

# Studies Concerning the Productivity and Quality of Permanent Grasslands in the Caraş-Severin County (Romania)

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## Abstract

Study results show that over 70% of the permanent grasslands are affected by soil acidity and moisture excess. In addition, 54% of the floristic structure of these grasslands is made up of invasive species of no value as fodder plants. Among these species, (common) bracken (*Pteridium aquilinum* (L.) Kuhn) has spread extensively these 20 years, covering about 20% of the floristically degraded grassland areas.

**Keywords:** area, invasive vegetation, limiting factors, permanent grassland

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## 1. Introduction

Permanent grasslands, covering about 5,000,000 ha, are one of the most valuable resources of our country. From this point of view, Romania ranks fourth among E.U. countries, i.e. 6.5% of the total area of grasslands, and 0.22 ha per capita compared to the E.U. mean, i.e. only 0.15 ha per capita.

Studies carried out these last three decades abroad and in Romania show that permanent grassland areas and their broad species diversity in permanent interconnection with natural and anthropic factors can be managed within a multifunctional system that focus on both their economic and social value, and on their sustainability [1 – 5].

The paper points out the share of natural factors limiting productivity and quality of permanent grasslands in the Caraş-Severin County (Romania).

## 2. Materials and methods

Studies concerning the quantification of agronomic and zootechnical value of permanent grassland areas in the Caraş-Severin (Romania) are were based on the following research methods: general observation, statistic data comparison, *in situ* measurements, and assessment of economic potential.

The evolution of grassland areas and of the number of animals was done by processing annual statistic data supplied by the Office for agriculture and rural development of the Caraş-Severin County between 2000 and 2011.

Measuring biomass production on permanent grasslands was done based on our own results of annual harvesting in early July and late September. The measurements were made in 4 locations for each of the following altitude segment: 150-300 m, 300-500 m, 500-1,000 m, 1,000-1,500 m, and above 1,500 m. Production results of the *in situ* measurements were compared to the results of other researchers which allowed us to finally structure 3 green material production

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classes: <1 t/ha DM, 1-2 t/ha DM, and 2-3 t/ha DM.

Animal load of permanent grasslands was measured in two ways:

- grazing capacity compared to animal numbers and to grassland areas;
- grazing capacity compared to the potential production of the grasslands and to the duration of the grazing period.

### 3. Results and discussion

Grasslands in the Caraş-Severin County (Romania) represent over 70% of the structure of the agricultural land: they could be one of the

most important natural assets if their potential were valorised. These grasslands also rank second in area in Romania, after the Harghita County.

Statistics supplied by the Caraş-Severin County Office for Agriculture show that permanent grasslands now cover 250,865 ha, of which 179,281 ha (72%) are considered pastures and 71,584 ha (28%) are considered hay-making fields. As far as the type of ownership is concerned, only 0.2% is public property grasslands; the rest of 99.8% are private property of which 57% belong to the territorial administrative units (communes, etc.) and 43% belong to individuals (Table 1).

**Table 1.** Permanent grassland areas in the Caraş-Severin County (2011)

UM	GENERAL TOTAL	Of which:					
		Public property			Private property		
		Total	Of which:	Total	Of which:		
			State property		Territorial administrative units	Individuals	
Total grasslands	ha %	250865 100	502 0.2	502 0.2	250363 99.8	146211 58.4	104152 41.6
Pastures	ha %	179281 72	361 72	361 72	178920 71.4	145104 99.3	33816 32.5
Hay-making fields	ha %	71584 28	141 28	141 28	71443 28.6	1107 0.7	70336 67.5

The structure of permanent grasslands depending on the forms of relief shows that in the Caraş-Severin County hill grasslands cover the largest area, i.e. 100,346 ha (40%), followed by mountain

grasslands covering 90,312 ha (36%), and by plain grasslands covering 60,207 ha (24%). From the point of view of ownership, individuals own the largest mountain grassland area (62%) (Table 2).

**Table 2.** Permanent grassland areas in the Caraş-Severin depending on relief (2011)

Ownership structure	Plain area		Hill area		Mountain area		
	ha	%	ha	%	ha	%	
GENERAL TOTAL,	60,207	24	100,346	40	90,312	36	
Of which:							
Public property	Total, of which:	602	1	0	0	0	0
	State property	602	1	0	0	0	0
Private property	Total, of which:	59,605	99	100,346	100	90,312	100
	Territorial administrative units	39,637	66.5	73,353	73.1	33,508	37.1
	Individuals	19,968	43.5	26,993	26.9	56,804	62.9

The most restrictive natural factors in grassland culture in the Caraş-Severin County are soil acidity, moisture excess, erosion share, and landslides. As we show in Table 3 below, only 21% (52,682 ha) are grassland areas not affected by these restrictive factors, the rest of 79% being

grassland areas more or less impacted by these factors: 68% (170,588 ha) cover high acidity soils, 6% (15,052 ha) cover excess-moisture soils, 3% (7,526 ha) cover eroded and landslide soils, and 2% (5,017 ha) cover broken stone lands (in flooding meadow areas) or rock-surfaced soils.

**Table 3.** Permanent grassland structure in the Caraş-Severin County depending on natural limiting factors (2011)

Ownership structure	No restrictions		Acidity		Moisture excess		Erosion and landslide		Broken stones, detritus, rock surface		
	ha	%	ha	%	ha	%	ha	%	ha	%	
GENERAL TOTAL, of which:	52,682	21	170,588	68	15,052	6	7,526	3	5,017	2	
Public property	Total. of which: 264	0.5	341	0.2	0	0	0	0	0	0	
	State property	264	0.5	341	0.2	0	0	0	0	0	
Private property	Total. of which: 52,419	99.5	170,247	99.8	15,052	100	7,526	100	5,017	100	
	Territorial administrative units	33,023	63	97,040	57	8,580	57	3,838	51	4,064	81
	Individuals	19,395	37	73,207	43	6,472	43	3,688	49	953	19

These grassland areas need special improvement measures to improve floristic structure and to increase production potential.

The very large share (54% of the total area) of invasive grassy and woody species is the greatest threat for the grasslands in the Caraş-Severin County, which reduces dramatically species diversity of the floristic structure of the vegetal cover. As a result of observations and studies in the field, we could see that the largest shares of invasive species are as follows: 20% of the grassland areas are covered by (common) bracken (*Pteridium aquilinum* (L.) Kuhn), 15% are represented by rushes (*Juncus* sp.), docks and sorrels (*Rumex* sp.), false helleborine (*Veratrum album* L.), 10% are grasslands invaded by semi-brushy woody vegetation – blackthorn (*Prunus spinosa* L.), common hawthorn (*Crataegus monogyna* Jacq.), dog rose (*Rosa canina* L.),

common hazel (*Corylus avellana* L.), etc.), 4% are grasslands of tufty hair-grass (*Deschampsia caespitosa* (L.) P.Beauv), and 5% are grasslands covered by mole hills (Table 4). If these grassland areas are not included in a special technological improvement programme, in 10-15 years the valuable grassland area will decrease to 30-40% of the present area.

While assessing grassland production level, we need to take into account punctual natural conditions and, in particular, the form of relief of their location. In general, biomass production decreases proportionally with altitude, but this is valid for mountain grassland areas between 800 and 1,800 m altitude. In the hill area, with better conditions of precipitations and temperature, production is higher than in the plain area or in the mountain area.

**Table 4.** Structure of permanent grasslands in the Caraş-Severin County invaded by invaluable grassy and woody vegetation

Specification	ha	% (of the total grassland area)
TOTAL of invaded area, of which:	13,5467	54
By (common) bracken	50,173	20
By rushes, docks and sorrels, false helleborine, etc.	37,630	15
By semi-brushy woody vegetation	25,086	10
By tufty hair-grass ( <i>Deschampsia caespitose</i> (L.) P.Beauv)	10,035	4
By mole hills	12,543	5
TOTAL of permanent grassland area	250,865	100

The measurements we have made at different altitudes (between 200 and 1,800 m) in several points we could see that 21% of the permanent grassland area of the Caraş-Severin County produced below 1 t/ha of dry matter, and that 62% of the total area can produce between 1 and 2 t/ha

DM. Higher production grassland areas, between 2 and 3 t/ha DM, cover only 17%. Levelled mean production of the grassland areas in the Caraş-Severin County is 1.45 t/ha DM (about 7.22 t/ha green matter) (Table 5).

**Table 5.** Estimated green matter production from permanent grassland areas in the Caraş-Severin County

Dry matter	Areas	
	ha	% (of the total area)
<1 t/ha	52,680	21
1-2 t/ha	155,536	62
2-3 t/ha	42,649	17

Levelled mean production: 1.45 t/ha DM (~7.22 t/ha green matter)

As for the number of animals per grassland area unit, this is an important parameter in the assessment of use degree in grassland economics. If we refer to the total number of bovines, sheep, and goats, on one hand, and the area of grassland for fodder production – 194,420 ha (except for the area covered by (common) bracken), on the other

hand, there were 0.41 large cattle units/ha in 2011. If we refer to the number of animals and to the grassland potential production, there were 0.80 large cattle units/ha in 2011, i.e. 95.1% more than in the first case. For such a size of the large cattle units/ha, potential animal numbers could reach 63,853 in bovines (85.5% more than the present number), and 605,934 in sheep and goats (105.3% more than the present number) (Table 6).

**Table 6.** Load and animal numbers on grassland areas in the Caraş-Severin County

Specification	Animal load compared to animal numbers in 2011 and grassland areas	Animal load and animal numbers compared to the grassland potential production
Large cattle units/ha	0.41	0.80 (+95.1%)
Bovines (all categories)	34,419	63,853 (+85.5%)
Sheep + goats (all categories)	295,145	605,934 (+105.3%)

<sup>\*)</sup> Grassland area for fodder production (no (common) bracken and surfaced rock): 194,420 ha

#### 4. Conclusions

As a result of our studies, observations, and measurements concerning the agro-zootechnical value of the permanent grasslands in the Caraş-Severin County (Romania), we could draw the following conclusions:

- from an orographic point of view, grassland areas in the Caraş-Severin County are located as follows: 24% in the plain area, 40% in the hill area, and 36% in the mountain area;
- as for natural limiting factors, grassland areas can be grouped as follows: 21% no restriction soils, 68% on acid soils, 6% on moisture-excess soils, 3% on erosion and landslide soils, 2% on alluvial and surfaced-rock soils;
- potential productivity of the grasslands is as follows: 21% of the total area can produce <1 t/ha DM; 62% produce between 1 and 2 t/ha DM; 17% produce between 2 and 3 t/ha DM;
- mean animal load on used grasslands is 0.41 large cattle units/ha (in 2011), while potential animal load is 0.80 large cattle units/ha.

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