COMPARATIVE ANALYSIS OF THE NATURAL HABITATS DOMINATED BY *ALNUS GLUTINOSA* AND *ALNUS INCANA*

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The representative habitats characterised by *Alnus glutinosa* and *Alnus incana* were selected and described for NATURA 2000 network. We mentioned the codes EUNIS, EMERALD, NATURA 2000 and Palearctic Habitats Classification for these types of vegetal communities. Using the cladistic method we represented the similarity of *Telekio speciosae-Alnetum incanae* communities in Azuga and Piatra Craiului Mountain. At the same time a comparison was made of the relevés of *Stellario nemori – Alnetum glutinosae* association near Călugăreni and Clinceanca forests. The dendrogram of similarity based on Jaccard index was performed for both plant associations.

Key words: habitats codes, *Alnus sp.*, plant communities, Jaccard index.

INTRODUCTION

In order to characterize the priority natural habitats from the Romanian Carpathians, a habitat selection was performed to designate the sites according to the criteria for the national valuation of the respective sites. These criteria include, among others, the co-existence of habitat and species types, such as those included in the annexes to the Directives, endangered endemic species, or natural monuments. Thus, the sites' value is emphasized from the point of view of their bio-geographical uniqueness in Romania, but also at the European Union level. According to this selection, special areas of conservation will be identified. Most selected sites are included in Annex I of Law no. 5/2000 regarding the Landscape development plan for the national territory – Section III – protected areas (15).

According to the synchronization strategy between the Romanian and the European legislation regarding the nature protection, the implementation of the *Habitats Directive* (13) is according to the characterisation of the Romanian Carpathian habitats and described them for NATURA 2000 network (8, 11).

On the other hand, the studies of the flora and vegetation in the Bucegi Mountains (11) and Piatra Craiului Massif (6) and the development of some management measures for the habitats of the previous area (7), represent an experience, which should be also extended to other massifs of the Romanian Carpathians (8, 12).

MATERIAL AND METHOD

This work lists and characterizes two types of habitats according to the NATURA 2000 habitats (9) and Palearctic Habitats Classification = Pal. Class. (3).

The following papers were used in order to classify the different types of habitats/vegetal associations: *Prodrome des associations végétales des Carpates du Sud-Est (Carpates Roumaines)* (1), *Les associations végétales de Roumanie. Tome 1. Les associations herbacées naturelles.* (2), *Cenotaxonomia şi caracterizarea grupărilor vegetale din România* (5) and *Vademecum ceno-structural privind covorul vegetal din România* (4).

In the context of identifying the habitats, described for NATURA 2000 network, in the Romanian Carpathians, we mentioned the codes EUNIS (9), EMERALD, NATURA 2000, Pal. Class. for the selected vegetal communities.

The distribution presupposes only the presence of an association, and not necessarily the surface occupied by it on the respective territory. Field data and recent literature information were used (1, 2, 4, 8).

Using the cladistic method mentioned by Forey in 1994 for vegetal communities we represented the similarity of *Telekio speciosae-Alnetum incanae* association in Azuga and Piatra Craiului Mountain. At the same time, a comparison of the relevés of *Stellario nemori – Alnetum glutinosae* was realised near Călugăreni and Clinceanca forests.

The comparison between plant communities points out the similarity of vegetation and is based upon the calculation of the Jaccard similarity index and the obtaining of the similarity dendrograms based on the cladistics method (10, 12). It was used the Jaccard quality index of similarity (based on the presence/absence criteria), which allowed a close examination of data and relevés from the vegetation tables.

RESULTS AND DISCUSSIONS

The *Telekio speciosae-Alnetum incanae* Coldea (1986) 1990 (syn. *Alnetum incanae* auct. roman) phytocoenoses characterized by *Alnus incana* that are mentioned in different massifs of the Carpathians (Tibleş, Rodnei, Retezat) and of the Apuseni Mountains (Gilăului, Vlădeasa) have in their floristic structure some Carpatho-Balcanic species as follows: *Telekia speciosa, Petasites kablikianus*, and other species that are characteristic for beech forests such as: *Symphytum cordatum, Dentaria glandulosa, Pulmonaria rubra, Leucanthemum waldsteinii, Euphorbia carniolica* and *Campanula patula ssp. abietina* (5).

The phytocoenoses of the *Stellario nemori – Alnetum glutinosae* (Kästner 1938) Lohm. 1957 (syn. *Alnus glutinosa-Salix purpurea* Paucă 1941, *Aegopodio-Alnetum precarpaticum* Kárpati V., Kárpati I. & Jurko 1963, *Alnetum glutinosae* Meijer-Drees 1936) represent the riverine riverside coppice characterised by *Alnus glutinosa* distributed along the rivers from colinar and mountain level. The floristic composition is heterogeneous: *Alnus incana, Fraxinus excelsior, Ulmus laevis, Frangula alnus, Humulus lupulus, Stellaria nemorum, Aegopodium podagraria, Matteuccia struthiopteris, Salvia glutinosa, Circaea lutetiana, Stachys sylvatica, Festuca gigantea, Carex montana, Geranium phaeum, Athirium filix-femina*, etc. (5).

In the Habitat Directives these types of plant communities are included as priority habitats for conservation: *91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, *Alnion incanae*, *Salicion albae*). The equivalent codes for these types are:

– EUNIS-G1 Broadleaved deciduous woodland; including G1.1/P-44.21 Montane *Alnus incana* galleries (Montane grey alder galleries);

– Pal. Class.: 41 Broad-leaved deciduous forests, 44 Temperate riverine and swamp forests and brush, including; 44.21 Montane grey alder galleries; 3.1.1. Broad-leaved forest),

– CORINE Land Cover 3.1.1. Broad-leaved forest;

– Bern Convention Resolution 4: 44.2 Boreo-alpine riparian galleries.

The comparison analysed the natural habitats dominated by *Alnus glutinosa* and *Alnus incana*. For the association *Telekio speciosae-Alnetum incanae* Coldea (1986) 1990, the analysis was based on the data from two natural protected areas: Piatra Craiului National Park (Mihailescu S., 2001, *The Flora and Vegetation of Piatra Craiului Massif*, table no. 40, relèves 1–9) and Bucegi Natural Park (Azuga, field data, table 1). For comparison 12 relevés from the field were selected.

For the association *Stellario nemori – Alnetum glutinosae* (Kästner 1938) Lohm. 1957 the field data was noted near to Călugăreni and Clinceanca forest (table 2). That is of particular importance as plant communities along the rivers and valleys in the mountain areas. For comparison 12 relevés from the field were selected.

The comparison between relevés of associations points out the similarity of vegetation and is based upon the calculation of the Jaccard similarity index and the similarity dendrograms are based on the cladistics method, which allowed a close examination of data and relevés from both plant associations tables (Figs. 1, 2).

Table 1

Telekio speciosae – Alnetum incanae Coldea (1986) 1990

No. of relèves	1	2	3	4	5	6	7	8	9	10	11	12	K
Height of vegetation – trees	**15**	**15**	**12**	**14**	**15**	**16**	**15**	**17**	**12**	**17**	**14**	**15**	
– shrubs	**2**	**2,5**	**2**	**3**	**2**	**2**	**2**	**1,5**	**2**	**3**	**2**	**3**	
– herbs	**30**	**25**	**30**	**40**	**25**	**50**	**45**	**50**	**50**	**60**	**50**	**40**	
Coverage (%) – trees	**75**	**70**	**60**	**75**	**80**	**75**	**70**	**80**	**75**	**75**	**70**	**85**	
– shrubs	**5**	**5**	**5**	**5**	**5**	**3**	**5**	**5**	**5**	**5**	**5**	**5**	
– herbs	**65**	**60**	**50**	**65**	**70**	**75**	**75**	**85**	**80**	**80**	**85**	**90**	
Area (m²)	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Char. ass.													
Alnus incana	4	4-5	4	4	4	4	4-5	4	4	4	4-5	4	V
Telekia speciosa	+	.	+	+-1	.	+	+	.	+	1	+-1	1	IV
Diff. subass.													
Petasites hybridus	+	.	+-1	+	1	2	3	2	2	2	1	3	V
Diff. Carpathians													
Symphytum cordatum	.	.	.	+	.	.	.	+	+	.	.	+	II
Pulmonaria rubra	.	.	+	.	+	+	.	+	.	+	+	.	III
Campanula abietina	.	.	+	.	+	.	.	.	+	.	.	+	II
Alno – Ulmion													
Stachys sylvatica	+	+	+	+	+	+	+	.	+	+	+	+	V
Circaea lutetiana	.	+	.	+	.	+	+	+	.	+	+	.	III
Stellaria nemorum	+	.	+	.	.	+	.	+	+	.	+	.	III
Festuca gigantea	.	+	.	.	+	.	+	.	.	+	.	+	III
Impatiens noli-tangere	+	.	.	+	.	.	+	.	.	+	.	.	II
Cirsium oleraceum	.	.	.	+	.	.	.	.	+	.	.	+	II
Geranium phaeum	.	+	.	+	+	+	+	+	.	+	.	+	IV
Matteuccia struthiopteris	.	+	.	+	.	+	.	+	.	+	.	+	III
Carex remota	.	+	.	+	.	.	.	+	.	+	.	.	II
Thalictrum aquilegiifolium	.	+	.	+	+	.	+	.	.	+	.	+	III
Glechoma hederacea	.	+	.	.	+	.	.	.	.	+	.	+	II

Table 1

(continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Fagetalia sylvaticae													
Euphorbia amygdaloides	+	.	.	+	.	+	.	+	.	.	+	+	III
Mycelis muralis	.	.	+	.	.	.	+	.	.	+	.	+	II
Salvia glutinosa	+	.	+	.	+	.	.	+	+	.	+	+	III
Rubus hirtus	.	+	.	+	.	.	+	.	.	+	.	+	III
Anemone ranunculoides	+	.	+	+	.	+	.	.	.	.	.	.	II
Isopyrum thalictroides	.	+	+	.	+	.	.	.	.	.	.	.	II
Rubus idaeus	.	+	+	.	+	+	+	.	.	.	.	+	III
Luzula sylvatica	.	.	+	.	+	.	.	+	+	.	.	+	III
Ajuga reptans	+	.	.	+	.	+	.	.	.	+	.	.	II
Senecio fuchsii	.	+	.	+	.	.	+	.	.	.	+	.	II
Campanula rapunculoides	.	.	+	.	+	.	.	.	+	.	.	.	II
Lamium galeobdolon	+	.	+	.	+	.	.	+	.	.	+	.	III
Carex sylvatica	.	+	+	.	+	.	+	.	+	.	+	+	III
Epilobium montanum	+	.	+	.	.	.	+	+	.	+	.	.	III
Luzula luzuloides	.	+	+	.	+	+	.	+	.	+	.	+	III
Mercurialis perennis	.	+	.	+	.	+	.	.	+	.	.	.	II
Oxalis acetosella	+	+	.	.	.	+	+	.	+	.	+	.	III
Veronica urticifolia	.	+	.	+	+	.	.	+	.	+	.	.	III
Querco – Fagetea													
Poa nemoralis	+	.	+	.	+	.	.	+	+	.	.	.	III
Brachypodium sylvaticum	.	+	.	+	+	.	+	+	.	+	+	+	IV
Aegopodium podagraria	+	+	+	.	+	.	+	.	.	+	+	+	IV
Viola reichenbachiana	+	.	+	.	+	.	+	.	+	.	+	+	III
Glechoma hirsuta	.	+	.	+	.	+	.	+	.	.	.	+	III
Fragaria vesca	.	.	+	.	+	.	.	+	.	.	.	+	II
Geum urbanum	.	+	.	+	.	.	.	+	.	.	+	.	Ii

Table 1

(continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Filipendulo – Petasition													
Chaerophyllum hirsutum	+	.	+	.	+	.	+	+	+	+	+	.	IV
Alchemilla mollis	.	+	+	.	+	.	.	.	+	.	+	.	III
Carduus personata	+	.	+	.	+	.	.	.	+	.	.	+	III
Adenostyles alliariae													
Viola biflora	.	+	.	+	.	.	.	+	.	.	+	+	III
Geum rivale	.	+	.	+	.	+	.	.	+	.	.	.	II
Heracleum palmatum	+	.	.	+	.	+	.	.	.	+	+	.	III
Delphinium elatum	.	+	+	.	.	.	+	+	.	+	.	.	III
Varia													
Taraxacum officinale	+	.	+	.	.	+	.	+	.	.	.	+	III
Prunella vulgaris	.	+	+	.	.	.	+	.	+	.	.	+	III
Tusillago farfara	.	.	.	+	.	.	+	.	.	+	.	+	II
Ranunculus repens	+	+	.	+	.	.	+	.	.	+	.	+	III

Species that are present in one relevé: *Deschampsia caespitosa* (6); *Filipendula ulmaria* (8); *Geranium pratense* (10); *Rumex acetosa* (5); *Caltha laeta* (11); *Cirsium palustre* (12); *Polygonum orientale* (7); *Impatiens glandulifera* (11).

Place and date: Azuga (the Bucegi Mountains) relevés 1–3: 15..V.2003; relèves 4–8: 6-8.VII.2003; relevés 9–12: 14–16.IX.2003.

Table 2

Stellario nemori – Alnetum glutinosae (Kästner 1938) Lohm. 1957

No. of relevés		1	2	3	4	5	6	7	8	9	10	11	12	K
Height of vegetation	– trees	18	20	18	18	20	21	35	30	30	35	35	35	
	– shrubs	5	5	4	6	5	5	8	10	8	8	8	10	
	– herbs	60	50	80	60	65	70	75	70	80	85	70	75	
Coverage %	– trees	80	85	75	80	75	75	80	85	80	75	70	75	
	– shrubs	5	5	5	7	5	5	7	8	7	5	5	7	
	– herbs	75	70	75	70	75	70	75	60	75	80	85	80	
Area (m^2)		500	500	500	500	500	500	500	500	500	500	500	500	
1		2	3	4	5	6	7	8	9	10	11	12	13	14
Car. ass.														
Stellaria nemorum		+	+	+	+	+	+ 1	.	+	.	.	.	+	IV
Alnus glutinosa		4	4	4	4	4	4	3-4	4	4	4	3-4	4	V
Alno – Ulmion														
Stachys sylvatica		+	.	1	+	+	+ 1	1	+	+ 1	1	+	1	V
Geranium phaeum		.	.	+	.	.	.	+	.	+	+ 1	+	+	III
Sambucus nigra		.	+	+	.	.	+	.	+	.	+	.	+	III
Festuca gigantea		+	.	+	+	+	+	.	+	.	.	.	.	III
Thalictrum lucidum		+	+	.	+	.	.	+	.	.	.	.	.	II
Humulus lupulus		+	.	+	+	.	.	+	.	.	.	.	+	III
Caltha laeta		.	+	.	+	.	.	.	+	.	.	.	+	II
Salix alba		1	+	.	1	.	1	.	.	.	.	.	.	II
Circaea lutetiana		.	.	.	.	.	.	+	.	+	.	.	+	II
Iris pseudacorus		.	+	.	+	.	.	.	.	.	.	.	.	I
Scilla bifolia		.	.	.	.	.	.	.	+	.	+	.	.	I
Parietaria officinalis		.	.	.	.	.	.	+	+	.	+	+	+	III
Galeopsis speciosa		+	.	.	.	+	.	+	.	.	+	.	.	II
Symphytum officinale		.	.	+	.	+	.	+	.	.	+	+	.	III
Frangula alnus		+	.	.	.	+	.	+	.	.	.	.	.	II
Fraxinus pallisiae		+	.	.	+	.	+	.	.	.	.	.	.	II
Physalis alkekengi		.	.	+	.	+	.	.	.	.	.	.	.	I
Cruciata laevipes		.	.	.	.	.	.	+	.	+	.	.	.	I

Table 2

(continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Fagetalia sylvaticae													
Lamium galeobdolon	+	.	+	.	+	+	+	.	.	.	+	.	III
Allium ursinum	.	.	.	.	.	.	1	2	2	.	+	.	II
Pulmonaria officinalis	.	.	.	.	.	+	+	+	.	+	.	.	II
Viola mirabilis	.	.	.	.	.	.	+	.	.	+	.	.	I
Anemone ranunculoides	.	.	.	.	.	.	.	+	+	.	+	.	II
Asperula taurina	.	.	.	.	.	.	+	+	.	.	.	.	I
Salvia glutinosa	.	.	.	.	.	.	+	.	+	+	.	.	II
Querco – Fagetea													
Acer campestre	+	.	+	+	.	.	.	.	+	+	.	+	III
Viola reichenbachiana	.	.	+	+	.	+	+	.	+	+	.	+	IV
Corylus avellana	+	+ 1	+	.	+	.	.	.	+ 1	1	.	.	III
Brachypodium sylvaticum	+	+	.	+	+	.	.	.	+	.	.	.	III
Cornus sanguinea	+	+	.	+	+	+	.	+	+	.	+	+	IV
Ranunculus ficaria	.	.	.	.	.	.	+	.	+	.	+	.	II
Geum urbanum	.	.	.	.	.	.	.	+	.	+	.	.	II
Lapsana communis	.	.	.	.	.	+	.	+	.	.	+	+	II
Poa nemoralis	.	.	+	.	.	+	.	.	+	.	.	+	II
Clematis vitalba	.	.	.	+	.	+	.	+	.	.	+	.	II
Ligustrum vulgare	.	.	.	.	+	.	+	.	.	+	.	+	II
Euonymus europaeus	.	.	.	.	+	+	.	+	+	.	.	.	II
Fraxinus excelsior	.	.	.	.	+	+	+	+	.	.	.	+	III
Crataegus monogyna	.	.	+	.	+	.	.	.	+	.	+	.	III
Galio – Urticetea													
Geum urbanum	+	.	+	.	+	.	+	+	.	+	+	+	IV
Aegopodium podagraria	+	.	+	.	+	.	+	.	+	.	+	+	IV
Rubus caesius	1	1	+ 1	2	2	+	1	2	3	2	+ 1	1	V
Galium aparine	+ 1	.	1	.	+	+	+	+	+	+	1	+	V

Table 2

(continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Urtica dioica	+	1	+	.	+	+	.	1	+	+	+	.	IV
Lamium maculatum	.	+	.	+	.	+	.	+	.	.	.	+	III
Dipsacus pilosus	.	.	.	.	.	.	+	.	+	.	+	.	II
Alliaria petiolata	+	+	.	+	.	+	.	+	+	+	+	+	IV
Stellarietea mediae													
Lamium purpureum	+	+ 1	.	+	.	.	.	+	.	.	.	.	II
Bilderdykia convolvulus	.	.	+	.	+	+	.	.	+	.	.	+	III
Stellaria media	.	+	.	+	.	.	+	.	.	+	.	.	II
Erigeron canadensis	.	.	+	.	+	.	.	+	.	.	+	.	II
Molinio –Arrhenatheretea													
Lysimachia nummularia	+	+	.	.	.	+	.	.	.	.	+	.	II
Mentha longifolia	.	+	+	.	+	.	+	.	+	+	+	+	IV
Veronica serpyllifolia	.	.	+	.	.	+	.	.	.	.	.	.	I
Dactylis glomerata	.	.	+	.	+	.	+	.	.	+	.	.	II
Ranunculus repens	.	.	.	+	.	.	+	.	+	+	.	+	III
Potentilla reptans	.	+	.	+	.	.	+	.	+	.	+	+	III
Prunella vulgaris	+	+	.	.	+	.	.	+	.	+	.	+	III
Agrostis stolonifera	.	+	+	.	.	+	+	.	+	+	.	+	III
Trifolium repens	.	+	+	.	+	.	+	.	+	.	+	.	III
Plantago major	.	.	+	.	+	.	.	+	.	+	.	.	II
Varia													
Carex riparia	.	+	+	.	+	+	.	.	.	.	.	.	II
Echium vulgare	.	+	.	+	.	.	.	.	.	.	.	.	I
Cirsium oleraceum	.	.	.	.	.	.	.	+	+	.	+	.	II

Species that are present in one relevé: *Arctium lappa* (4); *Morus alba* (5); *Solanum dulcamara* (3); *Galeopsis tetrahit* (5); *Mycelis muralis* (6); *Chelidonium majus* (7); *Heracleum sphondylium* (10); *Euphorbia cyparissias* (11); *Taraxacum officinale* (11); *Rorippa sylvestris* (9); *Plantago lanceolata* (12).

Place and date: Călugăreni: relevés 1–2. 10.V.2003; relevés 3–4. 15.VI.2003; relevés 5–6. 15.IX.2003. Pucheni, Prahova, Clinceanca Forest: relevés 7–8. 11.V.2003; relevés 9–10. 16.VI.2003; relevés 11–12. 16.IX.2003.

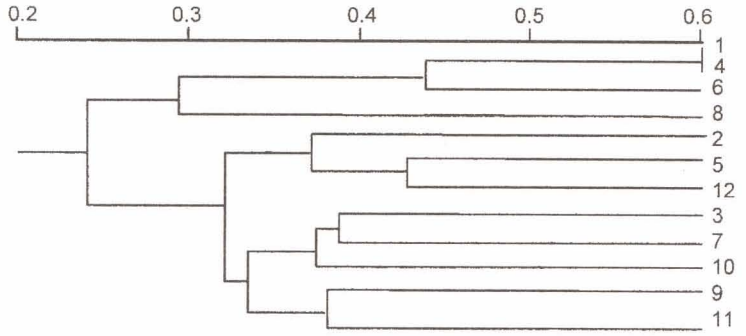

Fig. 1 – Dendrogram of *Telekio speciosae-Alnetum incanae* Coldea (1986) 1990.

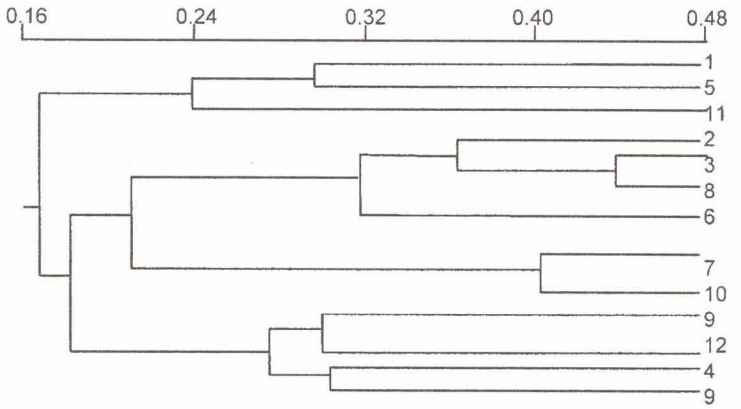

Fig. 2 – Dendrogram of *Stellario nemori – Alnetum glutinosae* (Kästner 1938) Lohm. 1957.

The edaphic characteristics and especially the geologic substratum give a specific floristic structure of herbaceous sinusia, made of a representative number of species, most of them being acidophilous.

The values of the calculated index for the associations are very close to each other. Even then, the values showed higher similarities between the relevés that belong to Piatra Craiului (calcareous region) as compared with those from Bucegi (substrate of acidic rocks).

CONCLUSIONS

• The selected habitats are representative for the vegetation of the Romanian Carpathians and designate sites where the types of habitats and species included in

the international Directives annexes co-exist. They constitute a base for laying the foundations of Natura 2000 sites in Romania, many of them having the quality of priority habitats and their value confers bio-geographic uniqueness to the site, within the European context of the system of natural protected areas.

- The floristic composition of vegetal communities, included at *Telekio speciosae-Alnetum incanae*, with many species included in *Querco-Fagetea* and *Agropyro-Rumicion crispi*, demonstrates that the vegetation ruderalisation was influenced by the high pastoral activity.
- Data analysis has lead to the above diagram. The differences shown in the picture between relevés from associations are due to the increase of the altitude and are influenced by the appearance within the association of the species that are usually spread at the subalpine level.
- The heterogeneity of floristic composition for the vegetal communities included at *Stellario nemori – Alnetum glutinosae* is the result of the altitude and hydric factor.

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