



Research Article

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Assessment of grazing capacity in subalpine and alpine summer pastures of Gjirokastra district

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Abstract

The article analyzes the summer pastures of the habitats of the Çajupi, Nëmërçka, Murgana, Trebeshina, Dhëmbeli and the Luca mountain in Southern Albania. This research aims to establish on a scientific basis the problems of livestock breeding in subalpine and alpine summer pastures in the Gjirokastra district. After determining the test areas that would be analyzed, they were marked and, at the time of reaching the full vegetation for the pasture, the biomass of these plots was collected and it converted in dry biomass and, based on of the norms given in the part of the work methodology, the pasture capacity of sheep was determined for each pasture habitat taken into analysis. These results were compared with those known from local literature and experience, as well as with those currently practiced by the Forest and Pasture Directorates of the municipalities of this district.

Keywords: Pasture, sheep, pasture capacity, biomass, subalpine, alpine.

1. Introduction

The work for the realization of this study started in October 2023 and was extended until November 2024. Field expeditions began in April 2024 and extended until September 2024. From October to March, the necessary literature was collected and utilized, extracting from it all the necessary preliminary data on the initial state of the situation before the start of this study. During the months of September and October the data obtained from the material collected in these expeditions were processed, such as: Determination of grazing capacity; area/number of animals, determination of biomass and identification of forage plants with high nutritional value for livestock (Baldacci, 1899; Demiri, 1983).

The current use of these grazing habitats is based mainly on the experience and annual practice of regional livestock farmers or even on calculations made according to literature data in general terms but not derived from a proper study in this direction. So, this paper not only analyzes this process on a scientific basis for the first time, but also increases our guarantee of a safe process of providing a food base for small livestock, thus avoiding food collapses and damage in livestock. Livestock, as one of the main bases of providing human food in our country, is currently experiencing many difficulties that have arisen as a result of the country's socio-economic changes and, in this perspective, avoiding other negative risk factors for it, would lead to a more sustainable development of both its subalpine and alpine summer pasture habitats as well as to necessary amount of its food biomass itself (Malo, 2010).

The expedition movement plan includes spring, summer and autumn expeditions (April-October) according to the pasture itineraries:

- Murgana Mountain (up to 1500 m altitude);
- Çajupi Mountain (up to 1300 m altitude);
- Nemërçka Mountain, (up to 2300 m altitude);
- Trebeshina Mountain (up to 1920 m altitude);
- Dhëmbeli Mountain (up to 1298 m altitude);
- Wide Mountain (up to 1340 m altitude);
- Luca Mountain (up to 1433 m altitude);

2. Materials and methods

Biomass assessment in subalpine and alpine pastures of the Gjirokastra District was carried out through test areas selected according to the quadrat transect method, as well as the interpretation of aerial photos taken with a drone or camera.

The biomass analysis test plots were taken in 1 x 1 m format. This was achieved during field expeditions, which were carried out on Wide Mountain, Luca Mountain, Çajupi Mountain, Murgana Mountain, Dhëmbel Mountain, Nemërçka Mountain and Trebeshina Mountain (Fig. 1). The correction coefficient was estimated using GIS and aerial photos.

The Biomass calculation is performed according to the following example:

- Example: [2600 Kg/ha /dry matter: (2 kg dry matter/sheep/day x 150 days sheep on the pastures feeding)] x 0.8 (20% sustainability factor) = 6.8 sheep/ha;

- [4,3 sheep/ha x size of area x 0,6 (rock factor of 40% cover)] +3,5% (relief factor in the subalpine meadows) = total sheep (grazing capacity of the area).

VO: 1 - A sheep will eat 2 kg of dry grass per day; (20 - Stability factor)

2 - The conversion coefficient of the fresh mass of biomass to dry mass is 18-20% (We, in our calculations, have maintained the coefficient of 20% of the fresh mass taken as dry mass).

Based on Instruction No. 2, dated 20.7.2016 of the Ministry of Environment "On the technical criteria for the classification of pastures and meadows and the procedures for their allocation for grazing and mowing", Chapter III - "Technical requirements of

the use of pasture land for grazing”, Point 4. “The grazing starting time is determined in the contract according to the specific condition of the pasture and meadow vegetation: The under/point: a) for the grazing of small livestock – the grazing of livestock is permitted when the height of the grass has reached 8–10 cm.



3. Results and discussions

To carry out this study, we have utilized the archives of the Directorates of Pastures, Environment and protected areas in the municipalities of Gjirokastra, Libohova, Dropull, Tepelena, Memaliaj, Këlcyra and Përmeti. We have also obtained a series of data from the use of the “Regional Statistical Yearbooks” processed by the District Prefecture and INSTAT (Vjetari Rajonal Statistikor, 2023). The data found on the number of head of livestock that are bred at the national or regional level are given in the two tables below.¹

Tab. 1 - Number of head of livestock at national level and for the Gjirokastra district

Unit	Category	At a country level	Gjirokastra
For 1000 head of livestock	Sheep	1.480	169
	Milk sheep	1.116	140
	Goat	775	93
	Milk goat	599	81

¹ The table according to the Regional Statistical Yearbook [Districts and Municipalities] 2022, pp. 188-189.

Tab. 2 - Number of head of livestock at national level and for the Gjirokastra district in %

Unit	Category	At a country level	Gjirokastra
For 1000 head of livestock	Sheep	100	11
	Milk sheep	100	11
	Goat	100	12
	Milk goat	100	14

Tab. 3 - The summer pasture carrying capacity

District	Municipality	Type of pasture	Area in ha	Exploitation	Capacity of number of sheep	Capacity of number of goats	Capacity of number of cattle	Total capacity	Head of livestock/ha
Gjirokastra	Gjirokastra	Summer	%	33051	77725	506	0	78231	2.4
Gjirokastra	Tepele	"	%	19606	64107	5120	322	69549	3.5
Gjirokastra	Permet	"	%	11354	41011	4314	493	45818	4.0

The control points were randomly selected in an area of 1m² (1x1m) with a total distance of 1000 m, separated by 300 m from each other with a vertical spacing of 300 m (Fig.2-/b/c).





Fig. 2 - Working moments for determining test areas, harvesting and weighing biomass in the areas of subalpine and alpine pastures in several habitats such as:
a- biomass weighing in Dhëmbeli mountain;
b - determination of test areas in Murgana mountain;
c - determination of test areas in Çajupi mountain;
d - biomass harvesting in Luca Mountain;
e - biomass harvesting in Trebeshina mountain;
f - biomass weighing in Çajupi mountain, etc.;

In contact with representatives of the pasture directorates of the Gjirokastra district municipalities, regarding the study area, we received the following information about the pasture areas and the number of head of livestock currently being raised in these summer pastures (according to the respective mountains)²

3.1 Subalpine pastures at altitudes of 900 - 1500 m above sea level

- Dhëmbeli mountain = 1333 ha, grazing capacity 3614 head of livestock;
- Wide mountain = 1956 ha, grazing capacity 6058 head of livestock;
- Luca mountain = 1962 ha, grazing capacity 4087 head of livestock;
- Çajupi mountain = 3072 ha, grazing capacity 6091 head of livestock;
- Murgana mountain = 47 ha, grazing capacity 257 head of livestock;

3.2 Alpine pastures at altitudes of 1500 - 2300 m above sea level

- Trebeshina mountain = 1345 ha, grazing capacity 7151 head of livestock;
- Nëmërçka mountain = 2854 ha, grazing capacity 7726 head of livestock;

The data obtained for the amount of biomass for each test plot of the summer area pastures according to the mountains are:

a - On the Çajupi mountain (Fig. 2-/c/f):

On the test area no. 1 - Rich pasture. Harvested area 1x1 m = 1m². Amount of pasture mass as

fresh vegetation = 1,250kg;

On the test area no. 2 - Normal pasture. Harvested area 1x1 m = 1m². Amount of

² Agjencia Kombëtare e Mjedisit. (2013). Raporti për gjendjen e mjedisit 2012.

pasture mass as

fresh vegetation = 0.76 kg;

On the test area no. 3 - Stony pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. Amount of pasture mass as

fresh vegetation = 0.250 kg;

The average amount of dry biomass for the three test plots is: $[1.250 + 0.76 + 0.25] : 3 = 0.753 \times 0.2 = 0.1506 \text{ kg/m}^2$ (average). For one ha of pasture, it is $0.1506 \times 10000 = 1506 \text{ kg/ha}$. $[1506 : (2 \times 150) \times 0.7] = 5.02 \times 0.7 = 3.5 \text{ sheep/ha}$.

b- On the Murgana mountain (Fig. 2-/b):

On the test area no. 1 - Rich pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture mass

as fresh vegetation is 0.1 kg;

On the test area no. 2 - Normal pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture

mass as fresh vegetation is 0.907 kg;

On the test area no. 3 - Stony pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture mass

as fresh vegetation is 0.625 kg;

The average amount of dry biomass for the three test plots is: $[1.1 + 0.907 + 0.625] : 3 = 0.877 \times 0.2 = 0.175 \text{ kg/m}^2$. For one ha of pasture, it is $0.175 \times 10000 = 1750 \text{ kg/ha}$ $[1750 : (2 \times 150) \times 0.7] = 5.8 \times 0.7 = 4 \text{ sheep/ha}$.

c- On the Dhembeli mountain (Fig. 2-/a):

On the test area no. 1 - Rich pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of the pasture

mass as fresh vegetation is 1.1 kg;

On the test area no. 2 - Normal pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of the pasture

mass as fresh vegetation is 0.56 kg;

On the test area no. 3 - Stony pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of the pasture

mass as fresh vegetation is 0.09 kg;

The average amount of dry biomass for the three test plots is: $[1.1 + 0.56 + 0.09] : 3 = 0.58 \times 0.2 = 0.116 \text{ kg/m}^2$. For one ha of pasture it is $0.116 \times 10000 = 1160 \text{ kg/ha}$ $[1160 : (2 \times 150) \times 0.7] = 3.86 \times 0.7 = 2.7 \text{ sheep/ha}$;

d- On the Trebeshinë mountain (Fig. 2-/e):

In the test area no. 1 - Rich pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture mass as

ry matter is 0.375 kg;

In the test area no. 2 - Normal pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture mass

as dry matter is 0.200 kg;

In the test area no. 3 - Stony pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture mass

as dry matter is 0.125 kg;

The average amount of dry biomass for the three test plots is: $[0.375+0.2+0.125] : 3 = 0.23 \text{ kg/m}^2$. For one ha of pasture, it is $0.23 \times 10000 = 2300 \text{ kg/ha}$ [$2300 : (2 \times 150) \times 0.7$] = $7.6 \times 0.7 = 5.3 \text{ sheep/ha}$;

e - In Mali i Gjerë:

In the test area no. 1 - Rich pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture mass as

fresh vegetation is 1.1 kg;

In the test area no. 2 - Normal pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture mass

as fresh vegetation is 0.5 kg;

In the test area no. 3 - Stony pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture mass

as fresh vegetation is 0.35 kg;

The average amount of dry biomass for the three test plots is: $[1.1+0.5+0.35] : 3 = 0.65 \times 0.2 = 0.13 \text{ kg/m}^2$. For one ha of pasture it is $0.13 \times 10000 = 1300 \text{ kg/ha}$ [$1300 : (2 \times 150) \times 0.7$] = $4.3 \times 0.7 = 3 \text{ sheep/ha}$;

f - On Mount Lucës (Fig. 2-/d):

On test area no. 1 - Rich pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture mass as

fresh vegetation is 1.066 kg;

On test area no. 2 - Normal pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture mass as

fresh vegetation is 0.5 kg;

On test area no. 3 - Rocky pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture mass as

fresh vegetation is 0.167 kg;

The average amount of dry biomass for the three test plots is: $[1.066+0.5+0.167] : 3 = 0.57 \times 0.2 = 0.114 \text{ kg/m}^2$. For one ha of pasture it is $0.114 \times 10000 = 1140 \text{ kg/ha}$ [$1140 : (2 \times 150) \times 0.7$] = $3.8 \times 0.7 = 2.6 \text{ sheep/ha}$;

g - On the Nëmërçka Mountain:

In the test area no. 1 - Rich pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture mass as

fresh vegetation is 1.1 kg;

In the test area no. 2 - Normal pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture mass

as fresh vegetation is 0.75 kg;

In the test area no. 3 - Stony pasture. Harvested area $1 \times 1 \text{ m} = 1 \text{ m}^2$. The amount of pasture mass

as fresh vegetation is 0.4 kg;

The average amount of dry biomass for the three test plots is: $[1.1 + 0.75 + 0.4] : 3 = 0.75 \times 0.2 = 0.15 \text{ kg/m}^2$. For one ha of pasture it is $0.15 \times 10000 = 1500 \text{ kg/ha}$ $[1500 : (2 \times 150) \times 0.7] = 35 \times 0.7 = 3.5 \text{ sheep/ha}$;

4. Conclusion

Based on the above calculations, we obtained these results (Tab. 4,5,6):

Tab. 4- Pasture capacity according to literature and study results in the area in question

Nr	Pastures according to the mountains	Pasture capacity for ha/year	
		According to the literature	From the study
1.	Mountain of Çajupi	2 sheep/ha	3,5 sheep/ha
2.	Mountain of Murgana	5,4 sheep/ha	4 sheep/ha
3.	Mountain of Dhëmbeli	2,7 dele/ha	2,7 sheep/ha
4.	Mountain of Trebeshina	5,3 sheep/ha	5,3 sheep/ha
5.	Wide Mountain	3 sheep/ha	3 sheep/ha
6.	Mountain of Luca	2 sheep/ha	2,6 sheep/ha
7.	Mountain of Nemërçka	2,7 sheep/ha	3,5 sheep/ha

Tab. 5 - Amount of biomass in kg/m² and kg/ha in the pastures in question

N.o.	Pastures according to the mountains	Amount of biomass in kg.	
		For m ² of surface area	For m ² of surface/ha
1.	Mountain of Çajupi	0,1506	1506
2.	Mountain of Murgana	0,175	1750
3.	Mountain of Dhëmbeli	0,116	1160
4.	Mountain of Trebeshina	0,23	2300
5.	Wide Mountain	0,13	1300
6.	Mountain of Luca	0,114	1140
7.	Mountain of Nemërçka	0,15	1500

Tab. 6 - List of the most nutritious forage plant species in the summer pastures of the Gjirokastra Region

Types of forage plants with the most nutritional value			
No.	Name in Latin	No.	Name in Latin

1	Agrostis capillaris	12	Lotus corniculatus
2	Alopecurus pratensis	13	medicagolupulina
3	Bromus hordeaceus	14	Onobrychis vicifolia
4	Cynodon dactylon	15	Trifolium medium
5	Dactylis glomerata	16	Trifolium repens
6	Festuca pratensis	17	Trifolium pratense
7	Holcus lanatus	18	Vicia craca
8	Lolium perenne	19	Plantago lanceolata
9	Phleum pratense	20	Rumex pulcher
10	Anthylis vulneraria	21	Taraxacum officinale
11	Astragalus onobrychis		

By comparing the data obtained from the study with those found in the literature, in some cases, a discrepancy in the values of pasture carrying capacity is observed, such as:

On the Çajupi, Luca and Nemërçka mountains the grazing capacity found is higher than that given in the literature. For Dhëmbeli mountain, Trebeshina mountain and Wide Mountain, the values match completely. Only on Murgana mountain does our data show that the grazing capacity is lower. These results are related to the lack of genuine scientific studies in this field. This study is also influenced by its extension in a period of only 1 year. Its extension in a time of only 1 year also has an effect on this study. Longer-term research for several consecutive years would give us a more original result. From the research in the literature used we did not find any practice or data for estimating biomass in these areas. Even specialists in the field have based many facts on the experiences of local shepherds. Of the species with the most nutritional value for livestock, we identified 21 species.

5. Recommendations

The floristic composition of the subalpine and alpine pastures of the Gjirokastra District constitutes a natural value that must be preserved and developed through the undertaking of other studies, not only to complement the study of biomass and pasture capacity, but also to see its progress under conditions of climate change and human impact. Based on the data from this project, increased control by the Directorates of Forests and Pastures over overgrazing phenomena can be achieved, by planning grazing after the flowering phase of various plants in order to enable the production of seeds of herbaceous plants and avoid grazing during the seedling stage. Increasing vigilance against fires and imposing sanctions on shepherds who continue to consider setting fire to pastures as something that clears the pastures of thorns and tough weeds (a phenomenon particularly widespread in the pastures of Wide Mountain and Sotira mountain). The subalpine and alpine pastures had many stones. This requires their cleaning and arrangement as they occupy a considerable

area in these pastures. The study in question would be productive to be repeated in cooperation between the Municipal Forest and Pasture Directorates and the Department of SHBMU, based on the considerable experience already gained by the latter. It would be good if this study was also carried out for natural winter pastures, thus covering the year-round pasture breeding of small livestock.

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