

PROBLEMS OF THE ASOCIATION *CASTANEO-FAGETUM*
SYLVATICAE MARINČEK & ZUPANČIČ (1979) 1995

PROBLEMATIKA ASOCIACIJE *CASTANEO-FAGETUM SYLVATICAE*
MARINČEK & ZUPANČIČ (1979) 1995

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ABSTRACT

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Problems of the association *Castaneo-Fagetum sylvaticae* Marinček & Zupančič (1979) 1995

More recent investigations have shown that the association *Castaneo-Fagetum* is classified in the alliance *Quercion roboris* and order *Quercetalia roboris*. To date, it has been placed in the sub-alliance *Luzulo-Fagenion* and alliance *Fagion sylvaticae*. On the basis of comparison with related, similar or neighbouring beech phytocenoses, we have defined new characteristic and distinguishing species for it. We described the new sub-associations *Castaneo-Fagetum typicum* subass. nova and *Castaneo-Fagetum fraxinetosum orni* subass. nova.

Key words: *Castaneo-Fagetum*, syntaxonomy, beech forests, Slovenia.

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Problematika asociacije *Castaneo-Fagetum sylvaticae* Marinček & Zupančič (1979) 1995

Novejše raziskave so pokazale, da asociacijo *Castaneo-Fagetum* uvrščamo v zvezo *Quercion roboris* in red *Quercetalia roboris*. Do zdaj je bila umeščena v podzvezo *Luzulo-Fagenion* in zvezo *Fagion sylvaticae*. Na osnovi primerjave s sorodnimi, podobnimi ali sosednjimi bukovimi fitocenozami smo določili njene nove značilnice in razlikovalnice. Opisali smo novi subasociaciji *Castaneo-Fagetum typicum* subass. nova in *Castaneo-Fagetum fraxinetosum orni* subass. nova.

Ključne besede: *Castaneo-Fagetum*, sintaksonomija, bukovci gozdovi, Slovenija.

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1 INTRODUCTION

This article is connected with the article »Advances in the problem of acidophilous beech forests in Slovenia« (MARINČEK & ZUPANČIČ 1979) and the review of their nomenclature (MARINČEK & ZUPANČIČ 1995: 31–33). We will not therefore repeat the already established and described synecological and synhorological conditions of the association *Castaneo-Fagetum*. We will only mention them briefly insofar as it is necessary for understanding the entire content of the article. We will supplement the synsystematic question of the association with new findings, which are based on comparison of similar or zonally related phytocenoses in Slovenia, the border region of Croatia and partially Bosnia. In Croatia, these associations are *Castaneo-Fagetum* (*Luzulo-Fagetum* s. lat.) and *Blechno-Fagetum*, in Bosnia *Castaneo-Fagetum* (*Luzulo-Fagetum castanetosum* s. lat.) and in Slovenia, in addition to the association *Castaneo-Fagetum* s. lat., also the association *Luzulo-Fagetum* Meusel 1937 s. str., (*Polygonato verticillati-Luzulo-Fagetum* var. geogr. *Cardamine trifolia* Marinček 1983, *Luzulo-Abieti-Fagetum* H. Mayer (1963) 1969 *praealpinum* Marinček & Dakskobler 1988 s. lat), *Hedero-Fagetum* Ž. Košir (1962) 1994, *Hacquetio-Fagetum* Ž. Košir 1962 var. geogr. *Ruscus hypoglossum* Ž.

Košir 1979, *Ranunculo-Fagetum* Marinček 1992 var. geogr. *Hepatica nobilis* Marinček 1993 and *Polysticho lonchitis-Fagetum* (Ht. 1938) Marinček and Poldini & Nardini 1993. (See Synthetic Table).

Better and broader understanding of the beech phytocenoses of Slovenia has enabled a more precise and perhaps more correct identification of the characteristic and distinguishing species of the association *Castaneo-Fagetum* and, at the same time, also a more suitable classification of the association *Castaneo-Fagetum* into a higher synsystematic units. To date, the association *Castaneo-Fagetum* has not been typologically divided into lower syntaxonomic units and we have attempted to do this now. In addition to two newly presented sub-associations, other even lower syntaxonomic units probably appear in nature.

The research is based on the standard Central European method (BRAUN-BLANQUET 1964). The floristic nomenclature is taken from Mala flora Slovenije (MARTINČIČ et al. 2007). The biological forms and phytogeographic distribution of the plant species are taken from POLDINI (1991) and the comparison of similarities of phytocenoses from Th. SØRENSEN (1948).

2 BRIEF SYNECOLOGICAL DESCRIPTION OF THE ASSOCIATION

The association *Castaneo-Fagetum* s. lat. grows on acid brown distric soils on non-carbonate rocks in the sub-montane zone. The climatic conditions are various, from continental to sub-mediterranean-atlantic. The habitats of the association, according to de Marton's index, are in the region of forest climates, in which a moderate continental climate predominates with more or less abundant precipitation. The association is for the most part distributed in the sub-alpine, pre-dinarid and sub-pannonian and partially in the dinarid

phytogeographic regions. In accordance with the phytographic division of Slovenia, we distinguish four geographic variants of the basic association, namely in Central Slovenia and Prekmurje, the typical variant *Castaneo-Fagetum* var. geogr. *typica*, in Dolenjsko a variant with the species *Epimedium alpinum*, on Pohorje with the species *Hieracium rotundatum* (= *H. transsilvanicum*) and in southern Notranjsko with the species *Calamintha grandiflora* (MARINČEK & ZUPANČIČ 1979: 716–719).

3 SYNSYSTEMATIC PROBLEM OF THE ASSOCIATION

MARINČEK & ZUPANČIČ (1979: 720–722) classified the association *Castaneo-Fagetum* (= *Quercu-Luzulo-Fagetum*) in the sub-alliance *Luzulo-Fagenion illyricum* Marinček & Zupančič 1979. Even then, there were doubts about the establishment of a new illyrian sub-alliance of acid beech forests. The sub-alliance did not have »...its own specific characteristic species...«, and this prevented the existence of an abstract sub-alliance. With the re-

view of nomenclature of acidophilous beech and sessile oak associations (MARINČEK & ZUPANČIČ 1995: 29–32) the association *Castaneo-Fagetum* was placed in the central european sub-alliance *Luzulo-Fagenion* Lohm. & R. Tx. 1954, alliance *Fagion sylvaticae* Luquet 1926 and order *Fagetalia sylvaticae* Pawlowski and Pawlovski et al. 1928, which Marinček already anticipated in his dissertation and confirmed this in his monograph (MARINČEK

1980: 153–154). The above classification of the association *Castaneo-Fagetum* (= *Luzulo-Fagetum* s. lat.) corresponds to the opinion of the majority of central European phytocenologists (OBERDORFER 1957). S. WALLNÖFER et al. in MUCINA et al. (1993) do not consider it the sub-alliance *Luzulo-Fagenion* but the alliance *Luzulo-Fagion*, which they classify in the order *Quercetalia roboris* R. Tx. 1931 and class *Quercio-Fagetea* Br.-Bl. & Vlieger and Vlieger 1937. Similarly, south-eastern European phytocenologists classify the alliance *Luzulo-Fagion* in the order *Quercetalia roboris-petraeae* and class *Quercetea roboris-petraeae* (FUKAREK & FABJANIĆ 1968). Soó (1964) placed the sub-alliance *Luzulo-Fagenion* in the alliance *Fagion medio-europaeum* Soó (1960) 1962. In Slovenia, M. WRABER (1960) classified the association *Luzulo-Fagetum* s. lat. (= *Castaneo-Fagetum*) in the alliance *Luzulo-Fagion* but later, influenced by Soó, changed his opinion and placed the alliance in the sub-alliance *Luzulo-Fagenion* of the alliance *Fagion medio-europaeum* (M. WRABER 1964) (MARINČEK & ZUPANČIČ 1979).

OBERDORFER (1957: 489–506) tried to define the sub-alliance *Luzulo-Fagenion* [= *Luzulo-Fagion* (Lohm. & R. Tx. 1954) em. Oberd. 1957] with distinguishing species indicated in phytocenoses of acid beech forests in the region of southern Germany. The majority of the chosen distinguishing species are from syntaxonomic units of spruce forests *Vaccinio-Piceetea* s. lat. Of these, our association contains *Castaneo-Fagetum Luzula luzuloides* (Lam.) Dandy & Wilmott, *Vaccinium myrtillus* L., *Calamagrostis arundinacea* (L.) Roth, *Dryopteris expansa* (Presl.) Fraser-Jenkins & Jermy, *Oxalis acetosella* L., *Galium rotundifolium* L. and *Senecio ovatus* (Gaerten., Mey. & Scherb.) Willd., which is ranked among high stemmed plants (*Adenostyletalia*). S. WALLNÖFER et al. (1993) propose an alliance *Luzulo-Fagion* Lohmeyer et R. Tx. and R. Tx. 1954 with a diagnostic species combination, namely as characteristic species *Luzula sylvatica* (Huds.) Gaudin subsp. *sylvatica* (in the author's opinion bad) and distinguishing species *Milium effusum* L., *Oxalis acetosella* L., *Fagus sylvatica* L. and *Veronica urticifolia* Jacq. Of those mentioned, *Luzula sylvatica* subsp. *sylvatica* and *Milium effusum* are not present in our association.

The distinguishing species of Oberdorfer and S. Wallnöfer are more or less relative and have a leading role in spruce syntaxonomic units, where they are regularly represented by high or the highest frequencies of appearance and medium cover values. In acid beech forests, they have relative value as distinguishing species and certainly not characteristic species, in marked distinction to basal or neutral beech forests. The distinguishing species of Oberdorfer or S. Wallnöfer are generally widespread species of spruce phytocenoses in

higher systematic ranks, above all classes and orders. So there is no typical distinguishing species for the sub-alliance *Luzulo-Fagenion*, and even less characteristic species, which would specifically, exemplarily define it as a sub-alliance or alliance. Nevertheless, we accept them as relative distinguishing species to a certain extent. From the previously enumerated distinguishing species of Oberdorfer, only four are sufficiently represented in the association *Castaneo-Fagetum*, these are *Luzula luzuloides*, *Vaccinium myrtillus*, *Calamagrostis arundinacea* and *Oxalis acetosella*, other distinguishing species are coincidental.

In view of the very poor presence of distinguishing species of the sub-alliance *Luzulo-Fagenion* in the association *Castaneo-Fagetum* and the numerical representation of the characteristic species of the alliance *Quercion roboris* Malc. 1929 and order *Quercetalia roboris* R. Tx. 1931, we are opinion that the association should be classified in these two synsystematic units. Eight characteristic species of the alliance *Quercion roboris* and 15 characteristic species of the order *Quercetalia roboris* are represented in the association *Castaneo-Fagetum*. Fourteen of these are adequately represented: *Castanea sativa* Mill., *Genista tinctoria* L., *Carex piluifera* L., *Melampyrum pratense* L. subsp. *vulgatum* (Pers.) Ronninger, *Pteridium aquilinum* (L.) Kuhn, *Dicranella heteromalla* (L. ap. Hedw.) Schimper., *Frangula alnus* Mil., *Hieracium racemosum* Waldst. & Kit. ex. Wild. *H. sabaudum* L., *H. vulgatum* Fries, *Polypodium vulgare* L., *Festuca heterophylla* Lam., *Veronica officinalis* L. and *Potentilla erecta* (L.) Raeuschel (see the Synthetic Table).

Analysis of syntaxonomic units exemplarily shows the predominance of species of pedunculate oak forests of the alliance *Quercion roboris* and order *Quercetalia roboris*, as is evident in the Synthetic Table. The classification of *Castaneo-Fagetum* in the alliance *Quercion roboris* Malc. 1929 is justified and the only possible classification. In addition to the predominance of species of pedunculate oak forests in the association *Castaneo-Fagetum*, a poorer representation of species of spruce forests is characteristic of it, especially species of the alliance *Vaccinio-Piceion* and order *Vaccinio-Piceetalia*, which are more numerous in the similar, more or less related association *Luzulo-Fagetum*, with higher levels of presence and medium cover values. We classify the association *Luzulo-Fagetum* in the sub-alliance *Luzulo-Fagenion* and alliance *Fagion sylvaticae*. The difference between other oak forests in Slovenia and the association *Castaneo-Fagetum* is the absence of high stemmed species (*Betulo-Adenostyletea* Br.-Bl. & R. Tx. 1943 or *Mulgedio-Aconitetea* Hadač in Klika & Hadač 1944 s. lat.), which indicates the dryness of the habitat. (See Synthetic Table).

3.1 Problem of characteristic and distinguishing species

MARINČEK & ZUPANČIČ (1979: 719–720 in 724) chose the following species as characteristic species: *Fagus sylvatica*, *Luzula luzuloides* (= *L. albida*), *Melampyrum pratense* subsp. *vulgatum* and *Castanea sativa*. They deliberately placed the species *Fagus sylvatica* among characteristic species because GLIŠIĆ (1975) tentatively (invalidly) described the association *Castaneo-Fagetum moesiaca* Glišić 1975 (nom. prov.), which MATOVIĆ (1986) later validly described as the association *Fago moesiaca-Castanetum* (Glišić 1975) Matović 1986. (= *Fageto-Castanetum sativae mixtum* Matović 1986). The aforementioned authors in all cases of designating the association believe that it is a wetland species of beech – *Fagus moesiaca* K. Maly (?). In view of the changes of the name of the originally designated association *Castaneo-Fagetum moesiaca* into *Fago moesiaca-Castanetum* it is not necessary for the species *Fagus sylvatica* L. to be ranked among characteristic species of the association *Castaneo-Fagetum*.

The second characteristic species *Luzula luzuloides* (Lam.) Dand. & Wilmott. (= *L. albida* Hoffm.) DC. was poorly chosen as a diagnostically important species of the association *Castaneo-Fagetum*. It is evident from the Synthetic Table that it is generally widespread in acid beech forests and more or less also beech forests on carbonate soil, especially where there is an acidified humus horizon of rendzina or carbonated soils. It can thus be seen that the species *Luzula luzuloides* does not have real diagnostic value in the association *Castaneo-Fagetum*.

The third characteristic species, *Castanea sativa* Mill., is also more or less widespread in other beech associations, especially in acid beech associations. Here and there it is well represented in the related association *Blechno-Fagetum*. Because of its wide distribution in beech forests, it is a poor characteristic species of the association *Castaneo-Fagetum*. However, because of the high level of presence and good medium cover values in the association *Castaneo-Fagetum*, it can be considered to be a relatively good distinguishing species of it. With its greater presence, it gives a specific seal to the association *Castaneo-Fagetum*, because of which we have also respected it in naming the association.

Of the old characteristic species, only the sub-species *Melampyrum pratense* L. subsp. *vulgatum* (Pers.) Ronninger is acceptable, but it is also relative. It appears in the association *Castaneo-Fagetum* for the most part with a high level of presence and with good medium cover values. It is also found with a smaller presence in the related association *Blechno-Fagetum*. The sub-species *Melampyrum pratense* subsp. *vulgatum* grows optimally on acidophilous sunny habitats (MARINČEK &

ZUPANČIČ 1979: 720) in heliophilous beech, oak and pine forests, in which there are for the most part acid to very acid distric soils on a non-carbonate base, with friable (raw) humus. The ecological sign of the sub-species *Melampyrum pratense* subsp. *vulgatum* corresponds to the habitat of the association *Castaneo-Fagetum* and it is therefore very acceptable as its characteristic species.

In addition to the species *Melampyrum pratense* subsp. *Vulgatum*, we have added the species *Chamaecytisus supinus* (L.) Link, *Frangula alnus* Mill., *Hieracium racemosum* Waldst. & Kit. ex Willd., *H. vulgatum* Fries, *Serratula tinctoria* L. and *Veronica chamaedrys* L. to the characteristic species. The enumerated species are very similar in terms of ecological conditions. They settle habitats on a non-carbonate bedrock, where there are dry, more or less nutrient and base rich, but limestone poor soils, with neutral to relatively acid friable humus. They are classified in semi-shade to light loving species of bright deciduous (oak, beech) and coniferous (pine) forests or scrubland (OBERDORFER 1979). These characteristic species are mostly closely connected to the association *Castaneo-Fagetum*. Here and there, the species *Melampyrum pratense* subsp. *vulgatum* and *Genista tinctoria* appear individually in the related acidophilous association *Blechno-Fagetum*. They are not found in basic beech forests. (See Synthetic Table).

In a paper on the problem of acidophilous beech forests, MARINČEK & ZUPANČIČ (1979) did not envisage distinguishing species of the association *Castaneo-Fagetum*. For defining the association as sub-montane, thermophilous and anthropozoogenic we chose distinguishing species in contrast to other montane beech phytocenoses and partially also in contrast to basic sub-montane beech associations. We already previously mentioned that the species *Castanea sativa* Mill. is rejected as a characteristic species and we rank it among distinguishing species of the association *Castaneo-Fagetum*. The species *Castanea sativa* is a southeast-european geoelement, which phytogeographically characteristically marks its area of distribution in the sub-montane zone of oceanic Europe. Its ecological character accords with the described habitat conditions of the association *Castaneo-Fagetum* or its characteristic species. It inhabits a non-carbonate base, with limestone poor, more or less nutrient and base rich dry soils with neutral friable humus. It is a semi-shade species in heliophilous deciduous forests or scrub (OBERDORFER 1979). It gives precedence to habitats with warm humid summer climate, where there are mild winters. We have added the species *Faxinus ornus* L., *Pyrus pyra-ster* (L.) Borkh. and *Tilia cordata* Mill. to distinguishing species, with similar ecological characteristics described for the species *Castanea sativa*. All the distinguishing species mark the thermophilous, open and anthropo-

genically influenced character of the habitat of the association *Castaneo-Fagetum*.

The enumerated distinguishing species are relative. They appear most often in the association *Castaneo-Fagetum* and are also present here and there in other associations of the sub-montane zone, e.g., in *Blechno-Fagetum* and *Hedero-Fagetum*. However, e.g., the species

Castanea sativa and *Faxinus ornus* are represented in the association *Castaneo-Fagetum* with higher levels of presence and medium cover values. The distinguishing species *Pyrus pyraeaster* and *Tilia cordata* are only present in the association *Castaneo-Fagetum*, but individually so with low values of presence. (See Synthetic Table). This can be seen exemplarily in the Analytical Tables.

3.2 Phytocenological groups

Synsystematic units	<i>CASTANEO-FAGETUM</i>	<i>BLECHNO-FAGETUM</i>	<i>HEDERO-FAGETUM</i>
	%	%	%
<i>Quercetalia roboris</i>	10.0	23.1	4.9
<i>Quercio-Fagetea</i> s. lat.	45.6	12.8	66.0
<i>Vaccinio-Piceetea</i> s. lat.	22.4	31.7	13.6
<i>Erico-Pinetea</i> s. lat.	1.4	2.6	1.0
<i>Betulo-Adenostyletea</i> s. lat.	1.9	1.3	5.8
<i>Mulgedio-Aconitetea</i> s. lat.			
<i>Epilobietea angustifolii</i> s. lat.	1.0	0.0	0.0
<i>Trifolio-Geranietea</i> s. lat.	1.4	0.0	1.9
<i>Nardo-Callunetea</i> s. lat.	1.4	3.8	0.0
<i>Seslerietea</i> s. lat.	0.5	0.0	0.0
<i>Festuco-Brometea</i> s. lat.	0.5	0.0	0.0
<i>Molinio-Arrhenatheretea</i> s. lat.	1.9	0.0	1.9
<i>Artemisietea</i> s. lat.	1.0	0.0	3.0
other species	11.0	16.7	1.9
TOTAL	100.0	100.0	100.0

Table 1: Synsystematic groups of the associations *Castaneo-Fagetum*, *Blechno-Fagetum* and *Hedero-Fagetum*

The composition of syntaxonomic groups of the association *Castaneo-Fagetum* is clear from Table 1. The majority contain species of beech phytocenoses, with almost 46%, which give beech associations their basic characteristics. In second place are species of spruce phytocenoses, with slightly over 22%, which mark the association as acidophilous. We add to this more or less acidophilous, xerophilous and thermophilous species of sessile oak-pedunculate oak forests, with 10%, which rank the association *Castaneo-Fagetum* in the alliance *Quercion roboris*. Unspecified (other) species account

for 11% , of which 9.5% are mosses, the majority acidophilous and xerophilous, which is characteristic of the association *Castaneo-Fagetum*. The 1.5 % unspecified vascular flora with 11 % from non-forest syntaxonomic units indicates the considerable anthropozoogenic influence. Species of oak forests also show the human influence on the association *Castaneo-Fagetum*. For comparison, we have included in Table 1 the disposition of syntaxonomic units of the related or neighbouring associations *Blechno-Fagetum* and *Hedero-Fagetum*, which we will discuss in Section 4.

3.3 Horological groups

Horological groups/species	%
southeast-european	2.4
euro-mediterranean	3.3
pontic	4.3
mediterranean-atlantic	1.0
illyrian	0.5
mediterranean - pontic	1.0
mediterranean - montane	3.8
northern-illyrian	1.4
southern-illyrian	1.0
southeast-european	6.1

Horological groups/species	%
euro-asian	10.4
european	26.6
circumboreal	9.0
paleotemperate	3.3
cosmopolitan	2.4
alpine-carpathian	0.5
alpine	0.5
arctic-alpine	0.5
adventive	0.5
unspecified (mosses, lichens)	21.0
TOTAL	100.0

Table 2: Horological groups of the association *Castaneo-Fagetum*

European species are most numerous in the association *Castaneo-Fagetum*, with almost 27 %, followed by unspecified species with 21 %; these are mosses and lichens. In third place are circumboreal species with 9 %. All the enumerated groups, together with other horological groups in the right hand column of Table 2 are classified among cryophilic plants, which predominate with a three-quarter share of all species in the association *Castaneo-Fagetum*. The left-hand column of Table

2 presents thermophilous horological groups or species, of which there are almost 25%. On the basis of horological groups, it can be concluded that the association thrives in somewhat more difficult habitat conditions, mainly edaphic, in which there are acidic brown, sometimes also distric and shallow soils on a non-carbonate base, and close to settlements very burdened with anthropozoogenic influences, in the past with constant littering.

3.4 Biological spectrum

Biological form	%
PHANEROPHYTES (Phanerophyta)	23,3
stem phanerophytes (P. scap.)	10,0
tufted phanerophytes (P. caesp.)	8,1
nanophanerophytes (NP)	3,3
climbing phanerophytes (P. lian.)	0,5
parasitic phanerophytes (P. ep.)	0,5
CHAMAEPHYTES (Chamaephyta)	26,3
semi-shrub chamaephytes (Ch. suffr.)	3,3
creeper chamaephytes (Ch. scap.)	1,0
stem chamaephytes (Ch. scap.)	0,5
shrub chamaephytes (Ch. frut.)	0,5
Σ =	5,3
moss chamaephytes (B. Ch.)	18,2
lichen chamaephytes (L. Ch.)	2,9

Biological form	%
HEMICRYPTOPHYTES (Hemicryptophyta)	33,3
stem hemicryptophytes (H. scap.)	19,0
tufted hemicryptophytes (H. caesp.)	6,7
rosette hemicryptophytes (H. ros.)	5,7
creeper hemicryptophytes (H. rept.)	1,9
GEOPHYTES (Geophyta)	15,6
geophytes with rhizomes (G. rhiz.)	13,2
geophytes with tubers (G. bulb.)	1,4
geophytes with root buds (G. rad.)	0,5
parasitic geophytes (G. par.)	0,5
THEROPHYTES (Therophyta)	1,0
stem therophytes (T. scap.)	1,0
unspecified species	0,5
TOTAL	100,0

Table 3: Biological forms of species of the association *Castaneo-Fagetum*

In the biological spectrum of the association *Castaneo-Fagetum*, chemicrophytes predominate with a one third majority and among them stem chemicrophytes are the most numerous. They are followed by chamaephytes, with moss and lichen chamaephytes having the largest share; together with geophytes these have an almost one half majority, indicating the specifically unfavourable habitat conditions. Phanerophytes, with slightly more than a fifth of all species, indicate more favourable habitat conditions. By combining phanerophytes and chaemicrophytes, which together considerably exceed half of the species in the association *Castaneo-Fagetum*, it can be established that the association grows in more or less favourable

habitat conditions with all the unfavourable aspects that were mentioned in the previous sections 3.2 and 3.3. The biological spectrum of the association *Castaneo-Fagetum* shows that its place is between a normal spectrum and the mountain zone, which would correspond to the previous finding of the analyses of phytocenological and horological groups. The majority of stands of the association *Castaneo-Fagetum* are affected by poor management. In addition to the poor edaphic conditions and cultivation measures, the relative closeness of settlements is fatal for these forests, which enables constant interventions in the forest (burning, littering, grazing, sometimes excessive felling etc.).

3.5 Typological division

We have distinguished two sub-associations and a stage in the complex of the association *Castaneo-Fagetum*.

The subassociation *Castaneo-Fagetum typicum* subass. nova is the main phytocenosis, which is impoverished of the characteristic species of the association. Primarily, and sometimes exclusively, only the characteristic species *Melampyrum pratense* subsp. *vulgatum* is

present, here and there with large cover values. It is also impoverished of distinguishing species. The presence of the leading distinguishing species *Castanea sativa* is very variable in the tree layer, from large cover values to complete absence but it is almost always present in the shrub layer. Stands are very anthropozoogenically influenced, which can be seen in the stand form of stump growth and sometimes very impoverished herb layer, which is replaced by an abundant moss layer; this is a

sign of previous and perhaps current littering and previous pollarding. **The subassociation *Castaneo-Fagetum typicum* does not have distinguishing species, for the holotype we took relevé 21 in the Analytical Table, which is optimal in relation to the representation of characteristic species.**

The subassociation *Castaneo-Fagetum fraxinetosum orni* subass. nova is a thermophilous phytocenosis with thermophilous distinguishing species *Sorbus torminalis* (L.) Crantz, *S. aria* (L.) Crantz, *Fraxinus ornus* L., *Lathyrus niger* (L.) Bernh. and *Serratula tinctoria* L. subsp. *tinctoria*. The first four distinguishing species are classified in the thermophilous order *Quercetalia pubescentis* and the last distinguishing species in the order *Molinietalia*. The distinguishing species stress the thermophilous aspect of the sub-association and lower screen value of the tree layer. It primarily inhabits xerophilous deciduous forests (oak, whitebeam, beech)

but is also found in pine forests, where a warm summer climate prevails. It grows on dry, sometimes relatively fresh, base and nutrient rich but limestone poor, sandy also rocky soils with lightly friable, relatively acid humus (OBERDORFER 1979). **The holotype of the subassociation *Castaneo-Fagetum fraxinetosum orni* is relevé 22 in the Analytical Table.**

Within the framework of the subassociation appears a stage with spruce *Castaneo-Fagetum fraxinetosum orni* stad. *Picea excelsa*, which has occurred because of human interventions. Probably more or less clear felled, which was then planted with spruce. Those who made the interventions were guided by endeavours for economic and technically better and more useable spruce. However, spruce in these low altitude and climatically warm habitats does not have the same high quality technological properties as in the suitable sub-alpine/alpine world.

4 COMPARISON WITH RELATED ASSOCIATIONS

In order to verify the reliability of the characteristic and distinguishing species of the association *Castaneo-Fagetum* and ensure that these indisputably and exemplarily represent it, we compared related and similar zonal and neighbouring associations of beech forests in Slovenia. In accordance with this comparison, we confirmed the correctness of treating the association independently in the Synthetic Table. The association *Blechno-Fagetum* is most closely related to the association *Castaneo-Fagetum*, followed by the high altitude acidophilous beech association *Hedero-Fagetum*. Because of the partial, although very small similarity but because of the vicinity in the sub-montane zone, we also compared the association *Castaneo-Fagetum* with the illyrian basophilous association *Hacquetio-Fagetum*. We thus ensured exclusive characteristic and distinguishing species of the association *Castaneo-Fagetum*, which do not appear in other beech phytocenoses. For this purpose, we also compared the association *Castaneo-Fagetum* with the altimontane, slightly acidophilous associations *Ranunculo-Fagetum* and *Polysticho lonchitis-Fagetum*, which are more or less similar to the association *Luzulo-Fagetum* in terms of the presence of sub-alpine or dealpine and acidophilous plant species.

Comparison between the associations *Castaneo-Fagetum* and *Blechno-Fagetum* showed $\sigma_s = 54$ according to Sørensen's similarity of phytocenoses, which means that they are sufficiently different and thus justifiably independent, although they have a large number of plant species in common. The index of similarity according to

Jaccard ($\sigma_j = 38$) is even lower. In the association *Blechno-Fagetum*, here and there we find characteristic species of the association *Castaneo-Fagetum Melampyrum pratense* subsp. *vulgatum* and the distinguishing species *Castanea sativa*. In contrast, in the association *Castaneo-Fagetum* characteristic species of the association *Blechno-Fagetum* are sometimes found, namely *Bazzania trilobata* and *Blechnum spicant*. These species, with common species of the order *Quercetalia roboris* s. lat. and the class *Vaccinio-Piceetea* s. lat. stress their partial relatedness. The major difference between the associations is in the greater presence of species of beech phytocenoses in the association *Castaneo-Fagetum* (Table 1) (See Analytical Table).

The associations *Castaneo-Fagetum* and *Hedero-Fagetum*, because of the mosaic alternation of carbonate and non-carbonate bedrock, are sometimes immediate neighbours. However, Sørensen's index of similarity of the phytocenoses ($\sigma_s = 51$) confirms the difference between the phytocenoses and Jaccard's index ($\sigma_j = 34$) is even lower, which more explicitly indicates their difference. However, there is a partial similarity between the associations, especially on mixed carbonate-noncarbonate habitats of the association *Hedero-Fagetum*, where species of spruce phytocenoses and species of pedunculate oak forests appear (Table 1) (See Analytical Tables). Because of the mixed geological base, here and there in the association *Hedero-Fagetum* are found distinguishing species of the association *Castaneo-Fagetum*, *Castanea sativa* and, because of the openness of

stands and thus higher levels of sunshine, also the distinguishing species *Faxinus ornus*. The majority of the characteristic species of the association *Hedero-Fagetum*, with a lower level of presence, appear in the association *Castaneo-Fagetum*; the most frequent are *Athyrium filix-femina*, *Cardamine bulbifera*, *Galeobdolon flavidum*, *Hedera helix*, *Sanicula europea*, *Dryopteris filix-mas* and *Sorbus torminalis* and the distinguishing species *Luzula luzuloides* and *Euphorbia amygdaloides*. The selection of characteristic and distinguishing species of the association *Hedero-Fagetum* is thus unconvincing, especially because the enumerated species are generally widespread in beech forests. The index of similarity between the associations on the level of characteristic and distinguishing species is $\sigma_s = 61$ or $\sigma_j = 44$. This is fairly high and draws attention to the unacceptability of the diagnostic species for the association *Hedero-Fagetum*. At the same time, we compared characteristic and distinguishing species between the associations *Hedero-Fagetum* and *Hacquetio-Fagetum*, for which the indexes are also very high, namely $\sigma_s = 81$ and $\sigma_j = 69$, which additionally confirms the unacceptability of the characteristic and distinguishing species of the association *Hedero-Fagetum*. (See Synthetic Table).

The neighbouring phytocenosis of the sub-montane zone is the basophilous association *Hacquetio-Fagetum*, rich with species of beech phytocenoses and especially characteristic species of illyrian beech forests *Aremonio-Fagion* and with an almost complete absence of species of pedunculate oak and spruce forests. Just like the association *Hedero-Fagetum*, the association *Hacquetio-Fagetum* is classified in the alliance *Aremonio-Fagion*. There is also a great difference between the associations in the number of species, with the association *Castaneo-Fagetum* being floristically richer. The difference between the associations is also shown by the index of similarity of phytocenoses $\sigma_s = 50$ and $\sigma_j = 34$. (See Synthetic Table).

In order to ensure the reliability of the characteristic and distinguishing species of the association *Castaneo-Fagetum*, we additionally made a comparison with the

altimontane beech associations *Luzulo-Fagetum*, *Ranunculo-Fagetum* and *Polysticho-Fagetum*, which contain a number of species of beech and spruce phytocenoses that are present in the association *Castaneo-Fagetum*. We thus avoided inappropriate designation of characteristic and distinguishing species of the association *Castaneo-Fagetum*.

In addition to the typical association *Castaneo-Fagetum* var. *geogr. typica*, which is now also presented in the Analytical Table, MARINČEK & ZUPANČIČ (1979) described three geographic variants, namely *Castaneo-Fagetum* var. *geogr. Calamintha grandiflora*, *Castaneo-Fagetum* var. *geogr. Epimedium alpinum* and *Castaneo-Fagetum* var. *geogr. Hieracium rotundatum* (= *H. transsilvanicum*), which were confirmed in a review of the nomenclature (MARINČEK & ZUPANČIČ 1995).

A further known secondary association *Galio rotundifolii-Pinetum sylvestris* (ZUPANČIČ & ČARNI 1988) is shown in the Analytical Table with six phytocenological relevés (38-43), namely a stage with the species *Fagus sylvatica*, which indicates the primary habitat of the association *Castaneo-Fagetum*, on which man influenced and created secondary red pine phytocenosis. The presence of characteristic and distinguishing species of the association *Castaneo-Fagetum* in the secondary association *Galio-Pinetum* can be seen from the Analytical Table. Species of oak and spruce forests are also numerous, which confirms the former distribution of the primary sub-montane acidophilous beech forest *Castaneo-Fagetum*. The species *Chimaphila umbellata*, *Lycopodium clavatum*, *Pyrola chlorantha*, *Diphasiastrum complanatum*, *Galium rotundifolium* and *Pinus sylvestris* have become established in the created secondary red pine forest, and they are its characteristic and distinguishing species. The retreat of species of beech phytocenoses is most marked. We have attempted in the Analytical Table exemplarily to show the development of vegetation after degradation of the association *Castaneo-Fagetum* in Goričko in the sub-pannonian phytogeographic region.

5 CONCLUSION

Comparison between the acidophilous and neighbouring important basophilous beech forests has given new knowledge about the classification of the association *Castaneo-Fagetum* in the alliance *Quercion roboris* and order *Quercetalia roboris*, which has been done on the basis of the Synthetic Table. The related association *Blechno-Fagetum* is already classified in this alliance, and acidophilous sessile oak, chestnut and birch phyto-

cenoses. The association *Luzulo-Fagetum* temporarily remains in the sub-alliance *Luzulo-Fagenion* of the alliance *Fagion sylvaticae*. The sub-alliance *Luzulo-Fagenion* is poorly defined, since it does not have its own characteristic species. OBERDORFER (1957) only indicated distinguishing species for the sub-alliance *Luzulo-Fagenion*, which are for the most part species of the characteristic species of the class *Vaccinio-Piceetea* s. lat., but

these, too, are frequently generally distributed in other beech, especially acidic beech phytocenoses. It is evident from the Synthetic Table that the distinguishing species of the sub-alliance *Luzulo-Fagenion* are represented in the association *Luzulo-Fagetum* with high or even with the highest levels of presence, among which *Dryopteris expansa* and *Galium rotundifolium* are only present in the association *Luzulo-Fagetum*. Particular attention must be drawn to the appearance of the species *Cardamine trifolia* and *C. enneaphyllos* from the illyrian alliance *Aremonio-Fagion*, which give the association *Luzulo-Fagetum* a special phytogeographic seal and we consider it to be a geographic variant.

Comparison enabled us reliable, indisputable and exemplary selection of characteristic and distinguishing species of the association *Castaneo-Fagetum*. (See Synthetic and Analytic Tables).

We described two new sub-associations in the context of the association *Castaneo-Fagetum* – *typicum* and – *fraxinetosum orni*.

In the comparison of beech phytocenoses in the Synthetic Table we came upon two problems. The first is the invalid designation of the association *Hedero-Fagetum*. These names were already used by Samek 1961, Jeschke 1964, Passarge & Hofmann 1968 with phytocological tables, Passarge 1968 and Bauer 1972. Precedence

in naming probably belongs to the authors Passarge and Hofmann 1968, when they published tables. The chosen characteristic and distinguishing species of the association *Hedero-Fagetum* are also unconvincing, since for the most part they appear in other beech phytocenoses, especially in the related association *Hacquetio-Fagetum*, where their index of similarity is very high ($\sigma_s = 81$ or $\sigma_j = 69$). Not least, the similarity of the associations *Hedero-Fagetum* and *Hacquetio-Fagetum* is also high, namely $\sigma_s = 61$ or $\sigma_j = 44$. On the basis of the Synthetic Table, it can be seen that the species *Doronicum austriacum*, which is placed among the distinguishing species of the association, and *Carex pilosa* are important for the association *Hedero-Fagetum*. The question of the independence of the association *Hedero-Fagetum* is whether it is perhaps only an illyrian geographic variant of the central european association *Carici pilosae-Fagetum* Oberd. 1957.

The Synthetic Table also reveals the problem of the floristic similarity of the associations *Ranunculo platanifolii-Fagetum* and *Polysticho lonchitis-Fagetum*, especially in connection with the choice of characteristic and distinguishing species of the association *Ranunculo platanifolii-Fagetum*. These are also found in other altimontane beech forests, e.g., *Luzulo-Fagetum*, *Polysticho lonchitis-Fagetum* etc.

6 POVZETEK

6.1 UVOD

Pričujoča razprava se navezuje na razpravo »Donos k problematiki acidofilnih bukovih gozdov v Sloveniji« (MARINČEK & ZUPANČIČ 1979) in njihovo nomenklaturno revizijo (MARINČEK & ZUPANČIČ 1995: 31–33). Zato ne bomo ponavljali že ugotovljenih in opisanih sinekoloških in sinhoroloških razmer asociacije *Castaneo-Fagetum*. Omenili jih bomo le na kratko, kolikor je potrebno zaradi razumevanja celotne vsebine razprave. Dopolnili bomo sinsistematsko problematiko asociacije z novimi dognanji, ki temeljijo na primerjanjih podobnih ali conalno sorodnih fitocenoz v slovenskem, obmejnem hrvaškem in deloma bosanskem prostoru. Na Hrvaškem sta to asociaciji *Castaneo-Fagetum* (*Luzulo-Fagetum* s. lat.) in *Blechno-Fagetum*, v Bosni *Castaneo-Fagetum* (*Luzulo-Fagetum castanetosum* s. lat.) ter v Sloveniji poleg asociacije *Castaneo-Fagetum* s. lat. še asociacije *Luzulo-Fagetum* Meusel 1937 s. str., (*Polygonato verticillati-Luzulo-Fagetum* var. geogr. *Cardamine trifolia* Marinček 1983, *Luzulo-Abieti-Fagetum* H. Mayer (1963) 1969 *praealpinum* Marinček & Dakskobler 1988

s. lat.), *Hedero-Fagetum* Ž. Košir (1962) 1994, *Hacquetio-Fagetum* Ž. Košir 1962 var. geogr. *Ruscus hypoglossum* Ž. Košir 1979, *Ranunculo-Fagetum* Marinček 1992 var. geogr. *Hepatica nobilis* Marinček 1993 in *Polysticho lonchitis-Fagetum* (Ht. 1938) Marinček in Poldini & Nardini 1993. (Glej Sintezno tabelo).

Boljše in širše poznavanje bukovih fitocenoz Slovenije je omogočilo natančnejšo in morda pravilnejšo določitev značilnic in razlikovalnic asociacije *Castaneo-Fagetum*, hkrati pa tudi ustrežnejšo uvrstitev asociacije *Castaneo-Fagetum* v višje sinsistematske enote. Asociacija *Castaneo-Fagetum* do zdaj še ni bila tipološko razčlenjena na nižje sintaksonomske enote, to smo poskušali storiti zdaj. Poleg dveh na novo predstavljenih subsociacij se v naravi verjetno pojavljajo še druge ali celo še nižje sintaksonomske enote.

Raziskava temelji na standardni srednjeevropski metodi (BRAUN-BLANQUET 1964). Floristična nomenklatura je povzeta po Mali flori Slovenije (MARTINČIČ et al. 2007). Biološke oblike in fitogeografska razširjenost rastlinskih vrst je povzeta po POLDINIJU (1991), primerjava podobnosti fitocenoz pa po Th. SØRENSEN (1948).

6.2 KRATEK SINEKOLOŠKI OPIS ASOCIACIJE

Asociacija *Castaneo-Fagetum* s. lat. porašča kislja rjava distrična tla na nekarbonatnih kamninah v podgorskem (submontanskem) pasu. Klimatske razmere so raznovrstne, od kontinentalnega do submediteransko-atlantskega podnebja. Rastišča asociacije so po de Martonovem indeksu v območju gozdne klime, kjer vlada zmerena kontinentalna klima z bolj ali manj obilnimi padavinami. Asociacija je v glavnem razširjena v predalpskem, preddinarskem in subpanonskem ter deloma v dinarskem fitogeografskem območju. Skladno s fitogeografsko delitvijo Slovenije ločimo štiri geografske variante osnovne asociacije, in sicer v osrednji Sloveniji in Prekmurju tipično varianto *Castaneo-Fagetum* var. geogr. *typica*, na Dolenjskem varianto z vrsto *Epimedium alpinum*, na Pohorju z vrsto *Hieracium rotundatum* (= *H. transsilvanicum*) in na južnem Notranjskem z vrsto *Calamintha grandiflora* (MARINČEK & ZUPANČIČ 1979: 716–719).

6.3 SINSISTEMATSKA PROBLEMATIKA ASOCIACIJE

MARINČEK & ZUPANČIČ (1979: 720–722) sta asociacijo *Castaneo-Fagetum* (= *Quercus-Luzulo-Fagetum*) uvrstila v podzvezo *Luzulo-Fagenion illyricum* Marinček & Zupančič 1979. Že tedaj sta bila v dvomih o postavitvi nove ilirske podzveze kisljih bukovih gozdov. Podzveza ni imela »...svojih specifičnih značilnic...«, to pa onemogoča obstoj abstraktne podzveze. Ob nomenklaturni reviziji acidofilnih bukovih in gradnovih asociacij (MARINČEK & ZUPANČIČ 1995: 29–32) sta asociacijo *Castaneo-Fagetum* uvrstila v srednjeevropsko podzvezo *Luzulo-Fagenion* Lohm. & R. Tx. 1954 zveze *Fagion sylvaticae* Luquet 1926 in reda *Fagetalia sylvaticae* Pawlovski in Pawlovski et al. 1928, kar je Marinček že predvidel v svoji disertaciji in to potrdil v monografiji (MARINČEK 1980: 153–154). Gornja uvrstitev asociacije *Castaneo-Fagetum* (= *Luzulo-Fagetum* s. lat.) ustreza mnenju večine srednjeevropskih fitocenologov (OBERDORFER 1957). S. WALLNÖFER et al. v MUCINA et al. (1993) ne upoštevajo podzveze *Luzulo-Fagenion*, temveč zvezo *Luzulo-Fagion*, ki pa jo uvrščajo v red *Quercetalia roboris* R. Tx. 1931 in razred *Quercus-Fagetea* Br.-Bl. & Vliieger in Vliieger 1937. Podobno so jugovzhodnoevropski fitocenologi uvrščali zvezo *Luzulo-Fagion* v red *Quercetalia roboris-petraeae* in razred *Quercetea roboris-petraeae* (FUKAREK & FABJANIĆ 1968). Soó (1964) je podzvezo *Luzulo-Fagenion* uvrstil v zvezo *Fagion medio-europaeum* Soó (1960) 1962. Pri nas je M. WRABER (1960) asociacijo *Luzulo-Fagetum* s. lat. (= *Castaneo-Fagetum*) uvrstil v zvezo *Luzulo-Fagion*, pozneje pa je pod vplivom Soója spremenil mnenje in zvezo uvrstil v podzvezo *Luzulo-Fagenion* zveze *Fagion medio-europaeum* (M. WRABER 1964) (MARINČEK & ZUPANČIČ 1979).

Podzvezo *Luzulo-Fagenion* [= *Luzulo-Fagion* (Lohm. & R. Tx. 1954) em. Oberd. 1957] je OBERDORFER (1957: 489–506) skušal določiti z razlikovalnicami, nakazanimi v fitocenozah kisljih bukovih gozdov na območju južne Nemčije. Večina izbranih razlikovalnic je iz sintaksonomskih enot smrekovih gozdov *Vaccinio-Piceetea* s. lat. V naši asociaciji *Castaneo-Fagetum* so od teh navzoče *Luzula luzuloides* (Lam.) Dandy & Wilmott, *Vaccinium myrtillus* L., *Calamagrostis arundinacea* (L.) Roth, *Dryopteris expansa* (Presl.) Fraser-Jenkins & Jermy, *Oxalis acetosella* L., *Galium rotundifolium* L. in *Senecio ovatus* (Gaerten., Mey. & Scherb.) Willd., ki jo uvrščamo med visoke steblikle (*Adenostyletalia*). S. WALLNÖFER et al. (1993) predlagajo zvezo *Luzulo-Fagion* Lohmeyer et R. Tx. in R. Tx. 1954 z diagnostično vrstno kombinacijo, in sicer za značilnico *Luzula sylvatica* (Huds.) Gaudin subsp. *sylvatica* (po mnenju avtorjev slaba) in razlikovalnice *Milium effusum* L., *Oxalis acetosella* L., *Fagus sylvatica* L. in *Veronica urticifolia* Jacq. Od navedenih v naši asociaciji nista prisotni *Luzula sylvatica* subsp. *sylvatica* in *Milium effusum*.

Razlikovalnice Oberdorferja in S. Wallnöfer so bolj ali manj relativne in imajo vodilno vlogo v sintaksonomskih enotah piceetov, kjer so stalno zastopane z visoko ali najvišjo frekvenco pojavljanja in srednjo pokrovno vrednostjo. V kisljih bukovih gozdovih imajo relativno vrednost razlikovalnic, vsekakor pa ne značilnic, kot poudarjeno razlikovanje od bazičnih ali nevtralnih bukovih gozdov. Obravnavane razlikovalnice po Oberdorferju ali S. Wallnöfer so splošno razširjene piceetalne vrste višjih sinsistematskih rangov, predvsem razreda in reda. Torej za podzvezo *Luzulo-Fagenion* ni tipičnih razlikovalnic, še manj značilnic, ki bi posebno, nazorno določile podzvezo oziroma zvezo. Kljub temu jih kot relativne razlikovalnice v določeni meri sprejemamo. Od prej naštetih Oberdorferjevih razlikovalnic so v asociaciji *Castaneo-Fagetum* zadovoljivo zastopane le štiri, te so *Luzula luzuloides*, *Vaccinium myrtillus*, *Calamagrostis arundinacea* in *Oxalis acetosella*, ostale razlikovalnice so slučajne.

Glede na zelo slabo prisotnost razlikovalnic podzveze *Luzulo-Fagenion* v asociaciji *Castaneo-Fagetum* ter številno zastopnost značilnic zveze *Quercion roboris* Malc. 1929 in reda *Quercetalia roboris* R. Tx. 1931 smo mnenja, da asociacijo uvrstimo v ti dve sinsistematski enoti. V asociaciji *Castaneo-Fagetum* je zastopanih 8 značilnic zveze *Quercion roboris* in 15 značilnic reda *Quercetalia roboris*. Od teh je zadovoljivo zastopanih 14, te so *Castanea sativa* Mill., *Genista tinctoria* L., *Carex*

pilulifera L., *Melampyrum pratense* L. subsp. *vulgatum* (Pers.) Ronninger, *Pteridium aquilinum* (L.) Kuhn, *Dicranella heteromalla* (L. ap. Hedw.) Schimper., *Frangula alnus* Mil., *Hieracium racemosum* Waldst. & Kit. ex. Wild. *H. sabaudum* L., *H. vulgatum* Fries, *Polypodium vulgare* L., *Festuca heterophylla* Lam., *Veronica officinalis* L. in *Potentilla erecta* (L.) Raeuschel (Glej Sintezno tabelo).

Analiza sintaksonomskih enot nazorno kaže prevlado vrst dobovih gozdov zveze *Quercion roboris* in reda *Quercetalia roboris*, kar je razvidno v Sintezni tabeli. Uvrstitev asociacije *Castaneo-Fagetum* v zvezo *Quercion roboris* Malc. 1929 je upravičena in edina mogoča. Poleg prevlade vrst dobovih gozdov v asociaciji *Castaneo-Fagetum* je za njo značilna slabša zastopanost vrst smrekovih gozdov, zlasti vrst zveze *Vaccinio-Piceion* in reda *Vaccinio-Piceetalia*, ki so v podobni bolj ali manj sorodni asociaciji *Luzulo-Fagetum* številnejše z višjo stopnjo navzočnosti in srednjo pokrovno vrednostjo. Asociacijo *Luzulo-Fagetum* pa uvrščamo v podzvezo *Luzulo-Fagenion* in zvezo *Fagion sylvaticae*. Razlika med drugimi bukovimi gozdovi v Sloveniji in asociacijo *Castaneo-Fagetum* je odsotnost vrst visokih steblik (*Betulo-Adenostyletea* Br.-Bl. & R.Tx. 1943 oz. *Mulgedio-Aconitetea* Hadač v Klika & Hadač 1944 s. lat.), kar nakazuje sušnost rastišča. (Glej Sintezno tabelo).

6.3.1 Problem značilnic in razlikovalnic

MARINČEK & ZUPANČIČ (1979: 719–720 in 724) sta za značilnice izbrala naslednje vrste: *Fagus sylvatica*, *Luzula luzuloides* (= *L. albida*), *Melampyrum pratense* subsp. *vulgatum* in *Castanea sativa*. Vrsto *Fagus sylvatica* sta namenoma uvrstila med značilnice, ker je GLIŠIĆ (1975) v doktorskem delu nedorečeno (invalidno) opisal asociacijo *Castaneo-Fagetum moesiaca* Glišić 1975 (nom. prov.), ki jo je pozneje MATOVIĆ (1986) validno opisal kot asociacijo *Fago moesicae-Castanetum* (Glišić 1975) Matović 1986. (= *Fageto-Castanetum sativae mixtum* Matović 1986). Omenjena avtorja pri vseh primerih imenovanja asociacije menita, da gre za mezijško vrsto bukve – *Fagus moesiaca* K. Maly (?). Glede na spremembo imena prvotno označene asociacije *Castaneo-Fagetum moesiaca* v *Fago moesiaca-Castanetum* ni treba, da je vrsta *Fagus sylvatica* L. uvrščena med značilnice asociacije *Castaneo-Fagetum*.

Druga značilnica *Luzula luzuloides* (Lam.) Dand. & Wilmott. (= *L. albida* Hoffm.) DC. je bila slabo izbrana za diagnostično pomembno vrsto asociacije *Castaneo-Fagetum*. Iz Sintezne tabele je razvidno, da je splošno razširjena v kisljih bukovih gozdovih in bolj ali manj tudi bukovih gozdovih na karbonatnih tleh, zlasti tam,

kjer je zakisan humusni horizont rendzin ali pokarbo-natnih tal. Iz tega se vidi, da vrsta *Luzula luzuloides* nima prave diagnostične vrednosti v asociaciji *Castaneo-Fagetum*.

Tretja značilnica *Castanea sativa* Mill. je tudi bolj ali manj razširjena v drugih bukovih združbah, zlasti v kisljih bukovih asociacijah. Tu in tam je dobro zastopana v sorodni asociaciji *Blechno-Fagetum*. Zaradi svoje velike razširjenosti v bukovih gozdovih je slaba značilnica asociacije *Castaneo-Fagetum*. Lahko pa jo štejemo, zaradi višje stopnje navzočnosti in dobre srednje pokrovne vrednosti v asociaciji *Castaneo-Fagetum*, za njeno relativno dobro razlikovalnico. S svojo večjo prisotnostjo daje določen pečat asociaciji *Castaneo-Fagetum*, zaradi tega smo jo tudi upoštevali pri imenovanju asociacije.

Od starih značilnic je sprejemljiva le podvrsta *Melampyrum pratense* L. subsp. *vulgatum* (Pers.) Ronninger, ki pa je tudi relativna. V asociaciji *Castaneo-Fagetum* se večinoma pojavlja z visoko stopnjo navzočnosti in z dobro srednjo pokrovno vrednostjo. Z manjšo navzočnostjo pa je prisotna tudi v sorodni asociaciji *Blechno-Fagetum*. Podvrsta *Melampyrum pratense* subsp. *vulgatum* optimalno uspeva na acidofilnih prisojnih rastiščih (MARINČEK & ZUPANČIČ 1979: 720) v svetloljubnih bukovih, hrastovih in borovih gozdovih, kjer so večinoma kislja do zelo kislja distrična rjava tla na nekarbonatni podlagi, s prhninastim (surovim) humusom. Ekološka oznaka podvrste *Melampyrum pratense* subsp. *vulgatum* ustreza rastišču asociacije *Castaneo-Fagetum* in je zato zelo sprejemljiva za njeno značilnico.

Poleg vrste *Melampyrum pratense* subsp. *vulgatum* smo k značilnicam dodali še vrste *Chamaecytisus supinus* (L.) Link, *Frangula alnus* Mill., *Hieracium racemosum* Waldst. & Kit. ex Willd., *H. vulgatum* Fries, *Serratula tinctoria* L. in *Veronica chamaedrys* L. Naštete vrste so glede ekoloških razmer zelo podobne. Naseljujejo rastišča na nekarbonatni matični podlagi, kjer so suha, s hranili in bazami bolj ali manj bogata, toda z apnencem revna tla, z nevtralnimi do zmerno kislimi prhninastimi humusom. Uvrščamo jih v polsenčne do svetloljubne vrste svetlih listnatih (hrastovih, bukovih) in igličastih (borovih) gozdov ali grmišč (OBERDORFER 1979). Te značilnice so večinoma tesno vezane na asociacijo *Castaneo-Fagetum*. Tu in tam se vrsti *Melampyrum pratense* subsp. *vulgatum* in *Genista tinctoria* posamič pojavljata v sorodni kisljiljubni asociaciji *Blechno-Fagetum*. V bazičnih bukovih gozdovih jih ni. (Glej Sintezno tabelo).

MARINČEK & ZUPANČIČ (1979) v razpravi o problematiki acidofilnih bukovih gozdov nista predvidela razlikovalnic asociacije *Castaneo-Fagetum*. Za določitev asociacije kot kolinske (submontanske), termofilne in antropozoogeno vplivane združbe smo izbrali razlikovalnice nasproti drugim montanskim bukovim fitoce-

nozam in deloma tudi nasproti bazičnim submontanskim bukovicim združbam. Predhodno smo že omenili, da vrsto *Castanea sativa* Mill. izločimo iz značilnic in jo uvrstimo med razlikovalnice asociacije *Castaneo-Fagetum*. Vrsta *Castanea sativa* je jugovzhodnoevropski geoelement, ki fitogeografsko značilno označuje svoj areal v submontanskem pasu oceanske Evrope. Njena ekološka oznaka se sklada z opisanimi rastiščnimi razmerami asociacije *Castaneo-Fagetum* oziroma njenimi značilnicami. Naseljuje nekarbonatno geološko podlago, z apnencem revno, bolj ali manj s hranili in bazami bogata suha tla z nevtralnimi prhninastim humusom. Je polsenčna vrsta v svetlopljnih listnatih gozdovih ali grmiščih (OBERDORFER 1979). Prednost daje rastiščem s poletno toplo humidno klimo, kjer so mile zime. K razlikovalnicam smo dodali še vrste *Faxinus ornus* L., *Pyrus*

pyraster (L.) Borkh. in *Tilia cordata* Mill. s podobnimi ekološkimi oznakami, opisanimi za vrsto *Castanea sativa*. Vse razlikovalnice označujejo toploljubnost, odprtost in antropozoogeno vplivnost na rastišče asociacije *Castaneo-Fagetum*.

Naštete razlikovalnice so relativne. Najpogosteje se pojavljajo v asociaciji *Castaneo-Fagetum*, tu in tam pa so prisotne tudi v drugih asociacijah kolinskega pasu, npr. v *Blechno-Fagetum* in *Hedero-Fagetum*. Vendar so v asociaciji *Castaneo-Fagetum* zastopane v višjih stopnjami navzočnosti in srednjimi pokrovnimi vrednostmi, npr. vrsti *Castanea sativa* in *Faxinus ornus*. Razlikovalnici *Pyrus pyraster* in *Tilia cordata* pa sta prisotni le v asociaciji *Castaneo-Fagetum*, vendar posamič, torej z nizkimi vrednostmi navzočnosti. (Glej Sintezno tabelo.) Nazorno to vidimo v Analitični tabeli.

6.3.2 Fitocenološke skupine

Sinsistematska enota	<i>CASTANEO-FAGETUM</i>	<i>BLECHNO-FAGETUM</i>	<i>HEDERO-FAGETUM</i>
	%	%	%
<i>Quercetalia roboris</i>	10,0	23,1	4,9
<i>Quercu-Fagetea</i> s. lat.	45,6	12,8	66,0
<i>Vaccinio-Piceetea</i> s. lat.	22,4	31,7	13,6
<i>Erico-Pinetea</i> s. lat.	1,4	2,6	1,0
<i>Betulo-Adenostyletea</i> s. lat.	1,9	1,3	5,8
<i>Mulgedio-Aconitetea</i> s. lat.			
<i>Epilobietea angustifolii</i> s. lat.	1,0	0,0	0,0
<i>Trifolio-Geranietea</i> s. lat.	1,4	0,0	1,9
<i>Nardo-Callunetea</i> s. lat.	1,4	3,8	0,0
<i>Seslerietea</i> s. lat.	0,5	0,0	0,0
<i>Festuco-Brometea</i> s. lat.	0,5	0,0	0,0
<i>Molinio-Arrhenatheretea</i> s. lat.	1,9	0,0	1,9
<i>Artemisietea</i> s. lat.	1,0	0,0	3,0
ostale vrste	11,0	16,7	1,9
SKUPAJ	100,0	100,0	100,0

Tabela 1: Sinsistematske skupine asociacij *Castaneo-Fagetum*, *Blechno-Fagetum* in *Hedero-Fagetum*

Iz tabele 1 je razvidna sestava sintaksonomskih skupin asociacije *Castaneo-Fagetum*. V večini so fagetalne vrste s skoraj 46 %, ki bukovi združbi dajejo osnovne značilnosti. Na drugem mestu so piceetalne vrste z dobrimi 22 %, ki združbo zaznamujejo kot kisloljubno. K tem prištevamo bolj ali manj kisloljubne, kserofilne in toploljubne vrste hrastovih dobovih (dobovo-gradnovih) gozdov z 10 %, ki asociacijo *Castaneo-Fagetum* uvrščajo v zvezo *Quercion roboris*. Neopredeljenih (ostalih) vrst je 11 % od teh je 9,5 odstotkov mahov, večinoma

kisloljubnih in kserofilnih, kar je značilno za asociacijo *Castaneo-Fagetum*. 1,5 % neopredeljene vaskularne flore z 11 % iz negozdskih sintaksonomskih enot pa nakazuje precejšen antropozoogen vpliv. Tudi vrste hrastovih gozdov kažejo na človekove vplive v asociaciji *Castaneo-Fagetum*. Za primerjavo smo v tabeli 1 posredovali še razpored sintaksonomskih enot sorodnih ali bližnjih asociacij *Blechno-Fagetum* in *Hedero-Fagetum*, o tem bomo spregovorili v poglavju 4.

6.3.3 Horološke skupine

Horološke skupine/vrste	%
jugovzhodno evropske	2,4
evromediterranske	3,3
pontske	4,3
mediteransko-atlantske	1,0
ilirске	0,5
mediteransko - pontske	1,0
mediteransko - montanske	3,8
severnoilirске	1,4
južnoilirске	1,0
jugovzhodnoevropske	6,1

Tabela 2: Horološke skupine asociacije *Castaneo-Fagetum*

V asociaciji *Castaneo-Fagetum* so najštevilnejše evropske vrste s skoraj 27 %, nato sledijo neopredeljene vrste z 21 %, to so mahovi in lišaji. Na tretjem mestu so cirkumborealne vrste z 9 %. Vse našteje skupine še z drugimi horološkimi skupinami v desnem stolpcu tabele 2 uvrščamo med hladnoljubno rastlinstvo, ki prevladuje s tričetrtinskim deležem vseh vrst v asociaciji *Castaneo-Fagetum*. Levi stolpec tabele 2 predstavlja toplo-

Horološke skupine/vrste	%
evroazijske	10,4
evropske	26,6
cirkumborealne	9,0
paleotemperatne	3,3
kozmpolitske	2,4
alpsko-kartpatske	0,5
alpske	0,5
arktično-alpske	0,5
adventivne	0,5
neopredeljene (mahovi, lišaji)	21,0
SKUPAJ	100,0

ljubne horološke skupine oziroma vrste, teh je skoraj 25 %. Po horoloških skupinah lahko sklepamo, da združba uspeva v nekoliko težavnejših rastiščnih razmerah, predvsem edafskih, kjer so kislja rjava, včasih lahko tudi distrična in plitva tla na nekarbonatni podlagi, blizu naselij pa zelo obremenjena z antropozoogenimi vplivi, v preteklosti z nenehnim steljarjenjem.

6.3.4 Biološki spekter

Biološka oblika	%
FANEROFITI (Phanerophyta)	23,3
stebelasti fanerofiti (P. scap.)	10,0
šopasti fanerofiti (P. caesp.)	8,1
nanofanerofiti (NP)	3,3
vzpenjalni fanerofiti (P. lian.)	0,5
zajedalni fanerofiti (P. ep.)	0,5
HAMEFITI (Chamaephyta)	26,3
polgrmičasti hamefiti (Ch. suffr.)	3,3
plazeči hamefiti (Ch. scap.)	1,0
stebelasti hamefiti (Ch. scap.)	0,5
grmovni hamefiti (Ch. frut.)	0,5
Σ =	5,3
mahovni hamefiti (B. Ch.)	18,2
lišajasti hamefiti (L. Ch.)	2,9

Tabela 3: Biološke oblike vrst asociacije *Castaneo-Fagetum*

V biološkem spektru asociacije *Castaneo-Fagetum* prevladujejo hemikriptofiti s tretjinsko večino in med njimi so najštevilnejši stebelasti hemikriptofiti. Naslednji so hamefiti z največjim deležem mahovnih in lišajastih hamefitov, ki z geofiti skupaj s skoraj polovično večino kažejo na določene neugodne rastiščne razmere. Na ugodnejše rastiščne razmere kažejo fanerofiti z dobro petino vseh vrst. Z združitvijo fanerofitov in hemikriptofitov, ki skupaj presegajo precej nad polovico vrst v asociaciji *Castaneo-Fagetum*, ugotavljamo, da združba uspeva v bolj ali manj ugodnih rastiščnih razmerah z

Biološka oblika	%
HEMIKRIPTOFITI (Hemicryptophyta)	33,3
stebelasti hemikriptofiti (H. scap.)	19,0
šopasti hemikriptofiti (H. caesp.)	6,7
rozetni hemikriptofiti (H. ros.)	5,7
plazeči hemikriptofiti (H. rept.)	1,9
GEOFITI (Geophyta)	15,6
geofiti s koreniko (G. rhiz.)	13,2
geofiti z gomolji (G. bulb.)	1,4
geofiti s koreninskimi brsti (G. rad.)	0,5
parazitski geofiti (G. par.)	0,5
TEROFITI (Therophyta)	1,0
stebelasti terofiti (T. scap.)	1,0
neopredeljena vrsta	0,5
SKUPAJ	100,0

vsemi neugodnostmi, ki so bile omenjene v predhodnih poglavjih 3.2 in 3.3. Biološki spekter asociacije *Castaneo-Fagetum* kaže, da je njeno mesto med normalnim spektrom in planinskim pasom, kar bi ustrezalo prejšnjim ugotovitvam analiz fitocenoloških in horoloških skupin. Večina sestojev asociacije *Castaneo-Fagetum* je slabše gospodarjeno. Poleg slabših edafskih razmer in slabih gojitvenih ukrepov je za te gozdove usodna relativna bližina naselij, ki omogoča neprestane posege v gozd (kurjava, steljarjenje, paša, včasih pretirana sečnja idr.).

6.3.5 Tipološka členitev

V sklopu asociacije *Castaneo-Fagetum* smo izločili dve subasociaciji in stadij.

Subasociacija *Castaneo-Fagetum typicum* subass. nova je osrednja fitocenozoza, ki je obubožana z asociacijskimi značilnicami. Predvsem, ali včasih izključno, je prisotna le značilnica *Melampyrum pratense* subsp. *vulgatum*, tu in tam z veliko srednjo pokrovno vrednostjo. Obubožana je tudi z razlikovalnicami. Prisotnost vodilne razlikovalnice *Castanea sativa* je v drevesni plasti zelo variabilna, od velike srednje pokrovnosti do popolne neprisotnosti, je pa skoraj vedno prisotna v grmovni plasti. Sestoji so zelo antropozoogeno vplivani, kar se vidi v sestojni obliki panjevca in včasih zelo obubožani zeliščni plasti, ki jo nadomesti obilna mahovna plast, to pa je znak prejšnjega in morda današnjega stelarjenja in predhodnega sekanja na panj. **Subasociacija *Castaneo-Fagetum typicum* nima razlikovalnic, za holotip smo vzeli popis 21 v Analitični tabeli, ki je optimalen glede zastopanosti značilnic.**

Subasociacija *Castaneo-Fagetum fraxinetosum orni* subass. nova je toploljubna fitocenozoza s toploljubnimi razlikovalnicami *Sorbus torminalis* (L.) Crantz, *S. aria* (L.) Crantz, *Fraxinus ornus* L., *Lathyrus niger* (L.) Bernh. in *Serratula tinctoria* L. subsp. *tinctoria*. Prve štiri razlikovalnice uvrščamo v termofilni red *Quercetalia pubescentis*, zadnjo razlikovalnico pa v red *Molinietalia*. Razlikovalnice poudarjajo toploljubnost subasociacije in manjšo zastrtost drevesne plasti. Njihovo domovanje so predvsem svetloljubni listnati gozdovi (hrastovje, belogabrovje, bukoveje), dobimo jih tudi v borovju, kjer vlada poletno toplo podnebje. Poraščajo sušna, včasih zmerno sveža, z bazami in hranili bogata, vendar z apnencem revna, peščena, tudi kamnita tla z rahlim prhninastim, zmerno kislim humusom (OBERDORFER 1979). **Holotip subasociacije *Castaneo-Fagetum fraxinetosum orni* je popis 22 v Analitični tabeli.**

V okviru subasociacije se pojavlja stadij s smreko *Castaneo-Fagetum fraxinetosum orni* stad. *Picea excelsa*, ki je nastal zaradi človekovega posega. Najverjetneje po manjšem ali večjem goloseku, ki je bil nato posajen s smreko. Izvajalca poseka je vodilo prizadevanje za ekonomsko in tehnološko boljše in uporabnejšo smreko. Vendar smrekovina na teh višinskih nizkih in klimatsko pretoplih rastiščih nima enakih kvalitetnih tehnoloških lastnosti kot v ustreznem predalpsko/alpskem svetu.

6.4 PRIMERJAVA S SORODNIMI ASOCIACIJAMI

Zaradi verodostojnosti značilnic in razlikovalnic asociacije *Castaneo-Fagetum*, da jo le-te nedvoumno in na-

zorno predstavljajo, smo medsebojno primerjali sorodne ali podobne conalne in sosednje združbe bukovih gozdov. Skladno s to primerjavo smo potrdili upravičenost samostojnosti obravnavanih asociacij v Sintezni tabeli. Asociaciji *Castaneo-Fagetum* je najbolj sorodna asociacija *Blechno-Fagetum*, sledi ji višinska kisloljubna bukova asociacija *Luzulo-Fagetum* ter v kolinskem pasu sosednja asociacija *Hedero-Fagetum*. Zaradi delne, sicer zelo majhne podobnosti, vendar zaradi sosedstva v kolinskem pasu, smo asociacijo *Castaneo-Fagetum* primerjali z ilirsko bazofilno asociacijo *Hacquetio-Fagetum*. S tem smo si zagotovili izključne značilnice in razlikovalnice asociacije *Castaneo-Fagetum*, ki se ne pojavljajo v drugih bukovih fitocenozah. V ta namen smo asociacijo *Castaneo-Fagetum* primerjali tudi z altimontanskima, nekoliko kisloljubnima asociacijama *Ranunculo-Fagetum* in *Polysticho lonchitis-Fagetum*, ki sta bolj ali manj podobni asociaciji *Luzulo-Fagetum* glede na prisotnost subalpskih ali dealpskih in kisloljubnih rastlinskih vrst.

Primerjava med asociacijama *Castaneo-Fagetum* in *Blechno-Fagetum* je po Sørensenovi podobnosti fitocenoza pokazala $\sigma_s = 54$, kar pomeni, da sta si dovolj različni in zato upravičeno samostojni, čeprav imata večje število skupnih rastlinskih vrst. Še nižji je indeks podobnosti po Jaccardu ($\sigma_j = 38$). V asociaciji *Blechno-Fagetum*, tu in tam, zasledimo značilnico asociacije *Castaneo-Fagetum Melampyrum pratense* subsp. *vulgatum* in razlikovalnico *Castanea sativa*. Nasprotno pa sta v asociaciji *Castaneo-Fagetum* včasih prisotni značilnici asociacije *Blechno-Fagetum Bazzania trilobata* in *Blechnum spicant*. Te vrste s skupnimi vrstami reda *Quercetalia roboris* s. lat. in razreda *Vaccinio-Piceetea* s. lat. poudarjajo njuno delno sorodnost. Velika razlika med asociacijama je v večji prisotnosti fagetalnih vrst v asociaciji *Castaneo-Fagetum* (Tabela 1) (Glej Analitično tabelo).

Asociaciji *Castaneo-Fagetum* in *Hedero-Fagetum* sta zaradi mozaične menjave karbonatne in nekarbonatne matične podlage včasih neposredni sosedi. Vendar Sørensenov indeks podobnosti fitocenoza ($\sigma_s = 51$), potrjuje različnost fitocenoza, še manjši je Jaccardov indeks ($\sigma_j = 34$), ki izraziteje kaže njuno različnost. Vendar je delna podobnost med asociacijama, zlasti na geološko mešanih karbonatno-nekarbonatnih rastiščih asociacije *Hedero-Fagetum*, kjer se pojavljajo piceetalne vrste in vrste dobovih gozdov (tabela 1). (Glej Analitično tabelo). Zaradi mešane geološke podlage tu in tam najdemo v asociaciji *Hedero-Fagetum* razlikovalnico asociacije *Castaneo-Fagetum Castanea sativa* in zaradi odprtosti sestoj in zato večjega osončenja še razlikovalnico *Fraxinus ornus*. Večina značilnic asociacije *Hedero-Fagetum* se z manjšo stopnjo navzočnosti pojavlja v asociaciji *Castaneo-Fagetum*, najpogostejše so *Athyrium filix-femina*,

Cardamine bulbifera, *Galeobdolon flavidum*, *Hedera helix*, *Sanicula europea*, *Dryopteris filix-mas* in *Sorbus torminalis* ter razlikovalnici *Luzula luzuloides* in *Euphorbia amygdaloides*. Izbor značilnic in razlikovalnic asociacije *Hedero-Fagetum* je neprepričljiv, posebno zato, ker so našteje vrste splošno razširjene v bukovih gozdovih. Indeks podobnosti med asociacijama na nivoju značilnic in razlikovalnic je $\sigma_s = 61$ oziroma $\sigma_j = 44$, to je precej visoko in opozarja na nesprejemljivost diagnostičnih vrst za asociacijo *Hedero-Fagetum*. Hkrati smo primerjali značilnice in razlikovalnice med asociacijama *Hedero-Fagetum* in *Hacquetio-Fagetum*, kjer je indeks tudi zelo visok, in sicer $\sigma_s = 81$ in $\sigma_j = 69$, kar dodatno potrjuje nesprejemljivost značilnic in razlikovalnic asociacije *Hedero-Fagetum*. (Glej Sintezno tabelo).

Sosednja fitocenoza kolinskega pasu je bazifilna asociacija *Hacquetio-Fagetum*, bogata s fagetalnimi vrstami in zlasti značilnicami ilirske zveze bukovih gozdov *Aremonio-Fagion* in s skoraj popolno odsotnostjo vrst dobovih in piceetalnih gozdov. Tako kot asociacijo *Hedero-Fagetum* tudi asociacijo *Hacquetio-Fagetum* uvrščamo v zvezo *Aremonio-Fagion*. Med asociacijama je tudi velika razlika v številčnosti vrst, saj je asociacija *Castaneo-Fagetum* floristično bogatejša. Različnost asociacij kažeta tudi indeksa podobnosti fitocenoz $\sigma_s = 50$ in $\sigma_j = 34$. (Glej Sintezno tabelo).

Zaradi verodostojnosti značilnic in razlikovalnic asociacije *Castaneo-Fagetum* smo naredili še primerjave z altimontanskimi bukovimi asociacijami *Luzulo-Fagetum*, *Ranunculo-Fagetum* in *Polysticho-Fagetum*, ki so nosilke marsikaterih fagetalnih in piceetalnih vrst, prisotnih v asociaciji *Castaneo-Fagetum*. Tako smo se izognili neustreznemu imenovanju značilnic in razlikovalnic asociacije *Castaneo-Fagetum*.

MARINČEK & ZUPANČIČ (1979) sta poleg tipične asociacije *Castaneo-Fagetum* var. geogr. *typica*, ki je sedaj predstavljena tudi v Analitični tabeli, opisala še tri geografske variante, in sicer *Castaneo-Fagetum* var. geogr. *Calamintha grandiflora*, *Castaneo-Fagetum* var. geogr. *Epimedium alpinum* in *Castaneo-Fagetum* var. geogr. *Hieracium rotundatum* (= *H. transsilvanicum*), ki so bile potrjene v nomenklaturni reviziji (MARINČEK & ZUPANČIČ 1995).

V Analitični tabeli je s šestimi fitocenološkimi opisi (38–43) predstavljena že znana sekundarna asociacija *Galio rotundifolii-Pinetum sylvestris* (ZUPANČIČ & ČARNI 1988) in sicer stadij z vrsto *Fagus sylvatica*, ki nam nakazuje prvotno rastišče asociacije *Castaneo-Fagetum*, na katero je vplival človek in je nastala drugotna rdečeborova fitocenoza. Iz Analitične tabele se vidi prisotnost značilnic in razlikovalnic asociacije *Castaneo-Fagetum* v sekundarni asociaciji *Galio-Pinetum*. Številne so tudi vrste dobovih in smrekovih gozdov, ki potrju-

jejo nekdanjo rast prvotnega podgorskega kislega bukovega gozda *Castaneo-Fagetum*. V nastalem sekundarnem rdečeborovem gozdu pa so se uveljavile vrste *Chimaphila umbellata*, *Lycopodium clavatum*, *Pyrola chlorantha*, *Diphasiastrum complanatum*, *Galium rotundifolium* in *Pinus sylvestris*, ki so njegove značilnice in razlikovalnice. Najbolj zaznavno je umanjkanje fagetalnih vrst. V Analitični tabeli smo skušali nazorno pokazati razvoj vegetacije po degradaciji asociacije *Castaneo-Fagetum* na Goričkem v subpanonskem fitogeografskem območju.

6.5 ZAKLJUČEK

Primerjava med kisloljubnimi in sosednjimi pomembnimi bazifilnimi bukovimi gozdovi je dala novo vedenje o uvrstitvi asociacije *Castaneo-Fagetum* v zvezo *Quercion roboris* in red *Quercetalia roboris*, kar je utemeljeno na osnovi Sintezne tabele. V to zvezo je že uvrščena sorodna asociacija *Blechno-Fagetum* ter kisloljubne gradnove, kostanjeve in brezove fitocenoze. Asociacija *Luzulo-Fagetum* začasno ostaja v podzvezi *Luzulo-Fagenion* zveze *Fagion sylvaticae*. Podzveza *Luzulo-Fagenion* je slabo definirana, saj nima svojih lastnih značilnic. OBERDORFER (1957) je nakazal le razlikovalnice za podzvezo *Luzulo-Fagenion*, ki pa so večinoma iz vrst značilnic razreda *Vaccinio-Piceetea* s. lat., vendar so tudi te pogosto splošno razširjene v drugih bukovih, zlasti kisljih bukovih fitocenozah. V Sintezni tabeli je za asociacijo *Luzulo-Fagetum* razvidno, da so razlikovalnice podzveze *Luzulo-Fagenion* zastopane z visoko ali celo z najvišjo stopnjo navzočnosti, med njimi sta *Dryopteris expansa* in *Galium rotundifolium* prisotni samo v asociaciji *Luzulo-Fagetum*. Opozoriti moramo zlasti na pojavljanje vrst *Cardamine trifolia* in *C. enneaphyllos* iz ilirske zveze *Aremonio-Fagion*, ki dajeta naši asociaciji *Luzulo-Fagetum* poseben fitogeografski pečat in jo štejemo za geografsko varianto.

Primerjava nam je omogočila verodostojno, nedvoumno in nazorno izbiro značilnic in razlikovalnic asociacije *Castaneo-Fagetum*. (Glej Sintezno in Analitično tabelo).

V sklopu asociacije *Castaneo-Fagetum* smo opisali dve novi subasociaciji – *typicum* in *-fraxinetosum ornii*.

Pri primerjavi bukovih fitocenoz v Sintezni tabeli smo naleteli na dva problema. Prvi je invalidno imenovanje asociacije *Hedero-Fagetum*. To ime so že uporabili Samek l. 1961, Jeschke l. 1964, Passarge & Hofmann l. 1968 s fitocenološko tabelo, Passarge l. 1968 in Bauer l. 1972. Prednost poimenovanja gre verjetno avtorjema Passargeju in Hofmannu l. 1968, ko sta objavila tabelo. Neprepričljive so tudi izbrane značilnice in razlikoval-

nice asociacije *Hedero-Fagetum*, saj se večinoma pojavljajo v drugih bukovih fitocenozah, zlasti v sorodni asociaciji *Hacquetio-Fagetum*, kjer je njihov indeks podobnosti zelo visok ($\sigma_s = 81$ oziroma $\sigma_j = 69$). Ne nazadnje je tudi podobnost asociacij *Hedero-Fagetum* in *Hacquetio-Fagetum* visoka, in sicer $\sigma_s = 61$ oziroma $\sigma_j = 44$. Na osnovi Sintezne tabele vidimo, da sta za asociacijo *Hedero-Fagetum* pomembni vrsti *Doronicum austriacum*, ki je uvrščena med razlikovalnice asociacije, in *Carex pilosa*. Vprašanje o samostojnosti asociacije *Hede-*

ro-Fagetum je, ali je morda le ilirska geografska varianta srednjeevropske asociacije *Carici pilosae-Fagetum* Oberd. 1957.

Sintezna tabela nam odkriva tudi problem floristične podobnosti asociacij *Ranunculo platanifolii-Fagetum* in *Polysticho lonchitis-Fagetum*, zlasti v zvezi z izbiro značilnic in razlikovalnic asociacije *Ranunculo platanifolii-Fagetum*. Te se nahajajo tudi v drugih altimontan-skih bukovih gozdovih, npr. *Luzulo-Fagetum*, *Polysticho lonchitis-Fagetum* idr.

7 REFERENCES – LITERATURA

- BRAUN-BLANQUET, J., 1964: *Pflanzensoziologie. Grundzüge der Vegetationskunde*. 3. Auflage. Springer, Wien-New York.
- FUKAREK, P. & B. FABJANIĆ, 1968: *Versuch einer pflanzensoziologischen Gliederung der Wald – und Šibljak – Gesellschaften Bosniens und der Hercegovina*. Pflanzensoziologische Systematik. Bericht Internationalen Vereinigung für Vegetationskunde: 112–123.
- GLIŠIĆ, M., 1975: *Castanea sativa Mill. in Serbia and its Biological and ecological variability*. Doctoral dissertation. Proceedings, Institute of Forestry and Wood Industry Belgrade. Special editon (Beograd) 36: 51–195.
- MARINČEK, L. & M. ZUPANČIČ, 1979: *Donos k problematiki acidofilnih bukovih gozdov v Sloveniji*. Savez društava ekologa Jugoslavije. Drugi kongres ekologa Jugoslavije. (Zagreb) Posebni otisak: 715–730.
- MARINČEK, L., 1980: *Gozdne združbe na klastičnih sedimentih v jugovzhodni Sloveniji*. Razprave IV. razreda SAZU (Ljubljana) 22 (2): 1–185 + tabele.
- MARINČEK, L. & M. ZUPANČIČ, 1995: *Nomenklaturna revizija acidofilnih bukovih in gradnovih gozdov zahodnega območja ilirske florne province*. Hladnikia (Ljubljana) 4: 29–35.
- MATOVIĆ, M., 1986: *Monograph on plant cover in the surroundings of Prijepolje*. Glas Polimlja (Prijepolje) 11–163.
- MARTINČIČ, A., T. WRABER, N. JOGAN, A. PODOBNIK, B. TURK & B. VREŠ, 2007: *Mala flora Slovenije*. Tehniška založba Slovenije, Ljubljana.
- OBERDORFER, E., 1957: *Süddeutsche Pflanzengesellschaften*. Pflanzensoziologie (Jena) 10: 1–564.
- OBERDORFER, E., 1979: *Planzensoziologische Exkursions Flora*. Ulmer, Stuttgart.
- POLDINI, L., 1991: *Piante vascolari*. Università degli studii di Trieste. Dipartimento di Biologia, Udine.
- SOÓ, R., 1964: *Die regionalen Fagion-Verbände und Gesellschaften Südosteuropas*. Studia biologica Hungarica 1: 1–104.
- SØRENSEN, Th., 1948: *A method of establishing groups of equal amplitude in plant sociology based on similarity of species content*. Det Kongelige Dansk Videnskaberens Selskab. Biologiske Skrifer (København) 5 (4): 1–34.
- WALLNÖFER, S., L. MUCINA & V. GRASS, 1993: *Querco-Fagetea (v: MUCINA, L., G. GRABHERR & S. WALLNÖFER: Pflanzengesellschaften Österreichs. Teil III. Wälder und Gebüsche)*. Fischer, Jena-Stuttgart-New York.
- WRABER, M., 1960: *Fitocenoška razčlenitev gozdne vegetacije v Sloveniji*. Ad anum horti botanici Labacensis sollemnem (Ljubljana).
- WRABER, M., 1964: *Vegetacija slovenskega bukovega gozda v luči ekologije in palinologije*. Biološki vestnik (Ljubljana) 12: 77–95.
- ZUPANČIČ, M., & A. ČARNI, 1988: *Nova združba rdečega bora v slovenskem predpanonskem obrobju*. Biološki vestnik (Ljubljana) 36 (3): 107–125 + tabeli.

DIFERENTIAL SPECIES (Razlikovalnice)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
RP1 <i>Castanea sativa</i>	I	II	220 III	+	1	44 II	65 IV	I	V	II	115 II	42 I	42 I	42 I	42 I	42 I	42 I	42 I	42 I	42 I
	II	III	227 V	I	2	9 V	3 II	-	III	I	26 IV	2 I	2 I	2 I	2 I	2 I	2 I	2 I	2 I	2 I
	III	I	1 I	II	-	1 I	2 I	I	II	I	1 I	-	-	-	-	-	-	-	-	-
	I	-	-	I	-	3 II	3 II	I	I	-	1 I	2 I	2 I	2 I	2 I	2 I	2 I	2 I	2 I	2 I
Q2 <i>Fraxinus ornus</i>	II	II	16 II	III	1	21 III	21 III	I	I	-	1 I	2 I	2 I	2 I	2 I	2 I	2 I	2 I	2 I	2 I
	III	-	-	-	-	37 III	37 III	I	I	-	1 I	2 I	2 I	2 I	2 I	2 I	2 I	2 I	2 I	2 I
	I	I	-	1	-	-	-	I	I	II	-	-	-	-	-	-	-	-	-	-
F3 <i>Pyrus pyraeaster</i>	II	-	2 II	-	1 I	1 I	1 I	-	I	-	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I
	I	I	-	1	-	-	-	-	-	-	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I
	II	I	-	1	-	2 I	3 I	-	-	-	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I
F3 <i>Tilia cordata</i>	II	I	-	1	-	2 I	3 I	-	-	-	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I
	III	-	-	-	-	1 I	1 I	-	-	-	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I

BLECHNO-FAGETUM Ht. 1950 corr. Marinček 1970

VP ₁ <i>Blechnum spicant</i>	I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	III	+	28 I	.	.	.	.	I	I	V	920 V	24 II	24 II	44 II	44 II	44 II	44 II	44 II	44 II	44 II
VP ₁ <i>Bazzania trilobata</i>	IV	I	145 II	.	48 IV	.	II	.	.	III	1065 V	.	.	.	.	.	.	.	.	.
NC <i>Lycopodium clavatum</i>	III	.	.	.	.	.	I	.	.	I	I	.	.	.	.	.	.	.	.	.
VP ₁ <i>Rhytidadelphus loreus</i>	IV	.	14 I	.	.	.	.	.	.	I	94 I	.	.	.	.	.	.	.	.	.

LUZULO-FAGETUM Meusel 1937 corr. Oberdorfer 1957

CHARACTERISTIC SPECIES OF THE ASSOCIATION

(Značilnica za asociacijo)

VP ₁ <i>Luzula luzulina</i>	III	.	.	.	.	.	.	.	.	.	.	.	24 II	24 II	32 II	32 II	32 II	32 II	32 II	32 II
III	.	.	.	.	.	.	.	.	.	.	.	.	1 I	23 II	17 II	87 III	87 III	87 III	87 III	87 III
VP ₂ <i>Phegopteris connectilis</i>	III	.	-	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
VP ₂ <i>Polygonatum verticillatum</i>	A	.	.	.	.	.	.	.	.	.	.	.	73 IV	43 II	47 III	110 II	110 II	110 II	110 II	110 II
A <i>Polygonatum verticillatum</i>	VP ₁	I	145 II	.	48 IV	.	II	.	.	III	1065 V	.	104 II	324 II	29 I	29 I	29 I	29 I	29 I	29 I
VP ₁ <i>Luzula sylvatica</i> subsp. <i>sylvatica</i>	VP ₁	I	145 II	.	48 IV	.	II	.	.	I	I	.	2 II	22 I	59 II	163 IV	163 IV	163 IV	163 IV	163 IV
VP ₁ <i>Gymnocarpium dryopteris</i>	II	.	.	.	.	.	.	.	.	.	.	.	2 II	22 I	59 II	163 IV	163 IV	163 IV	163 IV	163 IV
VP ₂ <i>Dryopteris carthusiana</i>	III	.	.	.	.	.	.	.	.	.	.	.	24 II	65 I	3 II	3 II	3 II	3 II	3 II	3 II

HERO-FAGETUM var. geogr. POLYSTICHUM SETIFERUM Košir (1962) 1994

CHARACTERISTIC SPECIES (Značilnice)

A <i>Athyrium filix-femina</i>	III	II	3 II	III	.	3 II	36 II	.	.	.	63 II	460 V	160 IV	332 V	1784 V	1784 V	1784 V	1784 V	1784 V	1784 V
F ₂ <i>Cardamine bulbifera</i>	?	I	1 I	+	.	18 I	.	.	.	.	.	24 I	44 II	1 I	18 I	18 I	18 I	18 I	18 I	18 I
F ₂ <i>Galeobdolon montanum</i> & <i>G. flavidum</i>	II	I	15 II	+	.	1 I	24 IV	.	.	.	.	25 II	24 II	117 III	153 III	153 III	153 III	153 III	153 III	153 III
F ₂ <i>Hedera helix</i>	III	I	2 II	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F ₂ <i>Sanicula europaea</i>	A	I	14 I	III	.	.	.	.	.	.	.	94 III	234 IV	76 IV	198 V	198 V	198 V	198 V	198 V	198 V
A <i>Dryopteris filix-mas</i>	I	.	2 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Q ₂ <i>Cephalanthera longifolia</i>	II	.	43 II	.	.	.	.	I	II	I	I	.	.	.	.	.	.	.	.	.
Q ₂ <i>Sorbus torminalis</i>	III	I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	V	2345 V	V	3	152 IV	428 V	428 V	V	I	V	V	742 V	346 V	753 V	468 V	354 V	354 V	354 V	354 V	354 V
F ₂ <i>Sambucus nigra</i>	II	.	.	.	.	.	1 I	.	.	.	.	.	2 II	24 II	.	129 III	129 III	129 III	129 III	129 III

DIFERENTIAL SPECIES (Razlikovalnice)

A <i>Doronicum austriacum</i>	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
VP ₃ <i>Luzula luzuloides</i>	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
F ₂ <i>Sambucus nigra</i>	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

F ₂ Euphorbia amygdaloides	III	I	-I	.	.	.	.	.	.	.	.	.	.	.	29 I	2 II	III	88 IV	IV	2 II	
F ₁ Festuca drymeia	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	I-III	.	.	.	
VP ² Hieracium rotundatum	.	-I	.	3	.	.	.	.	.	.	.	.	.	.	.	366 II	II	.	.	.	
F ₃ Melica uniflora	.	-I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	74 I	.	.	
C Dactylis polygama	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	
PHYTOGEOGRAPHIC DIFFERENTIAL SPECIES (Fitogeografska razlikovalnica)																					
F ₂ Polystichum setiferum	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	84 II	IV	.	.	.	
HACQUETIO-FAGETUM var. geogr. RUSCUS HYPOGLOSSUM Ž. Košir 1962																					
CHARACTERISTIC SPECIES (Značilnice)																					
F ₁ Hacquetia epipactis	III	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17	18	19	20
VP ³ Aposotis foetida	II	2 II	I	.	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	18 I	I-III	2084 V	I	176 II	
F ₂ Primula vulgaris	I	1 I	II	.	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	1 I	II	1303 V	IV	2175 V	
DIFFERENTIAL SPECIES (Razlikovalnice)																					
F ₂ Asarum europaeum subsp. caucasicum	III	.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
F ₁ Helleborus niger subsp. niger	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II-III	1128 V	.	.
C Rosa arvensis	II	I	1 I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	345 V	IV	2 II
P Crataegus monogyna	I	1 I	1 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	315 IV	.	.
P Crataegus laevigata	I	1 I	1 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	108 IV	.	.
MA Carex flacca	III	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	325 III	.	.
P Ligustrum vulgare	II	+	1 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	65 III	.	.
P Viburnum lantana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	47 III	.	.
PHYTOGEOGRAPHIC DIFFERENTIAL SPECIES (Fitogeografska razlikovalnica)																					
F ₁ Ruscus hypoglossum	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	565 IV	I	.
RANUNCULO PLATANIFOLIUM-FAGETUM Marinček et al. 1992 var. geogr. HEPATICA NOBILIS Marinček 1993																					
CHARACTERISTIC SPECIES (Značilnica)																					
A Ranunculus platanifolius	III	.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
PHYTOGEOGRAPHIC DIFFERENTIAL SPECIES (Fitogeografska razlikovalnica)																					
F ₃ Hepatica nobilis	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25 II	2 II	1 I	.	IV	7 IV
POLYSTICHO LONCHITIS-FAGETUM (Ht. 1938) Marinček in Poldini & Nardini 1993																					
CHARACTERISTIC SPECIES (Značilnice)																					
VP ₁ Polystichum lonchitis	III	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A Viola biflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	157 V
S ₃ Centaurea montana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	58 V	105 IV
S ₃ Carex ferruginea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	57 IV	7 IV
VP ₂ Rhododendron hirsutum	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5 III	5 III
A Salix waldesteiniana	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2 II	2 II
A Geranium sylvaticum	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2 II	2 II
F ₃ Ribes alpinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A Salix glabra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

RP₁ QUERCION ROBORIS Malc. 1929

	I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Castanea sativa	I II	220 III	+	1	44 II	65 IV	I	V	.	II	.	115 II	.	42 I	.	.	III	2 II	.	.
	II	227 V	I	2	9 V	3 II	-	III	.	I	.	26 IV	.	2 I	.	.	II-V	--	.	.
	III	I	II	-	11	2 I	I	II	.	I	.	1 I	.	--	.	.	--	--	.	.
Betula pendula	I	2 I	I	-	11	1 I	-	.	II	II	II	- I	.	.	.	3 II	I-II	.	.	.
	II	I	+	-	11	--	-	.	II	I	-	--	.	.	.	--	--	.	.	.
	III	I	--	1	--	--	I	-	I	-	-	--	.	.	.	--	--	.	.	.
Genista tinctoria	I	29 II	+	2	.	.	III	I	V	II	.	.	.	.	.	.	.	.	.	.
Populus tremula	I	1 I	I	.	1 I	.	.	-	II	II	.	.	.	.	.	.	.	.	.	.
	II	1 I	-	-	--	.	.	.	I	.	I	.	.	.	.	.	.	.	.	.
Carex pilulifera	III	1 I	+	.	3 II	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.
Viola riviniana	.	.	.	.	1 I	.	.	.	.	.	.	.	.	1 I	.	.	.	.	.	.
Hieracium umbellatum	.	.	.	.	.	.	.	.	V	I	v	III	I	.	.	.	.	.	.	.
Asplenium adiantum-nigrum	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.

RP₂ QUERCETALIA ROBORIS R. Tx. 1931

	I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Melampyrum pratense subsp. vulgatum	III	IV	484 V	2	232 II	.	II	I	III	.	II	117 II	.	2 I	.	.	I	.	.	.
Peridium aquilinum	IV	255 V	III	2	254 V	87 III	V	V	V	V	V	316 V	.	.	.	.	I-III	89 IV	.	.
Dicranella heteromalla	IV	238 II	+	.	4 III	18 II	III	.	.	II	.	88 IV	.	.	.	68 II	.	.	.	2 II
Frangula alnus	II	44 IV	II	1	1 I	.	.	.	.	.	.	2 I	.	.	.	.	.	.	.	.
Hieracium racemosum	III	181 V	I	.	.	70 III	.	.	.	.	.	.	.	.	.	2 II	.	.	.	.
Polypodium vulgare	II	2 II	III	2	2 I	2 I	.	.	.	.	.	3 II	.	.	.	.	.	.	.	.
Carex montana	I	1 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Festuca heterophylla	I	109 II	.	1	.	.	.	I	.	I	II	.	.	.	.	.	.	- I	.	3 II
Hieracium sabaudum	I	1 I	.	.	43 I	1 I	.	.	.	.	.	- I	.	.	.	.	.	.	.	.
Hieracium vulgatum	I	1 I	III	.	2 I	.	III	.	.	.	.	1 I	.	.	.	.	.	.	.	.
Veronica officinalis	I	.	II	.	2 I	.	II	II	IV	II	I	1 I	.	3 II	116 III	.	.	.	.	.
Potentilla erecta	+	1 I	II	II	.	.	II	II	IV	II	I	.	.	.	.	.	.	.	.	.
Teucrium scorodonia	.	1 I	.	.	2 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chamaespartium sagittale (=Genista sagittalis)	.	- I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lathyrus laevigatus (=L. montanus)	.	- I	.	.	.	.	I	.	.	I	.	.	.	.	.	.	I	150 I	.	.
Melampyrum pratense subsp. pratense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Luzula forsteri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	- I	.

C CARPINION Issler 1931 em. Oberdorfer 1953 s. lat.

	I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Carpinus betulus	I	28 I	.	-	2 I	68 II	II	IV	III	I	I	.	.	.	.	.	III-IV	267 III	.	.
	II	42 II	.	1	1 I	1 I	I	III	III	I	II	.	.	.	.	.	V	3 II	.	.
	III	+	.	.	--	--	I	II	II	I	II	.	.	.	.	.	V	--	.	.
	I	1 I	-	-	1 I	1 I	I	.	.	I	-	.	.	.	.	1 I	I-IV	2 I	.	.
Prunus avium	II	5 III	+	1	3 II	18 I	-	.	.	-	I	.	.	.	--	IV-V	2 II	.	.	.
	III	+	1 I	+	--	19 II	-	.	.	I	-	.	.	.	1 I	--	2 II	.	.	.
	I	2 I	.	1	.	.	.	-	.	.	.	.	.	.	.	II	43 II	.	.	.
Acer campestre	II	- I	.	-	.	.	.	IV	.	.	.	.	.	.	.	.	-	199 III	.	.
Lonicera caprifolium	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	42 I	.	.

<i>Crataegus laevigata</i>	-I	.	.	.	1 I	17 I	.	.	.	.	.	.	.	.	.	.	.	.	.	108 IV*	.
<i>Rhamnus catharticus</i>	-I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cornus sanguinea</i>	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	326 IV	.
<i>Viburnum lantana</i>	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	47 III	.
<i>Euonymus verrucosa</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	24 II	.

LF LUZULO-FAGENION (Lohmayer & R. Tx. 1954) em. Oberdorfer 1957
 DIFFERENTIAL SPECIES (Razlikovalnice)

VP ₃ <i>Luzula luzuloides</i>	III	V	2345 V	V	3	152 IV	428 V	V	I	V	V	742 V	346 V	753 V	468 V	354 V	V	.	.	.	.	17	18	19	20	
VP ₂ <i>Vaccinium myrtillus</i>	IV	1854 V	IV	2	775 V	1 I	IV	.	IV	V	V	1354 V	4 III	250 I	80 II	3 II	.	.	.	.	.	.	.	.	II	6 IV
VP ₃ <i>Calamagrostis arundinacea</i>	II	16 II	II	2	.	994 V	.	.	.	.	.	157 I	2275 V	523 II	817 IV	586 III	.	.	.	.	.	.	.	.	I	6 IV
VP ₁ <i>Dryopteris expansa</i>	I	1 I	70 II	.	61 III	270 IV	I	3 II
VP ₃ <i>Oxalis acetosella</i>	I	1 I	II	II	.	.	20 II	.	.	.	.	.	1235 V	393 IV	2116 V	1158 V	IV-V	188 I	IV	206 V	.	.	.	.	IV	206 V
A <i>Senecio ovatus</i>	I	.	+	.	.	20 II	.	.	.	.	.	.	199 V	346 IV	204 IV	626 V	III-IV	1 I	IV	605 V	.	.	.	.	IV	605 V
VP ₁ <i>Galium rotundifolium</i>	.	1 I	377 IV

• F₁ AREMONIO-FAGION (Ht. 1938) Török, Podani & Borhidi 1989

<i>Cyclamen purpurascens</i>	III	I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
<i>Euphorbia cernuifolia</i>	I	1 I	II	.	.	.	3 II	.	.	.	.	.	1 I	- I	84 II	- I	2 I	III-IV	253 IV	IV	4 III	
<i>Hacquetia epipactis</i>	I	.	.	.	.	.	17 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Knaulia drymeia</i> subsp. <i>drymeia</i>	I	2 II	+	.	.	.	- I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Anemone trifolia</i>	+	.	.	.	.	.	137 IV	.	.	.	.	.	.	.	.	.	17 I	.	.	.	.	.
<i>Cardamine trifolia</i>	+	.	.	.	.	.	- I	.	.	.	.	.	.	.	.	.	479 IV	115 I	837 V	385 V	IV	352 V
<i>Epimedium alpinum</i>	.	1 I	.	.	.	.	47 IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Festuca drymeia</i>	.	1 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Vicia oroboides</i>	.	1 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lamium orvala</i>	.	- I	.	.	.	.	- I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Calamintha grandiflora</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Arenonia agrimonoides</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cardamine enneaphyllos</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Geranium nodosum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cardamine waldsteinii</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Isopyrum thalictroides</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Helleborus niger</i> subsp. <i>niger</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Scopolia carniolica</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rhamnus fallax</i>	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ruscus hypoglossum</i>	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Omphalodes verna</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

F₂ FAGETALIA SYLVATICAE Pawl. 1928

<i>Fagus sylvatica</i>	I	V	6020 V	V	3	7500 V	8417 V	V	V	V	V	V	6771 V	5649 V	3522 V	3801 V	2278 V	V	7500 V	V	6000 V
	II	V	2610 V	V	3	648 V	395 V	V	V	V	IV	V	620 V	106 III	493 V	389 IV	444 V	V	1314 V	V	1979 V
	III	I	75 II	III	-	2979 V	461 V	V	II	IV	II	IV	76 II	50 IV	128 III	294 II	153 IV	V	- V	-	-
	I	II	- I	II	.	-	- I	I	-	II	-	-	-	- I	1 I	11	153 III	II	87 III	IV	2 II
<i>Acer pseudoplatanus</i>	II	I	3 II	-	.	1 I	18 I	I	-	II	I	-	1 I	11	107 III	31 II	53 III	IV	182 IV	-	7 IV
	III	-	1 I	-	.	-	169 III	-	II	I	-	III	-	27 III	2 I	15 I	203 IV	IV-V	3 II	-	-

<i>Mercurialis perennis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	115 II	.	19 II	.	471 V	IV	402 III
<i>Polystichum setiferum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	84 II	.	1 I	IV	.	.	.
<i>Phyteuma spicatum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	43 II	.	.	44 II	.	.	6 IV
<i>Veronica montana</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	22 I	.	.	.	.	.	.
<i>Impatiens noli-tangere</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2 I	.	.	.	.	.	.
<i>Circaea lutetiana</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1 I	.	54 III	II-IV	.	.	.
<i>Pulmonaria stiriaca</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16 I	.	.	.	.	.	.
<i>Digitalis grandiflora</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1 I	.	.	.	.	.	4 III
<i>Stellaria montana</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-I	285 III	.	.	.	.	.
<i>Sambucus racemosa</i>	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Polystichum aculeatum</i>	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	53 III	.	.	.	.	.
<i>Lonicera alpigena</i>	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	21 III	.	.	74 I	II	1 I
<i>Geranium robertianum</i>	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	67 I	.	.	43 II	II	204 V
<i>Asarum europaeum</i> subsp. caucasicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	34 I	I-II	.	.	.	.
<i>Lunaria rediviva</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II-III	1128 V	.	.	.
<i>Allium ursinum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.
<i>Phyllitis scolopendrium</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	1750 II	.	.	.
<i>Melica nutans</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	-I	.	.	.
<i>Cephalanthera damasonium</i>	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1 I
<i>Ulmus glabra</i>	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cephalanthera rubra</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Brachypodium sylvaticum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Aquilegia nigricans</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Poa nemoralis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8 V
F ₃ QUERCO-FAGETEA Br.-Bl. & Vlieger in Vlieger 1937 s. lat.																											
<i>Quercus petraea</i>	I	V	1420 V	V	3	4	1	316 IV	78 II	IV	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
	II	V	229 V	V	3	7 IV	-	7 IV	-	V	V	I	II	III	III	168 III	.	.	.	.	.	III	158 III	.	.
	III	I	103 II	IV	-	48 IV	20 II	IV	IV	I	I	I	I	II	II	3 II	.	.	.	.	.	I-III	65 II	.	.
	IV	II	16 II	III	3	8 IV	2 I	.	.	.	.	.	.	.	.	4 III	5 III	200 III	3 II	2 II	.	.	II	.	3 II
<i>Isoethecium myurum</i>	II	I	1 I	2 I	.	.	440 III	.	.	
<i>Clematis vitalba</i>	III	I	14 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Convallaria majalis</i>	II	I	1 I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Corylus avellana</i>	IV	I	1 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ctenidium molluscum</i>	II	I	15 II	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9 V
<i>Hedera helix</i>	I	I	-	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pyrus pyraeaster</i>	II	-	2 II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	I	I	-I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Tilia cordata</i>	II	I	-I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	III	-	-	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	I	+	-	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Taxus alpinus</i>	II	-	1 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Alnus glutinosa</i>	TA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Acer platanoides	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	- I	.	.	
	II	.	1 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I-II	23 II	.	.	
	III	.	-	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-	21 I	.	.	
Loranthus europaeus	II	.	1 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	180 III	II	3 II
Carex digitata	III	.	- I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	74 I	.	.
Melica uniflora		.	- I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anemone nemorosa		.	.	III	.	1 I	33 I	.	.	.	.	.	.	.	.	.	.	.	.	.	834 III	III	720 V
AU Impatiens noli-tangere		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
AU Stellaria nemorum		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lonicera xylosteum	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	54 III
Euonymus latifolia		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hepatica nobilis	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ribes alpinum	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2 II
VP ₁ VACCINIO-PICEION Br.-Bl. 1939 s. lat.																							
Hieracium sylvaticum	III	V	60 V	V	2	315 IV	54 III	V	II	8	7	12	13	14	15	16	17	18	19	20			
Picea abies	II	III	258 II	I	2	358 IV	1 I	.	.	.	.	46 III	94 III	331 IV	33 III	53 II	I-II	22 I	I	5 III			
Bazzania trilobata	IV	I	15 II	+	-	3 II	1 I	.	.	.	.	130 V	48 II	3 II	102 III	70 III	-	138 III	-	2 II			
Dryopteris expansa	I	1	145 II	.	.	48 IV	.	II	.	.	.	1065 V	.	.	.	.	.	.	.	.	.	.	2 II
Thelypteris limbosperma	I	1	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3 II
Blechnum spicant	III	+	28 I	.	.	.	.	.	II	8	7	481 II	2 II	1 I	- I	.	.	.	.	.	.	.	.
Peltigera leucophlebia	IV	+	- I	III	.	.	.	.	I	9	8	920 V	24 II	.	44 II	1 I	.	.	.	.	.	.	.
Rhytidiadelphus loreus	IV	.	14 I	.	.	.	.	.	.	.	.	94 I	.	.	.	.	.	.	.	.	.	.	.
Galium rotundifolium	III	.	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Myiia taylorii	IV	.	- I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Veronica urticifolia	III	.	- I	IV	.	38 III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	107 V
Melampyrum sylvaticum		.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Luzula sylvatica subsp. sylvatica		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Luzula luzulina		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3 II
Gymnocarpium dryopteris		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Calamagrostis villosa		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lonicera nigra	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1 I
Polystichum lonchitis	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	157 V
Homogyne alpina		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
VP ₂ VACCINIO-PICEETALIA Br.-Bl. in Br.-Bl. et al. 1939 emend. K.-Lund 1967 s. lat.																							
Polytrichum formosum	IV	V	936 V	I	2	689 V	53 II	V	III	8	7	12	13	14	15	16	17	18	19	20			
Vaccinium myrtillus	III	IV	1854 V	IV	2	775 V	1 I	IV	.	.	.	175 V	53 V	23 II	4 III	127 II	I	.	.	.	.	.	6 IV
Galluna vulgaris		II	118 III	II	2	.	.	IV	.	.	.	1354 V	4 III	250 I	80 II	3 II	.	.	.	.	.	.	.
Abies alba	I	I	-	+	-	1 I	.	I	I	9	10	21	48 II	4563 V	1465 V	3617 V	II-IV	- I	II	.	.	.	.
Atrichum undulatum	III	I	1 I	-	2	1 I	.	II	II	.	.	44 II	25 II	646 V	310 IV	428 V	I	3 II	-	.	.	.	.
Plagiothecium neglectum	IV	I	15 I	III	.	2 I	1 I	.	.	.	.	2 II	2 II	150 IV	154 IV	261 IV	-	-	-	.	.	.	.
		I	29 III	+	.	.	.	.	.	.	.	21 I	.	.	.	.	.	.	.	.	.	.	.

<i>Vaccinium vitis-idaea</i>	III	I	-I	.	.	.	.	.	.	.	94 I	.	.	.	.	.	.	.	.	1 I
<i>Pyrola rotundifolia</i>	IV	+	-I	I	.	.	.	.	.	.	-I	.	.	.	.	.	.	.	.	.
<i>Thuidium delicatulum</i>	III	II	1 I	II	.	.	.	.	.	.	232 III	23 I	325 II	15 I	2 I	.	.	.	.	.
<i>Avenella flexuosa</i>	IV	.	-I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Dicranum polysetum</i>	III	.	-I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hieracium rotundatum</i>	III	.	-I	.	3	.	.	.	.	.	.	.	366 II	.	.	.	.	.	.	II
<i>Monotropa hypopitys</i> subsp. <i>hypopitys</i>	III	.	-I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Phegopteris connectilis</i>	IV	.	-I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Plagiochila asplenoides</i> var. <i>major</i>	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Saxifraga cuneifolia</i>	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Huperzia selago</i>	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Larix decidua</i>	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rosa pendulina</i>	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Dryopteris carthusiana</i>	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Dryopteris affinis</i> subsp. <i>borrieri</i>	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Adenostyles glabra</i>	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Homogyne sylvestris</i>	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Mnium hornum</i>	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Mnium punctatum</i>	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Valeriana tripteris</i>	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Orthilia secunda</i>	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Clematis alpina</i>	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rubus saxatilis</i>	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rhododendron hirsutum</i>	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pyrola minor</i>	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
VP ₃ VACCINIO-PICEETEA Br.-Bl. in Br.-Bl. et al. 1939 em. Zupančič (1979) 2000 s. lat.																					
<i>Luzula luzuloides</i>	V	2345 V	V	3	152 IV	428 V	V	I	V	742 V	346 V	753 V	468 V	354 V	V	.	.	.	.	19
<i>Dicranum scoparium</i>	IV	119 IV	III	3	4 III	.	V	I	IV	305 V	1 I	44 II	1 I	59 I	.	.	.	.	.	18
<i>Gentiana asclepiadea</i>	III	45 III	III	.	5 III	19 II	IV	.	II	181 IV	49 III	522 II	116 II	221 V	I	.	.	.	.	19
<i>Hypnum cupressiforme</i>	IV	403 IV	V	2	8 IV	2 II	.	.	.	202 IV	72 III	.	1 I	38 III	.	.	.	.	.	20
<i>Solidago virgaurea</i>	III	73 IV	V	1	1 I	139 V	.	.	.	-I	2 II	.	50 I	153 IV	I-II	110 IV	I	.	.	21	
<i>Aposperis foetida</i>	II	2 II	I	.	1 I	1 I	I	.	II	.	2 II	.	1 I	18 I	I-III	1303 V	IV	.	.	22	
<i>Calamagrostis arundinacea</i>	II	16 II	II	2	.	994 V	.	.	.	157 I	2275 V	523 II	817 IV	586 III	.	.	.	.	.	23
<i>Leucobryum glaucum</i>	IV	449 V	I	.	278 V	18 I	V	I	I	244 V	.	.	.	.	.	.	.	.	.	24
<i>Luzula pilosa</i>	III	43 II	II	.	91 V	1 I	III	.	III	3 II	24 I	23 II	74 III	20 II	.	.	.	.	.	25
<i>Rubus hirtus</i>	II	27 II	+	1	.	2 I	.	IV	.	III	1 I	3 II	3 II	1 I	71 III	I-III	24 II	.	.	26	
<i>Hylacomium splendens</i>	IV	15 II	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Maianthemum bifolium</i>	III	I	1 I	II	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.
<i>Oxalis acetosella</i>	I	1 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pleurozium schreberi</i>	IV	55 II	.	.	1 I	.	III	.	II	.	.	.	.	.	.	.	.	.	.	.
<i>Rhytidadelphus triquetrus</i>	I	1 I	.	.	.	.	I	.	I	.	.	.	.	.	.	.	.	.	.	.
<i>Scapania nemorea</i>	I	1 I	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.
<i>Hypnum cupressiforme</i> var. <i>filiforme</i>	+	-I	I	.	.	2 I	1 I	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Calyptogeia trichomanis</i>	.	47 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cantharellus cibarius</i>	III	.	1 I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

ART ARTEMISIETEA Lohm., Prsg. & R. Tx. 1950 s. lat

Aegopodium podagraria	III	I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Galeopsis pubescens	I	.	.	+	.	.	.	.	.	.	.	.	.	25II	.	.	2II	I	-I	I	.
Urtica dioica	.	.	.	.	.	3II	.	.	.	.	.	.	.	.	2I	1I	2I	.	.	.	7IV
Melandryum rubrum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1I	1I	.	.	.	.	1I
Glechoma hederacea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I-II	.	.	.

AS ASPLENIETEA TRICHOMANIS Br.-Bl. in Meier & Br.-Bl. 1934 s. lat

Asplenium trichomanes	III	I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Asplenium viride	.	.	.	II	.	.	1I	.	.	.	.	.	.	.	.	.	3II	.	.	.	.
Cystopteris fragilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1I	.	.	.	7IV
O OTHER SPECIES (Ostale vrste)																					
Sorbus aucuparia subsp. aucuparia	III	I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	I	-	.	-	.	.	.	.	.	I	I	I	-	.	--	--	17I	.	.	.	.
	II	I	.	I	I	.	.	.	.	I	I	I	I	5III	2II	53III	.	.	.	.	.
	III	-	.	-	.	.	.	.	.	-	-	-	-	.	--	--	70III	.	.	.	.
Robinia pseudacacia	I	.	.	+	.	.	-I	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	II	.	.	+	.	.	17I	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rubus sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rubus fruticosus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Phyteuma ovatum	III	.	.	.	.	.	.	.	.	.	.	.	1I	.	.	.	.	II-III	.	.	.
Cerastium sylvaticum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19II	.	.	.
Laburnum alpinum	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.
Lilium carnolicum	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	21I	.	.
																			-I	.	.
Aconitum degonii subsp. paniculatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aconitum lycoctonum subsp. vulparia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Anthriscus nitida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
																				I	6IV
																				I	154IV

ML MOSSES AND LICHENS (Mahovi in lišaji)

Gladonia pyxidata	IV	I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Gladonia rangiferina	II	17III	III	2	5III	.	.	III	.	.	III	.	3II	.	.	.	.	.	.	.	.
Anomodon viticulosus	II	17III	.	.	.	.	.	.	.	.	.	.	21I	.	.	.	.	.	.	.	.
Brachythecium rutabulum	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mnium undulatum	I	.	.	.	.	.	.	.	.	.	.	.	-I	.	.	.	.	.	.	.	.
Plagiochila asplenioides	I	.	.	+	1	1I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1I
Plagiothecium denticulatum	I	.	.	.	1	6IV	72IV	.	.	.	.	.	172IV	.	44II	1I	35II	.	.	.	3II
Metzgeria pubescens	+	.	.	.	1	2I	.	.	.	.	.	.	16II	.	23II	.	2II	.	.	.	.
Radula complanata	+	.	.	.	.	3II	.	.	.	.	.	.	23II	.	.	.	.	.	.	.	.
Plagiothecium sp.	.	75I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polytrichum juniperinum	.	14I	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gladonia squamosa	.	-I	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.
Madotheca platyphylla	.	.	II	.	.	.	1I	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gladonia sp.	.	.	.	.	.	.	53III	II	.	I	.	.	.	.	.	.	.	.	.	.	.
Fissidens taxifolius	.	.	.	.	.	.	2I	.	.	.	.	.	.	.	.	.	53II	.	.	.	3II

Analytical table (Analitična tabela)

- 1 Castaneo-Fagetum Marinček & Zupančič (1979) 1995 var. geogr. typica (Quercu-Luzulo-Fagetum Marinček & Zupančič 1979)
- 2 Castaneo-Fagetum Marinček & Zupančič (1979) 1995 var. geogr. typicum Zupančič & Žagar 2011 & fraxinetosum ornii Zupančič & Žagar 2011
- 3 Castaneo-Fagetum Marinček & Zupančič (1979) 1995 (Quercu-Luzulo-Fagetum) var. geogr. Calamintha grandiflora Marinček & Zupančič (1979) 1995
- 4 Castaneo-Fagetum Marinček & Zupančič (1979) 1995 (Quercu-Luzulo-Fagetum) var. geogr. Hieracium transsylvanicum Marinček & Zupančič (1979) 1995
- 5 Castaneo-Fagetum Marinček & Zupančič (1979) 1995 var. geogr. Epimedium alpinum (Marinček & Zupančič 1995 (Epimedio-Luzulo-Fagetum Marinček 1980)
- 6 Castaneo-Fagetum Marinček & Zupančič (1979) 1995 (Luzulo-Fagetum Meusel 1937 var. geogr. Anemone trifolia Zukrigl 1989 forma Ruscus aculeatus Dakskobler 1996)
- 7 Castaneo-Fagetum Marinček & Zupančič (1979) 1995 (Luzulo-Fagetum Meusel 1937)
- 8 Castaneo-Fagetum Marinček & Zupančič (1979) 1995 (Luzulo-Fagetum castanetosum. M. Wraber 1958)
- 9 Castaneo-Fagetum Marinček & Zupančič (1979) 1995 (Luzulo-Fagetum Meusel 1937)
- 10 Blechno-Fagetum Ht. 1950 ex Marinček 1970
- 11 Blechno-Fagetum Ht. 1950 ex Marinček 1970
- 12 Blechno-Fagetum Ht. 1950 ex Marinček 1970
- 13 Luzulo-Fagetum Meusel 1937 (Polygonato verticillati-Luzulo-Fagetum var. geogr. Cardamine trifolia Marinček 1983)
- 14 Luzulo-Fagetum Meusel 1937 abietetosum Marinček & Dakskobler 1988 var. Galium rotundifolium Marinček & Dakskobler 1988 (Luzulo-Abieti-Fagetum H.Mayer (1963) 1969 praealpinum Marinček & Dakskobler 1988)
- 15 Luzulo-Fagetum Meusel 1937 (Luzulo-Abieti-Fagetum H.Mayer (1963) 1969 praealpinum Marinček & Dakskobler 1988 var. typicum Marinček & Dakskobler 1988)
- 16 Luzulo-Fagetum Meusel 1937 lamietosum orvalae Marinček & Dakskobler 1988 (Luzulo-Abieti-Fagetum H.Mayer (1963) 1969 praealpinum Marinček & Dakskobler 1988 lamietosum orvalae Marinček & Dakskobler 1988)
- 17 Hedero-Fagetum Ž. Košir (1962) 1994 var. geogr. Polystichum setiferum Ž. Košir 1994
- 18 Hacquetio-Fagetum Ž. Košir 1962 var. geogr. Ruscus hypoglossum Ž. Košir 1979
- 19 Ranunculo plataniifolii-Fagetum Marinček 1992 var. geogr. Hepatica nobilis Marinček 1993
- 20 Polysticho lonchitis-Fagetum (Ht. 1938) Marinček in Poldini et Nardini 1993 (Fagetum subalpinum praealpinum Marinček 1985)