SECONDARY *QUERCUS PETRAEA* PHYTOCENOSIS OF THE SUB-PANNONIAN REGION OF SLOVENIA (SYNTAXONOMIC PROBLEM OF SECONDARY ASSOCIATIONS OF *CALLUNO-QUERCETUM* AND *LEUCOBRYO-QUERCETUM*)

SEKUNDARNA GRADNOVA FITOCENOZA SUBPANONSKEGA OBMOČJA SLOVENIJE (SINTAKSONOMSKI PROBLEM SEKUNDARNIH ASOCIACIJ *CALLUNO-QUERCETUM* IN *LEUCOBRYO- QUERCETUM)*

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ABSTRACT UDC 582.632.2:581.9(497.411)

Secondary *Quercus petraea* phytocenosis of the sub-pannonian region of Slovenia

(Syntaxonomic problem of the secondary associations of *Calluno-Quercetum* and *Leucobryo-Quercetum*)

More recent study of secondary sessile oak phytocenoses on primary habitats of the association *Blechno-Fagetum* have shown that only one association appears, *Calluno--Quercetum petraeae*, with two sub-associations – *typicum* and *pinetosum sylvestris*. It was shown that the other association, *Leucobryo-Quercetum petraeae,* is floristically the same as *Calluno-Quercetum petraeae*. In addition to the aforementioned new sub-associations, we also recorded a new variant with manna ash, *Calluno-Quercetum petraeae* var. *Fraxinus ornus*, which is presumed to grow on habitats of the related association, *Castaneo-Fagetum*.

Keywords: Calluno-Quercetum petraeae, *Leucobryo--Quercetum petraeae*, phytocenology, sub-pannonian region of Slovenia.

IZVLEČEK UDK 582.632.2:581.9(497.411)

Sekundarna gradnova fitocenoza subpanonskega območja Slovenije

(Sintaksonomski problem sekundarnih asociacij *Calluno-Quercetum* in *Leucobryo-Quercetum*)

Novejša preučevanja sekundarnih fitocenoz gradna na primarnih rastiščih asociacije *Blechno-Fagetum* so pokazala, da se pojavlja le ena asociacija *Calluno-Quercetum petraeae* z dvema subasociacijama –*typicum* in *pinetosum sylvestris*. Za drugo asociacijo *Leucobryo-Quercetum petraeae* se je izkazalo, da je floristično enaka asociaciji *Calluno-Quercetum petraeae*. Poleg prej omenjenih novih subasociacij smo zabeležili še novo varianto z malim jesenom *Calluno-Quercetum petraeae* var. *Fraxinus ornus*, ki domnevno porašča primarna rastišča sorodne asociacije *Castaneo-Fagetum*.

Ključne besede: Calluno-Quercetum petraeae, *Leucobryo-Quercetum petraeae*, fitocenologija, subpanonsko območje Slovenije.

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INTRODUCTION

During a short visit to the edge of the sub-pannonian region of Slovenia (Log, Dobovec pri Rogatcu) we observed a form of secondary sessile oak stand similar to the already described secondary association of sessile oak and heather, *Calluno-Quercetum petraeae*. We were not sure whether it was the same phytocenosis, since the secondary association *Calluno-Quercetum petraeae* grows on primary habitats of the association *Blechno-Fagetum* on fresh, more or less shady non-carbonate ground/soil. Our relevés are on non-carbonate miocenic sandstone, but in warm exposures of primary forest that is difficult to determine because of the extremely degraded soil. It is probably a primary habitat of acidophilous beech forest, *Castaneo-Fagetum*. The presence of beech in the scrub layer, occasional European woodrush *Luzula luzuloides* and more frequent bilberry *Vaccinium myrtillus* and the presence of a few individual beech species supports this. The difference between phytocenoses from central Slovenia and the sub-pannonian margins is in the thermophilous nature of the latter ,with species of the order of downy oak, pine and non-forest species.

Research was carried out according to the standard Central European method (Braun-Blanquet 1964) and phytocenological code (Weber et al. 2000). Plant nomenclature is according to Mala flora Slovenije (Martinčič et al. 2007). We compared phytocenoses with the Sørensen's coefficient of similarity (1948).

PROBLEM OF THE ASSOCIATION CALLUNO-QUERCETUM

The beginning of understanding the secondary association *Calluno-Quercetum* goes back to the nineteen seventies. At that time in Slovenia, Marinček (1970) investigated acidophilous beech forests with hard fern *Blechno-Fagetum* on the basis of Horvat's (1950: 45–49) publication of the association then named *Fageto-Blechnetum* (previously it had been called *Fagetum silicicolum*). Horvat (1938: 199) already mentioned in his monograph the possibility of an acidophilous subassociation. Horvat (1962), in a monograph on the vegetation of western Croatia, validly named the association *Blechno-Fagetum,* with a statement of the diagnostically important plant species. In 1974, in a monograph by Horvat et al. (1974: 426–428), a short contribution on acidophilous beech forests was published with two synthesis tables of the association *Blechno-Fagetum* (Table 101) in the context of acidophilous beech associations of the alliance *Luzulo-Fagion*. Marinček (1970), in a discussion on the association *Blechno-Fagetum* in Slovenia, reported more extensively and grounded it with an analytical phytocenological table. He indicated in the text the possibility of degradation forms of the association *Blechno-Fagetum* (Marinček 1970: 117–118). In the following years, he supplemented and collected numerous phytocenological relevés and published the degradation or development pathway of the association *Blechno-Fagetum* (Marinček 1973).

Marinček (1973) described in six phytocenological tables and documented in table form, nine or twelve »so-called« development stages (three stages were not based on tables) on primary habitats of the assolciation *Blechno-Fagetum*. The following were described: *Fagus sylvatica-Vaccinium myrtillus*, *Fagus-Pinus-Vaccinium myrtillus*, *Pinus-Vaccinium*, *Quercus petraea-Vaccinium myrtillus*, *Castanea-Pinus-Vaccinium myrtillus*, *Quercus petraea-Calluna vulgaris* and *Quercus-Pinus-Calluna vulgaris*.

In accordance with the code of phytocenological nomenclature of 1986 (Barkman et al. 1986), in 1995 we performed a review of acidophilous beech and sessile oak associations of Slovenia, which corresponds to the new Code (Weber et al. 2000), and development stages in primary habitats of the association *Blechno-Fagetum* (Marinček & Zupančič 1995: 33–34). We incorporated in the association *Blechno-Fagetum* the stages *Fagus sylvatica-Vaccinium myrtillus*, *Fagus-Pinus-Vaccinium myrtillus* and *Pinus-Vaccinium myrtillus* and divided them into three sub-associations *Blechno-Fagetum vaccinietosum myrtilli*, *B.-F. pinetosum sylvestris* and *B.-F. quercetosum petraeae*. The aforementioned stages were not explicitly degradational or in any way different from the main association *Blechno-Fagetum*. The sub-associations show specific ecological particularities (soil or microclimate) and also a minor degradational or developmental direction of the phytocenosis, e.g., *B-F. pinetosum* and partially *B.-F. quercetosum petraeae*. The latter sub-association has only a slightly greater share of sessile oak than the normal (standard) association. The association *Blechno-Fagetum* is a phytocenosis of the submontane belt, in which Carpathian species are represented, including sessile oak.

We reformed the stages *Quercus petraea-Vaccinium myrtillus* and *Quercus-Pinus-Vaccinium* into the

secondary association *Leucobryo-Quercetum petraeae,* and we classified the stages *Castanea sativa-Vaccinium myrtillus* and *Castanea-Pinus-Vaccinium myrtillus* into a geographic variant with sweet chestnut of the same secondary association, *Leucobryo-Quercetum petraeae* var. geogr. *Castanea sativa*. The phytocenoses are located on the most degraded and acidified thermophilous habitats of the primary association *Blechno-Fagetum*. This is reflected in the numerous spruce (Picea) species with a large surface area of cover and permanence (presence) and abundant presence of sessile oak. In view of the similarity of the phytocenosis *Leucobryo-Quercetum* with the primary association *Blechno--Fagetum*, Sørensen's index σ_s = 86.0 or Jaccard σ_j = 75.4 is large but slightly smaller than in comparison with the secondary association *Calluno-Quercetum petraeae* (σ_s = 95.2, σ_j = 55.6). The index (σ_s = 86.0) nevertheless explains the specific floristic differences between the phytocenoses *Blechno-Fagetum* and *Leucobryo-Quercetum*.

The second complex of the secondary association *Calluno-Quercetum petraeae* was dictated to us mainly by the very widespread heather *Calluna vulgaris* in the stages *Quercus petraea-Calluna vulgaris* and *Quercus--Pinus-Calluna vulgaris*. Stands of sessile oak are open, so the habitats are sunny, impoverished and degraded. Marinček (1973: 90) was initially of the opinion that these development stages could not be treated as the secondary sessile oak association *Calluno-Quercetum*. He believed that there are no ecological conditions in Slovenia that would permanently ensure the existence of margins (*Calluno-Genistetum*), without constant anthropogenic influence. He later changed this opinion because in the Slovene case, these are not pure margins but more or less more stable, durable secondary sessile oak stands, several decades or centuries old and more. Development to primary beech forest *Blechno-Fagetum* is very slow, sometimes even impossible because of altered microclimatic and soil conditions and still present anthropomorphic influences. It is interesting that the similarity with the primary association is large (σ_s = 95.2 or σ_j = 55.6).

Synecological, synchronological, floristic and other general relations of the phytocenoses under discussion are described in detail in the paper by Marinček (1973), and synsystematically or a review of nomenclature in an article by Marinček & Zupančič (1995).

In the treatment of our two phytocenological relevés of sessile oak stands from the edge of the Slovene sub-pannonian region, we considered the similarities with one of the aforementioned secondary phytocenoses. In view of the predominance of heather *Calluna vulgaris* and sessile oak *Quercus petraea* the option was open of classifying our phytocenological relevés into the secondary association *Calluno-Quercetum petraeae*. However, the thermophilous nature of the stands in question bothered us, whereby above all appear thermophilous manna ash *Fraxinus ornus* with accompanying common whitebeam *Sorbus aria* and wild service tree *S. torminalis* and some other more or less thermophilous species (e.g., *Lathyrus niger*, *Tilia cordata*, *Galium laevigatum*, *Chamaecytisus hirsutus*, *Scleropodium purum*, *Digitalis grandiflora*, *Lembotropis nigricans*, *Teucrium chamaedrys*). It is certainly a secondary phytocenosis but on primary habitats of a more thermophilous phytocenosis. We suspect that it is the primary acidophilous association *Castaneo-Fagetum*. This conclusion, as was already said at the beginning of the paper, is confirmed by the presence of beech *Fagus sylvatica* in the shrub layer, the species *Luzula luzoloides* and *Vaccinium myrtillus* and a small number of Fagus and some neutral, moderately basophilous species. (See Tables 1 and 2). It follows from this that the secondary association *Calluno-Quercetum petraeae* does not appear only on primary habitats of the association *Castaneo-Fagetum*. Our two phytocenological relevés could perhaps, at least temporarily, be classified into the secondary association *Calluno--Quercetum petraeae* as an ecological variant with manna ash, so *Calluno-Quercetum petraeae* var. *Fraxinus ornus*. Numerical analysis of comparisons of similarity of our two relevés with the phytocenosis *Calluno-Quercetum,* though, indicated a low value, namely σ_s = 35.7 or σ_j = 21.7, which does not suggest classification of our relevés in the phytocenosis *Calluno-Quercetum*.

The aforementioned finding encouraged us to define the so far undetermined characteristic species of the associations *Calluno-Quercetum petraeae* and *Leucobryo-Quercetum petraeae* and to establish the similarity of the phytocenoses between our relevés and the associations *Blechno-Fagetum*, *Calluno-Quercetum petraeae* and *Leucobryo-Quercetum petraeae*.

On the basis of the synthesis comparative table (Table 2), we found that the characteristic species for the secondary association *Calluno-Quercetum petraeae* are the following: *Quercus petraea* as the leading species of the phytocenosis, in contrast to the primary association *Blechno-Fagetum*, *Calluna vulgaris*, *Chamaecytisus hirsutus*, *Genista germanica*, *G. tinctoria*, *G. pilosa*, *Teucrium scorodonia*, *Hieracium umbellatum*, *H. sabaudum* and *Potentilla erecta*. These characteristic species are not found in the primary association *Blechno-Fagetum,* or appear here and there with low or the lowest levels of presence (I–II) and have medium

cover value; these are *Chamaecytisus hirsutus*, *Genista pilosa*, *Potentilla erecta* and *Hieracium sabaudum*. The exception is the characteristic or distinguishing species *Quercus petraea*, which achieves a level of presence of II–IV with low values of median cover value. It should be noted that the species *Quercus petraea* is a constituent part of the submontane primary association *Blechno-Fagetum*.

In comparing the characteristic species of the associations *Calluno-Quercetum petraeae* and *Leucobryo-Quercetum* (Table 2), we found that eight characteristic species of ten with high to moderate presence also appear in the association *Leucobryo-Quercetum petraeae*. This finding led us to a comparison of similarity of the phytocenoses. The result showed that the associations *Calluno-Quercetum petraeae* and *Leucobryo-Quercetum petraeae* are very similar or the same, as is confirmed by the indexes σ_s = 100.0 or σ_j = 61.9. The species *Leucobrium glaucum*, which should decisively characterise or distinguish the association *Leucobryo-Quercetum petraeae* from the other two associations, the secondary *Calluno-Quercetum petraeae* and primary *Blechno-Fagetum,* does not have this role because it is represented in all three associations with the highest presence and with medium cover values.

We conclude that the secondary associations *Calluno-Quercetum petraeae* and *Leucobryo-Quercetum petraeae* are combined into a single secondary association *Calluno-Quercetum petraeae*.

We find that the association *Calluno-Quercetum petraeae* can be designated a Southeast-European - Illyrian geographic variant with the distinguishing species sweet chestnut, *Calluno-Quercetum petraeae* var. geogr. *Castanea sativa*. Sweet chestnut, *Castanea sativa,* is present in both phytocenoses or in all of the aforementioned development stages. In some it predominates in the tree layer (see column 7 of Table 2) but for the most part in the shrub layer (see columns 2, 3, 6 of Table 2) with high presence.

Sinsytematic arrangement of the phytocenoses would be: ***Calluno-Quercetum petraeae* (Marinček 1973) Marinček & Zupančič 1995 var. geogr. *Castanea sativa* Marinček & Zupančič 1995**

Incl.: *Calluno-Quercetum petraeae* (Marinček 1973) Marinček & Zupančič 1995 (Art. 1, 25)

Leucobryo-Quercetum petraeae (Marinček 1973) Marinček & Zupančič 1995 (Art. 1, 25)

Some characteristic species of the primary association *Blechno-Fagetum* remain here and there in the secondary association *Calluno-Quercetum petraeae*, mainly beech and in some places also the species *Bazzania trilobata* and *Blechnum spicant*. Remnants of characteristic species and some other more or less diagnostically important species for the primary association *Blechno-Fagetum* (e.g., species of the order *Quercetalia roboris-petraeae* or classes *Querco-Fagetea* and *Vaccinio-Piceetea*) confirm that the secondary association *Calluno-Quercetum petraeae* occupies primary habitats of the association *Blechno-Fagetum*. It is therefore no coincidence that in terms of the old division, the phytocenoses are very similar, as the indexes show (Table 2), namely *Calluno-Quercetum* (columns 2 and 3): *Blechno-Fagetum* (columns 4 and 5) σ_s = 95.,2, σ_j = 55.6 and *Blechno-Fagetum* (columns 4 and 5) : *Calluno-Quercetum* (= *Leucobryo-Quercetum* columns 6 and 7) σ_s = 86.0, σ_j = 75.4.

TYPOLOGICAL ARTICULATION OF THE ASSOCIATION *CALLUNO-QUERCETUM*

In relation to the degree of degradation, the association is divided into two sub-associations:

***Calluno-Quercetum petraeae* (Marinček 1973) Marinček & Zupančič 1995 var. geogr. *Castanea sativa* Marinček & Zupančič 1995 *typicum* subass. nova**

The habitat is slightly less affected by human influence. In terms of degradation of the stands, the exploiter is left to natural renewal, especially after the abandonment of grazing or even pasturage. We have classified here stands from previous development stages (Marinček 1973) *Quercus petraea-Calluna vulgaris* Marinček 1973 and *Castanea sativa-Vaccinium myrtillus* Marinček 1973. Details are described in the paper by Marinček (1973). The sub-association does not have distinguishing species and we consider it to be a generally widespread basic phytocenosis. **The holotype is relevé no. 5 from Table 3 (Marinček 1973: 98).**

***Calluno-Quercetum petraeae* (Marinček 1973) Marinček & Zupančič 1995 var. geogr. *Castanea sativa* Marinček & Zupančič 1995 *pinetosum sylvestris* subass. nova**

The greater human influence is mainly because of occasional planting or seeding with Scots pine. This later sub-spontaneously establishes itself with self-seeding, especially where there is more light. Scots pine does not have competitors on degraded habitats

so it successfully rejuvenates. The distinguishing species of the sub-association is Scots pine, *Pinus sylvestris*, which can even cover over half the surface area of the tree layer or achieve a good share of the tree mass. The sub-association is constructed through the previously described development stages (Marinček 1973), namely *Quercus petraea-Pinus sylvestris-Calluna vulgaris* Marinček 1973, *Quercus-Pinus-Vaccinium myrtillus* Marinček 1973 and *Castanea-Pinus-Vaccinium myrtillus* Marinček 1973. Ecological descriptions of the development stages also apply for the sub-association *pinetosum*. **The holotype is relevé no. 5 from Table 6 (Marinček 1973: 104).**

***Calluno-Quercetum petraeae* (Marinček 1973) Marinček & Zupančič 1995 var. geogr. *Fraxinus ornus* var. geogr. nova.**

In the region of Log – Dobovec pri Rogatcu, on presumed habitats of the association *Castaneo-Fagetum,* a variant with manna ash, *Fraxinus ornus,* appears, which is the distinguishing species for the variant. The habitat is thermophilous and fairly degraded. We temporarily placed the phytocenosis in the association *Calluno-Quercetum,* although except for characteristic species of the variant it does not correspond to the secondary association *Calluno-Quercetum petraeae*. This is shown by comparison with the phytocenoses in Marinček's (1973) paper, namely with the phytocenosis *Calluno-Quercetum* (columns 2 and 3, Table 2), where the index of similarity is $\sigma_s = 35.7$, $\sigma_j = 21.7$, with *Calluno-Quercetum* (= *Leucobryo-Quercetum* (columns 6 and 7, Table 2) where $\sigma_s = 28.9$, $\sigma_j = 16.9$ or with *Blechno-Fagetum* (columns 4 and 5, Table 2) where $\sigma_s = 22.2$, $\sigma_j = 12.5$. A deficiency of the presentation of the variant is that there are only two phytocenological relevés available. The relevés are presented in Tables 1 and 2. **The holotype of the variant is relevé no. 1 in Table 1.**

CONCLUSION

A fresh examination of the material on secondary associations of sessile oak on primary habitats of the association *Blechno-Fagetum* (Marinček 1973, Marinček & Zupančič 1995) established that only one secondary association appears *Calluno-Quercetum petraeae* (Marinček 1973) Marinček & Zupančič 1995 with two sub-associations *–typicum* and *–pinetosum sylvestris* and not two associations as was thought to date. The other secondary association, *Leucobryo-Quercetum petraeae* (Marinček 1973) Marinček & Zupančič 1995, which was recorded (Marinček & Zupančič 1995), is not distinguished in floristic composition from the association *Calluno-Queretum petraeae*, so it does not have syntaxonomic grounds for independence and we include it in the association *Calluno-Quercetum petraeae*.

Our decision on the combination of the secondary associations in question is confirmed by comparison in the synthesis table (Table 2) and Sørensen and Jaccard indexes ($\sigma_s = 100$, $\sigma_j = 61.9$). In further phytocenological research in this field, we do not exclude the possibility of other or different secondary phytocenoses on primary habitats of the association *Blechno-Fagetum*.

We have temporarily incorporated in the secondary association *Calluno-Quercetum petraeae* a variant with manna ash, *Fraxinus ornus*, which is presumed to grow on primary habitats of the related association *Castaneo-Fagetum*.

POVZETEK

Uvod

Ob kratkem obisku obrobja predpanonskega območja Slovenije (Log, Dobovec pri Rogatcu) smo opazili obliko drugotnega gradnovega sestoja, podobnega že opisani sekundarni asociaciji gradna in jesenske vrese *Calluno-Quercetum petraeae*. Nismo bili prepričani, ali gre za isto fitocenozo, saj sekundarna asociacija *Calluno-Quercetum petraeae* zarašča primarna rastišča asociacije *Blechno-Fagetum* na svežih, bolj ali manj zasenčenih nekarbonatnih tleh. Naša popisa sta sicer na nekarbonatnih miocenskih peščenjakih, vendar v toplih legah zaradi izredno degradiranih tal težko določljivega primarnega gozda. Verjetno gre za primarna rastišča kisloljubnega bukovega gozda *Castaneo-Fagetum*. Temu sklepu v prid govori prisotnost bukve v grmovni plasti, redke rumenkaste bekice *Luzula luzuloides* in pogostejše borovnice *Vaccinium myrtillus* ter prisotnost maloštevilnih posamičnih fagetalnih vrst. Razlika med fitocenozama iz osrednje Slovenije

in subpanonskega obrobja je v toploljubnosti slednje z vrstami reda puhastega hrasta, pinetalnih in negozdnih vrst.

Raziskava je potekala po standardni srednjeevropski metodi (Braun-Blanquet 1964) in fitocenološkem kodeksu (Weber et al. 2000). Rastlinska nomenklatura je po Mali flori Slovenije (Martinčič et al. 2007). Fitocenoze smo primerjali s koficienti Sørensenove (1948).

Problematika asociacije *Calluno-Quercetum*

Začetek zaznavanja sekundarne asociacije *Calluno--Quercetum* sega v sedemdeseta leta prejšnjega stoletja. V Sloveniji je v tem času Marinček (1970) raziskoval kisloljubni bukov gozd z rebrenjačo *Blechno-Fagetum* na osnovi Horvatove (1950: 45–49) objave o takrat imenovani asociaciji *Fageto-Blechnetum* (pred tem jo je imenoval *Fagetum silicicolum*). Horvat (1938: 199) je že v svoji monografiji omenjal o možnosti acidofilne subasociacije. Horvat (1962) v monografiji o vegetaciji zahodne Hrvaške pa validno imenuje asociacijo *Blechno-Fagetum* z navedbo diagnostično pomembnih rastlinskih vrst. Leta 1974 je v monografiji Horvata et al. (1974: 426–428) objavljen kratek prispevek o kislih bukovih gozdovih z dvema sinteznima tabelama asociacije *Blechno-Fagetum* (Tabela 101) v sklopu kislih bukovih združb zveze *Luzulo-Fagion*. Marinček (1970) je v razpravi o asociaciji *Blechno-Fagetum* v Sloveniji obširneje poročal in jo utemeljil z analitično fitocenološko tabelo. V tekstu je nakazal možnost degradacijskih oblik asociacije *Blechno-Fagetum* (Marinček 1970: 117–118). V naslednjih letih je dopolnil in zbral številne fitocenološke popise in objavil degradacije oziroma razvojne poti asociacije *Blechno--Fagetum* (Marinček 1973).

Marinček (1973) je v šestih fitocenoloških tabelah opisal in tabelarno dokumentiral devet oziroma dvanajst, »tako imenovanih« razvojnih stadijev (trije stadiji niso tabelarno utemeljeni) na primarnih rastiščih asociacije *Blechno-Fagetum*. Opisani so bili: *Fagus sylvatica-Vaccinium myrtillus*, *Fagus-Pinus-Vaccinium myrtillus*, *Pinus-Vaccinium*, *Quercus petraea--Vaccinium myrtillus*, *Castanea-Pinus-Vaccinium myrtillus*, *Quercus petraea-Calluna vulgaris* in *Quercus-Pinus-Calluna vulgaris*.

Skladno s kodeksom fitocenološke nomenklature iz leta 1986 (Barkman et al. 1986) smo leta 1995 opravili revizijo kisloljubnih bukovih in gradnovih združb Slovenije, ki se ujema z novejšim Kodeksom (Weber et al. 2000), in razvojnih stadijev na primarnih rastiščih asociacije *Blechno-Fagetum* (Marinček & Zupančič 1995: 33–34). Asociaciji *Blechno-Fagetum* smo priključili stadije *Fagus sylvatica-Vaccinium myrtillus*, *Fagus-Pinus-Vaccinium myrtillus* in *Pinus-Vaccinium myrtillus* in jih razporedili v tri subasociacije *Blechno-Fagetum vaccinietosum myrtilli*, *B.-F. pinetosum sylvestris* in *B.-F. quercetosum petraeae*. Navedeni stadiji niso izrazito degradacijski ali kakor koli floristično drugačni od matične asociacije *Blechno-Fagetum*. Subasociacije nakazujejo določene ekološke posebnosti (talne ali mikroklimatske) pa tudi manjše degradacijske oziroma razvojne smeri fitocenoze, npr. *B-F. pinetosum* in delno *B.-F. quercetosum petraeae*. Slednja subasociacija ima le nekoliko večji delež gradna kot običajna (standardna) asociacija. Asociacija *Blechno--Fagetum* je fitocenoza podgorskega pasu, kjer so zastopane karpinatalne vrste, med katerimi je tudi graden.

Stadija *Quercus petraea-Vaccinium myrtillus* in *Quercus-Pinus-Vaccinium* smo preoblikovali v sekundarno asociacijo *Leucobryo-Quercetum petraeae,* stadij *Castanea sativa-Vaccinium myrtillus* in *Castanea-Pinus-Vaccinium myrtillus* pa smo uvrstili v geografsko varianto z domačim kostanjem iste sekundarne asociacije *Leucobryo-Quercetum petraeae* var. geogr. *Castanea sativa*. Fitocenozi se nahajata na najbolj degradiranem in zakisanem toploljubnem rastišču primarne asociacije *Blechno-Fagetum*. To se zrcali v številnih piceetalnih vrstah z veliko površinsko pokrovnostjo in stalnostjo (prezenco) ter obilno prisotnostjo gradna. Glede na podobnost fitocenoze *Leucobryo-Quercetum* s primarno asociacijo *Blechno-Fagetum* je indeks Sørensenove σ_s = 86,0 oziroma Jaccarda σ_j = 75,4 velik, vendar nekoliko manjši kot v primerjavi s sekundarno asociacijo *Calluno-Quercetum petraeae* (σ_s = 95,2, σ_j = 55,6). Indeks (σ_s = 86,0) kljub temu pojasnjuje določene floristične spremembe med fitocenozama *Blechno-Fagetum* in *Leucobryo-Quercetum*.

Drugi sklop sekundarne asociacije *Calluno-Quercetum petraeae* nam je narekovala predvsem zelo razširjena jesenska vresa *Calluna vulgaris* v stadijih *Quercus petraea-Calluna vulgaris* in *Quercus-Pinus--Calluna vulgaris*. Sestoji gradna so odprti, zato so rastišča osončena, revna in degradirana. Marinček (1973: 90) je bil sprva mnenja, da te razvojne stadije ne moremo obravnavati kot drugotno gradnovo združbo *Calluno-Quercetum*. Menil je, da pri nas ni ekoloških razmer, ki bi trajno zagotavljale obstoj resav (*Calluno--Genistetum*) brez stalnega antropogenega vpliva. To mnenje je kasneje spremenil, ker v našem primeru ne gre za čiste resave, temveč bolj ali manj za stabilnejše dolgotrajnejše, sekundarne gradnove sestoje, stare več desetletij oziroma stoletje in več. Razvoj k primarnemu bukovemu gozdu *Blechno-Fagetum* je zelo počasen, včasih celo nemogoč zaradi spremenjenih mikrokli-

matskih in talnih razmer in še vedno prisotnih antropozoogenih vplivov. Zanimivo je, da je podobnost s primarno asociacijo velika (σ_s = 95,2 oziroma σ_j = 55,6).

Sinekološke, sinhronološke, floristične in druge splošne razmere obravnavanih fitocenoz so podrobno opisane v razpravi Marinčka (1973), sinsistematske oziroma nomenklaturne revizije pa v članku Marinčka & Zupančiča (1995).

Pri obravnavi naših dveh fitocenoloških popisov gradnovih sestojev z obrobja slovenskega predpanonskega območja smo pomislili na podobnost z eno izmed omenjenih sekundarnih fitocenoz. Glede na prevlado jesenske vrese *Calluna vulgaris* in gradna *Quercus petraea* se je nam odpirala možnost uvrščanja naših fitocenoloških popisov k sekundarno asociacijo *Calluno-Quercetum petraeae*. Vendar nas je motila termofilnost obravnavanih sestojev, kjer se predvsem pojavlja termofilni mali jesen *Fraxinus ornus* s spremljajočim navadnim mokovcem *Sorbus aria* in brekom *S. torminalis* ter nekatere druge bolj ali manj toploljubne vrste (npr. *Lathyrus niger, Tilia cordata*, *Galium laevigatum*, *Chamaecytisus hirsutus*, *Scleropodium purum*, *Digitalis grandiflora*, *Lembotropis nigricans*, *Teucrium chamaedrys*). Gotovo gre za sekundarno fitocenozo, vendar na primarnih rastiščih toploljubnejše fitocenoze. Domnevamo, da gre za primarno kisloljubno asociacijo *Castaneo-Fagetum*. Ta sklep, kot je bilo rečeno že v začetku razprave, potrjuje prisotnost bukve *Fagus sylvatica* v grmovni plasti, vrste *Luzula luzoloides* in *Vaccinium myrtillus* ter maloštevilnih fagetalnih in nekaterih nevtralno, zmerno bazifilnih vrst. (Glej Tabelo 1 in 2). Iz tega sledi, da se sekundarna asociacija *Calluno-Quercetum petraeae* ne pojavlja samo na primarnih rastiščih asociacije *Blechno-Fagetum*, temveč tudi na primarnih rastiščih asociacije *Castaneo-Fagetum*. Naša dva fitocenološka popisa bi morda lahko, ali vsaj začasno, uvrstili k sekundarni asociaciji *Calluno-Quercetum petraeae* kot ekološko varianto z malim jesenom, torej *Calluno-Quercetum petraeae* var. *Fraxinus ornus*. Numerična analiza primerjav podobnosti naših dveh popisov s fitocenozo *Calluno-Quercetum* pa je pokazala nizke vrednosti, in sicer σ_s = 35,7 oziroma σ_j = 21,7, kar ne govori za uvrščanje naših popisov v fitocenozo *Calluno-Quercetum*.

Navedene ugotovitve so nas spodbudile, da določimo do zdaj nedoločene značilnice sekundarnih asociacij *Calluno-Quercetum petraeae* in *Leucobryo-Quercetum petraeae* ter ugotovimo podobnost fitocenoz med našima popisoma in asociacijami *Blechno-Fagetum*, *Calluno-Quercetum petraeae* in *Leucobryo-Quercetum petraeae*.

Na osnovi sintezne primerjalne tabele (Tabela 2) smo ugotovili, do so značilnice za sekundarno asociacijo *Calluno-Quercetum petraeae* naslednje: *Quercus petraea* kot vodilna vrsta fitocenoze nasproti primarni asociaciji *Blechno-Fagetum*, *Calluna vulgaris*, *Chamaecytisus hirsutus*, *Genista germanica*, *G. tinctoria*, *G. pilosa*, *Teucrium scorodonia*, *Hieracium umbellatum*, *H. sabaudum* in *Potentilla erecta*. Teh značilnic ni v primarni asociaciji *Blechno-Fagetum* ali se pojavljajo tu in tam z nizkimi ali najnižjimi stopnjami navzočnosti (I–II) in imajo srednjo pokrovno vrednost, te so *Chamaecytisus hirsutus*, *Genista pilosa*, *Potentilla erecta* in *Hieracium sabaudum*. Izjema je značilnica oziroma razlikovalnica *Quercus petraea*, ki dosega stopnjo navzočnosti II–IV z nizko vrednostjo srednje pokrovne vrednosti. Vedeti moramo, da je vrsta *Quercus petraea* sestavni del flore podgorske primarne asociacije *Blechno-Fagetum*.

Pri primerjanju značilnic asociacij *Calluno-Quercetum petraeae* in *Leucobryo-Quercetum* (Tabela 2) smo ugotovili, da se osem značilnic od desetih z visoko do zmerno prezenco pojavlja tudi v asociaciji *Leucobryo-Quercetum petraeae*. Ta ugotovitev nas je vodila k primerjanju podobnosti fitocenoz. Rezultat je pokazal, da sta si asociaciji *Calluno-Quercetum petraeae* in *Leucobryo-Quercetum petraeae* najpodobnejši, oziroma enaki, kar potrjujeta indeksa σ_s = 100,0 oziroma σ_j = 61,9. Vrsta *Leucobrium glaucum*, ki naj bi odločilno označevala oziroma razlikovala asociacijo *Leucobryo-Quercetum petraeae* od drugih dveh asociacij, sekundarne *Calluno-Quercetum petraeae* in primarne *Blechno-Fagetum,* nima te vloge, ker je v vseh treh asociacijah zastopana z najvišjo prezenco in s srednjo pokrovno vrednostjo.

Sklepamo, da se sekundarni asociaciji *Calluno-Quercetum petraeae* in *Leucobryo-Quercetum petraeae* združita v enotno sekundarno asociacijo *Calluno-Quercetum petraeae*.

Ugotavljamo, da lahko asociacijo *Calluno-Quercetum petraeae* označimo kot jugovzhodnoevropsko-ilirsko geografsko varianto z razlikovalnico domačim kostanjem *Calluno-Quercetum petraeae* var. geogr. *Castanea sativa*. V obeh fitocenozah oziroma v vseh prej navedenih razvojnih stadijih je prisoten domači kostanj *Castanea sativa*. V nekaterih prevladuje v drevesni plasti (glej 7 stolpec Tabele 2), večinoma pa v grmovni plasti (glej stolpce 2, 3, 6 Tabele 2) z visoko prezenco.

Sinsistematska ureditev fitocenoz bi bila: ***Calluno-Quercetum petraeae*** **(Marinček 1973) Marinček & Zupančič 1995 var. geogr.** ***Castanea sativa*** **Marinček & Zupančič 1995**

Inkl.: *Calluno-Quercetum petraeae* (Marinček 1973) Marinček & Zupančič 1995 (Art. 1, 25)

Leucobryo-Quercetum petraeae (Marinček 1973) Marinček & Zupančič 1995 (Art. 1, 25)

V sekundarni asociaciji *Calluno-Quercetum petraeae* so tu in tam ostale nekatere značilnice primarne asociacije *Blechno-Fagetum*, predvsem bukev, ponekod tudi vrsti *Bazzania trilobata* in *Blechnum spicant*. Ostanki značilnic in še drugih, za primarno asociacijo *Blechno-Fagetum* bolj ali manj diagnostično pomembnih vrst (npr. vrste reda *Quercetalia roboris-petraeae* oziroma razredov *Querco-Fagetea* in *Vaccinio-Piceetea*) potrjujejo, da sekundarna asociacija *Calluno--Quercetum petraeae* naseljuje primarno rastišče asociacije *Blechno-Fagetum*. Zato ni naključje, da sta si oziroma po stari delitvi, da so si fitocenozi(e) zelo podobne, kot kažejo indeksi (Tabela 2), in sicer *Calluno--Quercetum* (stolpca 2 in 3): *Blechno-Fagetum* (stolpca 4 in 5) σ_s = 95,2, σ_j = 55,6 in *Blechno-Fagetum* (stolpca 4 in 5) : *Calluno-Quercetum* (= *Leucobryo-Quercetum* stolpca 6 in 7) σ_s = 86,0, σ_j = 75,4.

Tipološka členitev asociacije *Calluno-Quercetum*

Glede na stopnjo degradacije se asociacija deli na dve subasociaciji:

***Calluno-Quercetum petraeae* (Marinček 1973) Marinček & Zupančič 1995 var. geogr. *Castanea sativa* Marinček & Zupančič 1995 *typicum* subass. nova**

Rastišče je zaradi človekovega vpliva nekoliko manj prizadeto. Po degradaciji sestojev jih je izkoriščevalec prepustil naravni obnovi, zlasti po opustitvi steljarjenja ali celo paše. Sem uvrščamo sestoje iz prejšnjih razvojnih stadijev (Marinček 1973) *Quercus petraea-Calluna vulgaris* Marinček 1973 in *Castanea sativa-Vaccinium myrtillus* Marinček 1973. Podrobnosti so opisane v razpravi Marinčka (1973). Subasociacija nima razlikovalnic in jo štejemo za splošno razširjeno osnovno fitocenozo. **Holotip je popis št. 5 iz Tabele 3 (Marinček 1973: 98).**

***Calluno-Quercetum petraeae* (Marinček 1973) Marinček & Zupančič 1995 var. geogr. *Castanea sativa* Marinček & Zupančič 1995 *pinetosum sylvestris* subass. nova**

Večji človekov vpliv je predvsem zaradi občasne saditve ali nasemenitve z rdečim borom. Ta se kasneje subspontano uveljavlja z lastno nasemenitvijo, zlasti tam, kjer je več svetlobe. Na degradiranih rastiščih rdeči bor nima konkurenta, zato se uspešno pomlajuje. Razlikovalnica subasociacije je rdeči bor *Pinus sylvestris*, ki lahko pokriva tudi nad polovico površine drevesne plasti oziroma doseže dober delež drevesne mase. Subasociacijo gradijo prej opisani razvojni stadiji (Marinček 1973), in sicer *Quercus petraea-Pinus sylvestris-Calluna vulgaris* Marinček 1973, *Quercus-Pinus-Vaccinium myrtillus* Marinček 1973 in *Castanea--Pinus-Vaccinium myrtillus* Marinček 1973. Ekološki opisi razvojnih stadijev veljajo tudi za subasociacijo *pinetosum*. **Holotip je popis št. 5 iz Tabele št. 6 (Marinček 1973: 104).**

***Calluno-Quercetum petraeae* (Marinček 1973) Marinček & Zupančič 1995 var. geogr. *Fraxinus ornus* var. geogr. nova.**

Na območju Log – Dobovec pri Rogatcu se na domnevnih rastiščih asociacije *Castaneo-Fagetum* pojavlja varianta z malim jesenom *Fraxinus ornus*, ki je razlikovalnica za varianto. Rastišče je toploljubno in precej degradirano. Fitocenozo smo začasno uvrstili v asociacijo *Calluno-Quercetum,* čeprav se razen značilnic varianta ne ujema s sekundarno asociacijo *Calluno-Quercetum petraeae*. To nam kaže primerjava s fitocenozami v Marinčkovi (1973) razpravi, in sicer s fitocenozo *Calluno-Quercetum* (stolpca 2 in 3, Tabele 2), kjer je indeks podobnosti σ_s = 35,7, σ_j = 21,7, s *Calluno-Quercetum* (= *Leucobryo-Quercetum* stolpca 6 in 7) (Tabela 2) je σ_s = 28,9, σ_j = 16,9 ali z *Blechno-Fagetum* (stolpca 4 in 5, Tabela 2) je σ_s = 22,2, σ_j = 12,5. Pomanjkljivost predstavitve variante je, da imamo na voljo le dva fitocenološka popisa. Popisa sta predstavljena v Tabeli 1 in Tabeli 2. **Holotip variante je popis št. 1 v Tabeli 1.**

ZAKLJUČEK

S ponovnim pregledom gradiva o sekundarnih fitocenozah gradna na primarnih rastiščih asociacije *Blechno-Fagetum* (Marinček 1973, Marinček & Zupančič 1995) ugotavljamo, da se pojavlja le ena sekundarna asociacija *Calluno-Quercetum petraeae* (Marinček 1973) Marinček & Zupančič 1995 z dvema subasociacijama –*typicum* in –*pinetosum sylvestris* in ne dve asociaciji, kot je bilo dozdaj mišljeno. Druga sekundarna asociacija *Leucobryo-Quercetum petraeae* (Marinček 1973) Marinček & Zupančič 1995, ki je bila zabeležena

(Marinček & Zupančič 1995), se po floristični sestavi ne razlikuje od asociacije *Calluno-Queretum petraeae*, zato nima sintaksonomskih osnov za samostojnost in jo vključujemo v asociacijo *Calluno-Quercetum petraeae*.

Našo odločitev o spojitvi obravnavanih sekundarnih asociacij potrjuje primerjava v sintezni tabeli (Tabela 2) ter indeks Sørensenove in Jaccarda (σ_s = 100, σ_j = 61,9). Pri nadaljnjih fitocenoloških raziskavah na tem področju ne izključujemo možnosti še drugih oziroma drugačnih sekundarnih fitocenoz na primarnih rastiščih asociacije *Blechno-Fagetum*.

K sekundarni asociaciji *Calluno-Quercetum petraeae* smo začasno priključili varianto z malim jesenom *Fraxinus ornus*, ki pa domnevno porašča primarna rastišča sorodne asociacije *Castaneo-Fagetum*.

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PHYTOCOENOLOGICAL TABLE (Fitocenološka tabela) 1:
CALLUNO-QUERCETUM var. FRAXINUS ORNUS var. nova

Sinsistematical characteristic (Sinsistematska pripadnost)				
	Number of relevé (Zaporedna številka popisa)		1	2
	Altitude in m (Nadmorska višina v m)		500	360
	Aspect (Nebesna lega)		SW	W
	Slope in degrees (Nagib v stopinjah)		40	40
	Bedrock (Geološka podlaga)		mio	mio
	Stoniness in % (Kamnitost v %)		2	0
	Cover (Pokrovnost) %: Tree layer (drevesna plast)		90	70
	Shrub layer (grmovna plast)		30	20
	Herb layer (zeliščna plast)		80	100
	Moss layer (mahovna plast)		20	0
	Relevé (Velikost popisne ploskve) m^2		400	400
	Province (Pokrajina)		Štajerska	Štajerska
	Location (Kraj popisov)		Log	Dobovec
	CALLUNO-QUERCETUM PETRAEAE (Marinček 1973) Marinček & Zupančič 1995			
			1	2
		I	5.5	3.1
F_3	Quercus petraea	II	1.1	2.1
		III	1.1	1.1
VP_3	Calluna vulgaris		3.3	5.5
EP_3	Chamaecytisus hirsutus		1.1	2.1
NC	Genista germanica		+	+.2
MA	Genista tinctoria		1.1	.
RP_2	Hieracium umbellatum		+	.
	CALLUNO-QUERCETUM PETRAEAE var. FRAXINUS ORNUS var. nova			
			1	2
Q_2	Fraxinus ornus	II	2.2	+
RP_2	QUERCETALIA ROBORIS-PETRAEAE R. Tx. (1931) 1937			
			1	2
	Pteridium aquilinum	III	+.3	+
	Hieracium racemosum		+	.
	Hieracium umbellatum		+	.
	Populus tremula	I	+	.
	Veronica officinalis	III	+	.
F_3	QUERCO-FAGETEA Br.-Bl. et Vlieger 1937 s. lat.			
			1	2
		I	5.5	3.1
	Quercus petraea	II	1.1	2.1
		III	1.1	1.1
OO	Fraxinus ornus	II	2.2	+
F_2	Fagus sylvatica		+	+
F_2	Galium laevigatum	III	1.2	.
Q_2	Sorbus aria	II	1.1	.
F_1	Cyclamen purpurascens	III	+	.
P	Juniperus communis	II	+	.
Q_2	Lathyrus niger	III	+	.
Q_2	Sorbus torminalis	I	+	.
F_3	Tilia cordata	II	+	.
VP_3	VACCINIO-PICEETEA Br.-Bl. in Br.-Bl. et al. 1939 em. Zupančič (1976) 1980 s. lat.			
			1	2
	Calluna vulgaris	III	3.3	5.5
	Vaccinium myrtillus		+.3	1.2
	Hieracium murorum		1.2	+
	Calamagrostis arundinacea		4.3	.
	Luzula luzuloides		+	.
	Polytrichum formosum	IV	.	+
EP_3	ERICO-PINETEA Ht. 1959 s. lat.			
			1	2
	Chamaecytisus hirsutus	III	1.1	2.1
	Scleropodium purum	IV	1.1	2.1
	Pinus sylvestris	II	.	+

O	OTHER SPECIES (Ostale vrste)			
			1	2
NC	Genista germanica	III	+	+.2
	Boletus edulis		+	+
MA	Molinia caerulea		.	1.2
MA	Genista tinctoria		1.1	.
AT	Asplenium ruta-muraria		1.1	.
	Cladonia rangiferina	IV	.	+
E	Digitalis grandiflora	III	+	.
TG	Lembotropis nigricans		.	+
FB	Teucrium chamaedrys		+	.

LEGEND (Legenda)

Sinsistematical characteristic (Sinsistematska pripadnost)

AT Asplenietea trichomanis Br.-Bl. in Meier & Br.-Bl. 1934 corr. Oberd. 1977 s. lat.
EA Epilobietea angustifolii R. Tx. & Prsg. in R. Tx. 1950 s. lat.
F_1 Aremonio-Fagion (Ht. 1938) Török, Podani & Borhidi 1989
F_2 Fagetalia sylvaticae Pawl. 1928 s. lat.
FB Festuco-Brometea Br.-Bl. & R. Tx. 1943 s. lat.
MA Molinio-Arrhenatheretea R. Tx. 1937 s. lat.
NC Nardo-Callunetea Prsg. 1949 s. lat.
OO Fraxino orni-Ostryion Tomažič 1940
P Prunetalia spinosae R. Tx. 1952 s. lat.
Q_2 Quercetalia pubescentis-petraeae Br.-Bl. 1932
TG Trifolio-Geranietea sanguinei T. Müller 1961 s. lat.

Bedrock (Geološka podlaga)

mio Miocene sandstone (miocenski peščenjaki)

PHYTOCOENOLOGICAL TABLE (Fitocenološka tabela) 2:
CALLUNO-QUERCETUM PETRAEAE (Marinček 1973) Marinček & Zupančič 1995

Sinsistematical characteristic (Sinsistematska pripadnost)								
Number of anal. table (Zaporedna številka tabele)		1	2	3	4	5	6	7
Author of anal. Table (Avtor anal tabele)		Zupančič	Marinček	Marinček	Marinček	Marinček	Marinček	Marinček
Altitude in m (Nadmorska višina v m)		360-500	370-580	360-550	370-610	350-550	350-690	230-570
Aspect (Nebesna lega)		SW-W	SW-W-S-E	S-SW-SE	S-N-W-E	S-N-W-E	N-NW-E	W-S-N
Slope in degrees (Nagib v stopinjah)		40	5-35	10-35	10-30	5-30	5-17	2-27
Bedrock (Geološka podlaga)		mio	per p s b	per p s b	per p s b dil	per s w p por	per p g dil	per p s mio
Stoniness in % (Kamnitost v %)		0-2	0	0-20	0	0	0	0
Stage after Marinček (Stadij po Marinčku)			Qp-Cal*1	Qp-Pin-Cal*2	Fag-Vac*3	Fag-Pin-Vac*4 Pin-Vac*5	Qp-Vac*6 Cas-Vac*7	Qp-Pin-Vac*8 Cas-Pin-Vac*9
Location (Kraj popisov)		ŠTA	ZAS, DOL	ZAS, DOL	GOR, ZAS, ŠTA	ZAS, DOL, GOR	DOL, ŠTA, GOR	DOL, ZAS
Number of relevé (Število popisov)		2	6	9	12	12	11	10
CALLUNO-QUERCETUM PETRAEAE (Marinček 1973) Marinček & Zupančič 1995		1	2	3	4	5	6	7
	I	2^{3-5}	5417 V	2252 V	170 IV	128 IV	5750 V	3375 V
F_3 Quercus petraea	II	2^{1-2}	632 V	171 V	7 IV	6 IV	349 V	463 V
	III	2^{1}	380 V	171 V	3 II	3 II	1031 V	298 V
VP_3 Calluna vulgaris		2^{3-5}	5000 V	3496 V	2 I	127 III	6 IV	253 V
EP_3 Chamaecytisus hirsutus		2^{1-2}	83 I	.	.	.	.	.
NC Genista germanica		2+	2 I	1 I	.	.	.	83 I
NC Teucrium scorodonia		.	3 II	.	.	.	3 II	2 II
MA Genista tinctoria		1^{1}	2 I	.	.	.	.	.
RP_2 Hieracium umbellatum		1^{+}	2 I	.	.	.	.	.
NC Genista pilosa		.	1042 V	502 IV	1 I	140 II	63 I	5 III
NC Potentilla erecta		.	87 III	199 IV	.	43 II	.	2 II
NC Hieracium sabaudum		.	7 IV	1 I	1 I	1 I	3 II	2 I
CALLUNO-QUERCETUM var. FRAXINUS ORNUS var. nova		1	2	3	4	5	6	7
Q_2 Fraxinus ornus	II	2^{+-2}	.	.	.	.	.	.
BLECHNO-FAGETUM Ht. (1950) 1962 emend. Marinček 1970		1	2	3	4	5	6	7
	I	.	5 III	4 III	5833 V	3084 V	2411 V	295 III
F_3 Fagus sylvatica	II	2^{+}	297 IV	2 II	939 V	744 V	471 V	87 II
	III	.	.	2 I	45 III	3 II	1 I	.
VP_3 Bazzania trilobata		.	.	.	961 V	443 V	283 II	2 I
VP_3 Blechnum spicant		.	.	.	211 IV	483 IV	.	2 II
RP_2 QUERCETALIA ROBORIS-PETRAEAE R. Tx. (1931) 1937		1	2	3	4	5	6	7
Pteridium aquilinum	III	2^{+}	4375 V	4863 V	1839 V	3210 V	1470 V	4583 V
Hieracium umbellatum		1^{+}	2 I	.	.	.	.	.
Hieracium racemosum		1^{+}	.	.	.	.	.	.
Populus tremula	I	1^{+}	.	.	.	.	.	.
Veronica officinalis	III	1+	.	.	.	.	.	.
Frangula alnus	II	.	172 V	311 V	168 III	233 IV	68 IV	172 V
Hieracium sabaudum	III	.	7 IV	1 I	1 I	1 I	3 II	2 II
Melampyrum pratense subsp. vulgatum		.	377 III	307 III	711 V	544 V	876 IV	545 V
	I	.	3 II	1 I	3 II	47 IV	220 II	7 IV
Castanea sativa	II	.	92 V	6 IV	90 V	168 III	69 IV	87 II
	III	.	.	59 III	.	3 II	63 I	3 II
Teucrium scorodonia		.	3 II	.	.	.	3 II	2 II
Betula verrucosa	I	.	2 I	58 II	.	1 I	.	.
	II	.	.	2 II	.	.	.	.
Hieracium vulgatum (H. lachenalii)	III	.	2 I	.	43 II	1 I	65 II	.
Lathyrus montanus		.	2 I	.	.	.	.	.
Melampyrum pratense		.	.	.	131 V	.	283 II	2 I
Polypodium vulgare		.	.	.	3 II	2 I	4 II	.
Hieracium laevigatum		.	.	.	1 I	.	.	.
Erythronium dens-canis		.	.	.	.	42 I	.	.

			1	2	3	4	5	6	7
Q_2	QUERCETALIA PUBESCENTIS Br.-Bl. 1931								
	Fraxinus ornus	II	2^{+-2}	.	.	.	.	.	.
	Lathyrus niger	III	1^{+}	.	.	.	.	.	.
	Sorbus aria	II	1^{+}	.	.	.	.	.	.
	Sorbus torminalis		1^{+}	.	.	.	.	.	.
F_3	QUERCO-FAGETEA Br.-Bl. et Vlieger in Vlieger 1937 s. lat.								
			1	2	3	4	5	6	7
		I	2^{3-5}	5417 V	2252 V	170 IV	128 IV	5750 V	3375 V
	Quercus petraea	II	2^{1-2}	632 V	171 V	7 IV	6 IV	349 V	463 V
		III	2^{1}	380 V	171 V	3 II	3 II	1031 V	298 V
		I	.	5 III	4 III	5833 V	3084 V	2411 V	296 III
	Fagus sylvatica	II	2^{+}	297 IV	2 II	939 V	744 V	471 V	87 II
		III	.	.	2 II	45 III	3 II	1 I	.
	Galium laevigatum		1^{1}	.	.	.	.	.	.
	Cyclamen purpurascens		1^{+}	.	.	.	.	.	.
	Juniperus communis	II	1^{+}	3 II	2 II	.	.	.	5 III
	Tilia cordata	I	1^{+}	.	.	.	.	.	.
		II	1^{+}	.	.	.	.	.	.
	Prenanthes purpurea	III	.	3 II	.	4 III	3 II	189 III	2 I
	Isothecium myurum	IV	.	3 II	.	46 III	.	.	.
	Convallaria majalis	III	.	.	1 I	.	.	.	.
VP_3	VACCINIO-PICEETEA Br.-Bl. in Br.-Bl. et al. 1939 em. Zupančič (1976) 2000 s. lat.								
			1	2	3	4	5	6	7
	Calluna vulgaris	III	2^{3-5}	5000 V	3496 V	2 I	127 III	6 IV	253 V
	Vaccinium myrtillus		2^{+-1}	463 V	728 V	7292 V	5042 V	5375 V	4667 V
	Hieracium murorum		2^{+-1}	2 I	.	193 IV	88 IV	130 IV	5 III
	Calamagrostis arundinacea		1^{4}	.	.	.	.	.	.
	Luzula luzuloides		1^{+}	88 IV	3 II	502 IV	275 IV	1314 V	170 IV
	Polytrichum formosum	IV	1^{+}	298 IV	58 II	898 V	212 IV	1876 V	462 V
	Avenella flexuosa	III	.	172 V	61 IV	419 V	2104 V	345 III	753 V
	Leucobryum glaucum	IV	.	712 IV	480 V	752 V	858 V	1033 IV	335 V
	Hypnum cupressiforme		.	168 III	117 V	317 V	130 IV	131 V	172 V
	Gentiana asclepiadea	III	.	3 II	2 II	151 IV	129 IV	3 II	88 IV
	Pleurozium schreberi	IV	.	625 I	56 I	34 II	689 IV	130 IV	667 III
		I	.	2 I	.	857 IV	503 V	4 II	3 II
	Picea abies	II	.	85 III	.	461 IV	315 IV	65 II	87 III
		III	.	.	.	211 IV	87 III	3 II	7 IV
	Dicranum scoparium	IV	.	2 I	.	253 V	190 III	130 V	3 II
	Hypnum cupressiforme var. filiforme		.	2 I	2 II	3 II	43 II	4 II	.
	Dicranella heteromalla		.	.	58 II	.	190 III	5 III	.
	Hylocomium proliferum		.	.	56 I	43 I	86 III	3 II	2 I
	Plagiothecium denticulatum		.	.	1 I	168 III	2 I	3 II	.
	Solidago virgaurea	III	.	.	1 I	.	3 II	1 I	.
	Bazzania trilobata	IV	.	.	.	961 V	443 V	283 II	2 I
	Blechnum spicant	III	.	.	.	211 IV	483 IV	.	2 II
	Thuidium tamariscinum	IV	.	.	.	6 IV	.	4 II	2 I
	Luzula pilosa	III	.	.	.	3 II	3 II	66 III	83 I
	Plagiothecium neglectum (P. sylvaticum)		.	.	.	188 I	.	.	.
		I	.	.	.	2 I	1 I	.	.
	Abies alba	II	.	.	.	87 III	6 IV	.	.
		III	.	.	.	44 II	4 III	.	2 I
	Thelypteris limbosperma		.	.	.	2 I	3 II	219 I	.
	Maianthemum bifolium		.	.	.	.	3 II	.	.
	Vaccinium vitis-idaea		.	.	.	.	146 I	1 I	.
	Diphasiastrum tristachyum (Lycopodium chamaecyparissus)		.	.	.	.	.	1 I	.
EP_3	ERICO-PINETEA Ht. 1959 s. lat.								
			1	2	3	4	5	6	7
	Chamaecytisus hirsutus	III	2^{1-2}	83 I	.	.	.	.	.
	Scleropodium purum	IV	2^{1-2}	.	.	.	.	.	.
		I	.	88 IV	3803 V	5 III	2813 V	.	2750 V
	Pinus sylvestris	II	1^{+}	3 II	62 V	1 I	147 I	.	2 II
		III	.	5 III	2 II	.	3 II	.	87 III
	Molinia caerulea subsp. arundinacea		.	2213 IV	918 V	.	43 II	.	1132 V
	Polygala chamaebuxus		.	3 II	3 III	.	3 II	.	85 II
	Erica carnea		.	83 I	57 II	1 I	3 II	1 I	2 II

			1	2	3	4	5	6	7
MA	MOLINIO-ARRHENATHERETEA Tx. 1937 s. lat.								
	Genista tinctoria	III	1^{1}	2 I	.	.	.	.	.
	Molinia caerulea subsp. caerulea		1^{1}	.	.	.	.	.	.
	Agrostis tenuis		.	.	.	2 I	.	.	.
NC	NARDO-CALLUNETEA Prsg. 1949 s. lat.								
			1	2	3	4	5	6	7
	Genista germanica	III	2^{+}	2 I	1 I	.	.	.	83 I
	Genista pilosa		.	1042 V	502 IV	1 I	148 II	63 I	5 III
	Potentilla erecta		.	87 III	199 IV	.	43 II	.	2 II
	Carex pilulifera		.	3 II	111 II	.	3 II	.	85 II
	Danthonia decumbens (Sieglingia d.)		.	2 I	2 I	.	.	.	.
O	OTHER SPECIES (Ostale vrste)								
			1	2	3	4	5	6	7
	Boletus edulis	III	2^{+}	.	.	.	.	.	.
AT	Asplenium ruta-muraria		1^{+}	.	.	.	.	.	.
EA	Digitalis grandiflora		1^{+}	.	.	.	.	.	.
TG	Lembotropis nigricans		1^{+}	.	.	.	.	.	.
FB	Teucrium chamaedrys		1^{+}	.	.	.	.	.	.
	Sorbus aucuparia	II	.	2 I	2 II	3 II	4 III	1 I	3 II
	Rubus fruticosus		.	.	2 II	.	.	.	.
M	MOSSES AND LICHENS (Mahovi in lišaji)								
			1	2	3	4	5	6	7
	Cladonia rangiferina		1^{+}	3 II	2 II	2 I	.	3 II	.
	Cladonia pyxidata		.	90 V	310 V	88 IV	3 II	.	5 III
	Beomyces roseus		.	83 I	1 I	.	.	.	.
	Brachythecium rutabulum		.	.	1 I	3 II	.	.	.
	Dicranodontium sp.		.	.	1 I	.	2 I	.	.
	Dicranum spurium		.	.	1 I	.	.	.	.
	Metzgeria pubescens		.	.	.	45 III	4 III	1 I	.
	Radula complanata		.	.	.	4 III	3 II	.	.
	Bartramia pomiformis		.	.	.	84 II	.	.	.

LEGEND (Legenda)

Analytical tables (Analitične tabele)

1 Calluno-Quercetum petraeae (Marinček 1973) Marinček & Zupančič 1995
2 Calluno-Quercetum petraeae (Quercus petraea-Calluna vulgaris Marinček 1973)*1
3 Calluno-Quercetum petraeae (Quercus petraea-Pinus sylvestris-Calluna vulgaris Marinček 1973)*2
4 Blechno-Fagetum Ht. ex Marinček 1970 vaccinietosum myrtilli Marinček & Zupančič 1995 – (Fagus sylvatica-Vaccinium myrtillus Marinček 1973)*3
5 Blechno-Fagetum pinetosum sylvestris Marinček & Zupančič 1995 – (Fagus-Pinus-Vaccinium Marinček 1973)*4 (Pinus-Vaccinium Marinček 1973)*5
6 Leucobryo-Quercetum petraeae (Marinček 1973) Marinček & Zupančič 1995 – (Quercus petraea-Vaccinium myrtillus Marinček 1973)*6 (Castanea sativa-Vaccinium myrtillus Marinček 1973)*7
7 Leucobryo-Quercetum petraeae – (Quercus petraea-Pinus-Vaccinium myrtillus Marinček 1973)*8 (Castanea-Pinus-Vaccinium myrtillus Marinček 1973)*9

Bedrock (Geološka podlaga)

mio Miocene sandstone (miocenski peščenjaki)
per p Permian and carbon sandstone (permkarbonski peščenjaki)
per s Permian and carbon shale (permkarbonski skrilavci)
per b Permian and carbon breccia (permkarbonske breče)
g gröden sandstone (grödenski peščenjaki)
dil diluvial clay (diluvialne ilovice)
w p werfen sandstone (werfenski peščenjaki)
por porphyry (porfirit)

Sinsistematical characteristic (Sinsistematska pripadnost)

AT Asplenietea trichomanis Br.-Bl. in Meier & Br.-Bl. 1934 corr. Oberd. 1977 s. lat.
EA Epilobietea angustifolii R. Tx. & Prsg. in R. Tx. 1950 s. lat.
FB Festuco-Brometea Br.-Bl. & R. Tx. 1943 s. lat.
TG Trifolio-Geranietea sanguinei T. Müller 1961 s. lat.

Location (Kraj popisov)

DOL Dolenjska
GOR Gorenjska
ŠTA Štajerska
ZAS Zasavje