THE INFLUENCE OF THE ALTITUDE GRADIENT ON GRASSLANDS FEATURES

Ionel SAMFIRA*, Alexandru MOISUC*, Veronica SĂRĂȚEANU*, Cristian BOSTAN*, Ciprian Emil HAŞ*

***Banat's University of Agricultural Sciences and Veterinary Medicine – Timişoara, Romania**
Calea Aradului, no. 119, 300645 Timişoara, Romania, Sionel1969@yahoo.com

***Abstract:** Studies regarding the gradient altitude in the grassland field begins in our country in the last twenty years. The first applications regarding the altitude gradients dynamics were done at 100m intervals there being determined the differences of the air temperature as thermal gradient and the rainfalls amount as hydric gradient. In the mountain grassland has been observed great differences in the structure of vegetation induced by altitude and relief formations. At the same time was illustrated by the researches in this field, the great variability determined by altitude to the abiotic life condition of the grassland vegetation. The paper aim is to show the altitude gradient influence on the features of some grazed grasslands as: the dynamics of the dominant vegetation community, the dynamics of the pastoral value, and aspect regarding the vegetation cover biodiversity. The paper analyses the influence of the elevation gradient on the mountain grasslands from Ţarcu - Muntele Mic Massif. The researches were carried on mountain pastures between 1000-1800m. The research methods used were the quadrate point method and the biodiversity Shannon-Weaver Index. We consider the study of the interrelation between the altitude gradient and the main features of the grassland as being important for the vegetation analyses from the studied area. Following the results obtained in these researches we consider as important the possibility to improve the meadows management in the direction of the increase of the yield and quality of the vegetation.*

***Key words**: elevation gradient, mountain grassland, vegetation, biodiversity*

INTRODUCTION

Ţarcu-Muntele Mic is one of the greatest mountain massifs from the Carpathians, the surface of the area being about 1350 square kilometres and having 10 picks with the altitude over 2000m.

After the researches of HUA (2004) in Hubei province from China, the result showed a hump-shaped distribution , with high species richness in the middle elevation range from 800 to 1400 m. The maximum value of species richness was observed at 1000 m, and this is accounted for about 52 % of the total number found in Hubei province.

Much of the biological richness in MBRs results from the interaction of climatic contrasts and gravitational forces along elevational gradients. External forces such as atmospheric change and human land use interact with these gradients, and result in distinct landscape patchiness, ie mosaics of land cover types within and across elevational belts. The management of MBRs influences land use and land cover, which affects biodiversity and ecosystem processes, both of which provide goods and services to society. Due to their broad environmental and biological diversity, MBRs are ideally suited for global change research and will be increasingly important in illustrating biodiversity conservation (BECKER *et al.*, 2007).

Elevational patterns of species richness are not uniform and can be divided in to two types. The values of species richness are higher in the lowlands and then decrease monotonically with increasing elevation in the tropical mountains. Species richness has unimodal patterns with a bias towards high values in the lower half of the elevation gradients in the subtropical mountains. The patterns of species density are the same as that in species richness along elevation gradients (YANG *et al.*, 2007).

MATERIAL AND METHODS

This study is realised during 2007-2009 Muntele Mic Massif (1806m height) Cara□-Severin County (western Romania) exploited by grazing. The data were collected after quadrate point method (DAGET-POISSONET, 1971). The researches were carried between 1000-1800m at every 100m altitude intervals. The research methods used were the quadrate point method and the biodiversity Shannon-Weaver Index. There were performed vegetation surveys and the collected data were used for the calculation of different parameters of the grassland vegetation as are: floristic composition parameters and Shannon-Wiener index (H') using natural logarithms (JURKO & FAJMONOVA cited by CRISTEA, 1991) and pastoral value (VP). The pastoral value (VP) was calculated after the formula:

$$VP = \sum_{i=1}^{n} (VS_i x IS_i)/5 \quad (1)$$

where:
VP – pastoral value (0 – 100 scale);
IS_i – specific index;
i – species;
n – species number;
5 – maximal mark accorded;
VS – specific abundance estimation as specific volume calculated after the formula:

$$VS\% = (C_i/C_{tot})x100 \quad (2)$$

where:
VS% = specific volume;
C_i – number of coefficients given to *i* species;
C_{tot} – total number of given coefficients (MOISUC *et al.*, 2001).

RESULTS AND DISCUSSIONS

In table 1 is represented the botanical composition of the grassland surfaces studied on the 1000-1800m altitude interval.

Table 1

Botanical composition of the grassland vegetation from Muntele Mic Massif on 1000-1800m altitude interval

Nr. crt.	Species	Altitude (m)								
		1000	1100	1200	1300	1400	1500	1600	1700	1800
Grasses										
1	*Agrostis tenuis*	3	3	3	2	2	1	1	+	+
2	*Festuca rubra*	2	2	1	3	3	3	2	2	1
3	*Cynosurus cristatus*	1	1	1	+	+	+	+		
4	*Phleum pratense*	+		+	1	+				
5	*Briza media*	+	+							
6	*Trisetum flavescens*	+			+					
7	*Anthoxanthum odoratum*	+	+	+	+	+	+	+		
8	*Brachipodium pinnatum*	+	+			+				
9	*Poa pratensis*	+	+	1	+	1			+	
10	*Festuca pratensis*	+		+		+				
11	*Holcus lanatus*	+	+	+		+				
12	*Calamagrostis arundinacea*	+	+	+	+	+				
13	*Deschampsia caespitosa*					+	+	+		

Nr. crt.	Species	Altitude (m)								
		1000	1100	1200	1300	1400	1500	1600	1700	1800
14	*Nardus stricta*						2	3	4	5
	Cyperaceae and Juncaceae									
15	*Carex leporina*									
16	*Luzula campestris*	+	+							
	Legumes									
17	*Trifolium repens*	+	+	+	+	+	+	+	+	+
18	*Trifolium medium*	+	+	+	+	+				
19	*Trifolium montanum*				+		+	+		
20	*Medicago lupulina*	+	+	+	+	+	+	+	+	
21	*Medicago falcata*	+		+						
22	*Lotus corniculatus*	+	+	+	+	+	+	+	+	+
23	*Dorycnium pentaphyllum*	+	+		+	+	+		+	
24	*Lathyrus pratensis*	+	+							
25	*Genista sagittalis*	+	+	+	+					
26	*Genista tinctoria*	+		+						
27	*Anthyllis vulneraria*					+		+	+	+
	Other botanical families									
28	*Prunella vulgaris*	+	+	+	+	+	+	+	+	+
29	*Potentilla argentea*	+	+	+	+	+	+	+	+	+
30	*Plantago media*	+	+	+	+	+	+	+	+	+
31	*Plantago lanceolata*	+	+	+	+	+	+		+	
32	*Galium verum*	+		+	+					
33	*Leontodon autumnalis*	+	+	+	+	+	+	+	+	
34	*Hieracium pilosella*	+	+	+	+	+	+	+	+	+
35	*Daucus carota*	+	+	+	+	+	+		+	
36	*Achillea millefolium*	+	+	+	+	+	+	+	+	+
37	*Rumex crispus*	+		+	+	+	+			
38	*Rumex acetosella*	+	+	+	+	+	+	+	+	+
39	*Dipsacus laciniatus*		+	+	+	+				
40	*Carlina vulgaris*	+	+		+	+		+	+	
41	*Carlina acaulis*					+		+	+	+
42	*Pimpinela saxifraga*						+		+	+
43	*Polygala vulgaris*			+	+	+	+	+	+	+
44	*Primula veris*					+		+		
45	*Thymus collinus*			+		+	+	+	+	+
46	*Euphrasia stricta*	+	+	+	+	+	+	+	+	+
47	*Centaurium umbellatum*	+	+	+	+	+	+	+	+	+
48	*Taraxacum officinale*	+	+	+	+	+				
49	*Ranunculus repens*					+			+	+
50	*Ranunculus sardous*	+	+		+					
51	*Lychnis flos cuculi*	+			+					
52	*Alchemilla vulgaris*					+	+	+	+	+
53	*Potentilla reptans*	+		+	+					
54	*Mentha pulegium*		+		+		+	+	+	+
55	*Agrimonia eupatoria*	+	+	+	+	+	+	+	+	+
56	*Euphorbia cyparissias*	+	+		+	+	+		+	
57	*Vacciunium vitis-idaea*						+	+	+	+
58	*Campanula abietina*	+		+		+	+	+	+	+
	Shrubs and trees									
59	*Crataegus monogyna*	+	+	+	+		+	+		+
60	*Rosa canina*	+		+	+		+	+	+	
61	*Pirus piraster*		+			+				

The analysed parameters of the vegetation analysed here are the Shannon-Weaver biodiversity index and pastoral value. Those were analysed depending by the altitude intervals.

In figure 1 is represented the dynamics of biodiversity index of grassland vegetation from Muntele Mic Massif on 1000-1800m altitude interval. As is shown in the graph, the Shannon – Weaver index is decreasing by altitude, the decrease being more abrupt after the 1300m level, then decreasing more the species number from the vegetation cover.

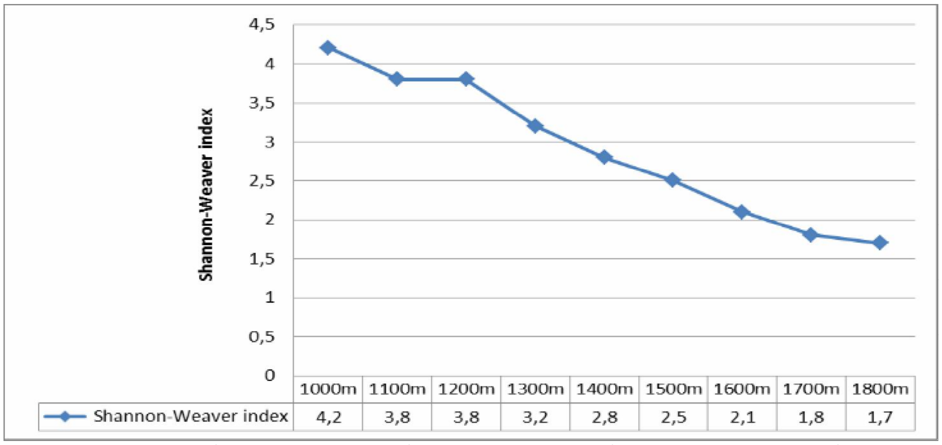

Figure 1: Dynamics of biodiversity index of grassland vegetation from Muntele Mic Massif on 1000-1800m altitude interval

In figure 2 was represented the evolution of the pastoral value index of grassland vegetation from Muntele Mic Massif on 1000-1800m altitude interval. From this point of view, in the analysed relief formation the pastoral value is good between 1000-1200m, medium at 1300m, satisfactory at 1400-1500m and poor between 1600-1800m.

In the case of the pastoral value, the decrease became more powerful from 1400m altitude level.

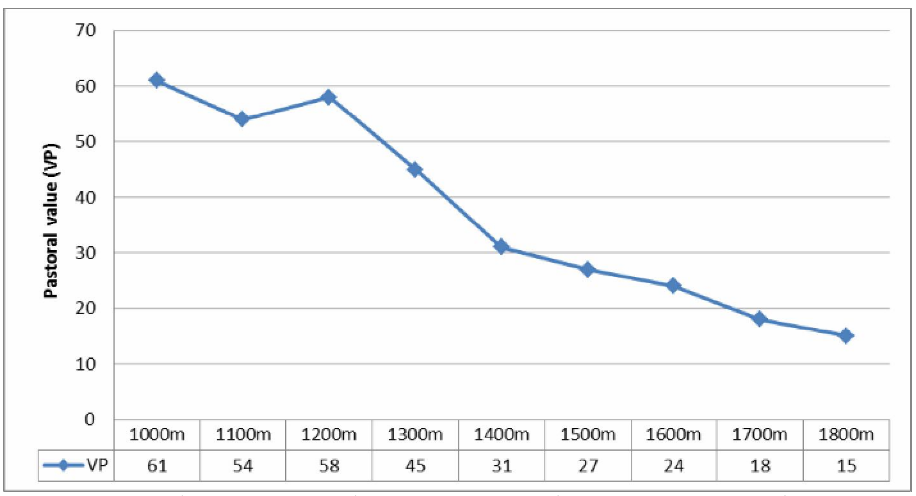

Figure 2: Dynamics of pastotoral value of grassland vegetation from Muntele Mic Massif on 1000-1800m altitude interval

CONCLUSIONS

The results regarding the influence of the altitude gradient on grassland vegetation from Muntele Mic Massif on the 1000-1800m altitude interval show that the altitude has great influence on Shannon-Weaver biodiversity index and on pastoral value index. Thus, the greatest values calculated for the vegetation parameters mentioned before were found at the 1000-1300m levels, the evolution trend of those being to decrease.

BIBLIOGRAFY

1. ARSENE G.G., 2003 - Fitocenologie şi vegetaţia României. Solness. Timişoara, 78 p.
2. BECKER A., C. KÖRNER, J.-J. BRUN, A. GUISAN, U. TAPPEINER, 2007 - Ecological and Land Use Studies Along Elevational Gradients. Mountain Research and Development 27(1), p. 58-65.
3. CRISTEA V., 1991 - Fitocenologie şi vegetaţia României. Îndrumător de lucrări practice. Babeş-Bolyai University. Cluj-Napoca. 149 p.
4. HUA, Y., 2004 – Distribution of plant species richness along elevation gradient in Hubei Province, China, International Institute for Earth System Science, Nanjing University.
5. MARUŞCA, T., 2001 – Elemente de gradientică şi ecologie montană, Editura Universităţii Transilvania din Braşov.
6. MOISUC A., SAMFIRA I., CARRERE P., 2001 - Pajişti naturale şi exploataţii ecologice, Editura Agroprint Timişoara.
7. MOISUC A., I. SAMFIRA, HORABLAGA M., COJOCARIU LUMINIŢA., 2002, Interrelaţia compoziţie floristică – valoare pastorală a unor pajişti din Banat, Sesiunea anuală omagială „80 de ani de la naşterea Prof.dr.doc.şt. Iulian Drăcea", vol.XXXIV, p.207-214.
8.YANG L., YIPING1 Z, DAMING H., MIN C., HUA Z., 2007 – Climatic control of plant species richness along elevation gradients in the Longitudinal Range-Gorge Region, Chinese Science Bulletin, vol. 52 (Supp. II), p. 50-58.