

**ECOLOGY AND PHYTOCOENOSIS OF *PULMONARIA RUBRA*
BEECH FORESTS FROM PĂDUREA CRAIULUI MOUNTAINS,
MANAGEMENT UNIT III SOHODOL, FOREST DISTRICT BEIUȘ,
AND MANAGEMENT UNIT V VALEA IADULUI, FOREST
DISTRICT REMEȚI**

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Abstract

The beech forest (Fagus sylvatica) mixed with fir (Abies alba) colonize mild to steep slopes of mountains up to an altitude ranging between 650-800 m.

Such forests present a high biodiversity, their phytocoenosis bringing together no less than 88 species. In relation to environmental factors, the beech forests surveyed are as follows: mesophilic (71.4%), micro-mesothermal (67.8%), acid-neutrophilic (40.2%), being dominated by hemicriptophytes (50.6%), geophytes (26.4%), European (34.5%) and Eurasian (30%) species, respectively.

The beech and fir stands surveyed show high conservation values, and rare species of plants and animals. They play a significant role in preserving soil stability, controlling erosion and securing protection of water in Les-Remeți storage lake area.

Key words: forests, phytocoenosis, association, bioform, ecological indices

INTRODUCTION

The first research activities in Pădurea Craiului Mountains were made in Crișul Repede Gorge Nature Reserve, Boșcaiu et al. (1966), succeeded by the research conducted by Burescu, Doniță (2001), Burescu et al. (2002, 2003), Groza (2008).

In terms of structure of both forest living soil cover in general and of the living soil cover of the high conservation value forests within Pădurea Craiului and Vlădeasa Mountains, one may find valuable information in the works of Burescu (2009, 2010, 2013), where reference is made to the compartments of Management Unit III Sohodol and Management Unit V Valea Iadului valley.

MATERIAL AND METHOD

The study material consists of the beech (*Fagus sylvatica*) and fir (*Abies alba*) forests located in the Management Unit III Sohodol, Forest District Beiuș, and the Management Unit V Valea Iadului valley.

In the study of *Pulmonaria rubra* beech and fir forests, one selected test sample surfaces which are homogeneous in terms of floristic and

physiognomic characteristics and sizing 400-600m² belonging to the specific stand by nature and complexity of the horizontal and vertical structure thereof.

For an accurate description of beech and fir forests vegetation as possible, association table provides information on the species that make up the floristic composition of phytocoenosis, quantitative participation of each species by abundance dominance criterion according to Braun-Blanquet 1928.

The species that make up the floristic inventory were assigned to appropriate cenotaxonomic (taxa) units, sub-alliance, alliance, order, and class in accordance with ecological and floral systems, as follows: Tüxen (1955) Borza, Boşcaiu 1965 Soó (1964-1980), Oberdorfer (1992) Rodwel et al. (2002) Borhidi (1996-2003), Coldea (1997-2012), Sanda et al. (1983, 2008), Mucina (1997), Chifu et al. (2014), Potl (1995), Tothmaler (2000). The association table also includes information on serial number of phytocenologic surveys, bioform type, type of floristic element, ecological indices for which graphical representation was drawn up as diragram spectra and charts.

RESULTS AND DISCUSSION

The beech (*Fagus sylvatica*) and fir (*Abies alba*) forests with *Pulmonaria rubra* (*Pulmonaria officinalis*) researched are spread on the mild slopes (20-25°) on Valea Sohodolului valley to steep slopes (41-48°) on Valea Iadului valley with predominantly northeast exposition at altitudes ranging between 650-800 m.

Trees layer with a covering between 60-80% is made of the co-dominant species *Fagus sylvatica* and *Abies alba* accompanied by *Acer pseudoplatanus*, *Picea abies*, *Sorbus aucuparia*, *Acer pseudoplatanus*, *Carpinus betulus*, *Fraxinus excelsior*. Shrub layer with low coverage (1-2%) consists of *Sambucus racemosa*, *Sambucus nigra*, *Daphne mezereum*, *Spiraea chamaedrifolia*, *Corylus avellana*, accompanied by undergrowth *Rubus idaeus*, *Rubus hirtus*, *Rosa canina*.

Floristic inventory of *Pulmonario rubrae* - *Fagetum* phytocoenosis association (Table 1) comprises a number of 88 cormophyte species. Besides the characteristic species of the association *Pulmonaria rubra* and *Fagus sylvatica* other numerous species characteristic for the *Symphyto-Fagenion* sub-alliance participate as follows: *Festuca drymeja*, *Dentaria glandulosa*, *Symphytum cordatum*, *Asplenium scolopendrium*, *Polystichum aculeatum*, alliance *Symphyto cordati-Fagion*: *Abies alba*, *Acer pseudoplatanus*, *Gymnocarpus dryopteris*, order *Fagetalia sylvaticae*: *Galium odoratum*, *Euphorbia amygdaloides*, *Oxalis acetosella*, *Mercurialis*

perennis, *Allium ursinum*, *Lamium galeobdolon*, *Asarum europaeum*, *Aposeris foetida*, *Carex sylvatica*, *Helleborus purpurascens*, *Polygonum verticillatum*, *Paris quadrifolia*, class *Querco-Fagetea*: *Athyrium filix-femina*, *Dryopteris filix-mas*, *Dentaria bulbifera*, *Mycelis muralis*, *Geranium robertianum*, *Doronicum austriacum*, *Stellaria nemorum*, *Anemone nemorosa*, *Lilium martagon*, *Aconitum vulparia*, *Cephalanthera longifolia*, *Campanula persicifolia*, *Digitalis grandiflora*.

Table 1

Pulmonario rubrae-Fagetum (Soó 1964) Täuber 1987

Bio.	E.f.	U	T	R	Survey No.	1	2	3	4	5	6	7
					Data	15.05.2016	15.05.2016	15.05.2016	15.06.2012	15.06.2012	15.06.2012	15.06.2012
					Locality/location	Valea Sohodol valley	Valea Sohodol valley	Valea Sohodol valley	Hodrinușă - brook Acrea summit	Hodrinușă - brook	Leș storag e lake slope	Leș lake lock slope
					Altitude (m)	650	680	710	800	750	740	620
					Exposition	N	NV	NE	E	S	NE	NE
					Slope (°)	15	25	20	41	41	48	45
					Stand layer consistency	0.9	0.8	0.8	0.8	0.7	0.6	0.5
					Tree height (m)	20	22	22	30	30	20	24
					Tree diameter (cm)	40	38	34	30	72	68	60
					Herbaceous layer coverage (%)	95	30	30	20	50	40	40
					Surface (m²)	400	400	400	600	600	500	400
H	Carp	3.5	2	3	<i>Pulmonaria rubra</i>	1	1	+	+	+	+	+
MPh	E	3	3	0	<i>Fagus sylvatica</i>	4	4	4	4	4	4	3
					Symphyto - Fagenion							
G	Carp	4	2	3	<i>Festuca drymeja</i>	.	+	+	1	2	2	3
G	nd. Carp.	4	2.5	4	<i>Dentaria glandulosa</i>	1	+	+	+	1	+	+
H	Carp	3	2	3	<i>Symphytum cordatum</i>	+	.	.	+	+	+	+
H	E	3.5	3.5	3.5	<i>Polystichum aculeatum</i>	+	.	+	.	.	.	.
G	Cp	3.5	3	5	<i>Asplenium scolopendrium</i>	.	+	.	.	.	.	+
					Symphyto cordati - Fagion							
MPh	Ec	4	3	0	<i>Abies alba</i>	+	+	+	2	1	1	1
MPh	Ec	3.5	3	3	<i>Acer pseudoplatanus</i>	+	.	+	+	+	.	+
G	Cp	3	2.5	2	<i>Gymnocarpium dryopteris</i>	.	.	.	+	.	+	.
					Fagetalia sylvaticae							
G	Eua	3	3	3	<i>Galium odoratum</i>	+	+	+	+	+	1	+
nPh	Eua	3.5	3	3	<i>Daphne mezereum</i>	+	+	+	.	.	.	.
G	Ec	4	3	3	<i>Leucojum vernum</i>	+	.	.	.	.	.	.
G	Ec	3	3	0	<i>Corydalis cava</i>	.	+	.	.	.	.	.
H	Ec	3	2.5	3.5	<i>Aposeris foetida</i>	+	+	+	.	.	.	.
Ch	E	3	3.5	4	<i>Euphorbia amygdaloides</i>	+	+	+	.	+	+	+
H	E	3.5	0	4	<i>Lamium maculatum</i>	.	.	+	.	.	.	+
H	Cp	4	3	3	<i>Oxalis acetosella</i>	+	+	.	+	+	+	.
H	E	3.5	3	4	<i>Carex sylvatica</i>	.	+	.	+	.	.	.
G	Ec	3.5	3.5	4	<i>Arum maculatum</i>	.	.	.	.	+	.	+
H	Cp	4	3.5	0	<i>Dryopteris carthusiana</i>	.	.	.	.	+	.	.
H	Eua	2.5	3	3	<i>Carex pilosa</i>	.	.	.	2	.	.	.
H	Carp	2.5	3	4	<i>Helleborus purpurascens</i>	+	+	.	.	.	.	.
H	E	2.5	2.5	2	<i>Luzula luzuloides</i>	+	.	.	.	+	+	+
H	Eua	3.5	3	4	<i>Asarum europaeum</i>	.	+	+	.	+	+	+
G	E	3	2.	2.	<i>Polygonatum verticillatum</i>	.	+	.	+	.	.	+

Bio.	E.f.	U	T	R	Survey No.	1	2	3	4	5	6	7
H	Ec	3	5	5								
H	Eua	3	0	4	<i>Lamium galeobdolon</i>	+	.	+	+	+	+	+
H	E	3	3	3	<i>Lathyrus vernus</i>	+	+	+	.	.	.	+
H	E	3. 5	3	4	<i>Mercurialis perennis</i>	.	+	1	+	1	1	+
H	Eua	3. 5	0	4	<i>Paris quadrifolia</i>	+	.	+	.	+	.	+
nPh	E	3	2. 5	3	<i>Rubus hirtus</i>	.	+	.	+	+	+	+
G	E	3. 5	3. 5	4	<i>Allium ursinum</i>	+	.	.	.	+	+	+
H	Eua	3. 5	3	3	<i>Myosotis sylvatica</i>	+	+	.	.	.	.	.
G	E	3. 5	3	4	<i>Anemone ranunculoides</i>	.	+	.	.	.	.	.
G	E	3	3	0	<i>Corydalis solida</i>	.	.	+	.	.	.	.
H	Eua	3. 5	3	4	<i>Salvia glutinosa</i>	.	.	+	.	.	.	.
G	E	3. 5	3	4	<i>Galanthus nivalis</i>	+	.	.	.	.	.	.
H	Eua	3	2	0	<i>Campanula rapunculoides</i>	.	.	.	.	.	.	.
mPh	Ec	2. 5	3	3	<i>Rubus scaber</i>	.	.	.	+	.	.	.
H	Eua	3. 5	0	0	<i>Stachys sylvatica</i>	.	+	.	.	.	.	.
H	Atl- M	3. 5	3	4	<i>Sanicula europaea</i>	+	.	.	.	.	.	.
H	Eua	3. 5	3	0	<i>Scrophularia nodosa</i> Quercu - Fagetea	+	.	.	.	.	.	.
H	Cosm	4	2. 5	0	<i>Athyrium filix femina</i>	+	+	.	+	+	.	+
H	Eua	3	3	0	<i>Campanula persicifolia</i>	+	.	.	.	.	.	.
MP h	E	3	3	3	<i>Carpinus betulus</i>	.	.	.	+	+	+	+
H	E	3	3	0	<i>Mycelis muralis</i>	.	+	.	+	+	+	+
G	Ec	3	3	4	<i>Dentaria bulbifera</i>	+	.	+	+	2	+	+
G	E	2. 5	3	4	<i>Cephalanthera longifolia</i>	.	.	+	.	.	.	.
G	Ec	2. 5	3	3	<i>Galium schultesii</i>	.	.	+	.	.	.	.
G	E	3	3	4	<i>Hepatica nobilis</i>	.	.	+	.	.	.	.
H	Ec	3. 5	2	3	<i>Doronicum austriacum</i>	.	.	.	.	+	+	+
Th	Cosm	3. 5	3	3	<i>Geranium robertianum</i>	.	+	+	.	+	+	.
H	Eua	3	3	0	<i>Poa nemoralis</i>	.	.	+	.	.	.	.
G	Eua	3. 5	3	4	<i>Circaea lutetiana</i>	+	.	.	.	.	.	.
H	E	3. 5	3	3	<i>Stellaria nemorum</i>	+	+	.	.	.	.	.
G	E	3. 5	4	0	<i>Anemone nemorosa</i>	1	+	.	.	.	.	.
H	Eua	3	3	4	<i>Brachypodium sylvaticum</i>	.	.	+	.	.	.	.
mPh	E	3	3	3	<i>Corylus avellana</i>	+	.	+	.	.	.	+
H	Cosm	4	3	0	<i>Dryopteris filix mas</i>	+	+	.	.	+	+	+
H	Mp	2. 5	3	4	<i>Glechoma hirsuta</i>	+	.	.	.	.	.	.
H	E	3	3	3	<i>Digitalis grandiflora</i>	.	.	+	.	.	.	.
MP h	E	3	3	4	<i>Fraxinus excelsior</i>	.	.	+	.	.	.	.
G	Eua	3. 5	0	3	<i>Platanthera bifolia</i>	.	.	+	.	.	.	.
G	E	3. 5	3	4	<i>Scilla bifolia</i>	+	.	.	.	.	.	.
H	Eua	3	3	3. 5	<i>Viola reichenbachiana</i>	.	+	.	.	.	.	.
H	Ec	2. 5	3	3	<i>Dactylis polygama</i>	.	.	+	.	.	.	.
H	E	2. 5	3	4	<i>Melica uniflora</i>	.	.	+	.	.	.	.
Th	Eua	2. 5	3	3	<i>Moehringia trinervia</i>	.	+	.	.	.	.	.
H	Eua	3. 5	3	3	<i>Ranunculus auricomus</i>	+	.	.	.	.	.	.
H	Ec	4	2. 5	4	<i>Aconitum vulparia</i>	.	+	+	.	.	.	.
G	Eua	3	0	4	<i>Lilium martagon</i>	+	.	+	.	.	.	.
Ch	E	3. 5	2. 5	3	<i>Veronica montana</i>	.	.	.	.	+	.	.
G	Eua	2	3	4	<i>Polygonatum odoratum</i>	.	.	.	.	.	.	.

Bio.	E.f.	U	T	R	Survey No.	1	2	3	4	5	6	7
H	Eua	3	2	5	<i>Primula veris</i>	.	+	.	.	.	.	.
H	Eua	3	3	4	<i>Variae syntaxa</i>	.	.	+	.	.	.	.
MP	E	0	0	0	<i>Anthriscus sylvestris</i>	.	.	.	.	.	.	.
h					<i>Picea abies</i>	+	+	.	.	.	.	.
H	Ec	3.	2.	2		+	1	+	.	.	.	.
		5	5		<i>Luzula sylvatica</i>	.	.	.	+	+	.	.
Th	Eua	5	3	3	<i>Lapsana communis</i>	.	.	.	.	.	.	.
MP	E	3	2.	2		+	+	+	.	.	.	.
h			5		<i>Sorbus aucuparia</i>	.	.	.	.	.	.	.
nPh	Eua	3	2.	0		.	.	.	.	.	.	+
			5		<i>Spiraea chamaedrifolia</i>	.	.	.	.	.	.	.
H	Ec	4	3	3	<i>Geranium phaeum</i>	.	.	+	.	.	.	.
mPh	E	3	3	3	<i>Sambucus nigra</i>	.	.	+	.	.	.	.
mPh	Eua	3	2	3	<i>Sambucus racemosa</i>	.	.	.	+	.	.	+
nPh	E	2	3	3	<i>Rosa canina</i>	.	.	+	.	.	.	.
H	Alp	3.	2	3.		+	.	+	.	.	.	.
		5	5		<i>Doronicum columnae</i>	.	.	.	.	.	.	.
nPh	Cp	3	3	3	<i>Rubus idaeus</i>	.	.	.	+	+	.	+
H	E	2	4	4	<i>Vincetoxicum hirundinaria</i>	.	+	.	.	.	.	.
H	Eua	3.	3	3		+	.	.	.	.	.	.
		5			<i>Senecio germanicus</i>	.	.	.	.	.	.	.

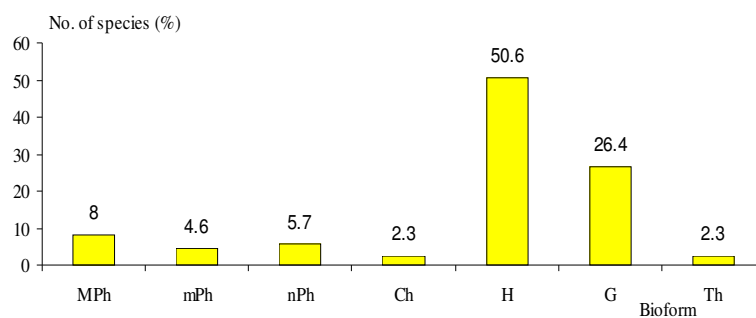


Fig. 1. Bioform spectrum of *Pulmonario rubrae-Fagetum* association

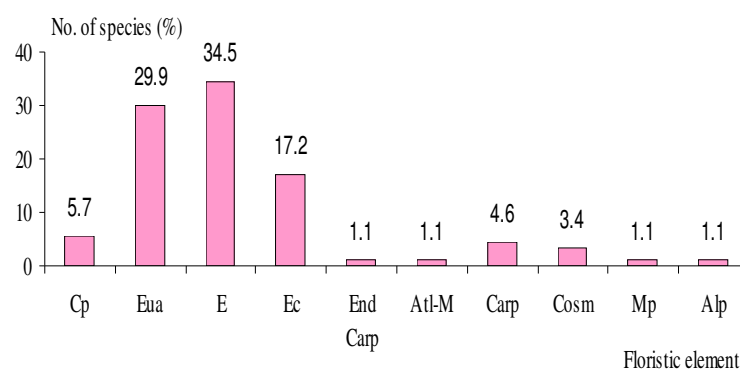


Fig. 2. Floristic elements spectrum of *Pulmonario rubrae-Fagetum* association

Within the bioforms spectrum (Fig. 1), hemicryptophytes prevails (50.6%), followed by geophytes (26.4%) and phanerophytes (mph + MPH + NPH = 18.3%). Regarding the process of speciation and the current geographic area (Fig. 2) the beech (*Fagus sylvatica*) mixed with fir (*Abies*

alba) forests are dominated by European species (34.5%) followed by Eurasian (30%), Central European (17.2%) and circumpolar (5.7%) species, respectively. Depending on the preferences toward environmental factors (i.e. humidity, temperature, soil chemical reaction), see Chart 3 above, beech and fir forests are mesophilic (71.4%), micro-mesothermal (67.8%), micro-thermal (21.8%), acid-neutrophilic (40.2%), and low-acid neutrophilic (33%) nature.

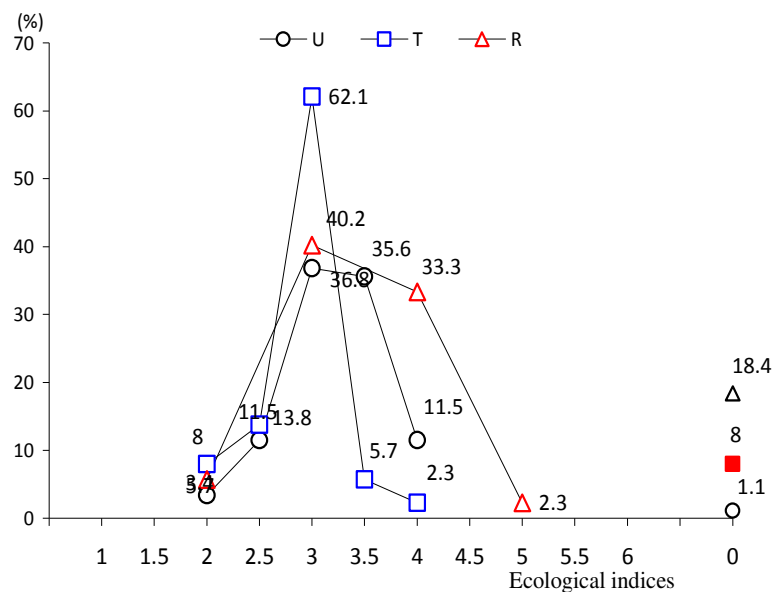


Fig. 3. Ecological indices diagram of *Pulmonario rubrae-Fagetum* association

Economic and environmental relevance

Beech and fir forests provide wood and accessories for wood, pulp, and chemical industries. From the ecological point of view these forests provide the preservation of drinking water. Four management units i.e. 106C, 107A, 108A and 109A, belonging to the functional group 1.1.b are located on the slopes of the Leş-Remeţi storage lake/dam. Since they colonize steep slopes (41-48°) with quasi-stable and unstable rocks and talus, such forests play a substantial role in enhancing and preserving soil stability, and in controlling soil erosion or sliding.

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