# The Exploitation of Grazing Lands with SCckler Cows in the Region of Central Macedonia, Greece

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**Abstract**
In this study, the potential use of available grazing land for suckler cow herds was examined and we determined their stocking rate in the Region of Central Macedonia, in 2019. Data were collected by field research and through interviews from a stratified sample of 66 breeders, to identify the livestock population and achieve the characterization of pastures. The pastures included public and private grazing lands that are used by suckler cows and their calves during the six-month summer grazing period that takes place in most cases by moving the animals from the farm's facilities. The survey revealed that the average stocking rate of the Region was 0.70 Livestock Units/ha with strong variability within the study area (min 0.13, max 1.06). Also, the relatively high predation risks on pastures and their seasonal use, on the one hand, do not help to achieve satisfactory productive yields and, on the other hand, pastures are at risk of direct deterioration due to over-grazing.

**Keywords**: Suckler cows, Grasslands, Pastures safety, Stocking rate.

## 1. Introduction

The Region of Central Macedonia (R.C.M.) covers 14.3% of the total surface of Greece. Husbandry is an important economic activity in this area, as 767,000 sheep, 403,200 goats, and 10,400 suckler cows are extensively raised [1]. According to recent data from the Greek Ministry of Rural Development and Food (M.R.D.F.), the number of suckler cows has almost doubled (19,500) in recent years, mainly due to the retention of most female calves born in previous years for breeding purposes.

Grazing lands and especially grasslands play an important role in the breeding of suckler cows. The areas mentioned with the term "grazing lands", as described in National Law 4351/2015, occupy the R.C.M. about 22% of its total area. About half of these areas (47%) are located in the mountainous zone, while the remaining percentage is distributed in the semi-mountainous (33%) and lowland zone (20%). Of the total of its grazing lands (R.C.M.) 21% is located in the Regional Unit (R.U.) of Thessaloniki, 38% is distributed in the R.U. of Kilkis and in the R.U. of Pella, 11.3% in the R.U. of Halkidiki, 10.9% in the R.U. of Serres, 10.1% in the R.U. of Imathia and 8.9% in the R.U. of Pieria.

The grazing material (forage), produced from the pastures, can cover about 50% of the nutritional needs of the extensively farmed animals [2]. About cattle, the coverage of their nutritional needs is largely based on the European Union financial aid Policy, which ensures the purchase of necessary feedstuffs [3]. Thus, the lack of grazing resources and their competitive demand from other farm animals, led to the adoption of more intensive systems for breeding suckler cows, using only seasonal grazing, which depending on

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stocking rate and the applied grazing system, can reach 5-6 months.

The purpose of this study is to give a detailed description of pasture land characteristics, used in the extensive breeding of suckler cows in R.C.M., as well as to investigate their adequacy during the summer grazing season, by calculating the stocking rate.

## 2. Materials and methods

The Region of Central Macedonia was defined as a research area that includes the Regional Units of Thessaloniki, Serres, and Pella, which contain a significant number of cattle farms registered (with breeding codes), in the meat production direction. Imathia, Kilkis, Halkidiki, and Pieria, participated also, in the sampling with a small number of holdings.

To determine the sample, 127 holdings were selected based on statistical data collected by the Ministry of Rural Development and Food for the year 2019. According to the survey, the holdings included in the study ranged in size from 20 to 400 suckler cows and the total number of Livestock Units (L.U.) on the above holdings was 9,677. The sampling method followed was Neyman's stratified sampling method (1934). The total number of suckler cow farms was divided into three strata according to farm size (h1: 20-50 cows; h2: 51-100 cows; h3: >100 cows). Stratification criteria were each one of the seven Regional Units (Thessaloniki, Serres, Chalkidiki, Pella, Kilkis, Imathia, Pieria) that are included in the Region of Central Macedonia. The optimal sample size for stratum h is determined by the following equation in the Neyman allocation:

$$n = \frac{(\Sigma N_h s_h)^2}{N^2 D^2 + \sum N_h {s_h}^2}$$

Where: n=sample size

$n_h$=sample size of stratum h

N=size of total (initial) sample

$N_h$=size of total sample concerning stratum h

$S_h$= the standard deviation of the variable in each stratum

D=the desired standard error

The final sample included 66 suckler cow farms and constitutes 52% of the total suckler cow farms in the study area. The Total Livestock Units (L.U.) of the suckler cows were 6.122 and constitute 63% of the total suckler cow population in the study area.

The pastures according to their dominant plant species were classified into four categories: 1) Shrubland, in which the dominant plant is kermes oak (*Quercus coccifera* L.) in combination with other shrubby species (*Paliurus spina-christi*, *Crataegus* sp. L. and *Juniperous oxycedrus* L.) there is herbaceous vegetation among the bushes, 2) Phrygana with low-growing thorny and aromatic shrubs that show seasonal dimorphism (Yiakoulaki and Kazoglou, 2017), 3) Grassland in which prevailing vegetation is grasses (*Graminae*, and *Fabaceae*) and is the pasture type in which cattle's graze, 4) Woody grassland or partially woody grassland consisting of open-harvested trees mixed with herbaceous or shrubby vegetation, suitable for grazing by cattle [4]. Public and private pastures were included in the study as grazing lands utilized by suckler cows and their calves during the summer grazing semester, which is typically carried out by moving the animals from their farm location.

All breeders were interviewed using structured questionnaires with either closed-ended questions and sub-questions (mostly quantitative, with YES/NO answers, 1-5 Likert scores, or multiple-choice answers), or open-ended questions (mostly quantitative). The collected data is related to 2019. The questionnaire also included information about the location of the farming, the land owned by private individuals surrounding the stable, and the arable land available for feedstuffs. The pastures were classified according to 1) their terrain morphology (Flat 0-15%, Sloppy 15-30%, Cragginess 30-45, % and Very Steep >45%), 2) Classification of pastures according to their dominant plant species (Grassland, Phrygana, Shrubland, and Partially wooded grassland) and 3) parameters that affect the safety of pastures (a. Flat-fenced pastures, b. Riverside pastures - with stream or swamp, c. Hilly or mountainous pastures, d. Pastures with ravines, e. Pastures with wild carnivores), Thus, based on the provided safety, grazing lands were divided into 4 categories 1) safe: flat pastures, fenced or pastures adjacent to rivers, streams or other aquatic formations, which not exposed to wild carnivorous animals, 2) relative safe: pastures that are hilly or mountainous and may be adjacent to rivers or streams 3) relative dangerous pastures: pastures that are hilly or mountainous and have steep ravines, 4) dangerous pastures which are hilly or mountainous and have steep ravines and conclude

wild carnivores. As long as the first category of safe pastures is excluded, carnivores may be found in the second and third categories. The results of the questionnaires were processed with descriptive statistics and expressed in percentages (%).

The stocking rate of each regional unit (R.U.) was estimated by assuming that one Total Livestock Unit (L.U.) was estimated by the assumption of 1 L.U. for each adult bovine, 0.6 L.U. for calves and heifers from 6–24 months, and 0.2 L.U. for calves up to 6 months. A majority of breeders provide supplementary feed to almost all categories of livestock, in addition to pasture grazing, to meet the nutritional needs of their animals.

## 3. Results and discussion

The area of the stable facilities of the farm amounts on average to 2.07 hectares (ha). The total arable land used by the farms in the sample amounts to 13,934.5 ha, a number which, if correlated with the average area per farm, amounts to 211 ha. Table 1 shows the distribution of grazing land, corresponding to the suckler cow farms based on their ownership status. The majority of farms use grazing land for livestock farming, which is mostly public, or granted away from the farm, while only six farms have privately owned pastures.

**Table 1.** Ownership of pastures allocated to extensive suckler cow farms in the Region of Central Macedonia

| Grazing land category | Number of farms | Percentage % |
|---|---|---|
| Public | 53 | 80.3 |
| Private | 6 | 9.1 |
| Public & Private | 7 | 10.6 |
| Total | 66 | 100 |

The distribution of available grazing lands on a suckler cow farm, total Livestock Units (L.U.), and stocking rate (L.U. / ha) by R.U. and farm are presented in Table 4. It appears that the availability of publicly mainly grazing lands for cattle was dependent on the total population of animals, in each R.U. For this reason, a large heterogeneity was observed regarding the area of available pastures per farm and R.U., ranging from 40 ha to 1,000 ha for Pieria and Kilkis, respectively.

Regarding the number of total L.U. calculated according to the above age view of the animals, the total of 9,768.3 L.U. is distributed as follows: 6,122 L.U. of cows + 186 L.U. of bulls + 755.7 L.U. of heifers + 2,704.6 L.U. of fattening calves.

Table 4 shows that the average stocking rate of pastures used by the total animal population in this study is 0.7 L.U. per ha. The stocking rate ranged from 0.13 L.U. / ha for Kilkis to 1.06 L.U. / ha for Pieria. The lowest stocking rate values, except for Kilkis, were observed in Imathia and Serres. In the R.U. of Pella, Thessaloniki, and Halkidiki, the highest values of stocking rate, were observed either due to the limited available area of pastures or due to the large number of suckler cow farms that exist.

A majority of cattle farmers (3 in 4) think the grazing lands for their suckler cows are sufficient (Table 2).

**Table 2.** Percentage of pasture sufficiency per farm

| Pastures sufficiency | Farms | Percentage % |
|---|---|---|
| Yes | 50 | 75.8 |
| No | 16 | 24.2 |
| Total | 66 | 100 |

Also, the largest percentage of farms have pastures on sloping lands with a slope of 15-30%, while only 10 farms had pastures on flatlands for raising their animals (Table 3).

There were no farms with pastures on very steep lands.

**Table 3.** Classification of pastures according to their terrain morphology

| Pastures terrain morphology | Farms | Percentage % |
|---|---|---|
| Flat | 10 | 15.2 |
| Sloppy | 41 | 62.1 |
| Cragginess | 15 | 22.7 |
| Very Steep | 0 | 0 |
| Total | 66 | 100 |

From the classification of pastures according to their dominant plant species, it was found that most pastures are characterized as shrublands, followed by partially wooded grassland, grasslands, and phrygana (Table 5).

The percentage of farms with flat-fenced pastures is the lowest compared to the other categories (Table 6). Most of the farms exploit pastures, where wild carnivores live, followed by pastures located in hilly or mountainous areas, in riparian areas with stream or swamp, and in pastures, which are characterized by the existence of ravines.

From the classification of farms, based on Supplied safety of their pastures (Table 7) it appears that most farms manage relatively dangerous pastures, while safe pastures are in the smallest percentage of farms.

**Table 4.** Distribution of pastures, number of suckler cows, total livestock units, and stocking rate per Regional Unit

| Regional Unit | Farms | Pastures (ha) | ha/farm | Suckler cows | Total L.U. | Stocking rate Total L.U./ha |
|---|---|---|---|---|---|---|
| Pella | 23 | 3,858 | 167.7 | 2,477 | 3,952.6 | 1.02 |
| Thessaloniki | 19 | 2,272.3 | 119.6 | 1,368 | 2,161.3 | 0.95 |
| Serres | 14 | 3,833 | 273.8 | 1,227 | 1,899.2 | 0.49 |
| Imathia | 5 | 2,093 | 418.6 | 377 | 693 | 0.33 |
| Halkidiki | 4 | 1,158 | 298.5 | 608 | 1,000 | 0.86 |
| Kilkis | 1 | 1.000 | 1,000 | 110 | 134.5 | 0.13 |
| Pieria | 1 | 40 | 40 | 27 | 42.5 | 1.06 |
| Total | 66 | 13,934.5 | 211.1 | 6,122 | 9,768.3 | 0.70 |

**Table 5.** Classification of pastures according to their dominant plant species

| Pasture type | Farms | ha / pasture type | ha/farm | % |
|---|---|---|---|---|
| Grassland | 39 | 2.857 | 73 | 23.6 |
| Phrygana | 21 | 1.170 | 55,7 | 9.6 |
| Shrubland | 47 | 4.331,5 | 92,2 | 35.7 |
| Partially wooded grassland | 35 | 3.773,7 | 107,8 | 31.1 |
| Total | 142 | 12.132,2 | | 100 |

**Table 6.** Parameters that affect the safety of pastures

| Safety parameters of pastures | Number of farms | Percentage of a total of farms (%) |
|---|---|---|
| 1. Flat-fenced pastures | 8 | 12.1 |
| 2. Riverside pastures - with stream or swamp | 25 | 37.9 |
| 3. Hilly or mountainous pastures | 53 | 80.3 |
| 4. Pastures with ravines | 20 | 30.3 |
| 5. Pastures with wild carnivores | 55 | 83.3 |

**Table 7.** Supplied safety of the sample pastures

| Pasture safety | Farms | Percentage % |
|---|---|---|
| A. Very safe (safety parameters 1 or 2) | 12 | 18.2 |
| B. Relatively safe (safety parameters 2 & 3 or 5) | 17 | 25.7 |
| C. Relatively dangerous (safety parameters 2 & 4 or 5) | 22 | 33.3 |
| D. Dangerous (safety parameters 2 & 4 & 5) | 15 | 22.8 |
| Total | 66 | 100 |

The information collected from the current study can be used to distinguish the degree of intensification-extensification of suckler cow farms because they focus on their dependence on pastures and the relationship of animals with their living environment [5]. Such information, which concerns the use of land and determines the degree of intensification-extensification, are the total available pastures for this specific farming sector and the applied stocking rate. Other pastures characteristics with an important role in suckler cow farming are the prevailing vegetation and the provided pasture safety [6, 7]. In the present study, the area of public and privately-owned pastures, used for grazing by suckler cows, was used to calculate the stocking rate. In a similar study in Italy [6], they used the pastures area, managed or owned by a farm, while in the extensive and semi-extensive farming systems, studied in the Mediterranean zone, the total available area of pastures has been used for the estimation of stocking rate, which is used for parallel feeding of other species of farm animal species [8, 9].

In our study, the average value of the stocking rate was 0.7 LU/ha. The stocking rate in studies concerning suckler cow farms of [5], [10], and [11] was reached 0.4 L.U./ha, 1.7 L.U./ha and 0.43 L.U./ha, respectively. In all the above studies carried out in Spain, the value of the stocking rate was lower than the European average, probably because the pasture yields of grazing lands in southern Spain were lower than those of other geographical areas of Europe [5]. In this study, the low average value of stocking rate (0.7 L.U./ha) concerns all available pastures. However, the hen stocking rate was calculated based on the available grasslands (on average 48 ha for each holding) for the same farms, then its average value amounted to 3.08 L.U./ha. This value is much higher than the average in Greece, which amounts to 0.45 L.U./ha [12]. In terms of shrublands, phrygana, or partially wooded grazing lands, where the same land is used by other types of animals, they cannot be sufficiently utilized to meet the nutritional needs of cattle. This is due both to the complexity of utilization complexity area of these pastures from other species of animals, but also to the nutritional preferences of cattle, which are not adapted to the grazing of shrubby and woody plants [13].

The data analysis shows that the availability of pastures for suckler cow farmers is directly dependent on the population of all the different species of farm animals in each geographical area. Thus, it is clear that meeting the nutritional needs of suckler cows can no longer be based on existing available grazing lands unless their distribution on existing farms is modified. The distribution and management of public pastures are exercised by the administration of the R.U. in the application of the priorities given by the regulatory decisions of the M.R.D.F. It is, therefore, appropriate to prepare plans and studies for pasture management at the level of the R.U. with a clear record of grazing capacity and a representative recording of livestock, which live and feed in these areas. The above plans should take into account when allocating pastures that cattle can exploit for feed only on grasslands. Care should also be taken to upgrade the infrastructure in the pastures, such as watering cans and feeders for the collection of animals, the opening of rural roads, shelters for the protection of animals, fencing, etc.

The high frequency in presence of wild carnivores, such as bears and wolves, significantly increases predation risks, especially when it comes to the safety of young calves. Although the bear is not considered an aggressive animal, in our country bear attacks, have been reported on both calves and shepherds. Thus, the increased predation risks lead breeders to earlier weaning of calves and moving only adult cattle to pastures, which increases the cost of feeding in calves.

Furthermore, in inaccessible pastures, veterinary care is almost impossible to provide immediately, which increases the rate of animal losses.

## 4. Conclusions

From the above it can be concluded that the presence of cattle breeders or shepherds in the steep and dangerous pastures becomes mandatory, but according to Bernués et al. [8] finding shepherds is the most “scary” factor in the suckler cow sector. Also these people should be trained in dealing with difficult situations, such as veterinary care in the injury of an animal, in order to reduce animal losses.

The general conclusion that emerges from the study of grazing land exploitation from suckler cows is that their adequacy to meet cow’s

nutritional needs is seasonal (summer semester of the year) and completely variable in any increase in livestock in Central Macedonia Region. Their rational management and directed distribution by species of farm animals are considered to be critical to achieving better utilization. A key point in this direction is to overcome the distrust with which goat, sheep and cattle breeders face joint grazing and to assess the potential expected benefits of this alternative form of pasture use. In that case, technical studies for the assessment of the grazing material of these pastures should be done in order to avoid overgrazing.

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