Ass. *Polysticho setiferi-Fagetum* Zupančič et al. 2000 in forest vegetation of Zrinska Gora (Croatia)

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Abstract:
The paper presents and describes submontane beech forests in the area of Zrinska Gora in central Croatia and compares them with similar beech forests inhabiting adjacent areas in Croatia, Slovenia and Bosnia and Herzegovina. In the absence of any previous phytocoenological study of forest vegetation on Zrinska Gora, the results of this research provide the first scientific insights in this issue.
Phytocoenological survey was conducted using the classical Central-European phytocoenological method, while relevés were analyzed with computer support (TURBOVEG, SYN-TAX 2000).
The conducted phytocoenological research showed that the studied stands belong to the association *Polysticho setiferi-Fagetum* Zupančič et al. 2000.
Differences in the appearance and the analysis of floral composition suggest two types of beech stands, which are described as two subassociations: *luzuletosum luzuloidis* Zupančič et al. 2000 and *ruscetosum hypoglossii* subass. nova hoc loco.

Key words:
Polysticho setiferi-Fagetum, forest vegetation, submontane beech communities, Zrinska Gora, Croatia, phytosociology, *ruscetosum hypoglossii.*

1. Introduction

The paper presents and describes submontane beech forests on Zrinska Gora in central Croatia and compares them with similar beech forests inhabiting adjacent areas in Croatia, Slovenia and Bosnia and Herzegovina. In the absence of any previous phytocoenological study of forest vegetation on Zrinska Gora, the results of this research provide the first scientific insights into forest vegetation of this interesting part of Croatia at the transition from the Dinaric into the Pannonian area.

Zrinska Gora is situated about ninety kilometers southeast of Zagreb (Figure 1). The entire complex belongs to a group of low mountains. The terrain is intersected by numerous ridges and ditches. The lowest point is 115 m, and the highest point is 615 m above sea level. Zrinska Gora was predominantly formed in the Tertiary. The geological base consists of layers of marls, clay, sandstone, sands, and gravel with some limestone. The soil over the larger part is medium deep to deep, relatively friable and fresh in northern and eastern expositions, and dry in southern and western expositions. The soil on the ridges is shallow to medium deep. Dominant soil types are dystric cambisol, ranker and colluvium. The mean

annual air temperature is 10.6 °C, and the average annual precipitation quantity is 866 mm (meteorological station Sisak 1961 – 1990).

Figure 1: Position of the Zrinska Gora

2. Methods

Phytocoenological survey was conducted in some twenty localities using the classical Central European phytocoenological method (Braun-Blanquet 1964). The obtained phytocoenological relevés were entered in TURBOVEG database (Hennekens & Schaminée 2001) and were processed, together with the relevés from adjacent areas, with multivariate analysis technique. Statistical SYN-TAX 2000 software (Podani 2001) and a classical method were used for this purpose. Two methods of multivariate statistical analysis were applied: cluster analysis and multivariate scaling.

Our own relevés from Zrinska Gora were compared with relevés from Vukomeričke Gorice (Šegulja 1974), Moslavačka Gora (Hruška-Dell' Uomo 1974), Požeško Gorje (Baričević 2002), as well as relevés from northern Bosnia (Fabijanić et al. 1967, Stefanović 1995) and Slovenia (Zupančič et al. 2000).

Latin names of plant species are adjusted to the web source – Flora Croatica Database (2004) (http://hirc.botanic.hr/fcd/).

The obtained results are part of the scientific project (Synecological-phytocoenological characteristics of forest vegetation in Banovina region), undertaken with the assistance of the Croatian Ministry of Science, Education and Sports.

3. Results and Discussion

Field phytocoenological research into submontane beech forests on Zrinska Gora during 2007 and 2008 indicates the existence of two types of beech forests, which can clearly be discriminated by their external characteristics. The results of synthetic analysis of phytocoenological relevés and multivariate analysis have confirmed this finding (Figures 2 and 3).

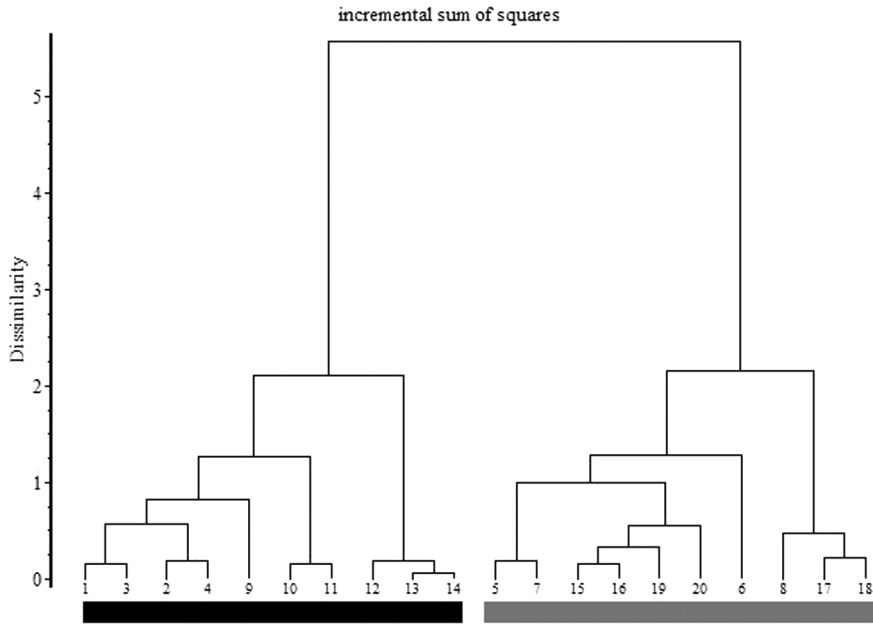

Figure 2: Dendrogram constructed with cluster analysis – Increment sum of squares method

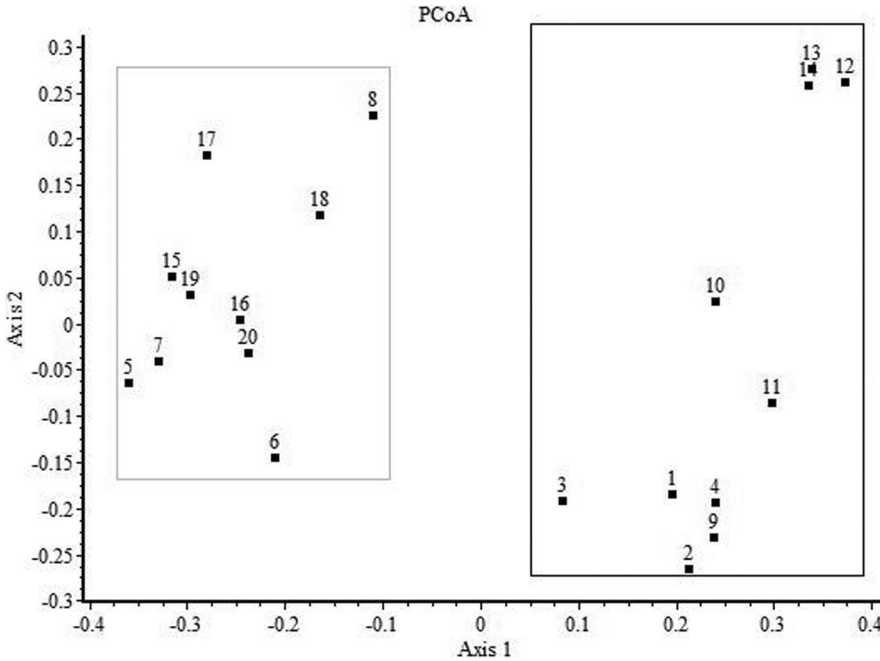

Figure 3: Ordination diagram made by means of multidimensional scaling – PCoA

The first, more neutrophilic type occurs on deeper soils and milder slopes, where the tree layer is almost completely dominated by beech, the shrub layer features considerable amounts of *Sambucus nigra, Acer pseudoplatanus, Ruscus hypoglossum* and *Ulmus glabra*, and the ground vegetation consists of *Circaea lutetiana, Dentaria bulbifera, Galeobdolon luteum, Galium odoratum, Galeopsis tetrahit, Polystichum setiferum, Pulmonaria officinalis, Dryopteris filix-mas, Alliaria petiolata, Polygonatum multiflorum, Anemone nemorosa* and others. The second, more acidophilic type occurring on shallower soils and steeper slopes, is primarily characterized by significant participation of the species such as *Quercus petraea, Carpinus betulus* and *Tilia cordata* (together with beech) in the tree and shrub layer, and distinct dominance of the species *Festuca drymeia* in the layer of ground vegetation, combined with considerable amounts of the species *Luzula luzuloides, L. pilosa, Pteridium aquilinum, Carex digitata, Hieracium racemosum, Potentilla micrantha, Carex pilosa* and *Gentiana asclepiadea*.

In order to validly interpret these types of beech forests, we made further multivariate analyses and compared phytocoelogical relevés of the studied area with similar relevés from different regions of Croatia, Bosnia and Herzegovina and Slovenia (a total of 92 releves). All the applied methods showed identical or similar grouping of relevés (only one dendrogram will be presented due to lack of space – Figure 4).

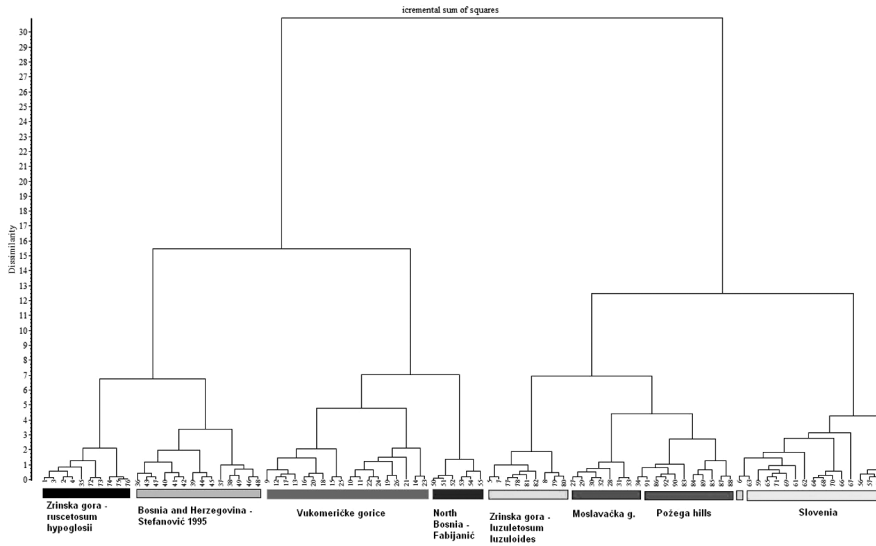

Figure 4: Dendrogram constructed with cluster analysis – Increment sum of squares method

Figure 4 clearly shows that the first group of relevés includes, in addition to the stands on Zrinska Gora (more neutrophilic type), stands from Bosnia described as *Fagetum pannonicum* I. Horvat 1938 s.l. (Fabijanić et. al. 1976) and *Rusco hypoglossii-Fagetum submontanum* V. Stefanović 1990 (Stefanović 1996), as well as stands from Vukomeričke Gorice described as *Fagetum croaticum montanum lathyretosum* I. Horvat 1938 (Šegulja 1974). The second group of beech stands is made up of relevés from Slovenia described as *Polysticho setiferi-Fagetum* Zupančič et al.2000 (Zupančič et al. 2000), a more acidophilic type from Zrinska Gora, relevés from Moslavačka Gora described as *Luzulo albidae-Fagetum* Wraber (1955) 1956 *festucetosum drymeiae* (Hruška-Dell' Uomo 1974) and Požeško Gorje described as *Festuco-Fagetum luzuletosum luzuloidis* Cimperšek 1988 em. Vukelić & Baričević 2002 (Baričević 2002). According to the results of more detailed analyses of similarities in the floral compositions (Table 1), the studied beech forests manifested the highest semblance with beech forests in Slovenia described by Zupančič et al. 2000 as the association *Polysticho setiferi-Fagetum*, and particularly with the second type containing the subassociation *luzuletosum luzuloidis*. This primarily indicates two things: the presence of characteristic species of the association *Polystichum setiferum*, differentiating species of the associations *Festuca drymeia* and *Cephalanthera longifolia*, and all differentiating species of the subassociation, and very high concordance in the occurrence of other species. This is not the case with other compared associations, since the research area shows a very small number of characteristic and differentiating species of particular associations. The first type also belongs to the same association, but it contains elements characteristic of eastern Croatia and Bosnia (*Tilia tomentosa, Ruscus hypoglossum* and similar), as well as species that indicate different synecological and geobotanical conditions of occurrence. We consequently believe that it

should be placed into a special subassociation *ruscetosum hypoglossii* subass. nova hoc loco. The holotype *(holotypus*) of this new subassociation is relevé 14 in Table 1. However, the status of this subassociation will conclusively be defined with further research and analyses, and so will the question of whether or not the stands from Bosnia belong to this association and subassociation.

Table 1: Comparison of floral compositions of the studied stands and the floral composition of the community *Polysticho setiferi-Fagetum*

Association:	*Polysticho setiferi-Fagetum* Zupančič et al. 2000																				Presence class		
Subassociation:	*Ruscetosum hypoglossii* subass. nova										*Luzuletosum luzuloidis* Zupančič et al. 2000										*Ruscetosum hypoglossii*	*Luzuletosum luzuloidis*	Zupančič et al. 2000
Source:	Baričević et al 2008																						
Area:	Zrinska gora - Croatia																						
Number of releves:	1	3	2	4	11	10	9	12	13	14	6	8	17	18	5	7	15	16	19	20			
Floral composition:																							
Characteristic species of association:																							
Polystichum setiferum C	1	1	2	2	2	+	+	+	1	1	.	.	.	+	+	+	.	.	.	1	5	2	2
Differential species of association:																							
Festuca drymeia C	.	+	+	+	.	+	+	.	.	.	4	2	5	3	3	2	3	2	2	3	3	5	4
Cephalanthera longifolia	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	3
Differential species of subassociation *Luzuletosum luzuloidis:*																							
Luzula luzuloides C	.	.	+	.	.	.	.	.	.	.	1	.	+	.	1	1	1	.	.	+	1	3	4
Hieracium racemosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	1
Luzula pilosa	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.	1	1
Solidago virgaurea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	2
Gentiana asclepiadea	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	+	.	2	2
Carex digitata	.	.	.	.	.	.	.	.	.	+	.	+	1	+	.	1	+	.	1	.	4	1
Hieracium murorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	2
Carex pilosa	.	.	.	.	.	.	.	.	.	.	2	2	1	.	1	.	.	.	.	.	.	2	2
Pteridium aquilinum	.	1	.	.	.	.	.	.	.	.	.	.	1	2	2	1	+	3	2	1	4	.
Luzula sylvatica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	+	.	1	.
Melampyrum pratense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.
Prenanthes purpurea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Differential species of subassociation *Ruscetosum hypoglossii:*																							
Tilia tomentosa B	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Ruscus hypoglossum	+	+	.	+	.	.	+	1	1	1	+	+	.	+	.	.	.	+	.	.	4	2	1
Sambucus nigra	+	+	1	1	1	1	2	3	2	2	.	.	.	.	.	.	.	.	.	.	5	.	2
Galeopsis tetrahit C	1	+	+	+	1		1	1	1	1	.	+	.	.	.	.	+	+	.	+	5	2	1
Pulmonaria officinalis	+	+	+	+	+	+	2	.	.	.	1	.	.	+	.	.	.	.	.	.	4	1	1
Dentaria bulbifera	+	+	.	1	2	3	.	3	2	2	.	1	+	1	.	.	.	.	.	.	4	2	2
Galeobdolon luteum	+	+	+	1	+	+	3	+	.	+	.	+	.	.	.	.	.	.	.	+	5	1	.
Circaea lutetiana	+	1	2	2	1	+	2	2	1	+	.	.	.	.	.	.	.	.	.	.	5	.	2
AREMONIO-FAGION:																							
Cyclamen purpurascens C	.	.	.	.	.	.	.	.	.	.	.	1	+	+	+	.	.	.	.	1	.	3	2
Cardamine trifolia	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	1	1
Lonicera caprifolium	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.

Helleborus odorus	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Aremonia agrimonoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	.
Daphne laureola	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Helleborus dumetorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Vicia oroboides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Euphorbia carniolica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Dentaria trifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Hacquetia epipactis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
FAGETALIA SYLVATICAE:																							
Fagus sylvatica A	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5
Acer pseudoplatanus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Ulmus glabra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Fagus sylvatica B	1	+	1	+	1	1	1	1	1	1	1	+	2	1	1	2	2	2	3	3	5	5	5
Acer pseudoplatanus	+	.	+	+	.	.	1	1	+	+	.	+	1	+	.	.	.	.	.	.	4	2	2
Ulmus glabra	.	+	+	+	.	.	+	+	+	+	.	.	.	1	.	.	.	.	.	.	4	1	2
Acer campestre	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Fraxinus excelsior	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Daphne mezereum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Galium odoratum C	1	+	3	1	2	2	4	+	+	+	1	.	.	.	.	.	.	.	.	.	5	1	5
Viola reichenbachiana	+	+	+	.	.	1	1	.	+	.	1	.	.	+	.	+	.	.	.	.	3	2	4
Lathyrus vernus	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	1	1
Euphorbia dulcis	.	.	.	+	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	1	1	3
Carex sylvatica	+	+	+	+	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	3	1	2
Fagus sylvatica	+	+	.	.	1	1	.	1	2	2	.	1	1	2	.	.	1	1	+	.	4	3	1
Dryopteris filix-mas	.	+	.	1	1	1	1	1	1	1	+	+	.	.	.	+	+	.	3	4	3	4
Athyrium filix-femina	+	.	+	1	+	1	.	.	1	.	+	.	+	.	+	+	.	+	.	1	3	3	5
Mycelis muralis	+	+	1	+	+	+	.	.	.	.	+	.	.	+	.	+	.	.	.	+	3	2	2
Acer pseudoplatanus	.	.	.	.	.	.	1	.	.	.	+	1	.	.	+	.	.	.	.	.	1	2	2
Scrophularia nodosa	.	.	+	.	.	+	.	.	.	.	+	.	1	.	.	.	.	.	.	.	1	1	3
Polygonatum multiflorum	.	.	+	.	.	.	.	2	2	1	.	+	.	.	.	.	.	.	.	.	2	1	1
Symphytum tuberosum	.	.	.	.	+	+	.	+	+	+	.	.	.	.	.	.	.	.	.	.	3	.	1
Asarum europaeum	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1
Sanicula europaea	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	4
Salvia glutinosa	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	4
Campanula trachelium	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	2
Cephalanthera damasonium	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	1
Epipactis helleborine	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	1
Geranium robertianum	.	+	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Mercurialis perennis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
Petasites albus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Galium laevigatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Epilobium montanum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Neottia nidus-avis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Chrisosplenium alternifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Asplenium scolopendrium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1

Senecio ovatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Lunaria rediviva	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Euphorbia amygdaloides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Acer platanoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Festuca altissima	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Polystichum aculeatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Paris quadrifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Prunus avium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
QUERCETALIA PUBESCENTIS:																							
Fraxinus ornus B	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	1	2
Sorbus torminalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.
Tamus communis C	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	1	1	2
Melitis melissophyllum	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	1	.
Chamaecytisus hirsutus	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	.
Potentilla micrantha	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	+	.	.	.	+	.	2	.
Lathyrus niger	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Hypericum montanum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Carex flacca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Fraxinus ornus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
QUERCO-FAGETEA:																							
Carpinus betulus A	.	.	.	.	.	.	2	.	.	.	.	.	1	1	+	+	+	.	.	1	1	3	4
Quercus petraea	.	+	.	.	.	+	.	.	.	.	.	.	.	1	+	+	1	+	+	.	1	3	2
Castanea sativa	.	.	.		+		.	.	.	.	.	.	.	.	1	.	.	+	.	.	1	1	1
Prunus avium	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1	.	1
Tilia cordata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Acer platanoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Carpinus betulus B	+	.	.	+	.	.	+	.	+	.	.	.	.	1	.	.	.	+	.	1	2	2	5
Castanea sativa	.	.	.	+	+	+	.	+	.	.	.	.	.	+	.	.	.	.	+	.	2	1	2
Tilia cordata	.	.	+	.	.	.	.	.	.	.	.	.	+	1	.	+	.	1	.	.	1	2	3
Prunus avium	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	1	3
Euonymus europaea	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	1	1	.
Euonymus latifolia	.	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	1	.	.
Crataegus laevigata	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Viburnum opulus	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Corylus avellana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	.	1	.
Acer platanoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Quercus petraea	.	.	.	.	.	.															.	.	2
Platanthera bifolia C	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	1
Cruciata glabra	.	.	.	.	.	.	.	.	.	.		.	1	+	.	+	.	.	.	.	.	2	1
Quercus petraea	+	+	+	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	2	1	1
Anemone nemorosa	.	.	.	.	.	1	.	4	4	3	.	+	+	.	.	.	.	.	.	.	2	1	.
Hedera helix	.	.	.	+	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	1	.
Melica uniflora	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	2
Veronica montana	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Brachypodium sylvaticum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Hepatica nobilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1

Castanea sativa	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	.	.	.	.	.	2	.
Festuca heterophylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	.
Veronica officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	.
Carpinus betulus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Glechoma hederacea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Moehringia trinervia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Convallaria majalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Clematis vitalba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
OTHER SPECIES:																							
Abies alba A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
Picea abies	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Populus tremula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Genista tinctoria B	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	1	.
Veronica chamaedrys C	.	+	+	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	1	1	1
Rubus hirtus	1	+	2	.	1	2	2	2	1	1	1	+	.	2	+	+	+	1	2	2	5	5	.
Carex pendula	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Alliaria petiolata	+	+	1	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Lilium sp.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Stellaria nemorum agg.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Ajuga reptans	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1
Aposeris foetida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	2
Doronicum austriacum	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	1	1
Hypericum perforatum	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	.
Genista germanica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Calluna vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Campanula sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Dryopteris carthusiana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Oxalis acetosella	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Urtica dioica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Eupatorium cannabinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Atropa bella-donna	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Vaccinium myrtillus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1

It is also necessary to revise submontane and montane beech forests in Croatia, similarly to what Zupančič et al. 2000 did in Slovenia, by unifying former descriptions of similar communities named *Luzulo albidae-Fagetosum festucetosum drymeiae* (M. Wraber 1954, 1956, 1960), *Festuco drymeiae-Fagetum* (M. Wraber 1954, 1960), *Fagetum subpannonicum* var. geog. *Festuca drymeia* (Marinček & Zupančič 1986), *Festuco drymeiae-Fagetum* var. geog. *Polystichum setiferum* (Cimperšek 1988) and *Hedero-Fagetum* var. geog. *Polystichum setiferum* (Ž. Košir 1994) into one uniform association *Polysticho setiferi-Fagetum*. In Croatia, this was only partially done by Vukelić & Baričević (2002) and Vukelić et al. (2005).

The analysis of the floral composition and especially of the occurrence of Illyrian and south-eastern European species shows reduced participation of these species. This clearly indicates that beech stands from Zrinska Gora belong to the sub-Pannonian region, while the association *Polysticho setiferi-Fagetum* is the boundary community belonging to the alliance *Aremonio-Fagion*.

4. Conclusions

According to the results of the phytocoenological research of beech forests in the submontane belt of Zrinjska Gora, these forests belong to the association *Polysticho setiferi-Fagetum* Zupančič et al 2000.

Differences in the appearance and analyses of the floral composition suggest two types of beech stands. These are described as two subassociations: *luzuletosum luzuloidis* Zupančič et al 2000 and *ruscetosum hypoglossii* subass. nova hoc. loco.

A comparison of the floral composition with similar beech stands in the narrower and wider surroundings shows that stands most similar to these are stands from Moslavačka Gora described as *Luzulo albidae-Fagetum* Wraber (1955) 1956 *festucetosum drymeiae* Hruška-Dell' Uomo 1974 and from Požeško Gorje described as *Festuco-Fagetum luzuletosum luzuloidis* Cimperšek 1988 em. Vukelić & Baričević 2002. Further analyses should focus on carrying out valid revision and final naming of these and other submontane stands in Croatia and Bosnia and Herzegovina.

This is the first time that beech stands from Zrinska Gora treated in this work are described and named according to the valid Code of Phytocoenological Nomenclature (Weber et al. 2000). Systematically, they belong to the alliance *Aremonio-Fagion* as a boundary community.

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