STUDY OF THE FORESTS BELONGING TO THE *PHYLLITIDI-FAGETUM* ASSOCIATION INCLUDED IN THE NATURAL HABITAT OF COMMUNITY INTEREST 91 VO DACIAN BEECH FORESTS *SYMPHYTO-FAGION* FROM THE VLĂDEASA MOUNTAINS - BIHOR

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RESEARCH ARTICLE

Abstract

The purpose of this paper is to conduct a geobotanical study in beech forests of high conservation values (HCV) with Phyllitis scolopendrium, included in natural habitats of community interest.

To achieve this goal, we set the following objectives: identifying forest areas ofhigh conservation values, and rare plant associations included in or containing rare ecosystems.

The forest compartmentswith secular, multi-layered forests, assessed as presumptive high conservation value forests were selected from the forest work plans.

A number of five phytocoenological surveys were carried out in the presumptive forests; the results obtained being included in a table belonging to the association Phyllitidi-Fagetum.

The species from the association table were ecologically reviewed from the standpoint of the type of bioform, phytogeographic element, valences of the ecological indices (moisture, temperature, chemical reaction of the soil) and the cytogenetic chromosomal karyotype. Five categories of forests with high conservation values HCVF 1.2, HCVF 1.3, HCVF 3, HCVF 4.1, HCVF4.2 were identified, included in the NATURA 2000 habitat: 91VO Dacian beech forest (Symphyto-Fagion) corresponding to R4116 in Romania.

Discussions and comparison of the results with a scientific paper on a similar topic were made, with research carried out over the last decade, in 2016 in the Padiş Massif - the northern side of the Bihor Mountains.

Keywords: phytocoenoses, association, habitat, high conservation values.

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INTRODUCTION

The purpose of the paper is to conduct a phytosociological, ecological, ecoprotective study of high conservation value forests built by *Fagus sylvatica*, with *Phyllitis scolopendrium*, *Acer pseudoplatanus*, and *Fraxinus excelsior* that develop along the intramontane valleys, on steep and shaded slopes with calcareous substrate (scrubs, rocks), and within rare, endangered forest ecosystems.

To achieve this goal, we set the following objectives:

(i) Pointing out those areas containing high conservation values (HCV) beech forests as well as rare, threatened, vulnerable, relict, endemic species, and natural monuments;

(ii) Identifying the types of ecosystems and habitats encompassing high conservation value forests;

(iii) Phytosociological and ecological analysis of the phytocoenoses of the plant association through the characterization of the species in terms of the type of bioform, phytogeographic element, cytogenetic element and the relationship with environmental factors: soil moisture, air temperature, and chemical reaction of soil;

(iv) Assessment of the conservation status of the phytocoenoses of the *Phyllitidi-Fagetum* association and potential related threats.

For research background purposes and the current state of knowledge about habitat types and ecosystems, we consulted the works of the following authors Alexiu et al. (2008), Candrea et al. (2009), Doniţă et al. (2005), Drăgulescu (2005), Drăgulescu et al. (2007), Gafta et al. (2008), Lazăr et al (2007), Schneider et Drăgulescu (2005), Stăncioiu et al. (2008), Togor (2016). We found references on high conservation value forests in the works of Burescu L.I.N. (2018), Jennings et al. (2003), Ioraş et Abrudan (2007), Stăncioiu (2008), Vlad et al. (2013). We extracted information about biodiversity and species included in the red lists from the works of the authors Angelstam et al. (2004), Bilz et al. (2011), Boşcaiu et al. (1994), Danciu et al. (2007),

Dihoru et Negrean (2009), Kliment et al. (2016), Oltean et al. (1994), Radu (2001), Schulze and Money (1993).

I obtained knowledge about the coenotaxa structure of the association and the diversity of forest ecosystems from the works of the authors Coldea (1991), Coldea et al. (2015), Pop et al. (2002), Sanda et al. (2007, 2008), Chifu et al. (2014), Burescu L.I.N. (2021), Pop Iulia Florina (2024).

MATERIAL AND METHOD

I carried out the research out in the Iadului Valley basin, Vlădeasa Mountains on an area of 1,409 ha, Management unit III Remeţi comprising a number of 12 forest compartments belonging to the Remeţi Forest District, Forestry Directorate of Bihor County.

We planned this research over the period of four successive stages as follows:

(i) Desktop researchand review of information documents (forest management plans, stand maps, scientific publications) with reference to habitat types, ecosystem types, virgin secular forests, red lists of protected plant species;

(ii) Preliminary assessment of forest compartments that could be presumed as high conservation value forests, aged≥100 years, a diversified structure and a concentrated biodiversity;

(iii) Field research of forest compartments selected as potentially containing high conservation value forests (HCVF);

(iv) Final assessment with the drafting up of a list of HCVF we found after carrying out surveys in the selected compartments and enclosing the resulted scientific data in an association table.

RESULTS AND DISCUSSIONS

The research results show that the beech stands with *Phyllitis scolopendrium*from the Vlădeasa Mountains - Bihor are stratified secular forests included in the Natura 2000 Ecological Network, the natural habitat 91VO Dacian beech forest (*Symphyto-Fagion*) to which the type R4116 corresponds in Romania, beech stands with hart's-tongue fern (Dacian *Phyllitis* Beech ravine forest Palaearctic Habitats 41.4641, Emerald 41.1 Beech forests.)

Habitat R4116 South-eastern Carpathian beech (Fagus sylvatica) forests with Phyllitis scolopendrium (hart's-tongue fern).

EMERALD: 41.1 Beech forests

PALAEARCTIC HABITATS: 41.4641 Dacian *Phyllitis* beechravine forest. Habitat type: of very high conservation value (Doniţă et al. 2005).

Association*Phyllitidi-Fagetum* Vida (1959)1963

The phytocoenoses of the association form an intra-zonal vegetation within the mountain beech forests, colonizing shaded slopes, moderate to steepslopes (25-45°) on calcareous rocks (stony places, scree) on skeletal, superficial rendzin-type soils, lithosols, eutrophic with mull-type humus, eubasic, permanently moderately moist to wet soils, on the intramontane valleys of Daica, Valea de Izvor, Pârâul Izvor spring, at altitudes ranging between 605-699 m in the Management unit III Remeţi, compartments 114A, 114D, 131, 240A, Remeţi Forest District, Bihor County.

In the structure of the phytocoenosis, the tree layer is notable having a general coverage of 63%, average height of 20m, a diameter of 30cm, and consisting in the upper canopy of *Fagus sylvatica* as dominant species accompanied by *Acer pseudoplatanus*, *Fraxinus excelsior*, *Ulmus glabra*, *Prunus avium*, and in the lower level of *Carpinus betulus*, *Acer campestre*, *Acer platanoides* as subdominant species, with a sporadic spread.

The poorly developed **shrub layer** having a share of only 2-5% in the lowest level of the stand consists of *Corylus avellana*, *Daphne mezereum*, *Lonicera xylosteum*, *Ribes uva-crispa*, *Sambucu nigra*, *Cornus mas*.

The **herbaceous layer** with an overall coverage of 30% is dominated by *Phyllitis scolopendrium* accompanied by mull flora elements: *Linaria rediviva*, *Cardamine glanduligera*, *Asarum europaeum*, *Galium odoratum*, *Mercurialis perennis*, *Lamium galeobdolon*, *Stachys silvatica*, etc.

If analysed from a phytocoenological standpoint, we note in the phytocoenoses of the association a group of species characteristic of the sub-alliance for the ***sub-allianceMoehringio muscosae-Acerenion****: Acer pseudoplatanus, Fraxinus excelsior, Ribes uva-crispa, Cystopteris fragilis, Moehringia muscosa, Geranium robertianum, Lunaria rediviva,* ***for the allianceSymphyto cordati-Fagion****: Veronica urticifolia, Festuca drymeja,*

Saxifraga cuneifolia, Primula elatior, subspecies *elatior,* for the ***OrderFagetalia sylvaticae:*** *Asarum europaeum,Salvia glutinosa, Viola reichenbachiana, Pulmonaria officinalis, Euphorbia amygdaloides, Epipactis helleborine,* characteristic to the **class*Querco-Fagetea***: *Hepatica nobilis, Hedera helix, Dryopteris filix-mas, Campanula persicifolia, Galium schultesii, Poa nemoralis, Mycelis muralis, Platanthera bifolia, Brachypodium sylvaticum,* which are joined by transgressive species from the **class*Asplenietea trichomanis*** *: Asplenium trichimones* subsp. *quadrivalens, Polypodium vulgaris, Sedum telephium* subsp. *maximum, Valeriana tripteris* . (see Table 1)

Ecological analysis of bioforms (see Chart 1) shows the dominance of hemicryptophytes (57.3%) followed by phanerophytes (24.9%), of which megaphanerophytes (11.8%), mesophanerophytes (7.3%), nanophanerophytes (2.9%), lianas (2.9%), geophytes (11.8%), therophytes (3%) and cameophytes (2.9%) are the species best adapted to the stationary pedo-climatic conditions of the habitat.

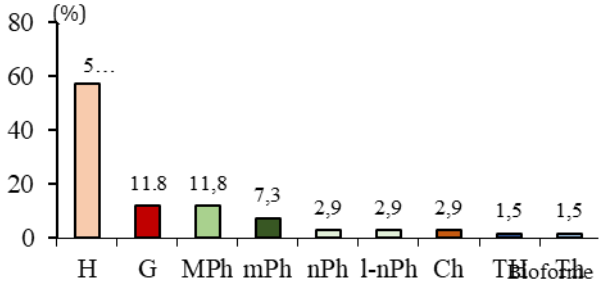

Chart 1 Spectrum of bioforms in the association (*Phyllitidi - Fagetum*) (original)

Analysis of the distribution of plants within the territory by geographical area (see Chart 2) highlights a diversified floristic overview in which Eurasian geoelements are dominant (25%), accompanied by European (23.5%), Central European (22.1%), circumpolar (10.3%) and cosmopolitan (7.3%) geoelements.

In small percentages, Ponto-Balkan (1.5%), Carpatho-Balkan-Ponto-Pannonic (1.5%), Alpine-Carpatho-Balkan (1.5%) and Alpine-European (1.5%) species are present, suggesting phytohistorical links established throughout evolution and migration with the flora of the Balkan Mountains south of the Danube and with that of the Alps in Central Europe.

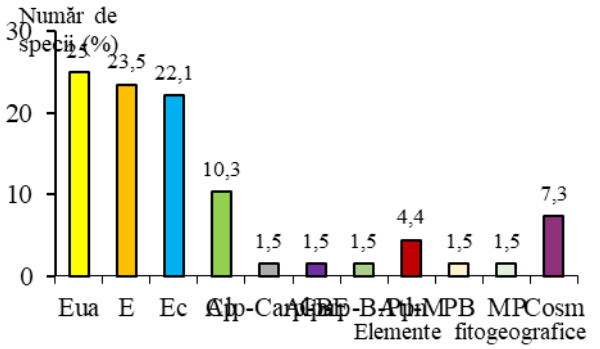

Chart 2 Spectrum of phytogeographic elements in the association (*Phyllitidi - Fagetum*) (original)

Environmental factors of the habitat (Chart 3) with reference to the soil moisture show the dominance of mesophilic species (73.5%) in sites with sufficient moisture of both soil and air, followed at a great distance by the mesohygrophilic ones (13.2%) in sites with high level of moisture and by the xeromesophilic ones (11.8%) in sites with a seasonal moisture deficit. The air temperature and solar radiation create an environment favourable to the development of micromesothermic species (66.1%) with an ecological optimum rangingat temperatures between6°-10°C, followed by microthermal species (23.5%) adapted to low temperatures between 0°C-6°C and by eurythermal species (8.8%) which show a high tolerance to thermal variability (see Table 2).

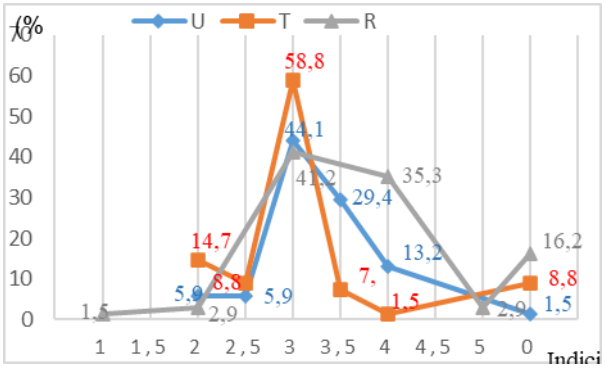

Chart 3. Ecological index chart for the association *Phyllitidi-Fagetum* (original)

Analysis of the chromosomal complement of the genetic karyotype (Chart 4.) highlights the predominance of diploid species in the phytocoenosis (42.6%), closely accompanied by polyploids (41.2%) and at a great distance from diplo-polyploid ones (14.7%), which ensures unhindered gene flow within species populations during panmixia.

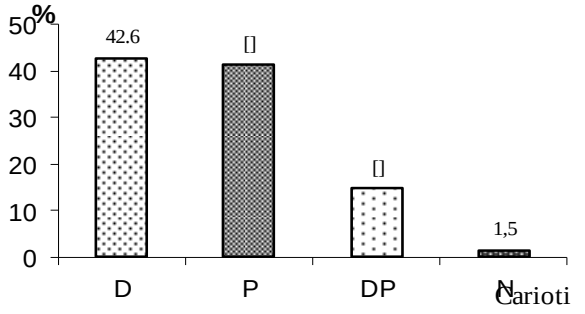

Chart 4. Karyological spectrum of the association *Phyllitidi-Fagetum* (original)

Forest categories found in the habitat by theirhigh conservation values

In the phytocoenoses of the NATURA 2000 habitat: 91V0 Dacian beech forest (*Symphyto-Fagion*) corresponding in Romania R4116 South-eastern Carpathian beech forests (*Fagus sylvatica*) with *Phyllitis scolopendrium* related to the *Phyllitidi – Fagetum* association, we found five categories of high conservation value forests in the Management unit III Remeți, the compartments 114A, 114D, 131, 240A, the Remeți Forest District: ***HCVF 1.2*** Forests hosting rare, threatened, endangered species, ***HCVF 1.3*** Forests hosting endemic and relict species, ***HCVF 3***Forest areas that are in or contain rare, threatened or endangered ecosystems some with characteristics of virgin forests, ***HCVF 4.1*** Forests that provide critical hydrological environmental services, drinking water sources, water catchments, reservoirs, retention dams, ***HCVF 4.2*** Forests with a role in the anti-erosion protection of slopes with rocks, scree, avalanche paths, degraded lands, etc.

The high conservation values contained in these forests are justified by the presence in the habitat of rare, endangered, vulnerable, endemic, relict species such as: *Dryopteris cristata*, *Blechum spicant*, *Sanicula europaea*, *Saxifraga cuneifolia*, *Cystopteris fragilis*, *Epipactis helleborine*, *Platanthera bifolia*, *Ranunculus platanifolius*, for which protection measures and special conservation works are required.

Assessment of conservation status and potential threats

High conservation value forests could be affected by illegal tree felling, improper timber extraction, and the action of risk factors: global climate change, fires, windfalls, damage caused by harmful insects (ipides), mycoses, and bacteriosis.

They also have negative effects, such as weed invasion, soil compaction that prevents the regeneration of the tree from the seed, as well as grazing and animal transit through the ecosystem.

Discussion and comparing results

With regard to the floristic composition of the forests gathered in the *Phyllitidi – Fagetum* association, the results regarding the biodiversity of the flora vary within negligible limits, almost similar, from 68 cormophyte species found in the ecosystems we researched in the Vlădeasa Mountains to 70 cormophyte species found by Togor (2016) in the Bihor Mountains – Padiș Mountainous Massif. Analysis of the ecological valences of the species in relation to environmental factors (moisture, air temperature, chemical reaction of the soil) for beech forests with *Phyllitis scolopendrium* shows very close results with some small exceptions (see Table 3).

Thus, with respect to moisture, the beech forests with *Phyllitis scolopendrium* from the Vlădeasa Mountains have a mesophilic (73.5%) to mesohygrophilic (13.2%) nature, compared to those from the Padiș-Valea Galbena Massif, which also have a mesophilic (72.85%) to mesohygrophilic (20%) character, highlighting very close percentage values, as an expression of the unique pedo-climatic conditions for the forest resorts where they grow.

In terms of temperature, the similarity between the percentage values is even more obvious, with the beech forests in the Vlădeasa Mountains having a micromesothermal (66.1%) to microthermal (23.5%) nature compared to those in the Padiș-Valea Galbenă Massif with micromesothermal (67.14%) to microthermal (22.86%) values (see Table 3).

In terms of the chemical reaction of the soil, the phytocoenoses of the *Phyllitidi – Fagetum* association in the Vlădeasa Mountains have an acido-neutrophilic nature (41.21%) with an ecological optimum around a pH ranging between 5.8-6.5, compared to the beech forests in the Padiș-Cheile Galbena Massif that grow on slightly neutral to completely saturated base soils and have a neutro-basiphilic nature (41.43%) with an ecological optimum for a pH ranging between 6.5-7.0 (see Table 3).

Analysis of life forms highlights results with close values obtained by us in the

Vlădeasa Massif: hemicryptophytes (57.3%), phanerophytes (24.9%), geophytes (11.8%), therophytes (3%), and cameophytes (2.9%) with those obtained by Togor (2016) in the Bihor Mountains: hemicryptophytes (54%), phanerophytes (21.43%), geophytes (17.34%), and therophytes (4.29%).

Territorial distribution of phytogeographic elements by origin, in the geographical area (see Table 4) highlights similar results between the two geographical areas, but also some differences in terms of absence in the Vlădeasa Mountains of endemic, adventive species and the absence of Ponto-Balkan species in the Padiş-Galbena Massif.

The differences resulted in the compared results are explained by the different living conditions (i.e. altitude, geomorphological structure of the relief, soil chemistry, water chemistry, temperature, zoo-anthropic influence) provided for the development of species by the habitats in the two geographical regions i.e. the Vlădeasa Mountains and the Northern Bihor Mountains-Padiş Plateau.

Table 1

As. *Phyllitidi-Fagetum* Vida (1955)1963

Biofor m	Geoele ments	M U	T	R	2n	Survey no	1	2	3	4	5	K	ADm
						Compartment	114A	114D	131	131	240D		
						Altitude (m)	605	615	680	600	699		
						Exposure	NE	N	E	E	NE		
						Slope (°)	30	60	40	40	25		
						Tree height (m)	20	18	20	20	20		
						Tree diameter (cm)	26	34	30	30	30		
						Degree of canopy density	0,6	0,7	0,6	0,6	0,7		
						Herbaceous layer coverage (%)	30	50	20	20	20		
						Stand age	170	170	150	150	110		
						Sampling area (m^2)	800	400	400	400	400		
MPh	E	3	3	3	D	As. *Fagus sylvatica*	4	4	4	4	4	V	62.4
G	Cp	3.5	3	5	D	As. *Phyllitis scolopendrium*	2	3	1	1	1	V	14
Moehringio muscosae-Acerenion													
MPh	Ec	3.5	3	3	P	*Acer pseudoplatanus*	+	+	+	+	+	V	0.5
MPh	E	3	3	4	D	*Fraxinus excelsior*	+	+	+	+	+	V	0.5
H	E	4	3	4	P	*Lunaria rediviva*	+	.	+	+	+	IV	0.4
mPh	E	0	3	0	D	*Ribes uva-crispi*	+	+	+	+	.	IV	0.4
MPh	E	3	3	3	DP	*Acer platanoides*	.	.	+	+	+	III	0.3
H	Cosm	3.5	0	0	P	*Cystopteris fragilis*	.	+	+	+	.	III	0.3
Th(TH)	Cosm	3.5	3	3	P	*Geranium robertianum*	.	.	+	+	+	III	0.3
H	Ec	4	2	4	D	*Moehringia muscosa*	.	.	+	+	+	III	0.3
H	Eua	3.5	3.5	3.5	D	*Polystichum aculeatum*	.	+	+	+	.	III	0.3
Symphyto cordati - Fagion													
H	Ec	3	2.5	4	D	*Veronica urticifolia*	+	+	.	+	+	IV	0.4
G(H)	Ec	4	2	3	D	*Festuca drymeja*	+	+	.	+	.	III	0.3
H	E	3	3	4	D	*Primula elatior* subsp. *elatior*	.	.	+	+	+	III	0.3
Ch	Alp-E	3.5	2	0	D	*Saxifraga cuneifolia*	.	+	+	+	.	III	0.3
MPh	Eua	4	3	3	P	*Ulmus glabra*	.	.	+	+	+	III	0.3
H	Ec	4	2	4	P	*Gentiana asclepiadea*	+	+	.	.	.	II	0.2
H	Ec	3.5	2.5	2.5	P	*Luzula sylvatica*	.	.	.	+	+	II	0.2
H	PB	3	2	3	N	*Verbascum lanatum*	.	.	+	+	.	II	0.2
H	Atl-M	3	3	3	D	*Primula acaulis* subsp. *acaulis*	+	.	.	.	.	I	0.1
MPh	E	3	3	3	DP	*Prunus avium*	.	+	.	.	.	I	0.1
Fagetalia sylvaticae													
H	Eua	3.5	3	4	DP	*Asarum europaeum*	1	+	+	+	+	V	1.4
MPh	E	3	3	3	P	*Carpinus betulus*	+	1	+	+	+	V	1.4
H	Eua	3.5	3	4	D	*Salvia glutinosa*	+	+	+	+	+	V	0.5
mPh	Eua	3.5	3	4	D	*Daphne mezereum*	.	+	+	+	+	IV	0.4
G	Eua	3	3	3	P	*Galium odoratum*	+	.	+	+	+	IV	0.4
H	Ec	3	0	4	D	*Lamium galeobdolon*	.	+	+	+	+	IV	0.4
H	E	3.5	3	5	P	*Mercurialis perennis*	.	+	+	+	+	IV	0.4
nPh	E	3	2.5	2	P	*Rubus hirtus*	.	+	+	+	+	IV	0.4
G	Eua	3	3	3	P	*Epipactis helleborine*	.	.	+	+	+	III	0.3
Ch	Ec	3	3.5	4	DP	*Euphorbia amygdaloides*	.	.	+	+	+	III	0.3
H	E	3.5	3	3	D	*Pulmonaria officinalis*	.	+	.	+	+	III	0.3
H	Eua	3	2.5	3	P	*Viola reichenbachiana*	.	.	+	+	+	III	0.3
H	Cosm	4	2.5	0	P	*Athyrium filix-femina*	.	.	+	+	.	II	0.2
H	Carp-B-Pp	2.5	3	4	P	*Helleborus purpurascens*	.	.	+	+	.	II	0.2
H	Eua	3	3	3	D	*Lathyrus vernus*	.	+	.	+	.	II	0.2

H	Ec	4	3.5	4	D	*Parietaria officinalis*	.	.	+	+	.	II	0.2
Biofor ms	Geoele ments	U	T	R	2n	Survey no	1	2	3	4	5	K	ADm
H	Atl-M	3.5	3	4	D	*Sanicula europaea*	.	.	+	+	.	II	0.2
H	Eua	3.5	0	0	P	*Stachys sylvatica*	+	+	.	.	.	II	0.2
H	Cosm	3	3	4	DP	*Urtica dioica*	.	.	.	.	+	1	0.1
Querco-Fagetea													
mPh	E	3	3	3	D	*Corylus avellana*	+	+	+	+	+	V	0.5
H	Cp	3	3	4	D	*Hepatica nobilis*	+	+	+	+	+	V	0.5
H	Cp	3	3	0	DP	*Poa nemoralis*	+	+	+	+	+	V	0.5
MPh	E	2.5	3	3	D	*Acer campestre*	+	.	+	+	+	IV	0.4
H	Cp	4	3	0	P	*Dryopteris filix-mas*	+	+	.	+	+	IV	0.4
l-nPh	Atl-M	3	3	3	P	*Hedera helix*	1	+	+	+	.	IV	1.3
H	Eua-M	3	3	4	DP	*Brachypodium sylvaticum*	.	.	+	+	+	III	0.3
H	Eua	3	3	0	D	*Campanula persicifolia*	.	.	+	+	+	III	0.3
G	Ec	2.5	3	3	P	*Galium schultesii*	+	.	+	+	.	III	0.3
H(Ch)	Eua	3.5	3	0	DP	*Glechoma hederacea*	.	.	+	+	+	III	0.3
mPh	Eua	3	3	4	D	*Lonicera xylosteum*	.	.	+	+	+	III	0.3
H	E	3	3	3	D	*Mycelis muralis*	+	.	+	+	+	III	0.3
G	Eua	3	3	4	D	*Polygonatum odoratum*	+	.	.	+	.	II	0.2
G	Eua	3.5	0	3	P	*Platanthera bifolia*	.	.	+	+	.	II	0.2
mPh	E	3	3	3	P	*Sambucus nigra*	+	+	.	.	.	II	0.2
H	Eua	3	3	3	P	*Carex digitata*	.	+	.	.	.	I	0.1
l-nPh	Ec	3	3	3	D	*Clematis vitalba*	+	.	.	.	.	I	0.1
Asplenietea trichomanis													
H	Cosm	3	0	4	P	*Asplenium trichomanes* subsp. *quadrivalens*	.	+	+	+	+	IV	0.4
H	Ec	3	0	4.5	D	*Valeriana tripteris*	.	.	+	+	+	III	0.3
G	Alp-Carp-B	3.5	2	3.5	P	*Doronicum columnae*	.	.	+	+	.	II	0.2
H	Ec	4	2	4	D	*Polypodium vulgare*	.	+	.	+	.	II	0.2
H	Eua	2	3	4	P	*Sedum telephium* subs. *maximum*	+	.	.	+	.	II	0.2
Variae syntaxa													
TH(H)	Ec-M	2	4	4	DP	*Arabis turrita*	.	.	+	+	+	III	0.3
H	Cp	3.5	2	1.5	P	*Blechnum spicant*	.	+	.	.	.	I	0.1
mPh	Mp	2	3.5	4	DP	*Cornus mas*	+	.	.	.	.	I	0.1
H	Cp	3.5	2	3	P	*Dryopteris cristata*	.	+	.	.	.	I	0.1
H	E	3.5	2,5	0	D	*Ranunculus platanifolius*	.	+	.	.	.	I	0.1
H	Cp	2.5	2	3	D	*Solidago virgaurea*	+	.	.	.	.	I	0.1

Place and date of surveys: 1-2 Daica (17.07.2022); 3-4 Valea de Izvor (19.09.2020); Izvor Stream (19.09.2020), Remeți Forest District; Bihor County.

Legend referring to:

Bioforms: H=hemicryptophytes, Ph=phenerophytes, MPh=megaphanerophytes, mPh=mesophanophytes, nPh=nanophanerophytes, l-nPh=liano-phanerophytes, G=geophytes, Th=annual therophytes, TH=biannual therophytes, Ch=chamaephytes;

Geoelements: Eua = Eurasian, E = European, Ec = Central European, Cp = Circumpolar, Cosm = Cosmopolitan, Carp-B = Carpatho-Balkan, Alp-E = Alpine-European, Atl-M = Atlantic-Mediterranean, Mp = Mediterranean-Pontic, PB = Ponto-Balkan, End = Endemic, Adv = Adventitious.

Ecological indices: Moisture categories (M): Euromesophiles U = 2-2.5, Mesophiles U = 3-3.5, Mesohygrophiles U = 4-4.5, Euryhydres U = 0.

Temperature categories (T): Microtherms T = 2-2.5, Micromesotherms T = 3-3.5, moderately Thermophilic species T = 4-4.5, Eurytherms T = 0.

Chemical reaction of soil(R): acidophilic R=2, acid-neutrophilic R=3, weakly acid-neutrophilic R=4, neutro-basiphilic R=5, euryionic R=0 species.

Table 2

Species distribution by ecological category of the association *Phyllitidi-Fagetum* (original)

Ecological indices		1	1.5	2	2.5	3	3.5	4	4.5	5	0	Total species
M	Species no	-	-	4	4	30	20	9	-	-	1	68 100
	%	-	-	5.9	5.9	44.1	29.4	13.2	-	-	1.5	
T	Species no	-	-	10	6	40	5	1	-	-	6	68 100
	%	-	-	14.7	8.8	58.8	7.3	1.5	-	-	8.8	
R	Species no	1		2		28		24		2	11	68 100
	%	1.5		2.9		41.2		35.3		2.9	16.2	

Table 3

Comparative spectrum of ecological indices (MTR) for beech stands included in the association *Phyllitidi-Fagetum* in the areas of the Vlădeasa Massif and the Padiș Karst Plateau - Valea Galbena, Valea Plaiului. (M=Moisture, T=Temperature, R=chemical Reaction of the soil).

Location	Ecological indices	Value of ecological indices and the number of species									
		1,5	2	2.5	3	3.5	4	4.5	5	0	Total species
Vlădeasa Massif	Mspecies no. %	-	4	4	30	20	0	-	-	1	68
		-	5.9	5.9	44.1	29.4	13.2	-	-	1.5	100
	T species no. %	-	10	6	40	5	1	-	-	6	68
		-	14.7	8.8	58.8	7.3	1,5	-	-	8.8	100
	R species no %	1	2		28		24		2	11	68
		2.5	2.9		41.2		35.3		2.9	16.2	100
Padiș – Galbena Massif	M species no.	-	-	3	28	23	14	-	1	1	70
	%	-	-	4.2	40	32.8	20	-	0.14	0.14	100
	T species no. %	-	8	8	43	4	-	-	-	7	70
		-	11.4	11.4	61.4	5.7	-	-	-	10	100
	R species no %	-	-		26		29		3	12	70
		-	-		37.1		41.4		4.2	17.1	100

Table 4

Comparative spectrum of phytogeographic elements (geoelements) for phytocoenoses of the association *Phyllitidi – Fagetum* in the areas of the Vlădeasa Massif and the Padiș-Valea Galbena karst plateau, Valea Plai

Location	Phytogrographic elements	Eua	E	Ec	Cp	Cosm	Carp-B	Alp-E	Atl-M	MP	PB	End	Adv	Total species
Vlădeasa Massif	Species no	18	16	14	7	5	2	1	3	1	1	-	-	68
	Percentage %	25	23.5	22.1	10.3	7.3	3	1.5	4.4	1.5	1.5	-	-	100
Padiș-Galbena Massif	Species no	17	13	12	9	4	3	2	3	2	-	3	1	70
	Percentage %	24.29	18.57	17.14	14.29	5.71	4.29	2.85	4.29	2.85	-	4.29	1.43	100

Legend: Eua=Eurasian, E=European, Ec=Central European, Cp=Circumpolar, Cosm=Cosmopolitan, Carp-B=Carpatho-Balkan; Alp-E=Alpine-European, Atl-M=Atlantic-Mediterranean, MP=Mediterranean-Pontic, PB=Ponto-Balkan, End=Endemic, Adv=Adventive

CONCLUSIONS

I identified and described the natural habitat of community interest Natura 2000 Ecological Network: 91VO Dacian beech forest (*Symphyto-Fagion*), which corresponds in Romania to the type R4116 South-eastern Carpathian beech forests (*Fagus sylvatica* with *Phyllitis scolopendrium*).

I found and described forest areas from 12 forest compartments included in the forest ecosystems coded 2316, 3316, which contain high conservation value forests
included in the categories: HCVF 1.2, HCVF 1.3, HCVF 3, HCVF 4.1 and HCVF 4.2.

For the sustainable and lasting development of these forests, special conservation works will be carried out to protect biodiversity.

The results we achieved can serve as a source of information for specialists who approach a similar topic research in other geographical regions.

REFERENCES

Alexiu V., Anastasiu P., Bărbos M., Burescu P., Coldea G., Drăgulescu C., Făgăraș M., Gafta D., Groza D., Groza G., Micu D., Mihăilescu S., Moldovan O., Nicolin L.A., Oprea A., Oroian S., Păucă-Comănescu M., Sârbu I., Șuteu A., (2008), *Manual de interpretare a habitatelor Natura 2000 din România (Interpretation manual for Natura 2000 habitats in Romania),* Risoprint Publishing House, Cluj-Napoca, 101 p.

Angelstam P., Persson R., Schlaepfer R.,2004:*The sustainable forest management vision biodiversity and bridges for implementation in actual landscapes.* Ecological Bulletins 51: 29-49.

Bilz, M., Kell, S.P., Maxted, N., Lansdown, R.V. *European Red List of Vascular Plants*, Publication Office of the European Union, Luxembourg, 2011.

Boşcaiu, N., Coldea, G., Horeanu, C., 1994: *The red list of extinct, endangered, vulnerable and rare vascular plants in Romania*, Ocrot. Nat. Med. Înconj. Bucharest, 38 (1): 45-56, Bucharest.

Burescu, L.I.N., 2018, *Research of ecological genetic on European beech-silver fir stand with Hungarian lilac (Syringa josikaea) in the Apuseni Mountains*, *Valea Iadului*Valley Basin. *Association Pulmonario rubrae-Fagetum, subassociation syringetosum josikaeae*, Analele Universității din Oradea, Fascicula Protecția Mediului, Vol. XXXI, Oradea 107-120.

Burescu Laviniu, 2021: *Ecology of european beech stands populated with Syringa josikaea in the Western Carpathians, Romania***,** Analele Universității din Oradea, Fascicula Protecția Mediului, 2021, Oradea.

Candrea Bozga, S.B., Lazăr G., Tudoran, G.M., Stăncioiu, P.T., 2009: *Forest habitats of community importance included in the project LIFE05 NAT/RO/000176: Priority alpine, sub-alpine and forestry habitats in Romania, Monitoring of the conservation status", Printing House: University "Transilvania" of Brasov, 74p.*

Chifu T., Irimia I., Zamfirescu O., 2014: *Phytocoenologic diversity of Romania vegetation. Forest and scrub vegetation.* Institutul European Publishing House, Iași, 3: 465-478, Romania.

Coldea G., 1991:*Prodome des association végétales DesCarpates du sud-est (Carpates Roumanies). (Prodome des association végétales des Carpates du sud-est (Carpates Roumanies).* Docum. Phytosoc., Camerino, 13:317-359.

Coldea G., Indreica A., Oprea A., 2015: *Les associations végétales de Roumanie. Tome 3. Les associations forestiéres et arbustives.*(*Plant associations of Romania. Volume 3. Forest and shrub associations*) Clujeană&Accent University Publishing House, 281 p.Danciu, M., Gurean, D., Indreica, A., 2007:*Endangered,vulnerableand rare vascular plants in Romanian forests*, Ed. Tehnică Silvică Publishing House, Bucharest.

Dihoru, G., Negrean, G., 2009: *The Red Book of vascular plants in Romania*, Romanian Academy Publishing House, Bucharest.

Doniță, N., Popescu, A., Paucă-Comănescu, M., Mihailescu, S., Biriş, I.A., 2005:*Habitats in Romania*, Ed. Tehnică Silvică Publishing House, 476 p., Bucharest.

Drăgulescu C., 1995: *Flora și vegetația Văii Sudului (Flora and vegetation of the South Valley),* Ed. Constant Publishing House, Sibiu, 355 p.

Drăgulescu C., Schneider E., Benedek A.M.,2007 *Habitats phytodiversity in the Carpathians*. "Lucian Blaga" University Publishing House, Sibiu, 185p.

Gafta, D., Mountford, OJ, (coord.), Alexiu, V., Anastasiu, P., B[rbos, M., Burescu, P., Coldea, Gh. Drăgulescu, C., Șuteu, A., 2008: *Manual for the interpretation of Natura 2000 habitats in Romania*. Risoprint Publishing House, 101 p., Cluj-Napoca.

Ioraș, F., Abrudan, I.V., 2007: *High Conservation Value Forest Identification and Management in Romania.* In: *Forest and sustainable development,* Editura Universităţii Transilvania din Braşov, pp. 649-658.

Jennings, S., Nussbaum, R., Judd, N., Evans, T., 2003: *The high conservation value forest toolkit,* Edition I, ProForest, Oxford OX 12 HZ, UK, 3:1-62.

Kliment J., Turis P., Janišová M., 2016, *Taxa of vascular plants endemic to the Carpatian Mts. Preslia*, 88:19-76.

Lazăr G., Stăncioiu PT, Tudoran GM, Şofletea N., Condrea Bozga SB, Predoiu G., Doniță N., Indreica A., Mazăre G., 2007: *Forest habitats of community interest included in the LIFE 05 NAT/RO/000176:Alpine, Subalpine and forest priority habitats in Romania Potential Threats*, Transilvania University Publishing House, Brasov, 200p.

Oltean, M., Negrean, G., Popescu, A., Roman, N., Dihoru, G., Sanda, V., Mihailescu, S., 1994: *Red list of superior plants in Romania, Studies, Syntheses, Ecology documentation issue 1*, Romanian Acadademy – Instituteof Biology, 1:1-52, Bucharest.

Pop I., Cristea V., Hodișan I.: *The vegetation of Cluj District (a phytocoenological, ecological, bioeconomic and ecoprotective study)*, Contribuții Botanice XXXV (2) pp.5-63, Cluj-Napoca.

Pop I.F., 2024: *Floristic phytocoenological, ecological and bioeconomic study of the ecosistems in the upper of Crișul Repede, Iadey Valley-Drăganului Valley interfluves,* Phd Thesis University of Oradea, pp 531-575.

Radu, S., 2001: *Biodiversity of virgin forests* in*The virgin forests in Romania*. ASBL Publishing House Forêt Wallone, pp. 59-70, Louvain la Neuve, Belgium.

Sanda, V., Barabaș, N., Răduțoiu, D., Biță-Nicolae, C., Blaj-Irimia, I., 2007: *Phytocenological summary III.* Sitech Publishing House, Craiova, 286 p., Romania.

Sanda, V., Öllerer, K., Burescu, P., 2008. *Phytocoenoses from Romania. Syntaxonomy, structure, dynamic and evolution.* Ars Docendi Publishing House, București, pp. 441-458, Romania.

Schneider, Erika, Drăgulescu C., 2005, *Habitats and sites of community interest,* Lucian Blaga University Publishing House, Sibiu.

Schulze, E.D., Mooney, H.A., 1993: *Biodiversity and Ecosystem Function*, Springer-Verlag, 525 p., Berlin.

Stăncioiu, P.T., 2008: *Silviculture and two new concepts related to biodiversity conservation: "High conservation value forests" and "Natura 2000 Ecological Network"*, 90 p.

Stăncioiu, P.T., Lazăr, G., Tuddoran, G.M., Bogdan, Ş., Predoiu, G., Şofletea, N., 2008: *Forest habitats of community interest in project LIFE 05 NAT/RO/000176. "Priority Alpine, Subalpine and forest habitats in Romania*" - *Management measures*. Transilvania University Publishing House, Braşov, 184 p.

Togor, G.C., 2016: *Flora and vegetation of the northern part of the Bihor Mountains.* Phd Thesis. University of Oradea, Romania, pp. 423-429, Romania.

Vlad, R.G., Bucur, C., Turtică, M., 2013, *Practical guide for the identification and management of high conservation value forests*. Green Steps S.R.L. Publishing House, Brasov