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PHYTOSOCIOLOGICAL RESEARCH IN THE FORESTS OF POIANA RUSCĂI MOUNTAINS

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Abstract: The paper describes several forest associations found in the Poiana Ruscăi Mts.: *Symphycordati* – *Fagetum*, *Festuco drymejae* – *Fagetum*, *Festuco drymejae* – *Abietum*, *Carpino* – *Fagetum*, *Lathyro hallersteinii* – *Carpinetum* and *Carici remotae-Fraxinetum*. The first three associations represent the zonal mountain vegetation, and occupy more than 80% of the massif. The associations *Carpino-Fagetum* and *Lathyro hallersteinii* – *Carpinetum* are spread in the foothills of the Poiana Ruscăi Mts. *Carici remotae* – *Fraxinetum* has a patchy distribution, on the bottom of certain valleys from the northern slope of the massif. The data have been gathered in the years 2006 and 2013 in vegetation surveys of the area (using phytocoenotic relevés).

Keywords: beech forests, plant associations, Poiana Ruscăi Mts., South-Western Romania.

Introduction

The Poiana Ruscăi Mts. are an integral part of the Apuseni Mts., with their northern limit at the Mureș river. To the East and South, the limit is represented by the Hateg basin, and to the west by the Bergheiul basin. The massif is surrounded by tectonic basins originating in the Miocene period, transformed over time into small hills. It has the shape of a shield, curved towards the middle, where we find the two highest peaks (both below 1400 m.s.m.) – Padeșul (1380 m.s.m.) and Rusca (1260 m.s.m.). Towards the outer limits of the massif, altitude declines gradually into narrow terraces of 400–500 m.s.m. A typical feature for the Poiana Ruscăi Mts. are the deep and narrow inner valleys, and the smooth and wide ridges, which forced human settlements to the top of the hills [14].

The two opposite valleys, Rușchița in the South, and Begheiul in the North, split the massif into two unequal sectors: a western sector, smaller, with higher altitudes (Padeșul peak, 1380 m.s.m.), and a north-eastern sector, larger, very fragmented by valleys (highest peak: Rusca, 1260 m.s.m.). The geological substrate is represented generally by crystalline schists. Dominating soils are brown acid and brown illuvial. The climate regime in the Poiana Ruscăi Mts. is characterized by average yearly temperatures of +8.1°C in the marginal areas (400-500 m.s.m.) and around 5.1°C in the highest peaks (1200-1300 m.s.m.). Yearly average precipitation is in the 750–1050 mm range.

Floristic and phytosociological research in the massif is scarce and focused mostly on the grasslands [1], with very little information on forests [12]. In the western part of the massif, around Lugoș, detailed phytocoenological research have been conducted by E. C. Vicol (1974) [18]. Our investigations in the massif have taken place in the years 2006 and 2013, part of the projects IntraBioDiv (GOCE-CT-2003-505376) and POS Mediu (SMIS CSNR 36430).

Material and Methods

Phytocoenological and floristic research in the Poiana Ruscăi Mts. have been conducted in order to identify phanerogams with subalpine distribution (for the IntraBioDiv project) and in order to map and describe forest habitat types in the ROSCI0250 Natura 2000 site (Ținutul Pădurenilor).

We have gathered data on the floristic structure of the forests, using the Braun-Blanquet method (1964) [5], with the additional specifications by Al. Borza (1934) [2] on the local frequency of species. The relevés have been grouped in associations using characteristic (*Kennarten*) and differential (*Trennarten*) species.

Results and Discussions

Using field research from the Poiana Ruscăi Mts., we have identified 6 forest associations with zonal and intrazonal distribution. These associations are part of the coenosystem described below:

Cls. *Carpino-Fagetea* Jakucs ex Passarge 1968

Ord. *Fagetalia* Pawl. 1928

Al. *Symphyto-Fagion* Vida 1959

1. *As. Festuco drymejae* – *Abietetum* Filipaș et al. 2013
2. *As. Festuco drymejae* – *Fagetum* Morariu ex Resmeriță 1977
3. *As. Symphyto cordati* – *Fagetum* Vida 1959

Al. *Lathyro hallersteinii* – *Carpinion* (Soo 1964) Boșcaiu 1979

4. *As. Lathyro hallersteinii* – *Carpinetum* Coldea 1975
5. *As. Carpino* – *Fagetum* Paucă 1941

Al. *Alnion incanae* Pawlowski et al. 1928

6. *As. Carici remotae* – *Fraxinetum* Koch ex Faber 1936

1. *As. Festuco drymejae* – *Abietetum* Filipaș et al. 2013 (Table 1)

Forests with fir (*Abies alba*) and beech (*Fagus sylvatica*) occupy peaks and high ridges in the massif, characterized in general by moderate slopes, with brown and luvic brown soils (slightly acidic - pH 5,8-6,4). These forests have a rather small number of boreal species, and a structure similar to forests described in the Semenik Mts. [3], as they grow on the same geological substrate (crystalline schists) and under similar climatic conditions.

Pollen research by I. Ciobanu (1948) [6] and S. Fărcaș et al. (2005) [10] in the Semenik Mts. show that fir pollen appears sporadically in the pollen diagrams starting with the *pine phase*. At the beginning of the *subatlantic* period, fir pollen has a maximum of 82%, while beech has only 18%. This *fir sub-phase* which occurred about 4000 years ago (Fărcaș et al. 2006) [11] coincides with the end of the *hornbeam and spruce sub-phase* [6] and is a precursor to the current *beech phase* (beech dominates the massif in our days). Currently, the fir populations from both massifs, pure or mixed with beech, are considered to be natural, while the spruce populations are most likely the result of planting [3, 12].

In the grass layer of these forests, nemoral species, typical of beech forests, are frequent. Along with these species, we have sporadic occurrences of regional, Carpathian-Balkan species

(*Symphytum cordatum*, *Dentaria glandulosa*, *Festuca drymeja*, *Glechoma hirsuta*), and this is the reason for including these forests in a regional association.

Some phytocoenosis with fir and beech, located on the *Iazuri* ridge, where fir dominates (65%), have been declared seed reserves for fir, by the forestry department.

2. *As. Festuco drymejae* – *Fagetum* Morariu ex Resmeriță 1977 (Table 2)

Forests with dominant *Fagus sylvatica* are distributed usually on strongly inclined slopes, with brown luvic and white luvisols, characterized by a strong acidic reaction (pH 5-5,6) and slightly below average trophicity [9]. This association is typical for the Carpathians and Balkans [15, 7, 17]. Aside from beech, in the tree layer we have sporadic occurrences of species such as *Acer pseudoplatanus*, *Acer platanoides*, *Fraxinus excelsior* and *Ulmus glabra*. In the grass layer of these forests, the species *Festuca drymeja* and *Luzula luzuloides* occur frequently, with dominant cover, reflecting the ecological specificity of this association. Due to the steep slopes where these beech forests occur and due to the reduced trophicity of the soils, the characteristic species for the alliance, order and class have reduced frequencies of occurrence. From an economic point of view, these type of forests are considered to have low productivity, but are important in stabilizing the slopes, reducing floods and stopping soil erosion. From a syntaxonomic point of view, the association *Festuco drymejae* – *Fagetum* is considered to be a geographic vicariant of the association *Luzulo-Fagetum* from Central Europe.

3. *As. Symphyto cordati* – *Fagetum* Vida 1959 (Table 3, rel. 1-5)

Beech forests with high productivity are characterized by mull flora, and are found in the Poiana Ruscăi Mts. at the base of slopes and on smooth ridges, with various expositions. The typical soils are brown eu-mezobasic and brown acidic mezobasic. These soils have above average depth, and a poorly acidic reaction (pH 5,8-6,3). The tree layer is dominated by *Fagus sylvatica* (65-85%), with sporadic occurrences by the species *Abies alba*, *Acer pseudoplatanus*, *Acer platanoides* and *Fraxinus excelsior*. In the grass layer we find species characteristic of the alliance *Symphyto-Fagion*: *Symphytum cordatum*, *Dentaria glandulosa*, *Euphorbia carniolica*. These species occur only in the Carpathians, and create a regional type of beech forest, different from the Central European type described by Oberdorfer 1992 [16], Dierschke 2004 [8]. While different, this regional type is still closely linked with the European type, through a range of mesotrophic species: *Galium odoratum*, *Anemone nemorosa*, *Dentaria bulbifera*, *Circaea lutetiana*, *Asarum europaeum*, *Mercurialis perennis*.

Table 1: Ass. *Festuco drymejae-Abietetum* Filipaş et al. 2013

Relevé nr.	1	2	3	4	5	6	7	8	K
Altitude (m.s.m.)	1370	1250	1180	1155	1068	1095	1000	1090	
Aspect	N	NV	V	NE	NV	N	SE	S	
Slope (degrees)	25	20	10	20	20	10	9	10	
Canopy	0,8	0,8	0,9	0,8	0,8	0,8	0,8	0,9	
Hight (m)	20	23	25	28	27	30	25	25	
Litter %	65	70	80	90	90	85	70	80	
Area (m ²)	400	400	400	400	400	400	400	400	
Char. ass.									
<i>Fagus sylvatica</i>	5,5	5,5	5,5	4,5	4,5	2,5	4,5	3,5	V
<i>Abies alba</i>	+3	+2	1,2	2,5	2,5	4,5	1	4,5	V
<i>Fagus sylvatica</i> (juv.)	+	+	2,5	1,5	.	2,5	.	.	IV
<i>Abies alba</i> (juv.)	.	.	+	2,5	.	2,5	.	.	II
<i>Rubus hirtus</i>	2,5	4,5	2,5	3,5	2,5	2,5	1,3	2,5	V
<i>Calamagrostis arundinacea</i>	+	1,4	1,3	+	2,5	1,2	1	1	V

Table 1: Ass. *Festuco drymejae-Abietetum* Filipaş et al. 2013

Relevé nr.	1	2	3	4	5	6	7	8	K
<i>Festuca drymeja</i>	.	+	1,5	2,3	+	+2	2	2	V
Symphyto-Fagion									
<i>Symphytum cordatum</i>	.	.	.	+	.	.	.	.	I
<i>Dentaria glandulosa</i>	.	.	.	+	.	+	.	.	II
<i>Glechoma hirsuta</i>	.	.	.	.	.	+	.	.	I
Fagetalia									
<i>Luzula luzuloides</i>	1,5	+	+	1,5	+	+	3	.	V
<i>Prenanthes purpurea</i>	+	+	+	+	+	+	+	.	V
<i>Dryopteris dilatata</i>	+	+	+	1,3	+	.	.	.	IV
<i>Polygonatum verticillatum</i>	+	.	+	+	+	+	+	.	IV
<i>Asperula odorata</i>	.	+	+	+	.	+	.	.	III
<i>Dentaria bulbifera</i>	.	.	+	+	.	+	.	+	III
<i>Luzula sylvatica</i>	+	.	.	.	+	.	.	1	II
<i>Mycelis muralis</i>	.	+	.	.	.	+	.	.	II
<i>Veronica officinalis</i>	.	+	.	.	.	+	+	.	II
<i>Gymnocarpium dryopteris</i>	.	.	+	.	+	.	.	.	II
<i>Pulmonaria officinalis</i>	.	.	.	+	.	+	.	.	II
<i>Anemone nemorosa</i>	.	+	.	.	.	.	.	.	I
<i>Circaea lutetiana</i>	.	.	+	.	.	.	.	.	I
<i>Acer pseudoplatanus</i>	.	.	+	.	.	.	.	.	I
<i>Sanicula europaea</i>	.	.	+	.	.	.	.	.	I
<i>Gentiana asclepiadea</i>	.	.	.	.	+	.	.	.	I
<i>Veronica montana</i>	.	.	.	.	.	+	.	.	I
<i>Lamium galeobdolon</i>	.	.	.	.	.	+	.	.	I
<i>Carex sylvatica</i>	.	.	.	.	.	+	.	.	I
<i>Phegopteris connectilis</i>	.	.	.	.	.	+	.	.	I
Carpino-Fagetea									
<i>Oxalis acetosella</i>	+	+	1,5	+	+	+	.	+	V
<i>Athyrium filix-femina</i>	+	+	+	+	+	+	+	+	V
<i>Dryopteris filix-mas</i>	.	+	+	.	.	+	.	.	II
<i>Poa nemoralis</i>	.	.	+	.	.	.	.	.	I
<i>Moehringia trinervis</i>	.	.	+	.	.	.	.	.	I
Piceetalia s.l.									
<i>Picea abies</i>	+	.	.	.	.	.	.	.	I
<i>Sorbus aucuparia</i>	.	+	+	+	+	+	.	+	IV
<i>Vaccinium myrtillus</i>	2,5	+	.	.	.	+	.	1	III
<i>Blechnum spicant</i>	.	.	.	.	+	+	+	+	III
<i>Huperzia selago</i>	.	.	.	.	+	.	.	.	I
<i>Orthilia secunda</i>	.	.	.	.	.	+	.	.	I

Companions: *Betula pendula* (+, Rel. 2), *Acer platanoides* (+, Rel. 2), *Rubus idaeus* (+, Rel. 1, 2, 6), *Deschampsia flexuosa* (+, Rel. 1, 2, 4), *Rumex arifolius* (+, Rel. 1, 2, 3), *Solidago virgaurea* (+, Rel. 1, 4), *Veratrum album* (+, Rel. 1, 3, 4), *Carex brizoides* (1,5, Rel. 1; 1,3, Rel. 3), *Dicranum scoparium* (+, Rel. 1, 2, 3, 5), *Polytrichum juniperinum* (+, Rel. 1, 3, 5), *Galeopsis speciosa* (+, Rel. 2, 3), *Polypodium vulgare* (+, Rel. 2), *Stellaria nemorum* (+, Rel. 3), *Cystopteris fragilis* (+, Rel. 6, 7)

Relevé location: 1,2: Padeş Summit, 26.07.2006; 3: Rusca Summit, 27.07.2006 ; 4,8: Pădureni Poiana Ruscăii Mts. 2013 (15-18.07; 20-22.08).

These type of forests are less frequent in the Poiana Ruscăi Mts. compared to the association *Festuco drymejae* – *Fagetum*. The distribution of beech forests types in the massif can be explained by the highly fragmented terrain, which is favourable to the latter association

Table 2: Ass. *Festuco drymejae-Fagetum* Morariu ex Resmeriță 1977

Relevé nr.	1	2	3	4	5	6	7	8	K
Altitude (m.s.m.)	754	940	670	740	930	775	670	750	
Aspect	SV	N	SE	SV	S	SE	E	S	
Slope (degrees)	35	15	10	17	10	9	15	10	
Canopy	0,9	0,9	0,9	0,7	0,7	0,8	0,8	0,9	
Hight (m)	30	28	24	20	20	23	20	22	
Littter %	100	100	85	70	70	75	80	70	
Area (m ²)	400	400	400	400	400	400	400	400	
Char. ass.									
<i>Fagus sylvatica</i>	5,5	5,5	4,5	4	4	4	5	5	V
<i>Festuca drymeja</i>	1,3	+	+	2	2	1	+	1	V
<i>Calamagrostis arundinacea</i>	+	+	.	.	+	+	.	+	IV
Symphyto-Fagion									
<i>Dentaria glandulosa</i>	.	+	+	.	.	.	.	.	II
<i>Rubus hirtus</i>	.	.	.	+	.	.	.	.	I
<i>Glechoma hirsuta</i>	.	+	.	+	.	.	.	.	II
<i>Galium schultesii</i>	.	.	.	+	.	.	.	.	I
Fagetalia									
<i>Acer pseudoplatanus</i>	+	.	.	.	.	+	.	.	II
<i>Fraxinus excelsior</i>	.	.	+	.	.	.	+	.	II
<i>Carpinus betulus</i> (juv.)	.	.	+	.	.	.	+	.	II
<i>Ulmus glabra</i> (juv.)	.	.	+	.	.	.	+	.	II
<i>Luzula luzuloides</i>	2,5	+	+	3	+	2	+	2	V
<i>Asperula odorata</i>	+	+	1,5	+	.	+	2	+	V
<i>Dentaria bulbifera</i>	+	+	.	.	+	+	.	+	IV
<i>Scrophularia nodosa</i>	+	.	+	+	.	.	+	+	IV
<i>Epilobium montanum</i>	+	+	+	+	.	.	+	+	IV
<i>Veronica urticifolia</i>	+	.	+	+	.	.	+	.	III
<i>Circaea lutetiana</i>	+	+	+	.	.	.	+	.	III
<i>Pulmonaria officinalis</i>	+	.	+	.	.	+	+	.	III
<i>Dryopteris dilatata</i>	+	+	.	.	.	.	.	+	II
<i>Polygonatum verticillatum</i>	.	+	.	.	+	.	.	.	II
<i>Prenanthes purpurea</i>	+	.	.	.	.	.	.	+	II
<i>Mycelis muralis</i>	+	.	.	+	+	.	.	.	II
<i>Veronica officinalis</i>	+	.	.	.	.	.	.	+	II
<i>Anemone nemorosa</i>	.	.	+	.	.	+	+	.	II
<i>Lamium galeobdolon</i>	.	+	.	.	+	.	.	.	II
<i>Phegopteris connectilis</i>	.	.	+	.	.	.	+	.	II
<i>Monotropa hypopitys</i>	+	.	.	.	.	.	.	+	II
<i>Asarum europaeum</i>	.	.	+	.	.	+	2	.	II
<i>Cephalanthera longifolia</i>	.	.	+	+	.	+	.	.	II
<i>Ribes uva-crispa</i>	.	.	+	.	.	.	+	.	II
<i>Mercurialis perennis</i>	.	.	+	.	.	.	+	.	II

Table 2: Ass. *Festuco drymejae-Fagetum* Morariu ex Resmeriță 1977

Relevé nr.	1	2	3	4	5	6	7	8	K
<i>Paris quadrifolia</i>	.	.	+	.	.	.	+	.	II
<i>Epipactis helleborine</i>	.	.	+	.	.	.	+	.	II
<i>Gentiana asclepiadea</i>	.	.	.	+	.	.	.	.	I
<i>Veronica montana</i>	.	+	.	.	.	.	.	.	I
<i>Carex sylvatica</i>	+	.	.	.	.	.	.	.	I
<i>Cardamine impatiens</i>	.	+	.	.	.	.	.	.	I
<i>Dactylis polygama</i>	.	+	.	.	.	.	.	.	I
<i>Viola reichenbachiana</i>	.	+	.	.	.	.	.	.	I
<i>Neottia nidus-avis</i>	.	.	.	+	.	.	.	.	I
<i>Pulmonaria mollis</i>	.	.	.	+	.	.	.	.	I
<i>Melica uniflora</i>	.	.	.	.	+	.	.	.	I
<i>Salvia glutinosa</i>	.	.	.	.	.	+	.	.	I
Carpino-Fagetea									
<i>Acer platanoides</i>	.	.	+	.	.	.	+	.	II
<i>Corylus avellana</i>	+	.	+	+	.	.	+	+	IV
<i>Crataegus monogyna</i>	.	.	.	.	+	.	.	.	I
<i>Athyrium filix-femina</i>	+	1,3	.	+	+	.	.	+	IV
<i>Dryopteris filix-mas</i>	+	+	.	.	.	+	+	+	IV
<i>Poa nemoralis</i>	.	.	+	+	.	.	+	.	II
<i>Moehringia trinervis</i>	.	+	.	+	.	.	.	.	II
<i>Geranium robertianum</i>	.	.	+	.	.	.	+	.	II
<i>Impatiens noli-tangere</i>	.	.	+	.	.	.	+	.	II
<i>Oxalis acetosella</i>	.	+	.	.	.	.	.	.	I

Companions: *Rubus idaeus* (+, Rel. 2, 3, 7), *Rubus serpens* (+, Rel. 5, 6), *Hypericum hirsutum* (+, Rel. 1, 3, 7, 8), *Solidago virgaurea* (+, Rel. 1, 8), *Polypodium vulgare* (+, Rel. 1, 8), *Polygonatum odoratum* (+, Rel. 3, 4, 7), *Cystopteris fragilis* (+, Rel. 3, 4, 7), *Ajuga reptans* (+, Rel. 3, 5), *Deschampsia flexuosa* (+, Rel. 2), *Carex brizoides* (+, Rel. 2), *Dicranum scoparium* (+, Rel. 1), *Pteridium aquilinum* (+, Rel. 2), *Asplenium trichomanes* (+, Rel. 4), *Doronicum austriacum* (+, Rel. 6), *Sambucus nigra* (+, Rel. 7), *Galium album* (+, Rel. 7), *Eupatorium cannabinum* (+, Rel. 7), *Cardaminopsis arenosa* (+, Rel. 7)

Relevé location: 1: Sălătruc valley, 19.07.2013; 2, 5: Bătrâna hill, 20.08.2013; 3, 7: Dobra valley, 17.07.2013; 4: Borod valley, 18.06.2013; 6: Tigan hill, 20.08.2013, 8: Sălătruc Valley, 19.07.13

Table 3: Ass. *Symphyto cordati-Fagetum* Vida 1959 (rel. 1-5), Ass. *Carpino-Fagetum* Paucă 1941 (rel. 6), Ass. *Lathyro hallersteinii-Carpinion* Coldea 1975 (rel. 7)

Relevé nr.	1	2	3	4	5	K	6	7
Altitude (m.s.m.)	780	730	820	820	680		530	630
Aspect	NV	SE	N	N	E		E	E
Slope (degrees)	25	25	7	5	5		25	15
Canopy	0,8	0,8	0,8	0,9	0,8		0,9	0,9
Hight (m)	20	23	20	30	25		22	20
Littter %	70	80	80	90	90		75	50
Area (m ²)	400	400	400	400	400		400	400
Char. ass.								
<i>Fagus sylvatica</i>	5	5	5	5	4	V	4,5	.
<i>Abies alba</i>	+	.	.	.	.	I	.	.

Table 3: Ass. *Symphyto cordati-Fagetum* Vida 1959 (rel. 1-5), Ass. *Carpino-Fagetum* Pauă 1941 (rel. 6), Ass. *Lathyro hallersteinii-Carpinion* Coldea 1975 (rel. 7)

Relevé nr.	1	2	3	4	5	K	6	7
<i>Fagus sylvatica</i> (juv.)	+	+3	1	3	1	V	.	.
<i>Symphytum cordatum</i>	+	+	+	+	+	V	.	.
<i>Carex digitata</i>	.	.	.	.	.	.	+3	+
<i>Lathyrus hallersteinii</i>	.	.	.	.	.	.	.	1,3
<i>Aposeris foedida</i>	.	.	.	.	.	.	.	1,5
Symphyto-Fagion								
<i>Rubus hirtus</i>	.	1	2	2	.	III	+	.
<i>Dentaria glandulosa</i>	.	.	.	+	.	I	.	.
<i>Glechoma hirsuta</i>	+	.	+	+	+	III	.	.
<i>Festuca drymeja</i>	.	.	.	.	.	.	+	.
<i>Euphorbia carniolica</i>	.	.	.	.	+	I	.	.
Carpinion								
<i>Carpinus betulus</i>	.	.	.	.	+	I	2,5	2,5
<i>Prunus avium</i>	.	.	+	.	.	I	+	+
<i>Galium schultesii</i>	.	.	.	.	+	I	1,3	+
<i>Dactylis polygama</i>	.	.	.	.	.	.	+	+
<i>Festuca heterophylla</i>	.	.	.	.	.	.	.	+
<i>Ranunculus auricomus</i>	.	.	.	.	.	.	.	+
Fagetalia								
<i>Acer pseudoplatanus</i>	+	.	.	.	.	I	.	.
<i>Fraxinus excelsior</i>	.	.	+	.	.	I	.	.
<i>Ribes uva-crispa</i>	+	.	.	.	+	I	.	.
<i>Ligustrum vulgare</i>	.	.	+	.	.	I	.	+
<i>Asperula odorata</i>	2	3	1	1	+	V	+	+
<i>Circaea lutetiana</i>	+	+	+	+	+	V	+	+
<i>Luzula luzuloides</i>	+	.	+	+	+	IV	+	.
<i>Anemone nemorosa</i>	+	2	1	+	.	IV	+	.
<i>Asarum europaeum</i>	+	+	+	.	2	IV	1,4	.
<i>Actaea spicata</i>	+	.	+	+	+	IV	.	.
<i>Epilobium montanum</i>	+	.	.	.	+	II	+	.
<i>Dentaria bulbifera</i>	.	1	+	1	.	III	.	.
<i>Viola reichenbachiana</i>	.	+	1	.	.	II	.	+
<i>Epipactis helleborine</i>	.	+	.	.	+	II	.	+
<i>Polygonatum verticillatum</i>	.	.	1	+	+	III	.	.
<i>Euphorbia amygdaloides</i>	.	.	+	.	+	II	.	.
<i>Sanicula europaea</i>	.	.	+	.	.	I	+	+
<i>Carex sylvatica</i>	.	.	+	.	.	I	+	+
<i>Mycelis muralis</i>	.	.	.	+	+	II	+	.
<i>Veronica officinalis</i>	+	.	+	.	.	II	.	.
<i>Paris quadrifolia</i>	+	.	.	+	.	II	.	.
<i>Lamium galeobdolon</i>	.	.	+	.	.	I	+	.
<i>Geum urbanum</i>	.	.	+	.	.	I	.	+

Table 3: Ass. *Symphyto cordati-Fagetum* Vida 1959 (rel. 1-5), Ass. *Carpino-Fagetum* Pauca 1941 (rel. 6), Ass. *Lathyro hallersteinii-Carpinion* Coldea 1975 (rel. 7)

Relevé nr.	1	2	3	4	5	K	6	7
<i>Calamagrostis arundinacea</i>	.	.	.	.	+	I	+	.
<i>Salvia glutinosa</i>	.	.	.	.	.	.	+	+
<i>Melica uniflora</i>	.	.	+	.	.	I	.	.
<i>Stachys sylvatica</i>	.	.	+	.	.	I	.	.
<i>Dryopteris dilatata</i>	.	.	.	+	.	I	.	.
<i>Phegopteris connectilis</i>	.	.	.	+	.	I	.	.
<i>Prenanthes purpurea</i>	.	.	.	.	+	I	.	.
<i>Pulmonaria officinalis</i>	.	.	.	.	+	I	.	.
<i>Cephalanthera longifolia</i>	.	.	.	.	+	I	.	.
<i>Neottia nidus-avis</i>	.	.	.	.	+	I	.	.
<i>Veronica urticifolia</i>	.	.	.	.	.	.	+	.
<i>Scrophularia nodosa</i>	.	.	.	.	.	.	.	+
<i>Pulmonaria mollis</i>	.	.	.	.	.	.	.	+
Carpino-Fagetea								
<i>Quercus petraea</i>	.	.	.	.	.	.	+	4,5
<i>Acer platanoides</i>	.	.	.	.	+	I	.	.
<i>Acer campestre</i>	.	.	.	.	.	.	+	.
<i>Corylus avellana</i>	+	.	.	.	+	II	1,2	.
<i>Crataegus monogyna</i>	.	.	+	.	.	I	.	+
<i>Geranium robertianum</i>	+	+	+	+	+	V	+	+
<i>Poa nemoralis</i>	+	+	+	.	+	IV	+	1,3
<i>Athyrium filix-femina</i>	+	+	+	+	.	IV	1,5	.
<i>Dryopteris filix-mas</i>	.	.	+	1	1	III	+	+
<i>Oxalis acetosella</i>	.	.	+	+	.	II	+	.
<i>Moehringia trinervis</i>	.	.	+	.	+	II	.	+
<i>Hedera helix</i>	.	+	.	.	.	I	+	.
<i>Brachypodium sylvaticum</i>	.	.	.	.	.	.	+	1,3
<i>Impatiens noli-tangere</i>	.	+	.	.	.	I	.	.
<i>Daphne mezereum</i>	.	.	.	.	.	.	.	+

Companions: *Betula pendula* (+, Rel. 3), *Sambucus nigra* (+, Rel. 3, 4), *Rosa pendulina* (+, Rel. 1), *Sorbus torminalis* (+, Rel. 7), *Polygonatum odoratum* (+, Rel. 1, 2, 4, 5), *Cystopteris fragilis* (+, Rel. 1, 2, 4, 5), *Ajuga reptans* (+, Rel. 1, 2, 5), *Asplenium trichomanes* (+, Rel. 2, 5), *Doronicum austriacum* (+, Rel. 2, 5, 6), *Hieracium lachenali* (+, Rel. 6, 7), *Stellaria nemorum* (+, Rel. 1), *Platanthera bifolia* (+, Rel. 3), *Galeopsis speciose* (+, Rel. 5), *Polypodium vulgare* (+, Rel. 5), *Hypericum hirsutum* (+, Rel. 6), *Elymus caninus* (+, Rel. 6), *Polystichum aculeatum* (+, Rel. 6), *Tamus communis* (+, Rel. 6), *Primula elatior* (+, Rel. 6), *Sedum fabaria* (+, Rel. 6), *Campanula persicifolia* (+, Rel. 6), *Asplenium scolopendrium* (+, Rel. 6), *Pteridium aquilinum* (+, Rel. 7), *Trifolium medium* (+, Rel. 7), *Potentilla micrantha* (+, Rel. 7), *Melitis melissophyllum* (+, Rel. 7), *Clinopodium vulgare* (+, Rel. 7)

Relevé location: 1,5: Pădureni (Cicera peak, Dobra valley, Tigan hill) 23.06.2013, 6: Luncani 26.07.2006; 7: Ghelari 15.07.2013.

Table. 4: Ass. *Carici remotae-Fraxinetosum* W. Koch ex Faber 36

Relevé nr.	1	2	3	4	5	6
Altitude (m.s.m.)	296	420	449	630	620	400
Aspect	N	N	N	NV	NV	NV
Slope (degrees)	5	5	5	5	5	3
Canopy	0,8	0,7	0,7	0,6	0,6	0,6
Area (m ²)	400	400	400	400	400	400
Char. ass.						
<i>Carex remota</i>	+	+	+	+	+	1,3
<i>Geranium phaeum</i>	+	+	.	+	+	+
<i>Alnion incanae</i>						
<i>Fraxinus excelsior</i>	4,5	2,5	2,3	5,5	5,5	5,5
<i>Alnus glutinosa</i>	+	3,2	3,2	.	.	.
<i>Stellaria nemorum</i>	+	.	.	.	+	.
<i>Chaerophyllum aromaticum</i>	1,3	+	+	+	+	.
<i>Glechoma hederacea</i>	+	+	.	+	+	1,3
<i>Ajuga reptans</i>	.	+	.	+	+	+
<i>Impatiens noli-tangere</i>	+	+	+	.	.	.
<i>Circaea lutetiana</i>	1,3	.	.	+	+	.
<i>Cirsium oleraceum</i>	.	+	.	.	+	+
<i>Aegopodium podagraria</i>	.	.	+	+	+3	.
<i>Stachys sylvatica</i>	.	.	+	+	+	.
<i>Festuca gigantea</i>	.	.	.	+	3,5	2,5
<i>Cirsium rivulare</i>	.	+	+	.	.	.
<i>Elymus caninus</i>	.	.	.	+	1,5	.
<i>Telekia speciosa</i>	.	.	.	2,5	.	+
<i>Hesperis matronalis</i>	.	.	.	+	+	.
<i>Rumex sanguineus</i>	+	.	.	.	.	.
<i>Poa trivialis</i>	+	.	.	.	.	.
<i>Valeriana officinalis</i>	.	+	.	.	.	.
<i>Carduus personata</i>	.	.	.	.	+	.
<i>Fagetalia</i>						
<i>Fagus sylvatica</i>	.	2,3	2,3	.	.	.
<i>Carpinus betulus</i>	+	.	+	+	.	.
<i>Tilia cordata</i>	.	+	.	.	.	.
<i>Acer pseudoplatanus</i>	.	.	+	.	.	.
<i>Acer platanoides</i>	.	.	.	+	.	.
<i>Lonicera xylosteum</i>	.	.	.	+	.	.
<i>Oxalis acetosella</i>	+	+	+	.	+	.
<i>Salvia glutinosa</i>	+	+	.	+	1,3	.
<i>Asarum europaeum</i>	+	.	+	1,5	+	.
<i>Geranium robertianum</i>	+	+	+	.	.	.
<i>Pulmonaria officinalis</i>	+	+	+	.	.	.
<i>Carex sylvatica</i>	+	.	.	2,5	+	.

Table. 4: Ass. *Carici remotae-Fraxinetosum* W. Koch ex Faber 36

Relevé nr.	1	2	3	4	5	6
<i>Dactylis polygama</i>	.	.	.	+	1,2	+
<i>Lamium galeobdolon</i>	+	.	+	.	.	.
<i>Symphytum cordatum</i>	.	+	+	.	.	.
<i>Geum urbanum</i>	.	.	.	+	+	.
<i>Carex divulsa</i>	+	.	.	.	.	.
<i>Cardamine impatiens</i>	+	.	.	.	.	.
<i>Euphorbia amygdaloides</i>	+	.	.	.	.	.
<i>Myosotis sylvatica</i>	+	.	.	.	.	.
<i>Allium ursinum</i>	+	.	.	.	.	.
<i>Scrophularia nodosa</i>	.	+	.	.	.	.
<i>Asperula odorata</i>	.	.	.	1,2	.	.
<i>Helleborus purpurascens</i>	.	.	.	+	.	.
<i>Euonymus verrucosus</i>	.	.	.	+	.	.
<i>Daphne mezereum</i>	.	.	.	+	.	.
<i>Gentiana asclepiadea</i>	.	.	.	+	.	.
<i>Carpino-Fagetum</i>						
<i>Acer campestre</i>	+	+	.	.	.	+
<i>Crataegus monogyna</i>	+	.	.	.	.	+
<i>Corylus avellana</i>	.	+	.	.	.	+
<i>Brachypodium sylvaticum</i>	+	.	.	2,5	+	.
<i>Poa nemoralis</i>	.	+	+	.	.	.
<i>Dryopteris filix-mas</i>	.	+	+	.	.	.

Companions: *Sambucus nigra* (+, Rel. 2, 3), *Salix purpurea* (+, Rel. 6), *Rubus sulcatus* (+, Rel. 1), *Urtica dioica* (2,5 Rel. 1, + Rel. 2, 4, 5, 6), *Lysimachia nummularia* (+, Rel. 4, 5, 6), *Tussilago farfara* (+, Rel. 4, 5, 6), *Galium aparine* (2,5 Rel 1, + Rel. 2), *Clematis vitalba* (+, Rel. 3, 5), *Mentha longifolia* (+, Rel. 3, 6), *Equisetum arvense* (+, Rel. 4, 6), *Ranunculus repens* (+, Rel. 5, 6), *Alliaria officinalis* (+, Rel. 1), *Galeopsis speciose* (+, Rel. 2), *Cardamine amara* (+, Rel. 2), *Cerastium sylvaticum* (+, Rel. 2), *Verbascum nigrum* (+, Rel. 2), *Silene dioica* (+, Rel. 5), *Carex hirta* (+, Rel. 6)

Relevé location: 1-3. Begeiu valley, 27.07.2006; 4-6. Dobra valley, 8.07.2014.

The association *Symphyto cordati-Fagetum* is a geographical vicariant of the association *Asperulo-Fagetum* in Central Europe.

4. **As. *Carpino* – *Fagetum* Paucă 1941 (Table 3, rel. 6)**

Forests dominated by hornbeam (*Carpinus betulus*) and beech (*Fagus sylvatica*) are well represented in the western part of the Poiana Ruscăi Mts, especially in the foothills of the mountains, where multiple phytocoenosis have been previously described [18]. In the north-western part of the massif, on the east-facing slope of the Luncani Valley, we have identified a mixed forest with hornbeam and beech, with typical floristic structure. In the tree layer, aside from the two dominant species, there are sporadic occurrences of *Acer campestre*, *Quercus petraea*, *Acer platanoides* and *Prunus avium*. In the grass layer we have mesophilic species typical of the alliance *Lathyro hallersteinii* – *Carpinion* (*Galium schultesii*, *Lathyrus hallersteinii*, *Dactylis polygama*, *Carex digitata*), as well as species characteristic of the order *Fagetalia*. As a consequence, we have included this association in the corresponding syntaxonomic units. From a

phyto-historical point of view, such forests are recorded in pollen deposits starting with the *subatlantic period*, with maximum values for beech pollen of about 60%, respectively 24% for hornbeam pollen (pollen analysis from peat bogs in the vicinity of the massif [6]).

5. **As. *Lathyro hallersteinii* – *Carpinetum* Coldea 1975 (Table 3, rel. 7)**

Phytocoenosis typical of hilly areas, with hornbeam and sessile oak (*Quercus petraea*), occur in the Poiana Ruscăi Mts. on sunny slopes with smooth sides, on deep, brown clay-iluvial soils (poorly acidic – 5,8-6,5 pH). These forests correspond to a certain Romanian forest type: *goruneto-șleau sau șleau de deal de productivitate superioară* (sessile oak hill forests with high productivity) [9].

In the tree layer the species *Quercus petraea* and *Carpinus betulus* are dominant, with a cover of more than 85%. Other tree species, *Prunus avium*, *Sorbus torminalis*, occur sporadically.

In the grass layer, we have nemoral species, characteristic of the alliance *Lathyro hallersteinii* – *Carpinion*: *Lathyrus hallersteinii*, *Aposeris foetida*, *Dactylis polygama*, *Festuca heterophylla*, *Ranunculus auricomus* and *Galium schultesii*. Aside from these, there are also species typical of the order *Fagetalia*.

These forests occupy large areas in the eastern part of the massif, near Ghelari. Forests with sessile oak and hornbeam, similar in floristic structure, but richer in thermophilic species (*Ruscus aculeatus*, *Ruscus hypoglossum*, *Helleborus odorus*) have been described in the western part of the massif, in the Lugoj foothills [18].

6. **As. *Carici remotae* – *Fraxinetum* W. Koch ex Faber 1936 (Table 4)**

Phytocoenosis dominated by *Fraxinus excelsior* and *Alnus glutinosa* occur sporadically in the Poiana Ruscăi Mts., on flooded river banks, with an edaphic substrate typical for such locations (alluvial soils, rich in gravel, with no diagnostic horizons, except a *histic* or *molic* horizon at the surface). In the tree layer we have sporadic occurrences of *Acer campestre*, *A. pseudoplatanus*, *Fagus sylvatica* and *Tilia cordata*. In the grass layer, the species *Carex remota* occurs frequently, and is accompanied by hygrophilous species such as *Geranium phaeum*, *Chaerophyllum aromaticum*, *Aegopodium podagraria*, *Elymus caninus* and *Festuca gigantea*. These species strengthen the ecological profile for the association, and help assign it to the proper alliance. A significant proportion of grass species occurring in these forests are also typical of the order *Fagetalia* and the class *Carpino-Fagetea*.

These type of forests are rather sporadic in Romania [4, 13] and occupy small areas on intra-mountain river banks, far from human settlements (ash wood is very versatile, and used extensively by local people).

Conclusions

The natural forest vegetation of the Poiana Ruscăi Mts. (south-western Romania) is represented by mesophilic beech forests (*Fagus sylvatica*), and mixed forests with beech and fir (*Fagus sylvatica* and *Abies alba*). These forests are grouped in 3 associations: *Symphyto cordati* – *Fagetum* Vida 1959, *Festuco drymejae* – *Fagetum* Morariu ex Resmeriță 1977, *Festuco drymejae* – *Abietetum* Filipaș et al. 2013. In the foothills of the massif, occupying smaller areas, we can find forests from the associations *Carpino* – *Fagetum* Paucă 1941 and *Lathyro hallersteinii* – *Carpinetum* Coldea 1975. On the bottom of intra-mountainous valleys, where the

valleys widen up, in areas often flooded (Beghei Valley, Dobra Valley) we can find forests from the association *Carici remotae – Fraxinetum* W. Koch ex Faber 1936.

With regard to the history of the vegetation in the area, at the end of the *sub-boreal* phase (beginning of *subatlantic* phase), fir expanded significantly its cover in the massif, and was followed by an even more significant expansion of beech. Beech forests represent today the typical vegetation in most of the Poiana Ruscăi Mts., with smaller fir populations surviving in the region, while the natural spruce forests have disappeared.

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CERCETĂRI FITOSOCIOLOGICE ÎN PĂDURILE DIN MUNȚII POIANA RUSCĂI

(Rezumat)

În lucrare se descriu, pe baza releveelor fitocenotice proprii, următoarele asociații forestiere: *Symphyto cordati – Fagetum*, *Festuco drymejae – Fagetum*, *Festuco drymejae – Abietum*, *Carpino – Fagetum*, *Lathyro*

hallersteinii – *Carpinetum* and *Carici remotae-Fraxinetum*. Primele trei asociații forestiere formează vegetația montană zonală, care ocupă peste 80% din masiv. Asociațiile *Carpino-Fagetum* și *Lathyro hallersteinii* – *Carpinetum* sunt răspândite în zona piemontană a masivului, iar *Carici remotae* – *Fraxinetum* se întâlnește sporadic, pe luncile unor văi de pe versantul nordic al masivului Poiana Ruscăi.

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