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THE RELATIONSHIP BETWEEN THE STRUCTURE OF GRASSLANDS FROM THE NORTH-EASTERN SLOPE OF THE VLĂDEASA MASSIF AND SOCIO-ECONOMIC ACTIVITIES

Gheorghe COLDEA, Liviu FILIPAŞ, Sorina FĂRCAŞ, Adrian STOICA, Tudor URSU, Ana-Maria POP
Institute of Biological Research Cluj-Napoca
48, Republicii str., **RO-400015 Cluj-Napoca, Romania**
e-mail: icb@cluj.astral.ro

Abstract: In this article we present the spatial distribution of plant communities from the north-eastern slope of the Vlădeasa massif, mapped at a 1:25000 scale, the most important environmental factors involved in the determination of the structural variability of grassland, as well as the relationship between their structure and socio-economic activities. The results from the canonical correspondence analysis (CCA) identify the presence of water and nitrogen in the soil as the main factors involved in the determination of the pastures' eco-coenotic variability. Nitrogen content in the soil is directly influenced by socio-economic activities, respectively by the different use of the fields (pastures or hay meadows). As a result, the phytodiversity of plant communities is influenced by their management. The highest phytodiversity is that of the *Poo-Trisetetum flavescentis* association, which is maintained artificially by traditional land use (periodical fertilization), depending on the quantity of hay that is needed, while the lowest phytodiversity is that of the *Violo declinatae-Nardetum* association, used as a pasture.

Key words: montane pastures, phytodiversity, CCA Analysis, socio-economic activities

Introduction

The semi-natural grasslands from the sub-alpine area are the habitats with the highest plant diversity in Europe (Kull and Zobel, 1991). Their areas are continuously diminishing because of abandonment of practices that led to their appearance or because of changes in their management.

Numerous studies report a significant decrease in biodiversity correlated with changes in traditional land use practices (Pimm *et al.*, 1995; Hannah *et al.*, 1995; Michelsen, 2003), with the decline of socio-economic activities in the region (Austrheim *et al*., 1999), or by their intensification (Vandvik and Birks, 2002).

In this study we have identified in the field the plant communities and delimited their areas in order to draw the vegetation map at a 1:25000 scale for the north-eastern slope of the Vlădeasa massif. Also, by multivariate analysis of data collected in the vegetation period of the year 2007, we have sought to reveal the relationships between the floristic structure of pastures, environmental factors and socio-economic activities.

Materials and Methods

The studied perimeter is located on the north-eastern slope of the Vlădeasa Massif (Apuseni Mountains) and includes the lower basin of Valea Hențului. Here, in the Western part of Cluj county, there are 6 rural localities (Bologa, Traniş, Valea Drăganului, Vişag, Săcueu, Rogojel) whose number of inhabitants varies between 362 and 1735. Like in most mountain settlements, the range of socio-economic activities is dominated by livestock raising (sheep and cattle).

The vegetation units for mapping have been established by doing releves in 1 square kilometer grid cells.

In order to highlight the relationship between certain environmental variables and the floristic composition of pastures from the north-eastern slope of Vlădeasa massif, multivariate data analysis has been used. From the ordering methods described in literature (Hill and Gauch, 1980, Ter Braak, 1986, 1987, Jackson, 1993), *Canonical Correlation Analysis* (CCA) was used. This method of direct data ordering was used because through the previous running of the *"Detrended" Correlation Analysis* (DCA-Hill and Gauch, 1980) the gradient length exceeded 4 SD units, which indicates a unimodal response of species to/versus the environmental factors (Ter Braak, 1987, Jackson, 1993; Cristea *et al.*, 2004).

Two input matrices have been devised for ordering: the main releves-species matrix (83 releves with 213 species) and the secondary matrix, releves-environment variables (83 releves with 12 variables). The following quantitative variables (Persson, 1981; Dzwonko and Loster, 1990) have been introduced in the secondary matrix: 1. vegetation cover (*Sum_Ad*), 2. altitude (*Alt*), 3. exposition (*Exp*), 4. slope (*S*), 5. longitude (*Long*), 6. latitude (*Lat*), the average indicator value in each releve of the plant species for: 7. light (*L*), 8. soil moisture (*U*), 9. temperature (*T*), 10. soil reaction (*R*), 11. preference for soil nitrogen (*N*), and a qualitative variable: 12. land use practice/mode (*Lan_U*). Their significance has been submitted to the Monte Carlo test for a level of 9,999 permutations, thus testing the null hypothesis of no existing relationship between the selected variables and the pastures floristic composition.

From the many extant diversity indices, the Shannon-Weaver (H) index has been chosen, being probably the most used of them all (Tothneresz, 1995, Smith and Wilson, 1996; Cristea and Denaeyer, 2004; Cristea *et al*., 2004). This index was calculated for each releve in part by importing the releves in the program JUICE 6. 5. 31 (Lubomir and Jason, 2006). The value of the H index was used as a co-variable in the CCA analysis. Vegetation cover was calculated by summing the abundance-dominance indices for each releve. The indicator species value in relation to the major ecological indices (UTRNL) was taken after Ellenberg (1992) and calculated on the basis of the abundance-dominance index of each species from each sampling spot

CCA analysis was performed by entering the data in the CANOCO 4.5 program (Ter Braak and Smilauer, 2002)

Results

Based on the syntaxonomic analysis of field releves, by correlating regional characteristic species and local dominant species, 16 mapping units of vegetation have been distinguished at the 1:25.000 scale (Fig. 1). Of these, 10 are herbaceous plant communities (Table 1).

CCA analysis highlights the fact that the first two axes of the ordering area are the most important with axis 1 explaining most of the floristic variability according to the variables considered.

Considering the length of the vectors (representing the analyzed variables) and their projections it can be seen that axis 1 is connected to an ecological gradient directed by soil moisture and nitrogen richness, while axis 2 can be attributed to an altitudinal gradient. Longitude and latitude have not proved to influence the floristic composition and plant species diversity of the pastures due to the large scale of the investigated area.

Table 1: The floristic structure of grassland communities from the study area.

Legend: ***Fes-A*** – *Festuco rubrae-Agrostietum capillaris*; ***Arr-e*** – *Arrhenatheretum elatioris*; ***Poo-T*** – *Poo-Trisetetum flavescentis*; ***Vio-N*** – *Violo declinatae-Nardetum strictae*; ***Gen-N*** - *Gentianello lutescentis-Nardetum strictae*; ***Ger-F*** – *Geranio-Filipenduletum*; ***Mol-c*** – *Molinietum caeruleae*; ***Bot-i*** – *Botriochloetum ischaemi*.

Community type	***Fes-A***	***Arr-e***	***Poo-T***	***Vio-N***	***Gen-N***	***Ger-F***	***Mol-c***	***Bot-i***
No. of releves	48	5	12	5	5	1	1	1
Area (m²)	25	25	25	25	25	25	25	25
Altitude (m)	583-1300	534-612	540-1076	1000-1550	671-1095	620-1128	752	700
Constancy (%)	K (%)	K (%)	K (%)	K(%)	K (%)	-	-	-
Abundance-dominance	-	-	-	-	-	AD	AD	AD
Agrostis capillaris	100,0	0,0	66,7	100,0	60,0	.	+	2
Festuca rubra	97,9	20,0	75,0	80,0	100,0	.	+	.
Arrhenatherum elatius	0,0	100,0	41,7	0,0	0,0	.	.	.
Trisetum flavescens	33,3	40,0	100,0	0,0	0,0	.	.	.
Poa pratensis	10,4	80,0	66,7	0,0	0,0	+	.	.
Nardus stricta	56,3	0,0	16,7	100,0	100,0	.	2	.
Gentianella lutescens	12,5	0,0	0,0	0,0	20,0	.	.	.
Viola declinata	4,2	0,0	8,3	60,0	0,0	.	.	.
Filipendula ulmaria	0,0	60,0	0,0	0,0	0,0	4	.	.
Geranium palustre	0,0	0,0	0,0	0,0	0,0	1	.	.
Molinia caerulea	0,0	0,0	0,0	0,0	0,0	.	3	.
Dicanthium ischaemum	2,1	0,0	0,0	0,0	0,0	.	.	2
Festuca ovina	8,3	0,0	0,0	0,0	0,0	.	.	3
Achillea distans	4,2	0,0	8,3	40,0	0,0	.	.	.
Achillea millefolium	85,4	80,0	83,3	40,0	60,0	.	.	+
Aegopodium podagraria	0,0	20,0	8,3	0,0	0,0	.	.	.
Ajuga genevensis	8,3	20,0	16,7	20,0	0,0	.	.	.
Ajuga reptans	2,1	0,0	8,3	0,0	0,0	.	.	.
Alchemilla acutiloba	4,2	0,0	0,0	0,0	20,0	.	.	.
Alchemilla crinita	0,0	0,0	8,3	0,0	20,0	.	.	.
Alchemilla gracilis	6,3	0,0	16,7	0,0	0,0	.	.	.
Alchemilla monticola	2,1	0,0	16,7	0,0	20,0	.	.	.
Alchemilla vulgaris	4,2	20,0	0,0	20,0	0,0	.	.	.
Alopecurus pratensis	2,1	20,0	0,0	0,0	0,0	+	.	.
Anchusa officinalis	0,0	0,0	8,3	0,0	0,0	.	.	+
Angelica sylvestris	4,2	0,0	0,0	0,0	0,0	+	.	.
Antennaria dioica	2,1	0,0	0,0	0,0	40,0	.	.	.
Anthemis tinctoria	2,1	0,0	0,0	0,0	0,0	.	.	+
Anthoxanthum odoratum	89,6	80,0	75,0	80,0	80,0	.	+	+
Anthriscus sylvestris	4,2	60,0	0,0	0,0	0,0	.	.	.
Anthyllis vulneraria	60,4	0,0	25,0	20,0	40,0	.	.	1
Arenaria serpyllifolia	0	20,0	8,3	0	0	.	.	.
Arnica montana	4,2	0	8,3	80,0	20,0	.	.	.
Asperula cynanchica	20,8	0	0	0	20,0	.	.	+
Astrantia major	0	0	8,3	0	0	.	.	.
Avenella flexuosa	4,2	0	8,3	40,0	0	.	.	.
Avenula pubescens	4,2	0	0	20,0	0	.	.	.
Bellis perennis	0	20,0	0	0	0	.	.	.
Briza media	77,1	20,0	50	40,0	80,0	.	1	+
Bromus hordeaceus	2,1	60,0	50	0	0	.	.	.

Bunias orientalis	12,5	40,0	33,3	0	20,0	.	.	.
Caltha palustris	0	20,0	0	0	0	+	.	.
Campanula abietina	4,2	0	0	0	0	.	.	.
Campanula patula	45,8	40,0	83,3	0	40,0	.	+	.
Campanula persicifolia	4,2	0	0	0	0	.	.	.
Campanula rapunculoides	0	20,0	0	0	0	.	.	.
Campanula rapunculus	2,1	0	0	0	0	.	.	.
Campanula rotundifolia	4,2	0	0	40,0	0	.	.	.
Campanula serrata	10,4	0	16,7	20,0	40,0	.	.	.
Cardamine pratensis	4,2	40,0	0	0	0	.	.	.
Cardaminopsis arenosa	4,2	40,0	8,3	20,0	20,0	.	.	.
Cardaria draba	0	20,0	0	0	0	.	.	.
Carex brizoides	2,1	20,0	0	0	0	1	+	.
Carex caryophyllea	39,6	0	33,3	20	40,0	.	.	.
Carex echinata	0	0	0	0	0	.	+	.
Carex hirta	2,1	40,0	8,3	0	0	.	.	.
Carex nigra	0	0	0	0	0	+	+	.
Carex ovalis	6,3	60,0	8,3	20,0	0	+	+	.
Carex pallescens	33,3	40,0	33,3	60,0	100	.	+	.
Carex rostrata	0	0	0	0	0	2	.	.
Carlina acaulis	56,3	0	16,7	60,0	80,0	.	.	+
Carlina vulgaris	12,5	0	0	0	0	.	.	.+
Carum carvi	8,3	60,0	25	0	0	.	.	.
Centaurea bibersteinii	4,2	0	0	0	0	.	.	+
Centaurea jacea	2,1	0	8,3	0	0	.	.	.
Centaurea phrygia	83,3	20,0	91,7	60,0	100	.	+	+
Centaurium erythraea	6,3	0	0	0	0	.	.	.
Cerastium caespitosum	31,3	40,0	33,3	20,0	20,0	.	.	.
Cerastium fontanum	4,2	20,0	33,3	0	0	.	.	.
Chaerophyllum hirsutum	0	0	0	0	0	+	.	.
Cirsium canum	0	20,0	0	0	0	.	.	.
Cirsium rivulare	4,2	40,0	0	0	0	2	+	.
Cirsium vulgare	0	0	0	0	0	.	.	.
Colchicum autumnale	2,1	0	16,7	0	0	.	.	.
Coronilla varia	25	0	8,3	0	0	.	.	+
Crepis biennis	14,6	40,0	41,7	0	0	.	.	.
Crepis paludosa	0	0	0	0	0	+	.	.
Cruciata glabra	37,5	20,0	66,7	40,0	80,0	.	+	.
Cynosurus cristatus	54,2	20,0	66,7	0	0	.	+	.
Cytisus nigricans	22,9	0	0	20,0	40,0	.	.	.
Dactylis glomerata	20,8	100	75	0	0	.	.	.
Danthonia decumbens	35,4	0	0	20,0	40,0	.	.	.
Daucus carota	8,3	20,0	8,3	0	0	.	.	.
Deschampsia cespitosa	4,2	0	8,3	0	0	+	+	.
Dianthus carthusianorum	45,8	0	8,3	0	40,0	.	.	+
Elymus hispidus	2,1	0,0	0,0	0,0	0,0	.	.	+
Equisetum arvense	2,1	20,0	25	0	20,0	.	+	.
Equisetum sylvaticum	2,1	0	0	0	0	.	+	.
Erigeron annuus	12,5	20,0	16,7	0	0	.	.	+
Euphorbia stricta	6,3	0	8,3	0	0	.	.	.
Euphrasia stricta	14,6	0	16,7	0	0	.	.	+
Ferulago sylvatica	2,1	0	0	0	20,0	.	.	.
Festuca pratensis	2,1	0	16,7	0	0	+	+	.
Filipendula vulgaris	12,5	0	16,7	0	0	.	.	.

Fragaria vesca	6,3	20,0	0	20,0	0	.	.	.
Fragaria viridis	6,3	0	0	0	0	.	.	+
Galium mollugo	22,9	40,0	0	0	0	.	.	+
Galium uliginosum	0	0	0	0	0	+	+	.
Galium verum	43,8	0	16,7	20,0	80,0	.	+	+
Genista tinctoria	43,8	0	0	20,0	40,0	.	.	+
Genista sagittalis	12,5	0	0	40,0	60,0	.	.	.
Geum urbanum	2,1	20,0	0	0	0	.	.	.
Gnaphalium sylvaticum	2,1	0	8,3	20,0	0	.	.	.
Gymnadenia conopsea	16,7	0	8,3	40,0	60,0	.	.	.
Helianthemum nummularium	20,8	0	0	20,0	60,0	.	+	.
Heracleum sphondylium	2,1	40,0	16,7	0	20,0	.	.	.
Hieracium aurantiacum	12,5	0	16,7	0	0	+	+	.
Hieracium lactucella	25	0	0	20,0	20,0	.	.	.
Hieracium pilosella	18,8	0	8,3	40,0	20,0	.	.	+
Holcus lanatus	75	100	83,3	0	20,0	+	1	.
Hypericum maculatum	62,5	20,0	66,7	100	100	.	+	.
Hypericum perforatum	4,2	20,0	0	0	0	.	.	.
Hypochoeris maculata	12,5	20,0	16,7	60,0	80,0	.	+	.
Hypochoeris radicata	37,5	0	16,7	20,0	0	.	+	.
Juncus conglomeratus	0	0	0	0	0	+	+	+
Knautia arvensis	50	20,0	33,3	0	20,0	.	.	+
Knautia dipsacifolia	0	0	8,3	40,0	20,0	.	.	.
Laserpitium krapfii	2,1	0	0	20,0	0	.	.	.
Lathyrus pratensis	2,1	0	0	20,0	0	+	.	.
Leontodon autumnalis	12,5	0	16,7	40,0	20,0	.	.	.
Leontodon danubialis	60,4	0	50	0	40,0	.	+	.
Leontodon hispidus	14,6	0	58,3	0	20,0	.	.	.
Leucanthemum vulgare	83,3	0	66,7	40,0	60,0	.	+	+
Linum catharticum	39,6	0	16,7	0	0	.	.	.
Lolium perenne	2,1	0	8,3	0	0	.	.	.
Lotus corniculatus	83,3	40,0	91,7	20,0	40,0	.	.	+
Luzula campestris	72,9	80,0	83,3	40,0	80,0	+	+	+
Luzula luzuloides	18,8	0	8,3	60,0	20,0	.	.	.
Lychnis flos-cuculi	14,6	60,0	25	0	0	+	+	.
Lychnis viscaria	18,8	0	33,3	0	40,0	.	.	.
Lysimachia nummularia	2,1	40,0	8,3	0	0	+	.	.
Lysimachia vulgaris	2,1	20,0	25	0	0	+	+	.
Lythrum salicaria	0	0	0	0	0	+	+	.
Medicago lupulina	20,8	60,0	41,7	0	0	+	+	.
Mentha arvensis	2,1	0	0	0	0	+	.	.
Myosotis arvensis	2,1	0	33,3	0	0	.	.	.
Myosotis scorpioides	0	20,0	8,3	0	0	+	+	.
Myosotis sylvatica	6,3	40,0	0	0	0	.	.	.
Oenanthe banatica	0	60,0	0	0	0	+	+	.
Orchis morio	2,1	0	0	0	20,0	.	.	.
Peucedanum oreoselinum	35,4	20,0	25	0	40,0	.	.	+
Phleum phleoides	2,1	0	0	0	20,0	.	.	.
Pimpinella saxifraga	72,9	0	41,7	20,0	100	.	.	+
Plantago lanceolata	87,5	60,0	91,7	40,0	80,0	+	1	+
Plantago media	25	0	16,7	0	20,0	.	.	+
Platanthera bifolia	12,5	0	16,7	0	20,0	.	.	.
Poa trivialis	0	40,0	0	0	0	+	.	.
Polygala vulgaris	77,1	20,0	25	40,0	100	.	+	+

Potentilla cinerea	6,3	0	0	0	0	.	.	+
Potentilla argentea	4,2	20,0	0	0	0	.	.	.
Potentilla aurea	2,1	0	0	40,0	0	.	.	.
Potentilla erecta	33,3	0	16,7	60,0	60,0	+	1	.
Primula elatior	4,2	0	0	0	20,0	.	.	.
Primula veris	6,3	0	16,7	0	20,0	.	.	.
Prunella laciniata	12,5	0	0	0	0	.	.	+
Prunella vulgaris	52,1	20,0	83,3	20,0	40,0	+	+	.
Ranunculus acris	18,8	80,0	58,3	0	20,0	+	2	.
Ranunculus polyanthemos	52,1	20,0	41,7	20,0	40,0	.	.	.
Ranunculus repens	2,1	60,0	16,7	0	0	+	.	.
Rhinanthus minor	72,9	80,0	91,7	20,0	60,0	.	+	+
Rorippa pyrenaica	12,5	40,0	25	0	0	.	.	.
Rumex acetosa	52,1	100	91,7	20,0	20,0	+	+	.
Rumex acetosella	16,7	0	25	20,0	0	.	.	+
Rumex crispus	0	60,0	16,7	0	0	.	.	.
Sanguisorba minor	12,5	20,0	0	0	20,0	.	.	1
Scabiosa columbaria	2,1	0	0	20,0	0	.	.	.
Scabiosa ochroleuca	27,1	0	8,3	0	0	.	.	+
Scirpus sylvaticus	0	40,0	0	0	0	1	+	.
Silene nutans	14,6	0	16,7	0	20,0	.	.	+
Stachys officinalis	6,3	0	16,7	20,0	0	.	+	.
Stellaria graminea	52,1	20,0	83,3	20,0	40,0	.	.	.
Succisa pratensis	2,1	0	0	0	0	+	1	.
Symphytum officinale	2,1	40,0	8,3	0	0	+	.	.
Taraxacum officinale	20,8	100	75	0	0	.	.	.
Teucrium chamaedrys	8,3	0	0	0	0	.	.	1
Thymus bihoriensis	6,3	0	0	20,0	0	.	.	.
Thymus glabrescens	47,9	0	16,7	20,0	60,0	.	.	1
Thymus pulegioides	4,2	0	0	40,0	20,0	.	.	.
Tragopogon pratensis	10,4	40,0	33,3	0	0	.	.	.
Traunsteinera globosa	0	0	0	20,0	20,0	.	.	.
Trifolium alpestre	22,9	0	0	20,0	40,0	.	.	.
Trifolium montanum	58,3	0	16,7	40,0	100	.	.	.
Trifolium pannonicum	10,4	0	0	0	20,0	.	.	.
Trifolium pratense	81,3	100	91,7	20,0	40,0	+	+	.
Trifolium repens	62,5	60,0	91,7	40,0	20,0	+	+	+
Vaccinium myrtillus	2,1	0	0	100	20,0	.	.	.
Vaccinium vitis-idaea	0	0	0	80,0	20,0	.	.	.
Veratrum album	2,1	0	8,3	0	0	.	2	.
Verbascum nigrum	2,1	0	8,3	0	0	.	.	.
Verbena officinalis	0	0	8,3	20,0	0	.	.	.
Veronica arvensis	2,1	20,0	8,3	0	0	.	.	.
Veronica chamaedrys	39,6	60,0	66,7	20,0	20,0	.	.	.
Veronica officinalis	10,4	0	8,3	20,0	20,0	.	.	.
Veronica serpyllifolia	0	20,0	16,7	0	0	.	.	.
Vicia cracca	43,8	60,0	75	20,0	0	+	.	.
Vicia sepium	6,3	20,0	16,7	0	0	.	.	.
Viola canina	52,1	0	33,3	80,0	80,0	.	.	.
Viola hirta	2,1	0	8,3	0	0	.	.	.
Viola tricolor	2,1	40,0	16,7	0	0	.	.	.

Species present in one type community: *Agrimonia eupatoria; Anagallis arvensis; Anemone nemorosa; Arabis hirsuta; Brachypodium sylvaticum; Carduus nutans; Convolvulus arvensis; Echium vulgare; Hieracium bauhinii; Lathyrus sylvestris; Luzula sylvatica; Orchis ustulata; Origanum vulgare; Primula acaulis; Rhinanthus rumelicus; Sagina procumbens; Scleranthus perennis; Silene armeria; Stachys germanica; Trifolium arvense; Viola* *reichenbachiana* (2,1 - ***Fe-A***), *Alchemilla micans; Galium album; Phleum pratense; Potentilla anserina; Pteridium aquilinum; Salvia pratensis; Scleranthus annuus* (4,2 - ***Fe-A***), *Cytisus albus*; *Orchis coriophora*; *Salvia verticillata* (6,3 - ***Fe-A***), *Seseli annuum* (8,3 - ***Fe-A***), *Euphorbia cyparissias; Trifolium campestre* (10,4 - ***Fe-A***), *Rhinanthus angustifolius* (12,5 - ***Fe-A***), *Thymus pannonicus* (16,7 - ***Fe-A***), *Galium aparine; Moehringia trinervia; Polygonatum verticillatum; Ranunculus auricomus* (25,0 - ***Arr-e***), *Glechoma hederacea* (50,0 - ***Arr-e***), *Cerastium arvense; Chenopodium bonus-henricus; Euphrasia rostkoviana; Galium boreale; Ononis arvensis; Poa annua; Sedum acre; Thesium alpinum; Vicia lathyroides* (8,3 - ***Poo-T***), *Festuca nigrescens; Gentiana pneumonanthe; Homogyne alpina; Soldanella oreodoxa* (20,0 - ***Vio-N***), *Luzula multiflora* (40,0 - ***Vio-N***), *Deschampsia flexuosa* (60,0 - ***Vio-N***), *Gentiana asclepiadea; Laserpitium latifolium; Lycopodium clavatum; Verbascum phlomoides* (20,0 - ***Gen-N***), *Epilobium palustre; Eriophorum angustifolium; Galium palustre; Geum rivale; Glyceria fluitans; Mentha longifolia; Plantago major; Valeriana officinalis; Valeriana simplicifolia* (25,0 - ***Ger-F***), *Equisetum palustre; Dactylorhiza maculata* (50,0 ***Ger-F***), *Juncus effusus* (75,0 - ***Ger-F***), *Serratula tinctoria* (+ - ***Mol-c***), *Bupleurum falcatum; Sedum hispanicum; Silene otites* (+ - ***Bot-i***).

Table 2: Eigenvalues, species-variable correlations and cumulated variance for the first CCA axes (Monte Carlo test at 9.999 permutation level, with p<0,001)

Axes	**1**	**2**
Eigenvalues	**0,675**	**0.448**
Cumulated variance for species	8,2	5,4
Cumulated variance for species-variables	8,2	13,6
Species-variable correlation	**0,941**	**0,890**

Table 3: Pearson (r) correlation coefficient between the environmental variables and the first 2 CCA axes

Variable	**Axis 1**	**Axis 2**
Alt	-0,283	**0,512**
L	**0,466**	0,192
U	**0,843**	0,006
T	**0,508**	0,186
R	-0,389	0,334
N	**0,740**	-0,411
Sum_Ad	**0,197**	-0,399

Discussion

In the ordinogram (Fig. 2, 3) 5 groups are visible being well differentiated coenotically and ecologically. Since soil nitrogen richness (revealed by the presence and abundance of nitrophilous species) is determined by the land use practices (hay-meadows manure, once every 2-3 years) there is a relationship of direct determination between these two variables.

Group A represents the meso-hygrophilous from the *Geranio-Filipenduletum* association (Fig. 2), having a relatively low plant diversity caused by its particular soil conditions (a pronounced water excess at soil level).

Group B is represented by mesophilous and eutrophic plant communities from *Arrhenatheretum elatioris*, that are maintain their relatively high plant diversity due to their land use practices (regular organic fertilizing).

Group C comprises mesophilous and mesotrophic phytocoenoses from *Poo-Trisetum flavescentis* used exclusively as hay-fields (Fig. 2), having the highest plant diversity.

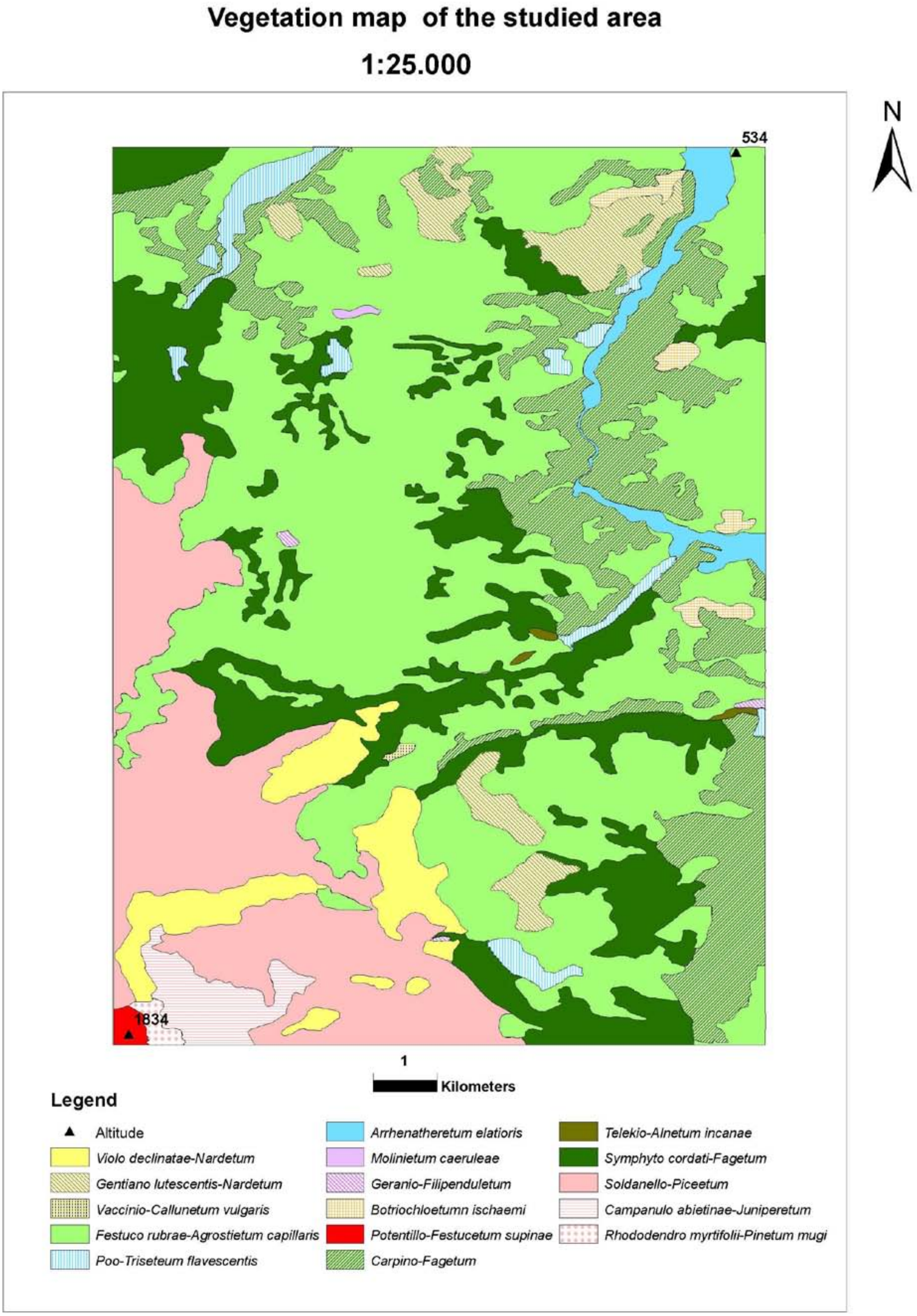

Fig. 1: Present day vegetation map of the Henţului Valley basin

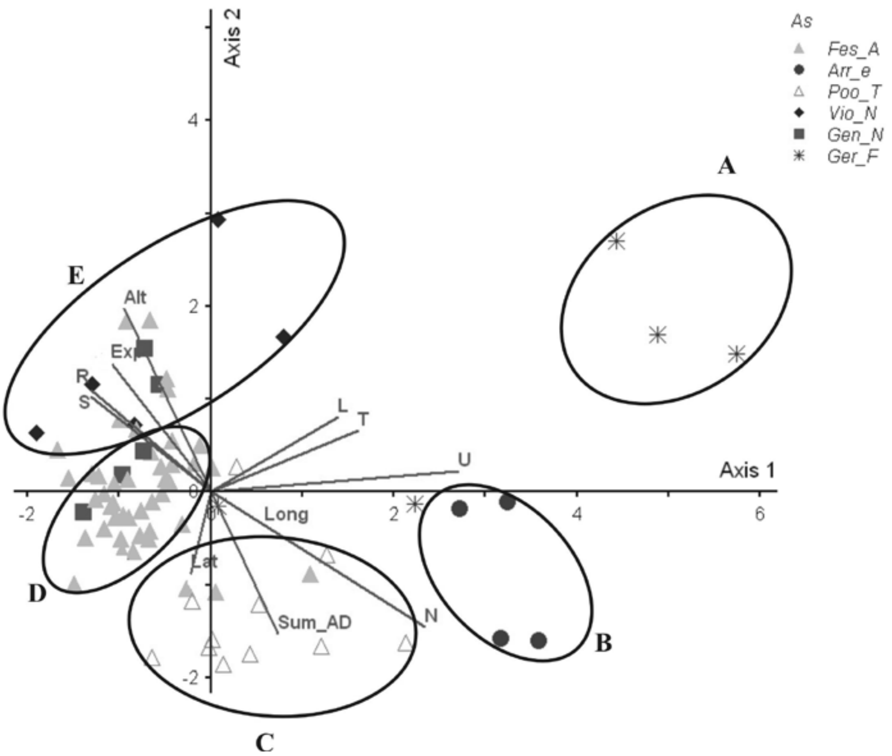

Fig. 2: Ordinogram of the 82 releves in the space determined by the first 2 CCA axes according to the considered variables

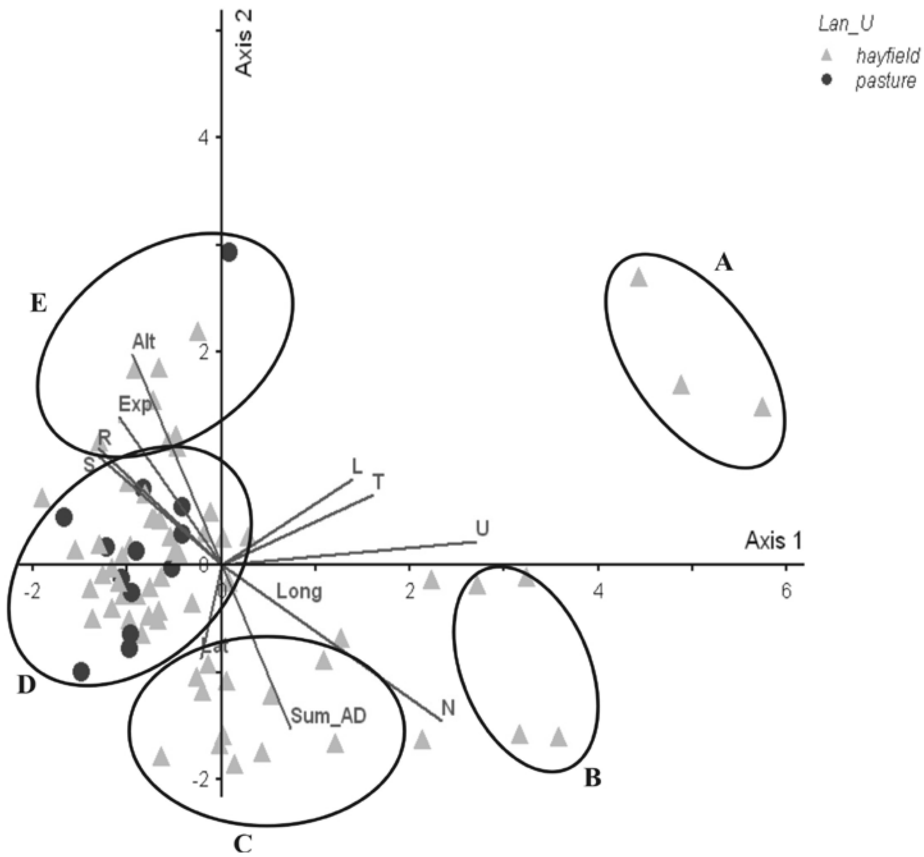

Fig. 3: Ordinogram of the 82 releves in the space determined by the first 2 CCA axes according to land use practices

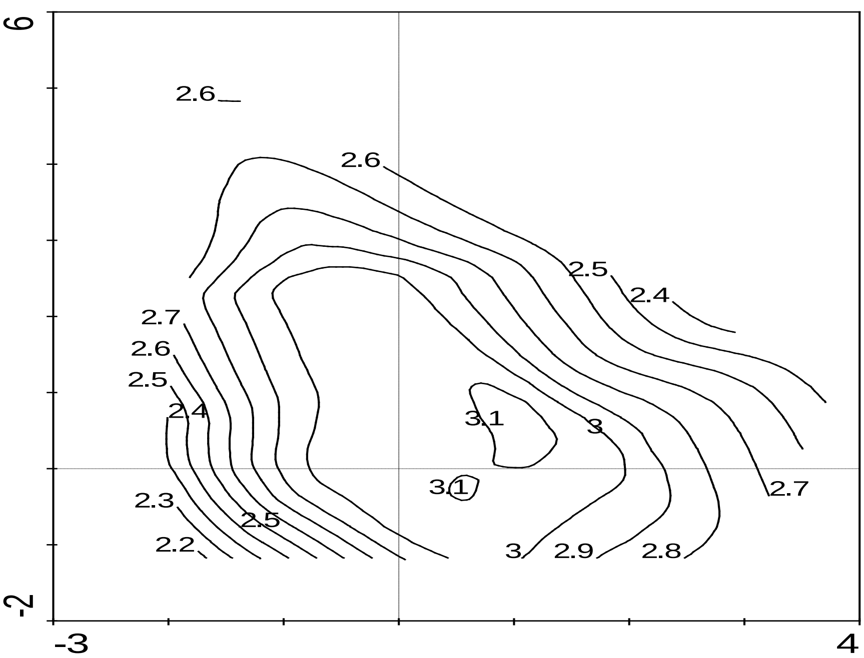

Fig. 4: Ordinogram of the isolines for the diversity indices H in the space determined by the first 2 CCA axes

Group D consists of mesophilous and oligo-mesotrophic communities from the association *Festuco-Agrostietum* used both as pastures and hay fields with a lower plant diversity caused by the decreased soil moisture and increased human impact (Fig. 4).

Group E is made of acidophilous and oligotrophic communities from the associations *Violo-Nardetum* and *Gentianello-Nardetum* used both as hay fields and pastures, having the lowest diversity (Fig. 4). They are situated in the uppermost third of the slopes, in the mountain and sub-alpine belt (800-1700 m.s.m).

The dominant pasture type is represented by communities belonging to the association *Festuco rubrae-Agrostietum capillaris*. They are used both as pastures and hay-fields, having a medium diversity (Fig. 4).

Grass lands communities dominated by *Arrhenatherum elatius* as well as those from the association *Poo-Trisetetum flavescentis* are used exclusively as hay fields. In order to maintain the floristic structure of these meadows, periodic manure is required.

Thus, the communities dominated by fescue and *Trisetum flavescens* maintain their structure just as long as they benefit from particular management practices, and only on relatively small areas (cca. 160-180 ha.), depending on the number of livestock. The relationship between the management of the pastures and their floristic structure is presented in Fig. 5. Such pastures shelter a large number of species (62) which improves the quality of the obtained hay. The pastures dominated by *Festuca rubra* and *Agrostis tenuis*, if used exclusively as pastures, in the absence of fertilization and under intensive grazing transform gradually, as the soil nutrients are depleted, into mat grass fields. These pastures dominated by *Nardus stricta* are used mostly as pastures and have low plant diversity.

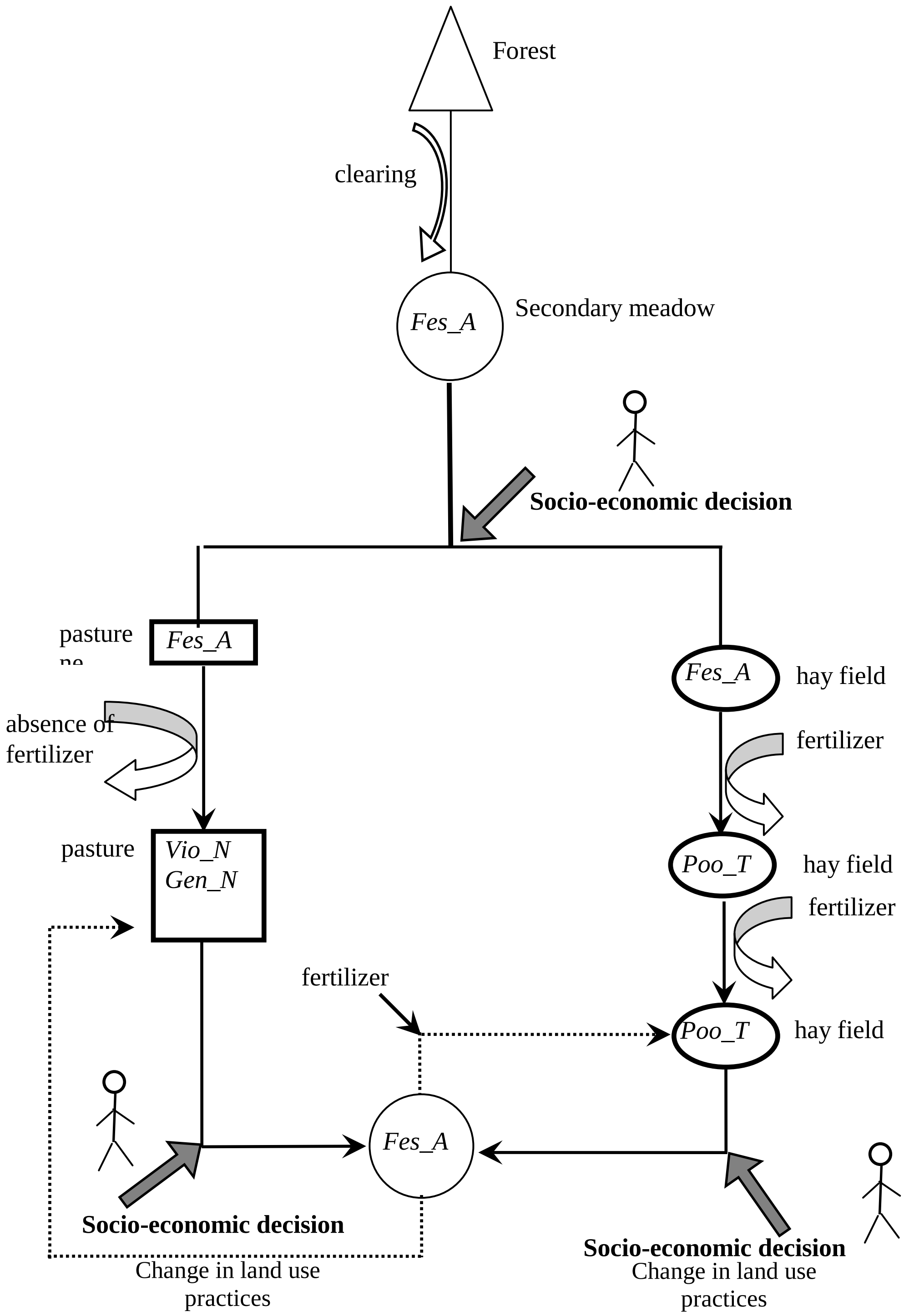

Fig. 5: Relations between meadow structure and socio-economic activities (Fes_A – *Festuco rubrae-Agrostietum capillaris*; Poo_T – *Poo –Trisetetum flavescentis;* Vio_N – *Violo declinatae-Nardetum*; Gen_N – *Gentiano lutescentis-Nardetum)*

Conclusion

The meadows from the north-eastern slope of the Vlădeasa massif are very diverse, belonging to 9 syntaxonomic categories. The main factors that determine this eco-coenotic variability are the water and nitrogen supply of the soil. The level of soil nitrogen is directly influenced by the socio-economic activities. Thus, the way that the meadows are used (pastures or hay fields) represents through different management practices (fertilization for hay fields and absence of fertilization for pastures), together with the water gradient of the soil, a main determinant of the floristic structure of these communities. The meadow communities dominated by *Trisetum flavescens* which maintain their structure due to traditional management have the highest species diversity. Thus, our study confirms the importance of maintaining the traditional practices of land use for conservation of plant diversity and biodiversity generally.

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RELAȚIA DINTRE STRUCTURA PAJIŞTILOR DE PE VERSANTUL NORD-ESTIC AL MASIVULUI VLĂDEASA ŞI ACTIVITĂȚILE SOCIO-ECONOMICE

(Rezumat)

În lucrare se prezintă distribuția spațială a comunităților vegetale de pe versantul nord-estic al masivului Vlădeasa (120 km ^{2}) cartate la scara 1:25000. Se evidențiază principalii factori de mediu implicați în determinarea variabilității structurale a pajiştilor, precum şi relația dintre structura acestora şi activitățile socio-economice. Asociațiile vegetale cu cea mai largă răspândire în teritoriu sunt *Festuco rubrae-Agrostietum capillaris*, *Gentianello lutescentis-Nardetum* şi *Violo declinatae-Nardetum*, iar asociațiile cu cu arealul cel mai restrâns sunt *Molinietum caeruleae*, *Geranio-Filipenduletum* şi *Botriochloetum ischaemi*. Comparativ cu acestea asociațiile *Arrhenatheretum elatioris* şi *Poo-Trisetetum flavescentis* au o răspândire medie, de câteva zeci de hectare, pe terenurile din preajma aşezărilor umane unde se administrează periodic îngrăşăminte organice. Rezultatele analizei canonice a corespondențelor (CCA) identifică gradul de aprovizionare cu apă şi cu azot a solului ca fiind principalii factori implicați în determinarea variabilității eco-cenotice a pajiştilor investigate. Conținutul de azot din sol este direct influențat prin activitățile socio-economice, respectiv prin modul diferit de utilizare al pajiştilor (păşune sau fâneață). De asemenea, fitodivesitatea comunitățior praticole este influențată de management-ul acestora. Cea mai mare fitodivesitate o au fitocenozele asociației *Poo-Trisetetum flavescentis*, care sunt menținute ca fânețe cu productivitate ridicată printr-un mod tradițional de gospodărire (fertilizarea periodică), iar cea mai mică fitodiversitate o au fitocenozele asociației *Violo declinatae-Nardetum* care înglobează păşunile montae-subalpine, slab productive, de pe soluri podzolice acide.

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