = 100 m2) in each of the 3 provinces of the Western Mediterranean Region in Turkey (Isparta, Burdur and Antalya), corresponding to 3 replications per each of the 4 grazing density (i.e., no grazing, weak, medium and heavy grazing). In total, the measurements were made in 36 trial areas in 2018 and 2019. In the study, representative areas were determined to meet the purpose of the study in determining the design to be selected for fieldwork (Figure 1).

Figure 1. Field study in experimental areas

In these trial areas, the feed material that could be eaten by goats was cut/plucked/collected and weighed by bringing it to air-dry weight. The value found was recorded as the amount of combustible material removed from this area.

III - Results

In this study, the importance of goat use and goat breeding in conservation of forests and prevention of forest fires in the Western Mediterranean Region of Turkey was investigated.
In this study, the factors affecting the amount of flammable materials removed by goats from forest areas; the rainfall amount of the region, the elevation of the land, the rate of vegetation covering the land, the number of grazing goats per unit area, the period of grazing were effective. In Table 1, the results obtained from the research are given in terms of the fields of study.

Table 1. Flammable material per unit area (kg ha-1) and the most suitable grazing period to prevent forest fires in the 3 provinces according to the grazing intensity

Working area	Grazing Level/Intensity	Flammable material (kg ha^{-1})	Most suitable grazing period to prevent forest fires
Antalya	No grazing	none	01 April – 01 June
	Weak grazing	-446	
	Medium grazing	-823	
	Heavy grazing	-1279	
Isparta	No grazing	none	30 April – 30 June
	Weak grazing	-395	
	Medium grazing	-841	
	Heavy grazing	-1320	
Burdur	No grazing	none	15 April – 15 June
	Weak grazing	-425	
	Medium grazing	-763	
	Heavy grazing	-1138	

Weak grazing (70-100% of the total available aboveground biomass) in grazing classes cannot reduce the amount of flammable material. Grazing intensities that should be used to reduce the risk of forest fire are medium grazing (70-40%) and heavy grazing (40%-10%).

The amount of medium grazing and heavy grazing areas in the state forests in the Western Mediterranean Region in Turkey is given in Table 2.

Table 2. Area Amounts by Grazing Density in the Western Mediterranean Region

Grazing Level/Intensity	Antalya (ha)	Isparta (ha)	Burdur (ha)
Heavy grazing	100 515.70	4 362.00	2 910.60
Medium grazing	763 007.30	354 709.90	255 251.31

Table 3. Amounts of flammable materials removed by goat grazing in areas where grazing is allowed in state forests in the Western Mediterranean Region

Working area	Grazing Level/Intensity	Amount of grazing land (ha)	Flammable material per unit (kg ha^{-1})	Removed flammable material (kg)	Total	
					(kg)	(ton)
Antalya	Heavy grazing land	100 516	-1 279	-128 560 000	-756 515 000	-756 500
	Medium grazing land	763 007	-823	-627 955 000		
Isparta	Heavy grazing land	4 362	-1 320	-5 758 000	-304 069 000	-304 000
	Medium grazing land	354 710	-841	-298 311 000		
Burdur	Heavy grazing land	2 911	-1 138	-3 313 000	-198 069 000	-198,000
	Medium grazing land	255 251	-763	-194 756 000		
Total					-1 258 653 000	-1 258 500

IV - Conclusion

Goats can be easily lived in bad environmental conditions. Because they use resources and roughage that cannot be utilized by other farm animals. It is the most important source of livelihood of the settlements in and on the edge of the forest, which do not have lands for plant production. Goats are animals that can easily turn into money at any time. They can be grown in simple and inexpensive shelters. They have a high adaptability to the growing environment and resistance to diseases. Goat breeding is mainly carried out in enterprises in forest and mountainous areas. Because due to natural conditions, other animal husbandry activities cannot be done in these areas or they are done at very low levels. Goat breeding is carried out in approximately 500 thousand enterprises in Turkey and this production line contributes to the income of approximately 3 million people (Türkoğlu et all., 2016).

The various characteristics of goats offer them advantages in applications for vegetation and vegetation management and control. Both foresters and small cattle breeders are not aware of this feature of goats in Turkey. Both sides highlighted their contrasts and could not enter into an understanding that would provide common gain. Foresters insisted that the goats should be kept away from the forest and never be allowed into the forest areas, and they did not give up on this idea for years. On the other hand, goat breeders, knowingly or unknowingly neglecting the grazing limits and rules, grazing ruthlessly, destroying the maquis and forest vegetation. For this reason, sustainable resource management has not been realized and sustainable animal breeding has not been done (Bekiroğlu and Tolunay, 2010).

Goat breeding is a low-input livestock business and requires minimal initial investment financing. In addition, the maintenance costs of the animals are low and only a medium level of labor is required for flock management.

However, sustainable resource management and sustainable animal husbandry require a high level of flock management knowledge. Goats have a variety of dietary preferences and consume a wide variety of herbaceous and woody plant species. Goats have lip and mouth structure that enables the selection and consumption of the most nutritious components of the biomass found in forest and pasture vegetation. Goats can make a feeding preference in the presence of herbaceous and woody species that they can eat in abundance in their environment. When they cannot find enough forage in the pastures, they can reach and feed on high tree branches and leaves by reaching more than 3 meters on their hind legs. Goats are better able to digest plant species with higher tannin levels than cattle or sheep (Tolunay *et. al.*, 2019).

Goat grazing prevents uncontrolled growth by eating the branches, leaves and flowers of annual or perennial herbaceous plants. Also, when the immature seeds of these plants are eaten by goats, they are completely destroyed in the digestive tract. In addition, with the reduction of vegetation and vegetation cover by goats, parasitic and parasitic animal populations such as ticks become controllable. The greatest benefit of controlling vegetation with goats will primarily be to remove combustible material that will cause major forest fires with the smallest spark in summer drought. Various methods can be used to prevent the formation of this combustible material. For example, chemical drug application can be made. This application has a cost of 50-100 Euro per hectare. However, doing this process using goats will not cost anything, and it will contribute to raising an animal that uses meat and dairy products with a monetary value of 50-100 Euro (Hart, 2020).

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References

Bekiroglu, S., and Ahmet Tolunay, A., (2010). Locality and its Importance in Pure Hair Goat Raising (Capra hircus L.): Example from the Teke Region. Journal of Animal and Veterinary Advances, 9: 2200-2206.

Dasdemir, İ., (2016). Scientific Research Methods, Nobel Academic Publishing and Consulting Trade. Ltd. Sti., Publication No:1536, ISBN 978-605-320-442-8, 210 s., Ankara.

GDF, (2018). Forest fire statistics. Website: https://www.ogm.gov.tr/ekutuphane/Sayfalar/Istatistikler Access: 15 September 2018.

Hart, S., (2020). Goats for Vegetation Management, Agricultural Research and Extension Programs, Langston University, USA. Website: http://www.luresext.edu/?q=content/goats-vegetation-management Access: 15 March 2020.

Kaşikçi, D., Armağan, M.E., Türkoğlu, T., and Tolunay, A., (2020). The effect of forest grazing planning on forest ecology and carrying capacity: a case study of Mediterranean region in Turkey. Pak. J. Bot., 52(2): DOI: http://dx.doi.org/10.30848/PJB2020-2(18)

Mutch, R. W., Arno, S. F., Brown, J. K., Carlson, C. E., Ottmar, R. D. ve Peterson, J. L., (1993): Forest Health in the Blue Mountains: A Management Strategy for Fire-adapted Ecosystems. USDA Forest Service, Pacific Northwest Research Station, General Technical Report, PNW-GTR-310, Portland, Oregon, USA.

Ortaş, İ., (2010). Is Goat Harmful? Farm Magazine Website: http://www.ciftlikdergisi.com.tr/keci-zararli-mi-2/ Access: 15 March 2020.

Raffella Lovreglio, R., Meddour-Sahar, O., Vittorio Leone, V., (2014). Goat grazing as a wildfire prevention tool: a basic review. iForest – Biogeosciences and Forestry, Technical Notes - doi: 10.3832/ifor1112-007

Tolunay A., Türkoğlu T., Özmiş M., (2019). Küçükbaş Hayvancılık Üretim Sistemlerinin Geliştirilmesi İçin Köy Analizi: Batı Akdeniz Bölgesi, Burdur İli - Beşkavak Köyü Örneği. IV. International Symposium on Strategic and Social Research (ISASOR 2019), Aralık 5-6.

Türkoğlu, T., Bekiroğlu, Ö. S., Tolunay, A. (2016). Sustainable goat production in Turkey Current situation and solution proposals. Turkish Journal of Forestry, 17, 99-106.https://doi.org/10.18182/tjf.49645

Yılmaz, E., (2016). A review on the rehabilitation of burned forest areas and the fire resistant forests establishment project (YARDOP). Journal of Forestry Research 2016/1, A, 1:3, 14-28