

Phytosociological analysis of beech forests in the Žumberak and Samobor highlands (Croatia)

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Key words: Vegetation, Relevés, Environmental gradients, *Fagus sylvatica*, Forest communities, Croatia.

Ključne besede: vegetacija, popisi, okoljski gradient, *Fagus sylvatica*, gozdne združbe, Hrvaška.

Abstract

The Žumberak and Samobor highlands are situated in the north-western part of Croatia where the characteristics of the Dinarides, the Alps and the Pannonian Plain meet. The greater part of the area is occupied by beech forests. The aim of the study was to determine the syntaxonomic affiliation of these forest communities, and to explore their floristic and main ecological features. Numerical analyses of floristic compositions were conducted on a data-set consisting of 144 new relevés and 99 relevés from the existing literature. Relevés were made following the standard Braun-Blanquet method. For descriptions of ecological conditions Ellenberg's indicator values were used. Six plant associations and two subassociations of beech forests were established in *Luzulo-Fagion* and *Aremonio-Fagion* alliances. The higher altitudes of the studied area are occupied by ass. *Cardamini savensi-Fagetum*, whereas the lower altitudes are occupied by ass. *Lamio orvalae-Fagetum* and *Hacquetio-Fagetum*. Ass. *Hacquetio-Fagetum* spreads on southern slopes and ridges, whereas ass. *Lamio orvalae-Fagetum* occurs in ditches and on northern slopes. In the warmer habitats with shallow soils on a dolomite base ass. *Ostryo-Fagetum* occurred. A small part of the area is characterized by silicate substrate which is occupied by ass. *Luzulo-Fagetum* and *Gentiano asclepiadeae-Fagetum*.

Izvleček

Žumberak-Samoborsko gorje se nahaja v severozahodnem delu Hrvaške, kjer se združi vpliv Dinarskega gorstva, Alp in Panonske nižine. Večji del območja poraščajo bukovi gozdovi. Namen raziskave je bil sintaksonomsko opredeliti gozdne združbe in proučiti njihovo vrstno sestavo in glavne ekološke značilnosti. Numerične analize floristične sestave smo naredili s podatki iz 144 novih popisov in 99 iz literature. Popise smo naredili v skladu s standardno Braun-Blanquetovo metodo. Za opis ekoloških razmer smo uporabili Ellenbergove indikatorske vrednosti. Ugotovili smo šest asociacij in dve subasociaciji bukovih gozdov iz zvez *Luzulo-Fagion* in *Aremonio-Fagion*. Na višjih nadmorskih višinah uspeva ass. *Cardamini savensi-Fagetum*, na nižjih pa *Lamio orvalae-Fagetum* in *Hacquetio-Fagetum*. Asociacija *Hacquetio-Fagetum* se pojavlja na južnih pobočjih in grebenih, medtem ko asociacijo *Lamio orvalae-Fagetum* najdemo v jarkih in na severnih pobočjih. Na toplejših rastiščih na plitkih tleh in dolomitni podlagi uspevajo sestoji asociacije *Ostryo-Fagetum*. Manjši del območja je na silikatni podlagi, kjer najdemo sestoj asociacij *Luzulo-Fagetum* in *Gentiano asclepiadeae-Fagetum*.

Received: 08. 02. 2020

Revision received: 24. 03. 2020

Accepted: 25. 03. 2020

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Introduction

The Žumberak and Samobor highlands are situated in the western part of Croatia and together with the Gorjanci range in Slovenia comprise a hilly massif on the edge of the Pannonian plain, between the south-eastern Alps and north-western Dinaric Mountains (Figure 1). Phytogeographically, it is a transitional area with Illyric, West-European, Balkan-Apennine and Pannonian plant species, and rich with diverse flora and vegetation (Horvat 1929, Trinajstić 1995). Because of its great biological and geomorphological diversity and its unspoilt nature most of the Croatian part of the massif has been declared a Nature Park. The whole area today is covered mostly by forest vegetation, currently comprising almost 80% and gradually increasing (Vrbek 2010, Jelaska et al. 2005). During the last decades the entire area has been strongly affected by depopulation which has resulted in the abandonment of agricultural land as well as a decrease of the anthropogenic impacts on forests. Because of that a large part of the area is affected by secondary succession.

There is a long tradition in botanical and vegetation research of the Samobor area (Šugar 1972, Trinajstić 1995), while the area of Žumberak is much less researched (Vrbek 2005). Since almost 60 % of the area is covered by beech forest (Jelaska et al. 2005) there is a strong need for systematic evaluation and ecological

characterization of the beech forest vegetation. There is a considerable amount of data in the literature on the forest vegetation of the Samobor mountain belt (Horvat 1938, Šugar 1972, Pavletić et al. 1982, Vukelić et al. 2003, Trinajstić 2004, Trinajstić & Cerovečki 2005). On the other hand, the literature on forest vegetation of Žumberak is very poor. However, forest vegetation in the neighbouring Slovenian area (Gorjanci) has been explored and elaborated in much more detail (Košir 1979, Marinček 1987, Marinček et al. 2001).

The aim of this study was to determine the syntaxonomic affiliation of beech forest communities of the Žumberak and Samobor highlands, and to explore their floristic and main ecological features.

Methods

Study area

The study area is comprising Žumberak and Samobor highlands (Croatia) which together with Gorjanci Mt. (Slovenia) makes 40 km long and 30 km wide dissected massif between the rivers Sava (on the north), Kupa (on the east), and Krka (on the west), with an elevation range between 180 m (Kupa River valley) and 1178 m a. s. l. at the top of St. Gera.

The largest part of the area is built of karstified carbonate beds (limestones, dolomites and breccias) of Triassic, Jurassic and Cretaceous age, with numerous karst relief forms, such as dolines, blind valleys, caves and pits (Buzjak 2002). In lesser amount are present clay shales, quartz conglomerates and sandstones of Paleozoic age (Vukelić et al. 2003). Structurally, whole area is in a border zone between the Inner Dinarides and the Zagorje-Mid-Transdanubian shear zone, overthrusting on the External Dinarides (Pamić & Tomljenović 1998).

Climate of the area is temperate continental. The mean annual temperature varies between 6 °C in the highest mountain parts and 11 °C in the lowest southeastern parts (Zaninović et al. 2004). The mean air temperature of January varies from -1 °C to less than -2 °C, and the mean air temperature in July varies from 20 °C to less than 18 °C. The highest precipitation occurs in June and October, and the lowest in March with an average annual precipitation between 1100 and 1700 mm (Penzar & Penzar 1982).

The study area is mostly covered by forest vegetation dominated by forests of sessile oak and common hornbeam (*Erythronio-Carpinion*) in colline vegetation belt and beech forests (*Aremonio-Fagion*) in submontane and montane vegetation belt. However, due to the complex relief and geological structure some other acidophilous



Figure 1: The study area with relevés locations. Red – new relevés, yellow – literature relevés.

Slika 1: Raziskovano območje z lokacijami popisov. Rdeče – novi popisni, rumeno – popisni iz literature.

and termophilous forest communities occur extrazonally or azonally. Coniferous forests (*Picea abies* and *Pinus sylvestris*) were planted after World War II, but their actual total surface is less than 1 %. The total surface of dry grasslands (*Bromion erecti*), mesophilous grasslands (*Arrhenatheretalia elatioris*) and heathlands (*Calluno-Genistion pilosae*) is rapidly decreasing due to abandonment of traditional land use and their cover is now probably less than 12 % of total land surface (Horvat 1962, Šugar 1972, Jelaska et al. 2005, Vrbek 2010).

Vegetation and environmental data

Vegetation was sampled and relevés were elaborated according to standard Central European method (Braun-Blanquet 1964, Westhoff & van der Maarel 1973). This study is based on a data-set consisting of 243 relevés. 99 relevés were used from the available literature (Horvat 1938, Šugar 1972, Pavletić et al. 1982, Trinajstić 2004, Trinajstić & Cerovečki 2005, Vukelić et al. 2003), and 144 are new and were made in 2010. The area of new relevés is 400 m², while the area of literature relevés vary between 100 and 1000 m² (average 299 m², mod and median 400 m²). The relevés were stored in TURBOVEG (Hennekens & Schaminée 2001). Taxonomic nomenclature follows Nikolić et al. (2020). Nomenclatural decisions follow the fourth edition of the International Code of Phytosociological Nomenclature (Theurillat et al. 2020). The names of higher syntaxa follow Škvorc et al. (2017).

Ellenberg's indicator values (EIV) were used for ecological interpretation of vegetation patterns (Ellenberg et al. 1992). Unweighted mean indicator values were calculated for each relevé using JUICE software (Tichý 2002). Aspects were transformed according to Beers et al. (1966).

Data analysis

The numerical classification of the relevés, based on their species composition was performed in the PC-ORD (McCune & Mefford 2006) using cluster analysis (Beta flexible / β = -0.25/ for group linkage with Sørensen index as the distance measure). The OptimClass method for identifying the optimal partition was used (Tichý et al. 2010).

Diagnostic species of obtained communities were determined by calculating fidelity using the phi (Φ) coefficient. Only species with $\Phi > 0.3$ and a probability under random expectation of the observed pattern of species occurrence lower than 0.001 (Fisher's exact test) were considered diagnostic. To calculate fidelity, the number of relevés for each order or alliance was virtually standardized to equal size (Tichý & Chytrý 2006).

To check the communities' differentiation and to explore relationship with environmental variables Non-Metric Multidimensional Scaling (NMDS) was applied using the Bray-Curtis dissimilarity matrix on square-root transformed percentage cover values. NMDS with passive projection of environmental variables was performed using the R package 'vegan' (<https://cran.r-project.org/web/packages/vegan/>) operated through the JUICE software (Tichý 2002). Plot scores on the first two NMDS axes correlated with environmental variables. Correlations for Ellenberg indicator values were corrected using the modified permutation test (Zelený & Schaffers 2012). Box & Whiskers diagrams of environmental variables were made using STATISTICA for WINDOWS 7.0 (Statsoft, Inc. 2005).

Results and Discussion

We recorded 293 taxa of vascular plants with *Fagus sylvatica*, *Rubus hirtus*, *Galium odoratum*, *Hedera helix*, *Acer pseudoplatanus*, *Cyclamen purpurascens*, *Pulmonaria officinalis*, *Sanicula europaea*, and *Aposeris foetida* being the most common ones (frequency ≥ 50 %). Numerical classification separated studied relevés of beech forests in nine clusters which are considered as seven associations and two subassociations in *Luzulo-Fagion* and *Aremonio-Fagion* alliances (Figure 2). According to the syntaxonomic system of higher units (Škvorc et al. 2017), these syntaxa can be classified as follows:

Carpino-Fagetea sylvaticae Jakucs ex Passarge 1968

Luzulo-Fagetalia sylvaticae Scamoni et Passarge 1959

Luzulo-Fagion sylvaticae Lohmeyer et Tx. in Tx. 1954

Luzulo luzuloidi-Fagetum Meusel 1937

Gentiano asclepiadeae-Fagetum sylvaticae ass. nova

Fagetalia sylvaticae Pawłowski 1928

Aremonio-Fagion (Horvat 1938) Borhidi in Török et al. 1989

Ostryo-Fagenion Borhidi 1963

Ostryo-Fagetum M. Wraber ex Trinajstić 1972

Epimedio-Fagenion Marinček et al. 1993

Vicio oroboidi-Fagetum Horvat (1938) Pócs et Borhidi

in Borhidi 1960

Note: Horvat (1938) divided the association '*Fagetum sylvaticae croaticum*' into two geographical races ('*boreale*' and '*australe*'). '*Boreale*' is further divided into two syntaxa, as '*montanum*' and '*abietosum*', and '*montanum*' is then further subdivided into '*lathyretosum*' and '*corydaletosum*'. The rank of these syntaxa is sometimes doubtful because Horvat gave them different ranks in different parts of the article. In the main text he consid-

ered ‘*montanum*’ as a subassociation as well as ‘group of subassociations’ (p. 197), while he included ‘*lathyretosum*’ as a subassociation of ‘*montanum*’ (p. 199). In the summary chapter ‘*montanum*’ is considered as a subassociation and he states that this subassociation could be divided into several facies that are not syntaxonomically equivalent and could well be united into a group of facieses or even subassociations (e.g. *Fagetum croaticum montanum lathyretosum*, *Fagetum croaticum montanum corydaletosum* etc.) (p. 295).

Moreover, when he refers to the subassociation *montanum* he described the acidophilous facies with *Luzula luzuloides* that is separated from two ‘sociological entities’, as *Fagetum croaticum montanum lathyretosum* and *Fagetum croaticum montanum corydaletosum* that are differentiated by some sociologically important species and can probably be treated as subassociations with some facies (p. 199).

Hence we cannot accept the opinion of Willner (2002) and Theurillat et al. (2020) who treat these two subassociations as facieses. We considered both subassociations as validly published. Art. 3d applies here, stating that in the case of several subassociations that are hierarchically subordinated the lowest level is validly described [Art. 3d]. In the same publication, Horvat (1938) used the alternative name of *Fagetum croaticum* as *Lamio orvalae-Fagetum* [Art. 3j, 39] and therefore subassociations *Lamio orvalae-Fagetum lathyretosum* and *Lamio orvalae-Fagetum corydaletosum* are validly published. *Lamio orvale-Fagetum lathyretosum* serves as basionym (Def. XI) of *Vicio oroboidi-Fagetum*. Borhidi (1960) was of the same opinion and described the association *Vicio oroboidi-Fagetum* and also Marinček et al. (1993), who typified it, as well as many other authors (Borhidi 1963, Marinček & Čarni 2002, Vukelić & Baričević 2002, Trinajstić 2008, Vukelić 2012, Šilc & Čarni 2013).

Hacquetio-Fagetum Ž. Košir ex Borhidi 1963

aceretosum obtusati subass. nova

Lamio orvalae-Fagenion Borhidi ex Marinček et al. 1993

Lamio orvalae-Fagetum Horvat 1938

Note: Marinček et al. (1993) agreed with Borhidi (1963) who corrected the illegitimate name *Fagetum silvaticae croaticum boreale montanum* described by Horvat (1938) [Art. 34a] to *Lamio orvalae-Fagetum*, which is later accepted in many literature sources (Marinček & Čarni 2002, Vukelić & Baričević 2002, Trinajstić 2008, Vukelić 2012, Šilc & Čarni 2013). However, Horvat (1938) also proposed on p. 212 the name ‘*Fageto-Lamietum orvalae*’ as an alternative for the *Fagetum silvaticae croaticum*. So this is an alternative, validly published name [Art. 3j, Example 2; Art. 39a, Example 2], typified by Marinček et al. (1993).

fraxinetosum orni subass. nova

Cardamini savensi-Fagetum Ž. Košir ex Marinček et al. 1993

Acidophilous communities

A small part of the studied area is characterized by a silicate substrate where acidophilous beech communities occur. These communities in the studied area are classified in two clusters (Figure 2). The first is corresponding with ass. *Luzulo-Fagetum* with 14 relevés from the literature (Šugar 1972, Vukelić et al. 2003) as well as five new relevés (Table 3). The second cluster includes literature relevés of *Blechno-Fagetum* in Samobosko gorje area (Šugar 1972, Vukelić et al. 2003).

This association was invalidly described by Horvat (1950) under the name *Fageto-Blechnetum* [Art. 7]. However, Tüxen & Oberdorfer (1958) validly published *Blechno-Fagetum* from Spain and used the epithet *ibericum* to differentiate from Horvat’s syntaxa. Rivas-Martínez (1962) corrected this illegitimate name to *Blechno-Fagetum* [Art. 34a]. Furthermore, Marinček (1970) validated Horvat’s name and produced a later homonym [Art. 31] (see also Trinajstić 2004).

Considering all the literature data, it is not correct to use the association name *Blechno-Fagetum* for acidophilous forest communities in SE and Central Europe (Marinček & Zupančić 1995). *Blechno-Fagetum sylvaticae* (Tüxen et Oberdorfer 1958) Rivas-Martínez 1962 comprises acidophilous beech forests of the atlantic regions of

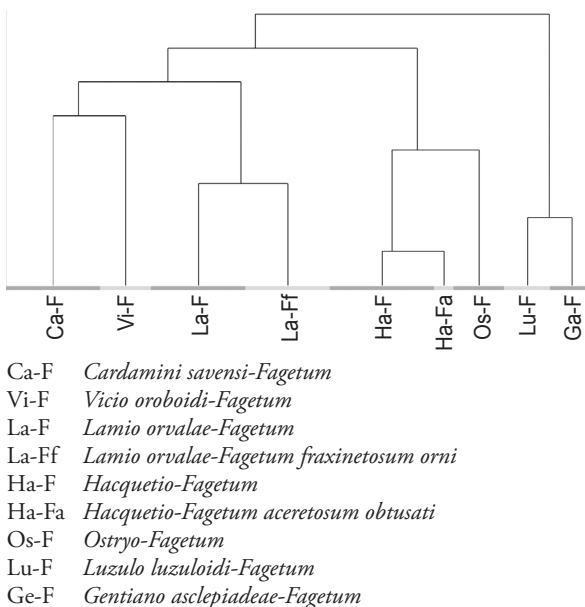


Figure 2: Dendrogram of beech forest communities of Žumberak and Samoborsko gorje area. Beta flexible ($\beta = -0.25$) with Sørensen index as a distance measure.

Slika 2: Dendrogram bukovih gozdnih združb Žumberka in Samoborskega gorja. Beta fleksibilna ($\beta = -0.25$) s Sørensenovim indeksom kot mero razdalje.

southwestern Europe of the alliance *Ilici-Fagion* (Mucina et al. 2016) or suballiance *Ilici-Fagenion* (Willner et al. 2017). Hence this community is considered here as a new association *Gentiano asclepiadeae-Fagetum sylvaticae* Škvorc, Franjić, Krstonošić et Sever *ass. nova hoc loco*.

Holotypus hoc loco: Tree layer: *Fagus sylvatica* 5; Shrub layer: *Fagus sylvatica* 2, *Acer pseudoplatanus* +, *Frangula alnus* +; Herb layer: *Vaccinium myrtillus* 4, *Pteridium aquilinum* 2, *Gentiana asclepiadea* 1, *Blechnum spicant* 1, *Oreopteris limbosperma* 1, *Frangula alnus* 1, *Athyrium filix-femina* +, *Hieracium murorum* +, *Hieracium rotundatum* +, *Luzula luzuloides* +, *Melampyrum pratense* +, *Prenanthes purpurea* +, *Rubus hirtus* +, *Solidago virgaurea* +; Moss layer: *Leucobryum glaucum* 2, *Polytrichum formosum* 1.

Locality: Right bank of the Presečina stream, Strahinščica, NW Croatia; relevé area 440 m², elevation 380 m, aspect N-NW; slope 24°, cover tree layer 95 %, cover herb layer 75 %, date 1975/08/22 (Regula Bevilacqua 1978; Table 35, relevé 3).

The association occurs on silicate bedrock and brown acid soils with a high percentage of raw humus. The soil profile is deeper than the profile supporting other acidophilic beech forests (Regula Bevilacqua 1978, Vukelić 2012). There are many open questions about the definition and distribution of syntaxa within the *Luzulo-Fagion* alliance in SE Europe (Willner 2002, Vukelić 2012), hence there is a need for a comprehensive numerical analysis of these communities.

Acidophilous beech communities in the researched area are characterized by poor floristic composition, dominated by acidophilous species (*Luzula luzuloides*, *Hieracium murorum*, *H. racemosum*, *Vaccinium myrtillus*, *Melampyrum pratense*, Table 1, 3). They are mainly distributed at lower altitudes (200–450 m a.s.l.), often on the slopes of deep ditches. *Ass. Gentiano asclepiadeae-Fagetum* occurs on wetter, more acid and nutrient poorer habitats compared to *ass. Luzulo-Fagetum* (Figure 3–5).

Ostryo-Fagetum

Thermophilous beech forests (*Ostryo-Fagetum*) have also been previously reported in the Samobor highland area (Šugar 1972, Vukelić et al. 2003, Trinajstić & Cerovečki 2005) and at one part of the Žumberak (Pavletić et al. 1982). These stands occupy warmer habitats with shallow soils on a dolomite base, mostly on ridges or steep southern slopes (Figure 3–5) and often they occur in a mosaic with dry grasslands. The floral composition, besides common beech, is dominated by thermophilic species such as *Ostrya carpinifolia*, *Acer obtusatum*, *Fraxinus ornus*, *Sorbus aria*, *Serratula tinctoria*, *Carex alba*, *C. flacca*, *Peucedanum oreoselinum*, *Vincetoxicum hirundinaria*, *Melittis melissophyllum*, *Tanacetum corymbosum* (Table 1). It often

represents a transitional stage in a succession of dry grasslands towards the *ass. Lamio orvalae-Fagetum*, which lasts a very long time due to the harsh environmental conditions. Compared to literature relevés (Pavletić et al. 1982) in new relevés (Table 4) a higher cover of woody species as well as a lower presence of *Festuco-Brometea* species was registered, which indicates the influence of succession in these stands. The absence of anthropogenic impact on dry grasslands in the studied area (mowing, grazing) leads to a loss of mosaic habitat structure, the reduction in area of thermophilous communities and the homogenization of habitats in general (Erdős et al. 2019).

Vicio oroboidi-Fagetum

Beech stands considered here as *ass. Vicio oroboidi-Fagetum* spread in the area of *ass. Lamio orvalae-Fagetum* stands on less moist, more acidophilic and nutrient poorer habitats (Figure 3, 4). Usually this association occurs as extrazonal Illyrian vegetation in the submontane vegetation belt on the southern edge of the Pannonian plain on carbonate bedrock (Vukelić 2012, Marinček & Čarni 2013) and here it is found on the edge of its distribution. The stands in the studied area are characterized by the absence or poor presence of many typical *Aremonio-Fagion* species such as *Omphalodes verna*, *Calamintha grandiflora*, *Aremonia agrimonoides*, *Rhamnus alpinus* ssp. *fallax*, etc. (Table 1, 5), similar to most of the stands in other areas of natural distribution (Vukelić & Baričević 2002, Marinček & Čarni 2013).

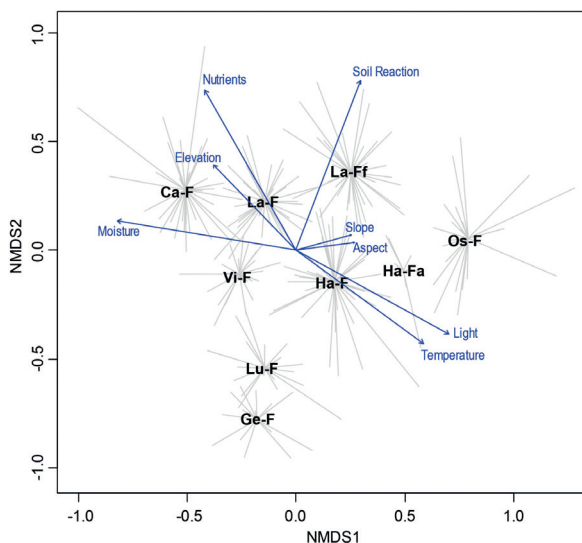


Figure 3: Ordination of the relevés classified into the nine communities based on NMDS of a Bray-Curtis dissimilarity matrix. Community acronimes corresponds to Figure 2.

Slika 3: Ordinacija popisova, razvrščenih u devet združba na osnovi NMDS Bray-Curtisove matrice različnosti. Okrajšave združba se enake kot na Sliki 2.

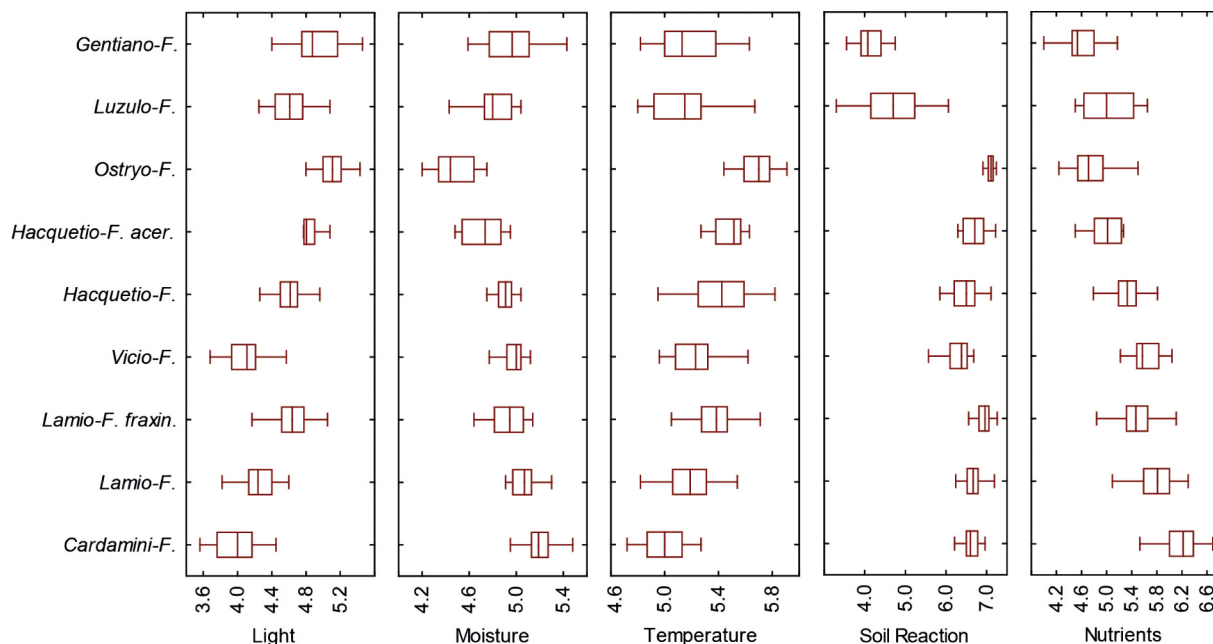


Figure 4: Comparison of analysed beech forest communities based on Ellenberg indicator values. Boxes show the 25–75% quartile range and the median value; whiskers indicate the range of values, except outliers.

Slika 4: Primerjava analiziranih bukovih gozdnih združb na osnovi Ellenbergovih indikatorski vrednosti. Škatle predstavljajo kvartile (25–75%) in mediano, ročaji pa prikazujuje razpon vrednosti brez osamelcev.

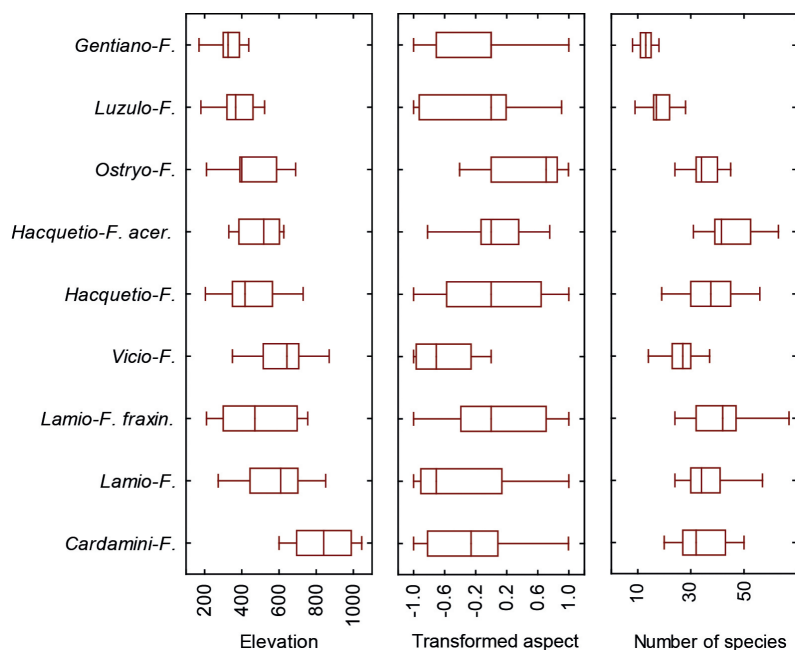


Figure 5: Comparison of analysed beech forest communities based on elevation, aspects transformed according to Beers et al. 1966 (-1.0 NE, 1.0 SW) and number of vascular plant species. Boxes show the 25–75% quartile range and the median value; whiskers indicate the range of values, except outliers.

Slika 5: Primerjava analiziranih bukovih gozdnih združb na osnovi nadmorske višine, ekspozicije transformirane po Beers et al. 1966 (-1.0 NE, 1.0 SW) in števila vrst cvetnic. Škatle predstavljajo kvartile (25–75%) in mediano, ročaji pa prikazujuje razpon vrednosti brez osamelcev.

Hacquetio-Fagetum

The presence of ass. *Hacquetio-Fagetum* in the Samobor highland area was recorded recently (Trinajstić 2004, Trinajstić & Pavletić 2004), although it has already been well researched in the neighbouring Gorjanci region

(Košir 1979). It is a widespread community of the pre-Alpine and pre-Dinaric regions of the Illyrian floral province, in the submontane vegetation belt above sessile oak and hornbeam forests, and below montane beech forests (Vukelić 2012, Marinček & Čarni 2013). In fact, in the

study area it usually alternates with ass. *Lamio orvalae-Fagetum*. Ass. *Hacquetio-Fagetum* spreads on ridges and southern slopes, while ass. *Lamio orvalae-Fagetum* spreads in ditches and on northern slopes (Figure 5). The tree layer is dominated by *Fagus sylvatica*, although *Quercus petraea* and *Q. cerris* are often present. The shrub layer is rich in species. In the herb layer, *Fagetalia* species are the most significant (*Galium odoratum*, *Aposeris foetida*, *Anemone nemorosa*, *Sanicula europaea*, *Asarum europaeum*, *Pulmonaria officinalis* etc.). *Aremonio-Fagion* and *Epimedio-Fagenion* species are also well represented – *Epimedium alpinum*, *Hacquetia epipactis*, *Aremonia agrimonoides*, *Cyclamen purpurascens*, etc. Many thermophilous species are present with a significant abundance – *Fraxinus ornus*, *Sorbus torminalis*, *S. aria*, *Viburnum lantana*, *Carex flacca*, *Melilotis mylyssophyllum*, *Tanacetum corymbosum*, *Serratula tinctoria* etc. (Table 1, 6).

In the studied area some thermophilous beech stands similar to ass. *Ostryo-Fagetum* but without *Ostrya carpinifolia*, are present. These stands are considered here as *Hacquetio-Fagetum* Ž. Košir ex Borhidi 1963 *aceretosum obtusati subass. nova hoc loco* (Typus: Table 6, relevé 34 *holotypus hoc loco*). Ecologically and floristically they are transitional communities between ass. *Ostryo-Fagetum* and *Hacquetio-Fagetum* (Figure 3–5, Table 1, 6). These stands are formed by the succession of thermophilous dry grasslands and they are still rich with *Festuco-Brometea* and *Trifolio-Geranietea* species (*Carex flacca*, *Cruciata glabra*, *Tanacetum corymbosum*, *Solidago virgaurea*, *Vincetoxicum hirundinaria*, etc.). However, they do not occur on a dolomite base and the environmental conditions are more mesophilous. Thus the succession progress of these habitats is faster than in *Ostryo-Fagetum*, and towards typical *Hacquetio-Fagetum*.

Lamio orvalae-Fagetum

It is a widespread community in the studied area and has already been recorded for the Samobor highlands (Vukelić et al. 2003). It occurs between 300 and 800 m a.s.l., on different slopes, mostly on northern aspects (Figure 5). The habitats are moist, cold and rich in nutrients (Figure 4), usually occurring on limestone and dolomite, and sometimes fragmentary on silicate bedrock (Vukelić et al. 2003). The floral composition is very rich and typical for stands of this association (Vukelić 2012). The tree layer is dominated by *Fagus sylvatica* with low abundance of other *Carpino-Fagetea* tree species (most often *Acer pseudoplatanus*). In the shrub layer there are a lot of typical beech forest species – *Fagus sylvatica*, *Acer pseudoplatanus*, *A. campestre*, *A. platanoides*, *Corylus avellana*, *Daphne mezereum*, *Euonymus latifolius*, *Prunus avium*, *Sambucus nigra*, etc. The herb layer is dominated by *Fagetalia* spe-

cies (*Galium odoratum*, *Carex sylvatica*, *Mercurialis perennis*, *Actea spicata*, *Dentaria bulbifera*, *Aposeris foetida*, *Anemone nemorosa*, *Sanicula europaea*, *Pulmonaria officinalis*), as well as *Aremonio-Fagion* species (*Lamium orvala*, *Hacquetia epipactis*, *Vicia oroboides*, *Cyclamen purpurascens*, *Aposeris foetida* etc.). The ferns (*Dryopteris filix-mas*, *Polystichum aculeatum*, *P. setiferum* etc.) often occur as significant cover (Table 1, 7).

In the area of the Samobor highlands Vukelić et al. (2003) registered a thermophilous variant of the association (var. *Acer obtusatum*). Similar stands were also found in the Žumberak area and they are common throughout the research area. We consider them here as *Lamio orvalae-Fagetum* (Horvat 1938) Borhidi 1963 *fraxinetosum orni subass. nova hoc loco* (Typus: Table 7, relevé 42 *holotypus hoc loco*). Unlike the typical variant, these stands rarely occur on northern aspects (Figure 5) and they generally occur on warmer habitats (Figure 4). Apart from many mesophilous species characteristic for typical stands, a large number of thermophilous species were also present here (*Ostrya carpinifolia*, *Acer obtusatum*, *Fraxinus ornus*, *Viburnum lantana*, *Rosa arvensis*, *Carex flacca*, *Tanacetum corymbosum*, etc.). Floristically, it is a transitional community towards ass. *Ostryo-Fagetum* (Table 1, Figure 3). It could be assumed that these stands present some stage of succession of dry grasslands on dolomite and limestone bedrock abandoned a long time ago, or heavily degraded forest stands which still retain many thermophilous species. According to our results, succession in these stands can be expected to continue towards the typical subassociation and it is doubtful whether on some habitats the stands will stay in a form that will differ from the typical ones.

Cardamino savensi-Fagetum

Ass. *Cardamino savensi-Fagetum* is widespread in the higher parts of the researched area (mostly above 700 m a.s.l., Figure 5). It has not been previously recorded in this area, although it is well researched and documented in the neighbouring area of Gorjanci (Košir 1979, Marinček 1987). It is a zonal association of the highest peaks in the predinaric phytogeographic region on dolomite and limestone bedrock (Marinček & Čarni 2002) and so far it has been recorded in Croatia only in the highest parts of Papuk (Škvorc et al. 2011). In the research area it is spread on the moistest, coldest and most nutrient rich habitats of all studied communities (Figure 3, 4). Floristically, these stands are similar to stands of ass. *Lamio orvalae-Fagetum*, but characterized by a greater cover of species indicating more humid and nutrient rich habitats (*Acer pseudoplatanus*, *A. platanoides*, *Sambucus nigra*, *Allium ursinum*, *Dentaria enneaphyllos*, *Omphalodes verna*, etc.) The tree

layer is dominated by *Fagus sylvatica*, and very common is *Acer pseudoplatanus*. The shrub layer is medium to poorly developed. Furthermore, there are many species usual in the montane vegetation belt which differentiate *Cardamino savensi-Fagetum* from *Lamio orvalae-Fagetum* – *Cardamine trifolia*, *C. kitaibelli*, *Sorbus aucuparia*, *Isopyrum thalictroides*, *Abies alba*, *Leucjum vernum*, *Polygonatum verticillatum*, *Stellaria nemorum* and *Dryopteris dilatata* (Table 1, 8).

Conclusion

This is a first systematic study of beech forests in the entire Žumberak and Samobor highland area. There were seven associations and two subassociations recorded, indicating a great diversity of beech communities depending on environmental conditions and anthropogenic influences. Observed succession processes indicate that further homogenization of the habitats will occur in the future, that is, increasing the proportion of mesophilous beech communities at the expense of all kinds of thermophilous forest communities, as well as open grasslands.

Acknowledgements

This research was financed by Žumberak – Samoborsko gorje Nature Park. We would like to thank Andraž Čarni for substantial advices concerning syntaxonomical nomenclature.

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Table 1: Synoptic tables of analysed communities of beech forests (including literature relevés). Only species with phi values higher than 0.3 and a frequency higher than 30 % in at least one group are included. Grey shaded values indicate diagnostic species with high ($\Phi \geq 0.3$) fidelity to particular clusters. At the end of the table frequencies of additional most abundant species are shown (frequency higher than 60 % in at least one group). Community acronimes corresponds to Figure 2.

Tabela 1: Sinoptična tabela preučevanih združb bukovih gozdov (vključno s popisi iz literature). Prikazane so samo vrste s fi vrednostjo večjo od 0,3 in frekvenco višjo od 30% v vsaj eni skupini. Sivo zasenčeno so diagnostične vrste z večjo ($\Phi \geq 0,3$) navezanostjo na določen klaster. Na koncu tabele so prikazane najbolj pogoste vrste s frekvencami (frekvenca višja od 60 % vsaj eni skupini). Okrajšave združb so enake kot v Sliki 2.

Community		Ca-F	Vi-F	La-F	La-Ff	Ha-F	Ha-Fa	Os-F	Lu-F	Ge-F
Number of relevés	Layer	39	21	39	36	42	8	21	19	18
<i>Sambucus nigra</i>	B	74	5	28	6	2	.	.	5	.
<i>Arum maculatum</i>	C	64	5	23	.	.	.	.	.	.
<i>Cardamine kitaibelli</i>	C	59	5	13	3	.	.	.	.	.
<i>Lonicera alpigena</i>	B	54	.	13	3	2	.	.	.	.
<i>Paris quadrifolia</i>	C	72	10	26	14	10	.	.	.	.
<i>Geranium robertianum</i>	C	36	.	3	.	.	.	.	.	.
<i>Cardamine trifolia</i>	C	51	5	8	8	2	.	.	.	.
<i>Isopyrum thalictroides</i>	C	31	.	3	3	.	.	.	.	.
<i>Ranunculus lanuginosus</i>	C	38	10	8	3	.	.	.	.	.
<i>Senecio ovatus</i>	C	54	5	23	31	5	.	.	5	.
<i>Oxalis acetosella</i>	C	31	5	5	3	2	.	.	.	.
<i>Dryopteris filix-mas</i>	C	92	67	74	44	33	13	.	11	.
<i>Asplenium scolopendrium</i>	C	41	10	15	8	2	.	5	.	.
<i>Polygonatum multiflorum</i>	C	72	43	46	28	17	.	5	11	.
<i>Dentaria enneaphyllos</i>	C	41	.	18	19	5	.	.	.	.
<i>Circaea lutetiana</i>	C	31	.	8	3	5	.	.	5	.
<i>Dentaria bulbifera</i>	C	87	71	64	31	38	13	5	16	.
<i>Acer pseudoplatanus</i>	A	74	10	64	39	31	25	14	.	.
<i>Anemone nemorosa</i>	C	64	71	54	8	29	13	.	11	.
<i>Actaea spicata</i>	C	56	33	67	36	19	.	5	.	.
<i>Polystichum aculeatum</i>	C	33	14	41	8	5	.	.	.	.
<i>Lamium orvala</i>	C	51	38	64	50	29	.	.	.	.
<i>Cornus sanguinea</i>	B	.	.	18	72	40	38	5	.	.
<i>Epimedium alpinum</i>	C	3	52	13	14	62	13	19	11	.
<i>Vincetoxicum hirundinaria</i>	B	.	.	.	22	5	63	29	.	.
<i>Knautia drymeia</i>	C	3	.	10	22	19	75	48	5	.
<i>Ostrya carpinifolia</i>	A	.	5	18	42	12	25	95	5	.
<i>Peucedanum oreoselinum</i>	C	.	.	.	3	.	13	52	.	.
<i>Sorbus aria</i>	A	.	.	.	28	7	.	67	.	6
<i>Mercurialis ovata</i>	C	3	.	.	8	5	13	52	.	.
<i>Melittis melissophyllum</i>	C	.	.	8	25	36	63	90	5	.
<i>Clematis recta</i>	C	.	.	.	6	.	.	33	.	.
<i>Chamaecytisus hirsutus</i>	B	.	.	.	3	5	13	43	5	.
<i>Polygonatum odoratum</i>	C	.	.	10	17	5	.	43	.	.
<i>Carex flacca</i>	C	3	14	.	50	24	75	81	.	.
<i>Quercus pubescens</i>	A	.	.	.	.	.	13	33	.	.
<i>Campanula persicifolia</i>	C	.	.	3	19	14	38	52	.	.
<i>Berberis vulgaris</i>	B	.	.	3	19	12	13	43	.	.
<i>Rhamnus cathartica</i>	B	.	.	3	19	2	13	38	.	.
<i>Sorbus torminalis</i>	B	.	10	8	19	21	50	71	26	33
<i>Fraxinus ornus</i>	B	5	5	21	75	74	75	95	32	22

Community		Ca-F	Vi-F	La-F	La-Ff	Ha-F	Ha-Fa	Os-F	Lu-F	Ge-F
Number of relevés	Layer	39	21	39	36	42	8	21	19	18
<i>Convallaria majalis</i>	C	.	5	13	19	31	5	62	16	11
<i>Sorbus aria</i>	B	8	.	15	28	19	38	57	16	6
<i>Viburnum lantana</i>	B	.	.	21	58	29	63	67	5	.
<i>Cephalanthera rubra</i>	C	.	.	5	3	5	13	33	.	6
<i>Hieracium murorum</i>	C	.	1	8	3	21	38	5	74	28
<i>Blechnum spicant</i>	C	.	.	.	.	.	.	.	.	67
<i>Frangula alnus</i>	B	.	.	.	.	2	.	.	5	44
<i>Calluna vulgaris</i>	C	.	.	.	.	.	.	.	21	44
<i>Pteridium aquilinum</i>	C	3	43	28	33	74	63	5	63	89
<i>Quercus petraea</i>	B	.	19	3	3	33	5	5	42	61
<i>Athyrium filix-femina</i>	C	67	62	28	8	7	.	.	32	.
<i>Acer obtusatum</i>	A	.	.	18	58	21	88	90	.	.
<i>Fraxinus ornus</i>	A	.	.	3	19	5	63	57	.	.
<i>Serratula tinctoria</i>	C	.	.	3	14	29	75	62	16	17
<i>Luzula luzuloides</i>	C	18	48	13	6	36	25	5	100	94
<i>Vaccinium myrtillus</i>	B	.	.	.	.	.	.	.	63	94
<i>Castanea sativa</i>	B	.	38	3	8	38	.	.	79	89
<i>Castanea sativa</i>	A	.	29	5	3	36	25	5	68	78
<i>Quercus petraea</i>	A	.	38	10	25	79	75	38	63	83
Tree layer										
<i>Fagus sylvatica</i>		100	100	100	100	100	100	100	100	100
Shrub layer										
<i>Fagus sylvatica</i>		100	95	95	86	100	100	67	95	89
<i>Acer campestre</i>		13	24	31	50	60	50	29	11	.
<i>Tamus communis</i>		8	19	64	56	45	63	52	.	.
<i>Rubus hirtus</i>		67	76	85	33	62	25	5	63	44
<i>Acer pseudoplatanus</i>		69	57	77	61	45	63	24	16	.
<i>Daphne mezereum</i>		41	24	64	64	50	63	52	.	.
<i>Rosa arvensis</i>		21	19	31	58	50	63	48	.	.
Herb layer										
<i>Melampyrum pratense</i>		3	5	21	19	38	38	29	68	67
<i>Helleborus niger</i>		23	5	23	36	19	63	24	.	.
<i>Tanacetum corymbosum</i>		3	.	8	42	38	75	62	11	.
<i>Galium odoratum</i>		9	86	77	36	57	38	24	26	.
<i>Gentiana asclepiadea</i>		18	38	44	39	64	63	5	47	67
<i>Salvia glutinosa</i>		10	24	38	50	43	50	62	.	.
<i>Pulmonaria officinalis</i>		31	71	62	67	74	38	38	5	.
<i>Cyclamen purpurascens</i>		46	57	77	67	60	75	43	5	.
<i>Lathyrus vernus</i>		.	14	46	44	36	63	33	.	.
<i>Potentilla micrantha</i>		13	14	15	25	31	63	24	.	.
<i>Solidago virgaurea</i>		3	1	5	56	38	63	43	47	28
<i>Asarum europaeum</i>		5	19	46	61	52	50	10	5	.
<i>Mercurialis perennis</i>		56	19	64	64	19	25	14	.	.
<i>Aposeris foetida</i>		23	52	38	61	69	50	57	58	6
<i>Galium sylvaticum</i>		8	33	26	61	60	75	62	32	6
<i>Carex sylvatica</i>		64	67	64	50	43	25	19	5	.
<i>Hedera helix</i>		44	43	77	58	64	88	52	42	6
<i>Sanicula europaea</i>		21	71	56	61	67	50	24	42	6
<i>Prenanthes purpurea</i>		46	43	33	14	21	.	.	63	61

Vegetation layers: A – tree layer, B – shrub layer, C – herb layer

Table 2: Spearman correlations of first two NMDS axes with environmental variables. Only significant correlations are presented ($p < 0.01$).

Tabela 2: Spearmanove korelacije prvih dvehi osi NMDS z okoljskimi spremenljivkami. Prikazane so samo statistično značilne korelacije ($p < 0,01$).

Environmental variable	Axis1	Axis2
Elevation	0.53	0.18
Light EIV	0.88	
Temperature EIV	0.75	
Moisture EIV	0.84	
Soil Reaction EIV		0.85
Nutrients EIV	0.81	0.31

Table 3 (Tabela 3): Ass. *Luzulo luzuloidi-Fagetum*.

Relevé No.	1	2	3	4	5
Date 2010 (Day/Month)	26/5	21/5	21/5	9/7	29/6
Elevation (m)	523	680	687	508	381
Aspect (°)	135	200	250	304	35
Slope (°)	10	15	50	50	8
Cover of layers (%):					
Tree (high)	90	100	100	90	100
Tree (middle)	40	10	10	10	10
Shrub	15	5	10	10	2
Herb	40	50	80	60	10

Charact. species of the ass.

<i>Luzula luzuloides</i>	c	2	3	4	3	+
<i>Hieracium racemosum</i>		+	2	.	+	+
Luzulo-Fagion						
<i>Vaccinium myrtillus</i>	b	1	.	.	.	.
<i>Melampyrum pratense</i>	c	+	+	.	.	.
<i>Polypodium vulgare</i>		.	.	.	+	.
Fagetalia						
<i>Fagus sylvatica</i>	a1	3	5	5	5	4
<i>Fagus sylvatica</i>	a2	2	1	1	1	2
<i>Fagus sylvatica</i>	b	1	1	+	+	+
<i>Fagus sylvatica</i>	c	+	+	1	+	1
<i>Aposeris foetida</i>		+	+	1	.	+
<i>Cardamine bulbifera</i>		+	+	.	+	.
<i>Sanicula europaea</i>		.	+	.	+	+
<i>Epimedium alpinum</i>		1	.	.	.	1
<i>Prenanthes purpurea</i>		+	.	.	1	.
<i>Galium odoratum</i>		.	+	1	.	.
<i>Lamium galeobdolon</i>		.	.	+	+	.
<i>Polygonatum multiflorum</i>		.	+	.	+	.
<i>Cyclamen purpurascens</i>		.	.	+	.	.
<i>Vicia oroboides</i>		.	.	+	.	.
<i>Asarum europaeum</i>		.	.	.	+	.

Relevé No.	1	2	3	4	5
<i>Euphorbia dulcis</i>		+	.	.	.
<i>Festuca altissima</i>		.	.	.	+
<i>Pulmonaria officinalis</i>		.	.	.	+
<i>Homogyne sylvestris</i>		.	.	.	+
<i>Athyrium filix-femina</i>		.	+	.	.
Carpino-Fagetea					
<i>Quercus petraea</i>	a1	2	.	.	+
<i>Quercus petraea</i>	b	.	.	.	.
<i>Prunus avium</i>	a1	+	.	.	.
<i>Prunus avium</i>	b	+	.	.	.
<i>Acer pseudoplatanus</i>		.	+	2	.
<i>Sorbus aria</i>		+	.	.	+
<i>Ilex aquifolium</i>		.	.	.	1
<i>Hieracium murorum</i>	c	.	+	+	1
<i>Anemone nemorosa</i>		1	.	+	.
<i>Hedera helix</i>		.	+	.	+
<i>Luzula pilosa</i>		.	.	.	.
<i>Carex pilosa</i>		.	.	.	+
<i>Convallaria majalis</i>		+	.	.	.
<i>Knautia drymeia</i>		.	.	+	.
<i>Melica nutans</i>		+	.	.	.
<i>Carex digitata</i>		.	.	.	+
<i>Galium sylvaticum</i>		.	.	+	.
<i>Galium schultesii</i>		.	.	.	+
<i>Symphytum tuberosum</i>		.	+	.	.
Quercetea roboris					
<i>Castanea sativa</i>	a1	3	.	.	.
<i>Castanea sativa</i>	a2	+	.	.	.
<i>Castanea sativa</i>	b	+	.	.	.
<i>Castanea sativa</i>	c	+	.	.	.
<i>Betula pendula</i>	a2	.	.	.	.
Quercetea pubescentis					
<i>Fraxinus ornus</i>	b	.	.	.	+
<i>Sorbus torminalis</i>		.	.	.	.
<i>Acer obtusatum</i>		.	+	.	.
Rhamno-Prunetea					
<i>Rubus hirtus</i>	b	+	+	+	.
<i>Corylus avellana</i>		+	+	.	.
<i>Juniperus communis</i>		.	.	.	+
Trifolio-Geranietea					
<i>Chamaecytisus hirsutus</i>	b	.	.	.	+
<i>Solidago virgaurea</i>	c	.	.	+	+
<i>Tanacetum corymbosum</i>		.	.	.	+
Festuco-Brometea					
<i>Cruciata glabra</i>	c	.	+	.	.
<i>Dorycnium germanicum</i>		.	+	.	.
Molinio-Arrhenatheretea					
<i>Gentiana asclepiadea</i>	c	+	+	+	.
<i>Platanthera bifolia</i>		.	.	+	+

Relevé No.	1	2	3	4	5
<i>Ajuga reptans</i>	.	.	.	.	+
Other species					
<i>Pteridium aquilinum</i>	c	+	+	.	+
<i>Clematis vitalba</i>	.	+	.	.	.

Legend:

- a1 – High tree layer,
- a2 – Middle tree layer,
- b – Shrub layer,
- c – Herb layer.

Coordinates of the relevés:

- 1 45.729413 15.406087; 2 45.820072 15.5198456;
- 3 45.8165494 15.5144942; 4 45.743835 15.66879;
- 5 45.6739407 15.4423374

Table 4 (Tabela 4): Ass. *Ostryo-Fagetum*.

Relevé No.	1	2	3	4
Date 2010 (Day/Month)	21/5	9/7	9/7	9/7
Elevation (m)	524	690	686	677
Aspect (°)	75	339	163	231
Slope (°)	65	35	40	30
Cover of layers (%):				
Tree (high)	100	90	100	90
Tree (middle)	30	20	20	40
Shrub	10	10	10	10
Herb	70	20	40	50

Charact. species of the ass.

<i>Ostrya carpinifolia</i>	a1	1	1	.	1
<i>Ostrya carpinifolia</i>	a2	+	+	1	.
<i>Ostrya carpinifolia</i>	b	.	.	.	+
Ostryo-Fagenion					
<i>Acer obtusatum</i>	a1	1	1	1	2
<i>Acer obtusatum</i>	a2	2	1	+	1
<i>Acer obtusatum</i>	b	+	+	+	+
<i>Fraxinus ornus</i>	a2	.	+	.	1
<i>Fraxinus ornus</i>	b	1	1	+	+
<i>Mercurialis ovata</i>	c	.	+	+	+
Aremonio-Fagion					
<i>Aposeris foetida</i>	c	2	+	.	.
<i>Knautia drymeia</i>		+	.	+	.
<i>Aremonia agrimonoides</i>		+	+	.	.
<i>Helleborus dumetorum</i>		+	.	.	.
<i>Homogyne sylvestris</i>		.	+	.	.
Fagetalia					
<i>Fagus sylvatica</i>	a1	5	4	5	3
<i>Fagus sylvatica</i>	a2	+	1	1	1
<i>Fagus sylvatica</i>	b	+	1	1	+
<i>Daphne mezereum</i>		.	+	+	.
<i>Primula vulgaris</i>	c	+	.	.	+

Relevé No.	1	2	3	4
<i>Mycelis muralis</i>	.	+	+	.
<i>Mercurialis perennis</i>	.	+	+	.
<i>Polygonatum multiflorum</i>	+	.	.	.
<i>Cardamine bulbifera</i>	+	.	.	.
<i>Lathyrus vernus</i>	.	+	.	.
<i>Pulmonaria officinalis</i>	+	.	.	.
<i>Campanula trachelium</i>	.	.	+	.
<i>Brachypodium sylvaticum</i>	.	+	.	.
<i>Festuca altissima</i>	.	.	+	.
Carpino-Fagetea				
<i>Quercus petraea</i>	1a	.	.	+
<i>Carpinus betulus</i>	1b	+	.	.
<i>Rosa arvensis</i>	b	+	+	.
<i>Convallaria majalis</i>	c	+	+	1
<i>Melittis melissophyllum</i>		+	+	+
<i>Hedera helix</i>		+	.	+
<i>Melica nutans</i>		.	.	+
<i>Galium sylvaticum</i>		+	.	.
<i>Lathyrus niger</i>		+	.	.
<i>Hieracium murorum</i>		+	.	.
<i>Carex digitata</i>		.	+	.
<i>Cephalanthera damasonium</i>		.	+	.
<i>Cephalanthera rubra</i>		.	.	+
Quercetea pubescentis				
<i>Sorbus aria</i>	1a	+	.	+
<i>Sorbus aria</i>	1b	.	+	+
<i>Sorbus aria</i>	b	+	+	+
<i>Quercus cerris</i>	1a	.	+	+
<i>Amelanchier ovalis</i>	b	.	+	.
<i>Sorbus torminalis</i>		+	.	.
<i>Tamus communis</i>		+	.	.
<i>Viburnum lantana</i>		.	.	.
<i>Genista tinctoria</i>		+	.	.
<i>Cephalanthera longifolia</i>	c	+	.	+
<i>Festuca heterophylla</i>		+	+	+
<i>Vincetoxicum hirundinaria</i>		.	+	+
<i>Clinopodium vulgare</i>		.	.	+
Quercetea roboris				
<i>Serratula tinctoria</i>	c	+	+	+
<i>Luzula luzuloides</i>		+	.	.
Erico-Pinetea				
<i>Carex alba</i>	c	+	.	1
Rhamno-Prunetea				
<i>Berberis vulgaris</i>	b	.	.	+
<i>Juniperus communis</i>		+	.	.
<i>Viburnum opulus</i>		.	.	.
<i>Rhamnus cathartica</i>		+	.	.
Epilobietea angustifolii				
<i>Salvia glutinosa</i>	c	.	+	.
<i>Heracleum sphondylium</i>		+	.	.
Trifolio-Geranietea				

Relevé No.	1	2	3	4
<i>Chamaecytisus hirsutus</i>	b	+	.	.
<i>Tanacetum corymbosum</i>	c	.	+	+
<i>Peucedanum oreoselinum</i>		+	.	+
<i>Solidago virgaurea</i>		+	+	.
<i>Campanula persicifolia</i>		+	.	+
<i>Iris graminea</i>		.	+	+
<i>Clematis recta</i>		.	.	+
<i>Veronica chamaedrys</i>		+	.	.
<i>Silene nutans</i>		.	.	+
<i>Potentilla micrantha</i>		.	.	+
<i>Bupthalmum salicifolium</i>		.	.	+
Mulgedio-Aconitetea				
<i>Thalictrum aquilegifolium</i>	c	+	+	.
<i>Phyteuma ovatum</i>		.	+	.
<i>Cirsium erisithales</i>		.	+	.
<i>Centaurea montana</i>		.	+	.
Festuco-Brometea				
<i>Carex flacca</i>	c	3	.	+
<i>Cruciata glabra</i>		+	+	.

Relevé No.	1	2	3	4
<i>Anthericum ramosum</i>		.	.	+
<i>Viola hirta</i>		.	.	+
<i>Euphorbia cyparissias</i>		.	.	+
<i>Pimpinella saxifraga</i>	r	.	.	.
Other species				
<i>Clematis vitalba</i>	b	.	+	.
<i>Malus sylvestris</i>		+	.	.
<i>Platanthera bifolia</i>	c	.	.	+
<i>Rubus</i> sp.		.	+	.
<i>Peucedanum</i> sp.		.	+	.

Legend:

- a1 – High tree layer,
- a2 – Middle tree layer,
- b – Shrub layer,
- c – Herb layer.

Coordinates of the relevés:

- 1 45.8291705 15.5567301; 2 45.748087 15.639837;
- 3 45.7476 15.639782; 4 45.747668 15.639245.

Table 5 (Tabela 5): Ass. *Vicio oroboidi-Fagetum*.

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Date 2010. (Day/Month)	9/6	9/6	9/6	26/5	26/5	26/5	26/5	26/5	26/5	21/5	21/5	21/5	21/5	29/6	29/6	29/6	29/6	29/6	29/6
Elevation (m)	350	557	733	568	707	515	558	714	716	675	700	687	774	238	593	223	643	648	870
Aspect (°)	40	10	360	315	225	60	45	110	75	30	260	45	330	33	315	360	30	75	130
Slope (°)	50	35	35	10	25	10	10	15	5	30	40	50	5	30	5	40	30	30	5
Cover of layers (%):																			
Tree (high)	100	100	100	100	90	100	90	100	90	100	100	100	90	100	100	100	90	100	100
Tree (middle)	5	10	30	50	20	20	30	5	20	15	10	10	5	20	10	5	5	3	10
Shrub	50	30	5	15	10	3	2	25	20	5	5	40	10	5	20	3	5	30	5
Herb	50	30	50	10	70	30	20	65	70	60	80	80	90	30	80	30	60	70	80

Charact. species of the ass.

<i>Epimedium alpinum</i>	c	+	.	.	+	1	1	+	+	+	.	.	.	.	1	.	1	1	1	.
<i>Vicia oroboides</i>		.	.	.	+	.	.	+	.	.	.	+	1	.	+	+	+	.	.	+
Epimedio-Fagenion																				
<i>Aposeris foetida</i>	c	+	.	.	.	1	.	.	+	.	+	1	.	2	+	+	+	+	+	.
<i>Hacquetia epipactis</i>		+	.	.	+	+	.	.	.	+	.	.	.	.	.	+	.	+	.	.
<i>Ruscus hypoglossum</i>		.	+	+	.	.	.	.	.	+	.	.	.	.	.	1	.	.	.	.
Aremonio-Fagion																				
<i>Staphylea pinnata</i>	b	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Daphne laureola</i>		.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cyclamen purpurascens</i>	c	.	.	.	+	+	+	+	.	+	+	.	+	.	+	+	+	+	+	.
<i>Lamium orvala</i>		.	+	+	+	.	+	.	+	.	+	.	.	.	.	.	.	.	+	.
<i>Omphalodes verna</i>		.	.	.	.	1	.	.	.	2	.	.	.	.	.	.	.	.	.	3
<i>Aremonia agrimonoides</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	+
<i>Cardamine kitaibelii</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
<i>Euphorbia carniolica</i>	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Helleborus niger</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Cardamine trifolia</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.

Relevé No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Fagetalia																				
<i>Fagus sylvatica</i>	a1	5	5	4	5	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5
<i>Fagus sylvatica</i>	a2	+	1	2	3	2	2	1	1	2	2	1	1	1	2	1	1	1	+	1
<i>Fagus sylvatica</i>	b	3	2	+	1	1	+	+	2	1	+	1	3	1	1	1	1	+	1	+
<i>Fagus sylvatica</i>	c	+	.	.	.	+	.	1	.	1	1	+	1	.	.	.	.	.	2	.
<i>Daphne mezereum</i>	b	.	.	.	.	+	.	.	.	.	.	.	.	+	.	+	.	+	+	.
<i>Crataegus laevigata</i>		+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Galium odoratum</i>	c	2	2	2	+	2	1	+	2	1	2	1	3	2	.	3	.	1	2	.
<i>Cardamine bulbifera</i>		+	1	+	+	+	1	1	+	.	1	+	.	.	+	.	1	1	+	+
<i>Sanicula europaea</i>		.	+	+	+	.	.	.	+	+	+	1	+	+	1	+	+	+	+	+
<i>Pulmonaria officinalis</i>		+	.	+	+	+	.	.	+	+	+	+	+	+	+	+	.	+	+	.
<i>Carex sylvatica</i>		.	+	+	+	+	.	.	.	+	.	+	+	.	+	+	.	+	+	+
<i>Athyrium filix-femina</i>		+	+	+	+	+	+	.	+	.	.	.	+	+	.	+	.	.	+	1
<i>Dryopteris filix-mas</i>		+	+	.	+	+	.	.	+	.	+	1	1	.	+	.	.	+	+	.
<i>Lamium galeobdolon</i>		.	+	+	.	+	+	+	+	.	+	.	.	.	.	.	.	2	+	.
<i>Prenanthes purpurea</i>		+	+	+	.	.	+	.	.	.	1	+	+	+	.	.	.	.	.	+
<i>Polygonatum multiflorum</i>		.	.	.	+	.	+	+	+	.	.	+	.	.	+	.	+	.	+	+
<i>Actaea spicata</i>		.	.	.	+	+	.	.	.	+	+	+	+	.	.	.	.	+	.	.
<i>Viola reichenbachiana</i>		.	.	.	+	.	.	.	.	.	.	+	+	+	+	.	+	.	.	.
<i>Euphorbia dulcis</i>		.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	+	.	+	+
<i>Euphorbia amygdaloides</i>		.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+
<i>Mercurialis perennis</i>		.	.	.	.	.	.	.	.	.	+	.	+	.	.	+	.	.	.	+
<i>Asarum europaeum</i>		+	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.
<i>Lilium martagon</i>		.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	.	.	.	.
<i>Neottia nidus-avis</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.
<i>Mycelis muralis</i>		.	.	.	.	+	.	.	+	.	.	.	.	+	.	.	.	.	.	.
<i>Lathyrus vernus</i>		+	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
<i>Scrophularia nodosa</i>		.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Paris quadrifolia</i>		.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+
<i>Primula vulgaris</i>		.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+
<i>Ranunculus lanuginosus</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+
<i>Brachypodium sylvaticum</i>		.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.
<i>Allium ursinum</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
<i>Leucojum vernum</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Epilobium montanum</i>		.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Festuca altissima</i>		.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Carpino-Fagetea																				
<i>Quercus petraea</i>	a1	.	+	2	+	+	.	.	.	.	.	.	.	.	.	+	.	+	.	.
<i>Quercus petraea</i>	b	.	+	.	.	.	.	+	.	+	.	.	.	.	.	.	1	.	.	.
<i>Acer pseudoplatanus</i>	a1	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.
<i>Acer pseudoplatanus</i>	a2	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Acer pseudoplatanus</i>	b	+	.	+	.	.	.	.	.	+	+	+	+	1	.	+	+	+	.	+
<i>Carpinus berulus</i>	a2	+	.	.	.	.	+	2	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carpinus berulus</i>	b	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	+
<i>Ulmus glabra</i>	a2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Ulmus glabra</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Prunus avium</i>	a1	.	.	+	1	.	.	.	+	.	1	.	.	.	.	.	.	.	.	.
<i>Prunus avium</i>	b	+	+	+	.	+	.	+	+	+	+	+	.	+	.	+	.	.	.	.
<i>Acer campestre</i>		+	.	.	+	.	.	.	+	+	.	.	.	.	.	.	.	.	.	+
<i>Rosa arvensis</i>		.	.	.	.	+	.	.	1	+	.	.	.	+	.	.	.	.	.	.
<i>Lonicera xylosteum</i>		.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
<i>Ulmus glabra</i>	+
<i>Tilia platyphyllos</i>	+
<i>Populus tremula</i>	+
<i>Acer platanoides</i>	+
<i>Anemone nemorosa</i>	c	.	.	1	2	2	2	1	2	2	2	1	1	.	+	1	1	2	1	
<i>Hedera helix</i>	+	.	.	.	.	.	.	.	+	+	+	+	.	+	+	+	.	.	.
<i>Symphytum tuberosum</i>	.	.	+	+	+	.	.	+	.	.	.	+	+	.	.	.	.	.	.
<i>Melica uniflora</i>	.	.	.	+	.	.	.	3	2	.	.	.	.	+	.	.	+	+	.
<i>Galium sylvaticum</i>	+	.	+	+	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Luzula pilosa</i>	+	.	.	+	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.
<i>Polystichum aculeatum</i>	+	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.
<i>Carex pilosa</i>	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Hieracium murorum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+
<i>Glechoma hirsuta</i>	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
<i>Poa nemoralis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Polygonatum verticillatum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Convallaria majalis</i>	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Crocus purpureus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Arum maculatum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Carex digitata</i>	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	+	.	+	.
<i>Cephalanthera damasonium</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Polystichum setiferum</i>	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Stellaria holostea</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Galium schultesii</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Lathyrus niger</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Quercetea roboris																				
<i>Castanea sativa</i>	a1	.	1	+	+	.	2	2	.	.	.	.	.	.	.	.	.	.	.
<i>Castanea sativa</i>	a2	.	.	.	+	.	+	1	.	.	.	.	.	.	.	.	.	.	.
<i>Castanea sativa</i>	b	.	+	+	.	.	+	+	.	.	.	.	.	+	+	+	.	.	.
<i>Betula pendula</i>	a1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Luzula luzuloides</i>	c	1	1	1	.	.	.	+	.	.	2	3	1	3	.	1	.	.	2	
<i>Melampyrum pratense</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Vaccinio-Piceetea																				
<i>Picea abies</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
<i>Oxalis acetosella</i>	c	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Maianthemum bifolium</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Quercetea pubescentis																				
<i>Quercus cerris</i>	a1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
<i>Ostrya carpinifolia</i>	a2	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sorbus torminalis</i>	b	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Tamus communis</i>	c	.	.	.	+	.	.	.	.	+	.	+	.	.	.	.	.	.	.
<i>Cephalanthera longifolia</i>	.	.	.	+	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.
<i>Festuca heterophylla</i>	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+
<i>Hieracium racemosum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Rhamno-Prunetea																				
<i>Rubus hirtus</i>	b	+	+	1	+	+	+	+	1	+	.	.	1	+	.	2	.	+	+	
<i>Corylus avellana</i>	.	.	.	.	.	+	.	+	+	+	.	.	+	.	.	+	+	.	+
<i>Crataegus monogyna</i>	.	.	.	.	+	.	.	+	+	.	.	.	.	.	+	.	.	.	.
Robinietea																				
<i>Clematis vitalba</i>	b	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.
<i>Robinia pseudoacacia</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
<i>Sambucus nigra</i>	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Epilobietea angustifolii</i>																					
<i>Salvia glutinosa</i>	c	.	.	.	.	.	.	.	+	+	.	+	+	.	.	.	.	.	.	.
<i>Aegopodium podagraria</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.
<i>Senecio ovatus</i>	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Trifolio-Geranietea</i>																					
<i>Potentilla micrantha</i>	c	.	.	.	+	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Solidago virgaurea</i>	c	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.
<i>Galium mollugo</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Mulgedio-Aconitetea</i>																					
<i>Doronicum austriacum</i>	c	.	.	.	.	1	.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Phyteuma ovatum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Festuco-Brometea</i>																					
<i>Veronica austriaca</i>	c	1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	+	.
<i>Cruciata glabra</i>	.	.	.	.	.	+	.	.	+	.	.	.	.	+	.	.	.	.	.	.	+
<i>Carex flacca</i>	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.
<i>Dorycnium germanicum</i>	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Molinio-Arrhenatheretea</i>																					
<i>Gentiana asclepiadea</i>	c	.	.	.	+	+	+	+	.	.	.	+	+	+	.	.	.	.	.	+	.
<i>Platanthera bifolia</i>	.	+	.	+	.	.	.	.	.	.	+	.	.	+	.	+	+	.	.	+	+
<i>Ajuga reptans</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Asplenietea trichomanis</i>																					
<i>Polypodium vulgare</i>	c	+	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.
<i>Asplenium scolopendrium</i>	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.
Other species																					
<i>Pteridium aquilinum</i>	c	.	.	+	+	.	+	+	+	.	.	.	.	.	+	+	.	.	.	+	.
<i>Poa</i> sp.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Legend: a1 – High tree layer, a2 – Middle tree layer, b – Shrub layer, c – Herb layer.

Coordinates of the relevés:

1 45.7325168 15.5860148; **2** 45.773606 15.6202815; **3** 45.8126617 15.544225; **4** 45.714703 15.338975;
5 45.725445 15.370827; **6** 45.7294106 15.4066316; **7** 45.7281809 15.4078134; **8** 45.7243258 15.369575;
9 45.7251875 15.3693379; **10** 45.8194708 15.5196302; **11** 45.8173445 15.5152848; **12** 45.8170271 15.5154358;
13 45.7968954 15.4954816; **14** 45.6719983 15.4672067; **15** 45.7461280 15.678812; **16** 45.6715753 15.468671;
17 45.71554 15.3850633; **18** 45.7194897 15.3854567; **19** 45.7785958 15.3912386.

Table 6 (Tabela 6): Ass. *Hacquetio-Fagetum*.

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Date 2010 (Day/Month)	9/6	9/6	9/6	9/6	9/6	26/5	26/5	26/5	26/5	26/5	21/5	21/5	21/5	21/5	
Elevation (m)	369	353	340	730	327	289	520	525	725	669	533	555	650	510	
Aspect (°)	65	270	225	225	135	135	135	90	270	155	275	120	100	10	
Slope (°)	70	40	40	20	10	40	15	20	00	70	30	40	15	5	
Cover of layers (%):															
Tree (high)	90	100	100	90	90	90	90	80	90	90	80	80	100	90	
Tree (middle)	3	20	40	30	40	30	40	50	50	5	10	20	10	20	
Shrub	60	40	40	10	30	40	20	50	10	10	30	30	10	20	
Herb	40	90	50	50	40	90	50	60	70	70	90	30	90	70	
Subass.														<i>typicum</i>	
Charact. species of the ass.															
<i>Hacquetia epipactis</i>	c	1	1	+	.	.	1	+	.	+	.	.	.	2	+
<i>Aposeris foetida</i>		+	+	+	+	+	+	+	.	3	+	1	1	1	1
<i>Primula vulgaris</i>		+	+	+	.	+	+	+	.	+	+	+	.	+	.
<i>Asarum europaeum</i>		+	+	.	.	+	+	.	.	.	+	+	.	+	+
<i>Cardamine enneaphyllos</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.
Diff. species of the subass.															
<i>Acer obtusatum</i>	a1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Acer obtusatum</i>	a2	.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Acer obtusatum</i>	b	+	+	+	.	+	.	.	.	.	+	+	.	.
<i>Vincetoxicum hirundinaria</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.
Epimedio-Fagenion															
<i>Epimedium alpinum</i>	c	1	3	2	.	.	2	2	2	.	.	.	.	.	2
<i>Knautia drymeia</i>		.	.	.	+	.	+	.	.	+	.	+	+	.	.
<i>Helleborus odorus</i>		+	+	+	.	.	+	.	+	.	.	.	.	.	.
<i>Ruscus hypoglossum</i>		.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Vicia oroboides</i>		+	.	.	.	+	.	.	.	.	.	.	.	.	.
Aremonio-Fagion															
<i>Staphylea pinnata</i>	b	+	1	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lonicera caprifolium</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cyclamen purpurascens</i>	c	+	+	+	.	+	+	.	+	+	+	.	.	+	.
<i>Aremonia agrimonoides</i>		.	.	.	+	+	+	.	+	+	.	.	.	+	+
<i>Lamium orvala</i>		.	1	+	.	+	+	.	+	.	+	.	+	+	.
<i>Omphalodes verna</i>		.	.	.	.	.	.	.	.	+	.	.	.	.	.
<i>Helleborus niger</i>		.	+	.	.	.	.	.	.	+	.	.	.	+	+
<i>Euphorbia carniolica</i>		+	.	.	.	.	+	.	.	.	.	.	.	.	.
<i>Homogyne sylvestris</i>		.	+	.	.	.	.	.	.	+	.	+	.	.	.
<i>Helleborus dumetorum</i>		.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Cardamine trifolia</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Calamintha grandiflora</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fagetalia															
<i>Fagus sylvatica</i>	a1	5	5	5	5	4	5	2	3	5	5	5	4	5	4
<i>Fagus sylvatica</i>	a2	+	1	2	2	2	3	2	2	3	1	1	1	1	1
<i>Fagus sylvatica</i>	b	3	1	2	1	2	2	1	1	2	1	1	2	1	2
<i>Fagus sylvatica</i>	c	.	.	+	.	.	+	.	.	.	.	.	.	.	+
<i>Daphne mezereum</i>	b	+	+	.	.	.	+	.	.	+	+	.	.	+	+
<i>Crataegus laevigata</i>		+	+	+	.	.	.	.	.	.	.	.	.	.	.
<i>Lonicera alpigena</i>		.	.	.	.	.	.	.	.	+	.	.	.	.	.

15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
21/5	21/5	21/5	29/6	29/6	29/6	29/6	29/6	29/6	29/6	9/7	9/7	29/6	29/6	29/6	9/5	9/6	21/5	21/5	9/7
360	312	204	378	388	410	570	644	651	888	502	325	350	391	571	247	625	512	524	626
350	310	50	42	309	319	230	154	240	136	348	110	325	10	200	325	270	80	120	184
40	50	8	10	20	10	10	5	30	45	5	45	45	30	30	20	70	60	70	40
100	70	100	80	90	80	100	100	90	90	90	100	100	80	90	100	70	80	100	100
10	40	10	20	30	20	30	20	20	20	50	30	5	30	10	0	30	30	30	30
40	60	30	50	30	15	20	5	5	20	20	50	5	30	40	20	50	30	30	15
70	20	90	70	70	60	70	80	80	30	80	30	50	60	50	60	50	50	80	70
<i>typicum</i>																<i>aceretosum ob.</i>			
1	.	+	+	.	+	3	.	.	.	+
+	.	+	+	+	+	.	+	1	+	.	+	.	+	+	4
+	+	+	+	+	.	+	.	.	+
+	.	+	.	.	.	+	.	+	.	+	+	.	.	.	1
.	+
.	1	2	1	2
.	+	1	+	1	+
+	+	1	1	1	1
.	+	+	+	+
3	2	2	3	3	3	.	3	3	.	.	.	2	2	.	2	.	2	.	.
.	+	+	+	+	+
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.	2	+
.	.	+
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.	.	+	.	.	.	+	+	.	.	+	.	+	.	.	+	+	+	.	+
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.	+	.	.	.	r	.	.	.
.	.	1	1	2
.	1	.	.
.	.	+	+	.	.
.
.	.	+
.	+
5	3	5	2	3	3	4	4	5	5	5	3	5	3	3	5	3	4	5	4
1	2	.	1	3	2	3	1	2	2	3	3	1	1	1	2	1	1	1	2
2	3	3	+	2	1	2	1	1	2	1	3	1	1	1	1	2	1	1	2
.	.	.	+	.	.	+	+	+	+	.
+	.	.	+	+	+	.	+
.	.	.	+	.	+	+	.	.	.	+
.

Relevé No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Pulmonaria officinalis</i>	c	+	+	+	.	+	+	+	+	.	+	+	+	+	+
<i>Sanicula europaea</i>		+	+	+	1	+	+	+	.	.	.	1	+	.	+
<i>Galium odoratum</i>		2	.	1	1	2	.	.	+	.	+	.	1	3	+
<i>Cardamine bulbifera</i>		+	+	+	.	+	+	+	+	+	.	.	.	.	+
<i>Lathyrus vernus</i>		+	+	+	.	.	.	.	+	.	.	.	.	.	.
<i>Euphorbia dulcis</i>		.	+	.	.	.	+	.	+	.	+	.	.	+	+
<i>Dryopteris filix-mas</i>		+	.	+	.	+	+	+	+	.	+	.	.	.	+
<i>Neottia nidus-avis</i>		.	.	+	.	.	.	.	.	.	+	+	+	+	.
<i>Carex sylvatica</i>		.	.	.	+	+	+	.	.	.	.	.	.	.	+
<i>Brachypodium sylvaticum</i>		.	.	.	.	.	+	.	.	.	1	+	+	+	+
<i>Viola reichenbachiana</i>		+	.	.	.	+	+	.	.	.	.	.	+	+	+
<i>Lilium martagon</i>		.	+	.	.	.	+	+	+	.	.	+	.	.	+
<i>Prenanthes purpurea</i>		.	+	.	+	.	.	+	.	.	+	+	.	.	.
<i>Mycelis muralis</i>		.	.	.	.	.	.	.	.	+	.	+	+	.	.
<i>Lamium galeobdolon</i>		.	+	+	.	+	.	.	.	.	.	.	.	.	.
<i>Mercurialis perennis</i>		.	+	.	.	.	+	.	.	+	.	.	.	.	.
<i>Polygonatum multiflorum</i>		.	+	+	.	.	.	.	.	.	.	.	.	.	.
<i>Actaea spicata</i>		.	+	.	.	.	+	.	+	.	.	+	.	.	+
<i>Phyteuma spicatum</i>		.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Campanula trachelium</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Festuca altissima</i>		.	.	.	.	.	.	+	.	.	.	.	.	+	.
<i>Euphorbia amygdaloides</i>		.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Paris quadrifolia</i>		.	+	.	.	.	.	.	+	.	.	.	.	.	.
<i>Circaea lutetiana</i>		.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Athyrium filix-femina</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carpino-Fagetea															
<i>Quercus petraea</i>	a1	.	1	1	.	1	1	.	1	.	1	.	2	+	1
<i>Quercus petraea</i>	a2	.	+	+	.	.	.	.	.	.	.	.	.	.	+
<i>Quercus petraea</i>	b	.	.	.	.	.	.	.	.	.	.	+	+	+	.
<i>Quercus petraea</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carpinus betulus</i>	a1	.	.	.	.	+	.	.	.	.	.	.	.	.	+
<i>Carpinus betulus</i>	a2	.	.	1	.	+	.	.	+	.	.	.	.	.	+
<i>Carpinus betulus</i>	b	.	.	.	.	.	.	.	1	.	.	.	.	.	.
<i>Acer pseudoplatanus</i>	a1	.	.	.	.	.	.	.	+	.	.	.	1	.	1
<i>Acer pseudoplatanus</i>	a2	.	+	.	.	.	.	+	1	.	.	+	1	.	.
<i>Acer pseudoplatanus</i>	b	.	.	.	.	.	+	+	.	.	+	2	+	.	+
<i>Acer campestre</i>	a2	.	.	.	.	+	+	+	+	.	.	.	+	+	.
<i>Acer campestre</i>	b	+	+	+	.	+	2	.	+	.	+	+	+	.	+
<i>Prunus avium</i>	a1	.	.	.	.	.	+	.	+	.	.	.	.	.	.
<i>Prunus avium</i>	b	.	.	+	+	+	1	.	.	.	.	+	+	+	2
<i>Populus tremula</i>	a1	.	.	.	.	.	.	+	1	.	.	.	.	.	.
<i>Populus tremula</i>	b	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Acer platanoides</i>	a1	.	.	.	.	.	.	1	.	.	.	.	.	.	.
<i>Acer platanoides</i>	b	.	.	.	.	+	.	1	+	.	.	.	.	.	+
<i>Ulmus glabra</i>	a2	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Ulmus glabra</i>	b	.	+	.	.	.	.	.	.	.	.	+	+	.	.
<i>Tilia platyphyllos</i>	a1	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Tilia platyphyllos</i>	b	.	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Pyrus pyraster</i>	a1	.	.	.	.	.	+	.	.	.	.	.	.	.	.
<i>Pyrus pyraster</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	+	.

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Rosa arvensis</i>	.	+	+	+	.	+	.	+	+	+	+	+	+	.
<i>Ilex aquifolium</i>	.	+	+	.	+	.	.	.	.	.	.	.	.	2
<i>Lonicera xylosteum</i>	.	.	.	.	.	+	.	.	+	.	.	.	+	1
<i>Euonymus latifolius</i>	.	+	+	.	.	.	.	.	.	.	.	.	.	.
<i>Euonymus europaeus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Abies alba</i>	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hedera helix</i>	c	+	+	+	2	1	.	.	.	1	1	+	.	.
<i>Galium sylvaticum</i>	+	+	.	+	.	+	+	.	.	1	.	.	+	.
<i>Melittis melissophyllum</i>	.	+	+	.	+	+	.	.	+	.	+	+	.	+
<i>Carex digitata</i>	+	+	.	.	+	+	.	.	+	.	.	.	.	+
<i>Hieracium murorum</i>	+	.	.	+	+	.	.	.	.	.	+	.	.	.
<i>Anemone nemorosa</i>	.	+	.	.	.	1	2	.	+	1	.	+	1	.
<i>Convallaria majalis</i>	.	+	+	+	.	.	+	+	.	.	+	.	.	.
<i>Cephalanthera damasonium</i>	.	+	+	+	.	.	.	.	.	+	+	+	.	.
<i>Carex pilosa</i>	.	+	.	.	.	2	.	.	.	2	.	.	.	.
<i>Symphytum tuberosum</i>	+	.	.	+	+	.	+	.	+	.	.	.	+	+
<i>Melica uniflora</i>	.	+	.	.	.	.	.	.	.	2	.	.	1	1
<i>Luzula pilosa</i>	.	.	.	+	+	.	.	.	.	.	.	.	+	+
<i>Melica nutans</i>	.	+	.	.	.	+	.	.	+	.	.	.	.	.
<i>Lathyrus niger</i>	.	.	.	.	+	.	.	.	.	.	+	.	.	.
<i>Aruncus dioicus</i>	.	+	.	.	.	.	+	.	.	.	.	.	.	.
<i>Hepatica nobilis</i>	.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Galium schultesii</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Polystichum aculeatum</i>	.	+	.	.	.	+	.	.	.	.	.	.	.	.
<i>Poa nemoralis</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	+
<i>Aconitum lycoctonum</i>	.	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Glechoma hirsuta</i>	.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Cardamine impatiens</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Stellaria holostea</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Milium effusum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cephalanthera rubra</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Quercetea pubescentis														
<i>Quercus cerris</i>	a1	.	+	.	+	.	.	.	.	.	.	+	1	+
<i>Quercus cerris</i>	a2	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Quercus cerris</i>	b	.	.	.	.	.	.	.	.	.	.	.	+	.
<i>Sorbus torminalis</i>	a1	.	+	.	.	+	.	.	.	.	.	.	.	.
<i>Sorbus torminalis</i>	a2	.	.	.	.	+	.	.	.	.	.	.	.	.
<i>Sorbus torminalis</i>	b	.	.	.	.	.	1	.	.	.	.	+	.	.
<i>Sorbus aria</i>	a2	.	+	.	.	.	.	+	+	.	.	.	.	.
<i>Sorbus aria</i>	b	.	+	.	.	.	.	.	.	+	.	.	+	.
<i>Fraxinus ornus</i>	a2	.	.	.	.	+	.	.	.	.	.	.	.	.
<i>Fraxinus ornus</i>	b	+	+	.	.	+	+	+	+	+	+	.	+	+
<i>Ostrya carpinifolia</i>	a1	.	.	.	.	.	.	1	.	+	.	.	+	.
<i>Tamus communis</i>	b	.	+	+	+	+	+	.	+	.	.	.	+	+
<i>Viburnum lantana</i>	.	+	+	.	.	+	.	.	.	.	.	.	+	.
<i>Cornus mas</i>	+	+	1	.	.	.	.	.	.	.	.	.	.	.
<i>Genista tinctoria</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sorbus domestica</i>	.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Cephalanthera longifolia</i>	c	+	.	+	+	.	.	.	.	.	.	+	.	+
<i>Festuca heterophylla</i>	.	.	.	+	+

15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
+	.	+	+	.	.	1	+	+	.	+	+	+	+
.	+	.	+	+	1	.	+
2	+	+
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.	.	+	+	.	.	.
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.	+	+	.	+	+	.	.	+	.	1	+	+	.	+	1	+	1	1	+
.	+	+	1	+	.	+	+	+	+	.	.	.	+	+	.
+	+	+	.	.	+	+	1	+	+
+	+	.	+	+	+	.	r	.	+	+	+
.	.	+	.	.	+	+	.	.	+	.	+	1	+	+	.
.	.	2	+	+	1	+	.
.	+	.	.	+	+	+	+
.	+	+	.	.	+	.	+	.
.	.	4	+	.	.	3	.	+	+	1	+
.	.	+	+	+
.	+	+	+	.	+	.	.	.	+
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.	+	.	+	.	.
.	.	.	+	.	+	+	.	.
.	+	.	.	+	1	+	+	+
+	+	+	+	+	+	+	.	.	+	.	.	+
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+	+	+	+	+
+	+
+	+
+	1	.	+	+	+	.	+	+	+	+	+	.	+	2	.
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+	+	+	+	+
+	.	+	2	.
+	1	.	.	.	+	1	.	.
.	+	.	.
.
.
+	+	+	.	+

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Hieracium racemosum</i>	+	+	+	+	.
<i>Clinopodium vulgare</i>	+
<i>Aristolochia lutea</i>	.	.	+	.	.	+	.	+	.	.	.	.	.	.
<i>Mercurialis ovata</i>	.	.	.	.	.	.	.	.	+	.	.	.	.	.
<i>Lathyrus venetus</i>	.	.	.	.	.	+	.	+	.	.	.	.	.	.
Quercetea roboris														
<i>Castanea sativa</i>	a1	.	.	.	1	.	3	2	.	.	.	+	.	.
<i>Castanea sativa</i>	a2	.	.	.	.	.	1	1	.	.	.	.	.	.
<i>Castanea sativa</i>	b	.	.	.	+	+	2	+	.	.	+	+	.	.
<i>Castanea sativa</i>	c	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Betula pendula</i>	a1	.	.	.	.	.	1	1	.	.	.	.	.	.
<i>Serratula tinctoria</i>	c	.	+	+	.	+	+	+	.	.	+	.	.	.
<i>Luzula luzuloides</i>	.	+	.	2	1	.	1	+	.	.	1	+	+	.
<i>Melampyrum pratense</i>	.	+	+	.	+	.	+	+	.	.	.	.	2	+
<i>Luzula forsteri</i>	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Vaccinio-Picetea														
<i>Picea abies</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pyrola rotundifolia</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Oxalis acetosella</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erico-Pinetea														
<i>Carex alba</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhamno-Prunetea														
<i>Rubus hirtus</i>	b	+	.	.	+	+	+	1	.	.	3	+	.	+
<i>Cornus sanguinea</i>	.	+	.	.	.	+	.	2	.	.	.	.	+	.
<i>Crataegus monogyna</i>	.	+	.	+	.	.	.	+	.	.	.	.	+	.
<i>Corylus avellana</i>	.	.	2	.	+	.	+	1	.	.	.	1	.	+
<i>Berberis vulgaris</i>	.	+	.	.	.	+	.	.	.	.	.	.	.	.
<i>Juniperus communis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Viburnum opulus</i>	+	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ligustrum vulgare</i>	.	+	.	.	.	+	.	.	.	.	.	.	.	.
<i>Rhamnus cathartica</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Prunus spinosa</i>	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Robinietae														
<i>Clematis vitalba</i>	b	.	+	.	.	+	.	.	+	+	.	.	+	.
<i>Sambucus nigra</i>	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Epilobietea angustifolii														
<i>Salvia glutinosa</i>	c	.	+	.	.	+	+	.	.	+	+	+	+	+
<i>Fragaria vesca</i>	.	.	.	.	+	+	.	.	.	.	.	.	.	.
<i>Aegopodium podagraria</i>	+	+	+	.	.	.	.	.	.	.	.	.	.	.
<i>Heracleum sphondylium</i>	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Digitalis grandiflora</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Geranium phaeum</i>	.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Senecio ovatus</i>	.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Betonica officinalis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Valeriana officinalis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolio-Geranietae														
<i>Chamaecytisus hirsutus</i>	b	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Tanacetum corymbosum</i>	c	.	+	+	+	.	+	+	+	+	+	.	+	.
<i>Potentilla micrantha</i>	.	+	.	+	+	.	.	.	.	+	.	.	.	+
<i>Solidago virgaurea</i>	+	.	+	.	+	+	+	.	+	+	+	+	.	+

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Campanula persicifolia</i>	.	.	.	.	.	.	.	.	+	.	+	.	+	.
<i>Veronica chamaedrys</i>	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Iris graminea</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Silene nutans</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Laser trilobum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hypericum montanum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mulgedio-Aconitetea														
<i>Phyteuma ovatum</i>	c	+	+	+	.	+	+	.	.	+	+	.	.	.
<i>Thalictrum aquilegifolium</i>	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Doronicum austriacum</i>	.	+	.	.	.	.	.	+	.	.	.	.	.	.
<i>Cirsium erisithales</i>	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Festuco-Brometea														
<i>Cruciata glabra</i>	c	+	.	.	.	+	.	.	.	+	+	+	+	1
<i>Carex flacca</i>	.	.	.	.	.	.	.	.	.	+	+	.	+	.
<i>Anthericum ramosum</i>	.	.	.	.	.	.	.	.	.	.	2	.	.	.
<i>Arabis hirsuta</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Molinio-Arrhenatheretea														
<i>Gentiana asclepiadea</i>	c	+	+	+	+	+	+	.	.	+	+	+	.	.
<i>Platanthera bifolia</i>	.	+	.	+	+	.	+	+	+	.	+	.	+	.
<i>Ajuga reptans</i>	+	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Dactylis glomerata</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Taraxacum officinale</i>	.	.	.	.	.	.	.	.	.	.	.	.	r	.
Asplenetetea trichomanis														
<i>Polypodium vulgare</i>	c	+	+	.	.	+	.	.	.	.	.	.	.	.
<i>Asplenium scolopendrium</i>	.	.	.	.	.	.	.	1	.	.	.	.	.	.
<i>Asplenium trichomanes</i>	.	.	.	.	.	.	.	+	.	+	.	.	.	.
Other species														
<i>Malus sylvestris</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Frangula alnus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pteridium aquilinum</i>	c	+	+	+	+	+	.	+	+	+	+	.	+	+
<i>Rubus</i> sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Orchis</i> sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Legend: a1 – High tree layer, a2 – Middle tree layer, b – Shrub layer, c – Herb layer.

Coordinates of the relevés:

1 45.73193 15.58546; 2 45.7324883 15.586955; 3 45.7344283 15.5856017; 4 45.7652483 15.5999733;
5 45.781455 15.6404417; 6 45.705087 15.456413; 7 45.728812 15.412297; 8 45.729803 15.404405; 9 45.765137 15.367078;
10 45.7591014 15.3709664; 11 45.8290343 15.5563338; 12 45.8256753 15.5533546; 13 45.7657176 15.4506171;
14 45.7467283 15.4665097; 15 45.7292171 15.4570139; 16 45.7234695 15.4592164; 17 45.7031623 15.4865234;
18 45.67484 15.4409367; 19 45.67142 15.4376217; 20 45.6677617 15.4311183; 21 45.71184 15.388115;
22 45.714945 15.385295; 23 45.7194917 15.3842883; 24 45.767287 15.38527; 25 45.74379 15.66779;
26 45.759313 15.661213; 27 45.6725002 15.4374473; 28 45.6689466 15.4333993; 29 45.7121667 15.3863054;
30 45.6762659 15.3936626; 31 45.7572755 15.565091; 32 45.8355808 15.5656181; 33 45.831667 15.5599682;
34 45.744067 15.647915.

15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
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Table 7 (Tabela 7): *Lamio orvalae-Fagetum*.

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Date 2010 (Day/Month)	9/6	9/6	9/6	9/6	9/6	9/6	9/6	9/6	9/6	9/6	9/6	9/6	26/5	26/5	26/5	26/5	26/5	26/5	21/5	
Elevation (m)	530	702	789	464	613	664	727	304	518	791	484	660	688	851	273	491	874	575	759	
Aspect (°)	250	360	290	80	230	30	60	80	225	360	45	225	45	45	70	40	45	330	360	
Slope (°)	50	35	70	45	40	40	30	15	40	30	35	40	45	35	40	60	20	25	15	
Cover of layers (%):																				
Tree (high)	100	90	100	100	100	100	100	80	100	100	100	100	100	90	100	100	100	100	80	
Tree (middle)	10	5	5	20	20	5	15	30	60	20	20	30	20	20	10	10	5	10	30	
Shrub	5	5	30	3	5	20	20	40	5	15	10	30	10	10	5	5	50	5	30	
Herb	60	40	70	20	60	90	50	70	50	80	50	70	8	80	60	50	90	80	80	
Subass.																			<i>typicum</i>	
Charact. species of the ass.																				
<i>Lamium orvala</i>	c	+	+	+	.	+	.	+	+	+	+	.	.	+	.	+	1	.	+	+
Diff. species of the subass.																				
<i>Fraxinus ornus</i>	a2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Fraxinus ornus</i>	b	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Acer obtusatum</i>	a1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Acer obtusatum</i>	a2	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Acer obtusatum</i>	b	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
<i>Cornus sanguinea</i>	b	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	+	.	.
<i>Carex flacca</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lamio orvalae-Fagenion</i>																				
<i>Cardamine kitaibelii</i>	c	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cardamine trifolia</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
<i>Scopolia carniolica</i>		.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.
<i>Aremonio-Fagion</i>																				
<i>Staphylea pinnata</i>	b	.	+	1	.	.	1	1	+	2	.	+	.	.	.	.	.	.	.	.
<i>Lonicera caprifolium</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cyclamen purpurascens</i>	c	+	.	.	.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Aposeris foetida</i>		.	.	.	+	1	.	+	+	.	.	+	.	.	.	.	+	.	.	.
<i>Hacquetia epipactis</i>		.	.	.	+	.	.	.	.	1	.	.	.	.	+	2	+	1	3	.
<i>Helleborus odorus</i>	1	.	.	.	+	.	.	.	+	.	.	.	.	.	.	+	.	.	+	.
<i>Ruscus hypoglossum</i>		.	.	.	+	+	+	.	1	.	.	.	.	.	.	.	.	.	.	.
<i>Helleborus niger</i>	+	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.
<i>Aremonia agrimonoides</i>		.	.	.	.	+	.	.	.	.	.	+	.	.	+	.	+	.	+	.
<i>Cardamine enneaphyllos</i>	+	+	.	.	+	+	+	.	1	+	.	.	.	.	.	.	.	.	.	.
<i>Vicia oroboides</i>		.	.	.	+	.	.	.	.	.	.	+	.	.	+	.	.	+	.	.
<i>Knautia drymeia</i>		.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+
<i>Homogyne sylvestris</i>		.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.	.
<i>Euphorbia carniolica</i>	+	.	.	.	.	.	.	.	+	+	.	.	.	.	+	.	.	.	.	.
<i>Epimedium alpinum</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	+	2	.	+	.	.
<i>Omphalodes verna</i>		.	.	.	.	.	.	.	.	.	.	.	.	3	2	.	.	1	.	.
<i>Isopyrum thalictroides</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Fagetalia</i>																				
<i>Fagus sylvatica</i>	a1	5	5	5	5	4	5	5	4	3	5	4	5	5	5	5	5	5	4	4
<i>Fagus sylvatica</i>	a2	2	1	1	2	2	1	1	2	3	1	1	3	2	2	+	1	+	1	2
<i>Fagus sylvatica</i>	b	+	+	1	+	+	2	+	2	+	.	+	+	.	1	1	1	1	1	2
<i>Fagus sylvatica</i>	c	.	.	+	+	.	1	.	.	.	+	.	.	+	.	+	+	.	.	+
<i>Tilia cordata</i>	a1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Tilia cordata</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	
21/5	9/7	9/7	9/7	9/7	9/7	9/7	9/7	9/7	9/7	29/6	9/6	9/6	26/5	26/5	26/5	26/5	21/5	29/6	9/7	9/7	9/7	9/7	9/7	9/7	9/7	9/7
668	587	585	625	516	519	593	609	702	444	702	600	631	650	733	716	754	256	696	502	538	659	698	730	715	296	
55	210	354	78	246	345	307	78	170	23	80	225	225	225	110	280	125	120	145	177	153	112	234	309	59	247	
40	20	20	30	2	55	25	40	10	35	25	30	15	40	40	35	70	80	10	20	15	5	10	20	40	65	
100	90	100	100	100	100	100	100	100	100	100	100	100	100	80	90	80	100	80	100	90	100	100	80	100	30	
5	15	10	30	20	10	5	20	20	50	5	40	50	20	20	15	20	30	20	15	20	15	20	30	30	30	
5	25	10	70	50	30	60	5	20	20	20	50	10	10	20	15	10	30	50	80	70	20	10	20	10	50	
90	60	50	80	50	40	50	10	80	50	90	60	70	80	70	60	60	70	100	50	50	80	20	80	50	30	
<i>typicum</i>											<i>fraxinetosum orni</i>															
+	+	+	.	+	.	+	.	.	+	+	.	.	+	.	.	+	+	.	.	.	+	.	.	+	.	
.	1	.	.	+	+	+	+	.	.	+	
.	.	.	.	+	.	.	+	.	.	.	+	+	+	+	+	1	+	+	+	+	.	+	.	+	1	
.	1	+	.	.	.	+	+	2	.	2	1	2	1	.	
.	+	1	.	+	+	1	+	.	
.	+	+	+	.	.	+	.	.	+	.	.	.	1	+	+	+	+	+	+	
.	+	+	+	+	+	1	+	+	+	+	+	+	.	
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1	2	1	1	2	1	1	2	1	3	+	2	3	2	2	1	1	2	1	1	1	1	1	2	2	2	1
1	+	+	1	+	1	1	+	+	2	1	1	+	1	1	1	+	1	1	.	.	2	1	2	1	1	
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Relevé No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
<i>Daphne mezereum</i>	b	.	+	+	+	+	.	+	.	.	.	+	.	+	+	+	+	+	.	.	
<i>Lonicera alpigena</i>	b	+	.	+	+	1	.	.	+	.	.	
<i>Crataegus laevigata</i>	b	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.
<i>Cardamine bulbifera</i>	c	+	+	+	1	1	.	1	+	+	.	+	+	+	1	1	+	.	.	+	
<i>Galium odoratum</i>		.	1	1	+	1	+	2	1	.	2	2	2	+	2	.	.	.	+	+	
<i>Mercurialis perennis</i>		1	1	.	.	.	.	2	.	+	2	.	+	+	1	+	.	2	.	+	
<i>Dryopteris filix-mas</i>		1	+	.	+	.	1	+	.	+	+	+	+	+	+	+	1	+	.	+	
<i>Pulmonaria officinalis</i>		+	.	+	+	+	.	.	+	+	.	+	+	+	+	+	.	.	.	.
<i>Carex sylvatica</i>		.	+	.	.	.	+	+	+	.	+	+	+	.	+	+	.	+	.	.	
<i>Sanicula europaea</i>		.	.	.	.	1	+	+	+	.	.	+	+	.	.	.	+	.	.	+	
<i>Mycelis muralis</i>		.	.	+	+	+	.	.	.	.	+	+	.	.	.	.	.	.	.	+
<i>Actaea spicata</i>		+	.	.	+	.	+	.	.	+	+	1	.	+	1	.	+	+	+	+	
<i>Asarum europaeum</i>		.	.	.	.	.	.	.	1	.	.	+	.	+	.	+	.	.	+	.	
<i>Lathyrus vernus</i>		+	+	.	+	+	.	+	.	+	.	+	+	.	.	.	+	.	.	.	
<i>Polygonatum multiflorum</i>		.	.	.	.	.	.	+	.	+	.	+	.	+	+	.	+	+	+	+
<i>Primula vulgaris</i>		.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
<i>Prenanthes purpurea</i>		.	+	1	.	.	+	.	.	.	+	.	.	+	+	.	+	.	.	.	
<i>Euphorbia dulcis</i>		.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	+	.
<i>Brachypodium sylvaticum</i>		.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.
<i>Lamium galeobdolon</i>		+	.	.	.	.	.	.	+	+	.	.	.	.	+	.	+	.	.	+	.
<i>Lilium martagon</i>		.	+	+	.	+	.	.	.	.	+	.	.	.	+	+	.	+	+	.	.
<i>Viola reichenbachiana</i>		.	.	.	+	.	.	.	+	.	.	+	.	.	.	.	.	.	.	+	.
<i>Neottia nidus-avis</i>		.	.	.	.	+	.	.	.	.	+	+	.	+	.	+	+	.	.	.	.
<i>Euphorbia amygdaloides</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	+	+
<i>Paris quadrifolia</i>		.	.	.	.	.	.	+	.	.	+	.	.	.	+	.	.	.	.	.	+
<i>Campanula trachelium</i>		.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Allium ursinum</i>		.	.	.	.	+	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Athyrium filix-femina</i>		.	+	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Ranunculus lanuginosus</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	+
<i>Circaea lutetiana</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Scrophularia nodosa</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Veronica montana</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Phyteuma spicatum</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Epipactis helleborine</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Festuca altissima</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Carpino-Fagetea																					
<i>Acer pseudoplatanus</i>	a1	.	+	+	.	1	+	.	.	2	+	2	.	.	+	+	1	+	.	.	
<i>Acer pseudoplatanus</i>	a2	.	.	.	.	.	.	.	.	.	+	1	+	.	+	.	.	.	.	.	.
<i>Acer pseudoplatanus</i>	b	.	1	+	.	+	.	+	+	+	+	+	.	.	+	+	+	+	+	1	
<i>Acer pseudoplatanus</i>	c	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	+	.	.	.	.
<i>Carpinus betulus</i>	a1	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	.	.	.	.	.
<i>Carpinus betulus</i>	a2	.	.	.	.	+	.	.	.	+	.	+	+	+	.	+	.	.	1	1	.
<i>Carpinus betulus</i>	b	.	.	.	.	1	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.
<i>Acer campestre</i>	a1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+
<i>Acer campestre</i>	a2	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+
<i>Acer campestre</i>	b	.	.	.	.	.	.	.	+	.	.	+	.	+	+	+	.	+	.	1	.
<i>Acer platanoides</i>	a1	+	.	.	.	1	1	.	.	+	1	.	.	.	.	.	+	.	.	.	.
<i>Acer platanoides</i>	a2	.	.	.	.	1	.	.	.	.	1	.	.	.	.	.	+	.	.	.	.
<i>Acer platanoides</i>	b	.	+	+	+	+	.	.	+	+	+	.	.	.	.	.	2	+	+	.	.
<i>Prunus avium</i>	a1	.	.	.	.	+	.	.	.	1	.	+	+	.	.	.	.	.	1	1	.
<i>Prunus avium</i>	a2	+

20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
+	+	.	.	+	+	.	+	+	+	+	.	+	+	+	+	+	+	.	.	+	+	+	.	.	
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2	2	1	1	+	.	+	.	2	.	2	2	2	2	.	+	1	+	.	.	1
.	+	2	1	+	2	2	+	2	1	1	1	1	+	3	2	+
+	+	1	+	+	.	+	+	1	+	+	+	.	.	+	.	.	.
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+	+	+	+	+	.	.	+	+	+	+	.	+	+	+	+	+	+
1	+	.	.	+	.	.	+	+	.	2	+	1	+	.	+	.	.	+	+	+	+	+	.	.	.
+	+	+	+	+	.	.	+	+	.	+	+	.	+	+	+	.	+	+	+	.	.
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Relevé No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
<i>Prunus avium</i>	b	.	+	.	+	+	+	.	.	+	.	.	+	+	+
<i>Quercus petraea</i>	a1	+	.
<i>Ulmus glabra</i>	a2	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
<i>Ulmus glabra</i>	b	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	+	.	+	.
<i>Tilia platyphyllos</i>	a1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<i>Tilia platyphyllos</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	1
<i>Rosa arvensis</i>		.	+	.	.	.	.	.	.	.	+	.	+	+	+	.	.	.	.	.
<i>Ilex aquifolium</i>		.	.	.	.	.	+	+	.	.	+	.	+	.	.	.	.	.	.	.
<i>Euonymus latifolius</i>		+	+	.	.	.	+	+	.	+	+	.	+	+	.	.	.	+	.	.
<i>Lonicera xylosteum</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	2	.
<i>Tilia cordata</i>		.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Pyrus pyraeaster</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Euonymus europaeus</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hedera helix</i>	c	+	1	+	1	2	.	+	+	.	1	+	2	+	.	.	1	+	.	.
<i>Anemone nemorosa</i>		.	+	.	.	+	2	+	.	+	.	.	.	1	1	1	1	1	1	+
<i>Carex digitata</i>		+	.	.	.	+	.	.	+	.	.	.	+	+	.	.	+	+	.	.
<i>Galium sylvaticum</i>		.	.	1	.	+	.	.	.	.	.	.	+	1	+	+	+	.	+	.
<i>Symphytum tuberosum</i>		.	.	+	.	+	.	+	+	.	+	+	+	.	.	+	+	.	.	+
<i>Polystichum aculeatum</i>	1	.	.	.	+	.	.	.	.	.	+	+	+	2	+	+	.	.	.	.
<i>Cephalanthera damasonium</i>		.	.	.	+	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.
<i>Aconitum lycoctonum</i>		+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Arum maculatum</i>		+	+	+	.	+	.	+	.	.	+	.	.	.	+	.	.	.	.	+
<i>Convallaria majalis</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Melica uniflora</i>		.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.
<i>Aruncus dioicus</i>		+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Melica nutans</i>		.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Glechoma hirsuta</i>		.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	+	.
<i>Melittis melissophyllum</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Stachys sylvatica</i>		.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hepatica nobilis</i>		.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	+	.	.
<i>Galium schultesii</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hieracium murorum</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Polystichum setiferum</i>		+	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Carex pilosa</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.
<i>Luzula pilosa</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Lathyrus niger</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Luzula sylvatica</i>		.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.
<i>Stellaria holostea</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Moehringia trinervia</i>		+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Milium effusum</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cerastium sylvaticum</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cephalanthera rubra</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Aquilegia vulgaris</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
<i>Epipactis microphylla</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Quercetea pubescentis																				
<i>Sorbus aria</i>	a1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sorbus aria</i>	a2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sorbus aria</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.	.
<i>Ostrya carpinifolia</i>	a1	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.
<i>Ostrya carpinifolia</i>	a2	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.
<i>Ostrya carpinifolia</i>	b	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.

Relevé No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
<i>Quercus cerris</i>	a1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	+	.	.	.	1	
<i>Quercus cerris</i>	b	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Sorbus torminalis</i>	a2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sorbus torminalis</i>	b	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Tamus communis</i>		+	.	+	+	+	.	+	+	+	+	+	.	.	.	+	+	.	+	+	
<i>Viburnum lantana</i>		.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.
<i>Vincetoxicum hirundinaria</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cornus mas</i>		.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cephalanthera longifolia</i>	c	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Mercurialis ovata</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Aristolochia lutea</i>		.	.	.	+	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.
<i>Lathyrus venetus</i>		.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.
<i>Festuca heterophylla</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Clinopodium vulgare</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Laserpitium latifolium</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Quercetea roboris																					
<i>Castanea sativa</i>	a1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
<i>Castanea sativa</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Melampyrum pratense</i>	c	.	.	+	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	2
<i>Luzula luzuloides</i>		.	.	+	.	1	.	.	.	.	.	.	1	.	.	.	+	.	.	.	+
<i>Serratula tinctoria</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Erico-Pinetea																					
<i>Carex alba</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Genista januensis</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Erica herbacea</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Vaccinio-Piceetea																					
<i>Oxalis acetosella</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.
<i>Maianthemum bifolium</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Rhamno-Prunetea																					
<i>Rubus hirtus</i>	b	+	+	1	.	+	3	1	2	+	1	+	1	+	.	+	+	.	+	+	
<i>Corylus avellana</i>		+	+	+	+	.	+	+	+	.	.	+	.	+	+	+	.	1	.	.	+
<i>Viburnum opulus</i>		.	+	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	+	.
<i>Crataegus monogyna</i>		.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	.	.	+	.	+
<i>Ligustrum vulgare</i>		.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.
<i>Berberis vulgaris</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rhamnus cathartica</i>		.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Prunus spinosa</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sorbus aucuparia</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Robinietea																					
<i>Sambucus nigra</i>	b	.	+	+	+	.	.	+	.	.	+	.	.	.	.	.	+	.	.	.	+
<i>Clematis vitalba</i>		.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rubus idaeus</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rubus plicatus</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Epilobietea angustifolii																					
<i>Salvia glutinosa</i>	c	.	.	.	+	+	+	+	.	.	.	+	.	.	+	.	+	.	.	.	+
<i>Heracleum sphondylium</i>		.	.	+	+	.	.	.	+	.	.	+	.	.	+	.	.	.	.	+	+
<i>Senecio ovatus</i>		.	.	+	.	.	.	.	.	.	+	+	.	.	.	.	+	.	.	.	+
<i>Fragaria vesca</i>		.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Aegopodium podagraria</i>		.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.
<i>Silene dioica</i>		+	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Geranium phaeum</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
<i>Hypericum hirsutum</i>	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Galium lucidum</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Impatiens noli-tangere</i>	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Glechoma hederacea</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Atropa bella-donna</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Geranium robertianum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Geum urbanum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Digitalis grandiflora</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Trifolio-Geranietea																			
<i>Chamaecytisus hirsutus</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Tanacetum corymbosum</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Solidago virgaurea</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Potentilla micrantha</i>	.	.	.	.	+	.	.	.	.	.	.	+	.	.	+	.	.	.	+
<i>Campanula persicifolia</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Iris graminea</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Veronica chamaedrys</i>	+	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Tephrosia longifolia</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Laser trilobum</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Clematis recta</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Polygonatum odoratum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Geranium sanguineum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Hypericum montanum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lathyrus linifolius</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mulgedio-Aconitetea																			
<i>Phyteuma ovatum</i>	c	.	.	+	.	+	.	+	.	.	+	+	+	.	.	+	.	+	.
<i>Doronicum austriacum</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.
<i>Lilium carnioolicum</i>	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Cirsium erisithales</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Saxifraga rotundifolia</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Festuco-Brometea																			
<i>Cruciata glabra</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Veronica austriaca</i>	+	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.
<i>Listera ovata</i>	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Euphorbia cyparissias</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Anthericum ramosum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Molinio-Arrhenatheretea																			
<i>Astrantia major</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Taraxacum officinale</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Gentiana asclepiadea</i>	+	.	.	.	.	+	.	+	.	.	+	+	+	+	+	.	.	.	+
<i>Platanthera bifolia</i>	.	+	.	.	.	+	.	.	.	.	+	.	.	+	.	+	.	.	+
Asplenietea trichomanis																			
<i>Asplenium scolopendrium</i>	c	1	.	.	+	.	.	.	+	.	.	+	+	.	.	.	.	.	.
<i>Asplenium trichomanes</i>	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.	.	.
<i>Valeriana tripteris</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Polypodium vulgare</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Other species																			
<i>Juglans regia</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Malus sylvestris</i>	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Rosa</i> sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pteridium aquilinum</i>	c	.	.	.	.	+	.	+	.	.	+	.	.	.	.	.	.	.	.
<i>Polystichum lonchitis</i>	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
<i>Carex pendula</i>
<i>Sesleria</i> sp.
<i>Festuca</i> sp.	+
<i>Orchis</i> sp.
<i>Arabis</i> sp.	+
<i>Peucedanum</i> sp.
<i>Verbascum</i> sp.	+
<i>Rubus</i> sp.
<i>Ornithogalum pyramidale</i>

Legend: a1 – High tree layer, a2 – Middle tree layer, b – Shrub layer, c – Herb layer.

Coordinates of the relevés:

1 45.7567571 15.5832003; **2** 45.7464770 15.5979779; **3** 45.7468641 15.6007159; **4** 45.7555850 15.5711155;
5 45.7640318 15.5785592; **6** 45.7650903 15.5849703; **7** 45.7632525 15.6002531; **8** 45.7808486 15.6411193;
9 45.7573383 15.5819833; **10** 45.748515 15.602165; **11** 45.7561433 15.5708967; **12** 45.7658517 15.5891483;
13 45.759662 15.36923; **14** 45.742907 15.306145; **15** 45.7057738 15.456563; **16** 45.7294027 15.4119246;
17 45.7425239 15.3054183; **18** 45.7151832 15.3396807; **19** 45.8036911 15.4972854; **20** 45.7663131 15.4499749;
21 45.7341820 15.656613; **22** 45.737662 15.659547; **23** 45.744143 15.681007; **24** 45.741272 15.663415;
25 45.741228 15.663497; **26** 45.739455 15.663512; **27** 45.744853 15.649172; **28** 45.745973 15.642012;
29 45.75639 15.624458; **30** 45.768983 15.4521663; **31** 45.757715 15.56269; **32** 45.7640917 15.5798533;
33 45.75733 15.373283; **34** 45.768115 15.36673; **35** 45.7645447 15.3672001; **36** 45.768759 15.3666986;
37 45.7158634 15.4626465; **38** 45.7679917 15.4508067; **39** 45.730737 15.650652; **40** 45.733065 15.654508;
41 45.744617 15.645718; **42** 45.746258 15.640677; **43** 45.753217 15.64244; **44** 45.753423 15.643365;
45 45.781238 15.643157.

Table 8 (Tabela 8): *Ass. Cardamino savensi-Fagetum.*

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Date 2010 (Day/Month)	9/6	9/6	9/6	9/6	9/6	26/5	26/5	26/5	26/5	26/5	26/5	26/5	26/5	26/5	26/5
Elevation (m)	538	791	649	540	734	988	1035	1025	1029	1026	706	695	997	1044	1030
Aspect (°)	360	320	150	45	360	135	315	315	135	90	360	80	70	110	15
Slope (°)	60	40	35	30	35	20	5	5	15	10	25	60	5	5	15
Cover of layers (%):															
Tree (high)	100	100	100	100	100	100	90	90	100	90	100	100	80	90	100
Tree (middle)	20	5	5	20	20	20	30	30	20	30	20	10	30	10	10
Shrub	5	5	3	5	5	15	20	10	15	20	10	5	40	10	30
Herb	80	70	70	90	80	90	100	100	60	100	60	80	90	90	80

Charact. and diff. species of the ass.

<i>Cardamine trifolia</i>	c	.	.	.	+	.	+	+	+	.	1	.	.	+	+	.
<i>Veronica montana</i>	.	.	.	.	+	.	.	+	.	.	.	.	.	+	.	.
<i>Cardamine waldsteinii</i>	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.
Lamio orvalae-Fagenion																
<i>Cardamine kitaibelii</i>	c	.	.	.	1	+	+	+	+	+	2	+	.	.	+	+
<i>Lamium orvala</i>	.	.	.	.	+	1	.	.	.	.	.	.	.	+	.	.
<i>Scopolia carniolica</i>	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.
Aremonio-Fagion																
<i>Staphylea pinnata</i>	b	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cyclamen purpurascens</i>	c	+	.	.	.	+	+	.	.	+	.	+	+	+	.	+
<i>Vicia oroboides</i>	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+
<i>Cardamine enneaphyllos</i>	.	.	+	.	.	.	1	3	.	.	.	.	1	2	+	.
<i>Isopyrum thalictroides</i>	1	1	+	+	+

20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	
.	+
.	2
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.	+
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.	+	+	+	.	+
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16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37		
26/5	26/5	21/5	21/5	21/5	21/5	21/5	21/5	21/5	29/6	29/6	29/6	29/6	29/6	29/6	29/6	29/6	29/6	29/6	29/6	29/6	28/5	28/5	
1044	1045	686	679	659	668	708	685	845	880	882	853	834	836	839	859	879	861	873	832	840	850		
150	140	30	330	20	70	230	120	6	214	275	309	146	125	190	10	310	300	40	20	360	315		
20	40	20	30	40	15	35	15	25	15	15	10	30	15	15	50	40	20	5	40	5	25		
90	100	100	90	100	100	100	100	90	90	100	100	80	80	90	100	100	90	100	90				
20	20	10	10	20	5	5	20	20	20	15	20	30	20	2	10	5	15	3	5				
10	3	30	10	5	30	10	50	5	5	5	40	70	60	60	5	2	5	5	10				
50	70	90	100	50	100	100	70	50	70	80	80	80	80	60	40	60	90	80	90				

.	+	+	+	.	3	2	1	.	+	+	+	.	+	1	+	+
+	+	.	.	.	+	+
.
2	.	+	1	.	+	+	2	+	+	.	+	+	+	.	+	.	.	.	
.	.	+	1	.	+	1	+	+	+	.	+	1	+	.	.	.	+	+	.	+	
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.
.	+	+	+	.	.	+	+	+	+	+	+	.	.	+	+	+	
.
.	.	.	+	.	+

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
<i>Aremonia agrimonoides</i>	
<i>Aposeris foetida</i>	+	+	+	.	+	.	
<i>Omphalodes verna</i>	.	.	.	.	.	.	.	1	.	1	.	.	+	+	.	
<i>Helleborus niger</i>	.	.	.	.	.	+	+	.	.	.	.	.	.	+	.
<i>Hacquetia epipactis</i>	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.
<i>Euphorbia carniolica</i>	.	.	.	.	+	+	+	.	.	.	.	.	.	+	.
<i>Knautia drymeia</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Epimedium alpinum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fagetalia																
<i>Fagus sylvatica</i>	a1	4	5	5	3	4	5	5	5	5	5	5	5	4	5	
<i>Fagus sylvatica</i>	a2	2	1	1	2	1	2	2	2	2	2	1	2	1	1	
<i>Fagus sylvatica</i>	b	+	+	+	+	+	1	1	+	1	2	1	+	2	1	2
<i>Fagus sylvatica</i>	c	.	.	.	.	+	.	.	.	.	.	+	.	+	.	+
<i>Fraxinus excelsior</i>	a1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Fraxinus excelsior</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lonicera alpigena</i>	.	.	.	.	.	+	1	+	2	.	.	+	1	+	+	
<i>Daphne mezereum</i>	.	.	.	.	.	.	+	.	+	.	.	.	+	+	.
<i>Galium odoratum</i>	c	.	3	+	.	3	3	2	3	2	3	2	1	2	.	2
<i>Cardamine bulbifera</i>	+	1	+	+	+	.	1	+	1	1	1	1	+	+	1	1
<i>Dryopteris filix-mas</i>	1	+	1	1	+	+	+	+	+	+	+	1	+	+	+	1
<i>Paris quadrifolia</i>	+	+	+	.	+	+	+	+	.	+	.	+	+	.	+	+
<i>Athyrium filix-femina</i>	.	+	+	+	+	.	+	+	.	1	1	+	+	.	1	1
<i>Polygonatum multiflorum</i>	+	.	+	+	.	.	+	.	+	.	+	+	+	+	+	+
<i>Carex sylvatica</i>	.	+	.	.	+	+	+	+	.	+	+	+	+	+	+	.
<i>Mycelis muralis</i>	+	+	.	.	+	+	+	.	.	.	.	.	+	+	.	.
<i>Mercurialis perennis</i>	1	.	.	.	.	1	1	+	1	+	.	1	.	+	+	+
<i>Actaea spicata</i>	.	.	+	.	.	+	.	+	+	.	.	+	+	.	.	.
<i>Lamium galeobdolon</i>	.	.	+	.	.	.	+	.	+	+	+	+	.	+	+	+
<i>Prenanthes purpurea</i>	.	.	+	.	.	+	.	+	+	+	+	.	.	+	+	+
<i>Lilium martagon</i>	+	.	.	.	+	+	.	+	+	.	.	+	.	+	+	+
<i>Ranunculus lanuginosus</i>	.	.	.	.	.	+	+	+	.	.	.	.	+	+	+	+
<i>Circaea lutetiana</i>	.	+	.	+	+	+	.	.	.	.	.	.	.	+	.	.
<i>Euphorbia amygdaloides</i>	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	.
<i>Pulmonaria officinalis</i>	.	+	+	+	+	.	.	.	+	.	.	+	.	.	.	.
<i>Brachypodium sylvaticum</i>	.	.	.	.	.	.	+	.	+	.	.	.	+	.	.	.
<i>Leucojum vernum</i>	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.
<i>Scrophularia nodosa</i>	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.
<i>Sanicula europaea</i>	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.
<i>Allium ursinum</i>	.	.	3	5	.	.	.	.	.	.	.	.	.	1	.	.
<i>Epilobium montanum</i>	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.
<i>Euphorbia dulcis</i>	.	.	.	.	+	+	+	.	.	.	+	.	.	+	.	.
<i>Viola reichenbachiana</i>	.	.	+	+	.	.	.	.	.	.	+	+	.	.	.	.
<i>Epipactis helleborine</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Corydalis bulbosa</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
<i>Hordelymus europaeus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ranunculus ficaria</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Neottia nidus-avis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Asarum europaeum</i>	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Festuca altissima</i>	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	
.	.	+	.	+	.	.	.	+	+	+	1	.	.	+	.	.	+	.	.	.	.
.	+	.	.	.	+	+	+	
.	1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	3	.	.
.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	1	1	.	.	.	.	.
.	2	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
.	
.	+	
.	+	
5	5	5	4	5	3	4	2	5	5	5	5	5	5	5	5	5	5	5	5	5	4	
1	2	1	1	2	+	+	2	2	2	3	1	3	2	+	2	1	2	+	1	1	1	
+	+	2	1	1	+	+	+	+	+	+	3	+	3	1	1	+	+	1	1	+	1	
.	.	+	+	+	+	+	+	.	+	
.	+	.	
.	1	.	
.	.	+	+	1	+	.	2	+	+	.	+	1	+	1	+	.	
.	.	.	+	+	+	+	+	+	+	.	.	+	+	+	.	.	.	
2	3	2	1	1	1	1	.	2	2	3	3	1	2	1	+	2	2	2	1	+	+	
+	1	1	+	2	+	1	1	.	+	+	+	.	.	+	+	+	1	1	.	+	+	
+	+	.	2	+	1	1	1	.	.	1	1	1	+	+	2	+	1	2	2	+	+	
+	.	+	.	+	+	+	+	+	+	.	.	+	+	+	.	+	.	+	.	+	+	
.	.	2	.	+	+	+	.	+	+	+	+	.	.	+	.	+	.	1	+	+	+	
+	+	+	+	+	+	+	.	+	+	+	+	+	+	.	.	.	+	.	.	+	+	
.	.	+	+	+	.	+	.	+	+	+	.	+	+	1	+	.	+	+	+	+	+	
+	.	.	1	+	.	1	.	+	1	.	2	.	1	.	+	+	+	
.	.	+	+	+	.	.	.	+	+	.	+	+	+	+	+	+	.	+	+	+	.	
.	+	.	2	+	+	+	+	+	+	.	+	.	.	
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Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Carpino-Fagetea															
<i>Acer pseudoplatanus</i>	a1	1	.	.	3	1	.	+	1	2	.
<i>Acer pseudoplatanus</i>	a2	+	.	.	.	+	.	+	.	.	+	.	+	2	+
<i>Acer pseudoplatanus</i>	b	.	+	.	.	+	+	.	+	+	+	+	+	2	+
<i>Acer pseudoplatanus</i>	c	.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Acer platanoides</i>	a1	2	.	.	+	2	.	.	.	.	.	.	.	.	.
<i>Acer platanoides</i>	a2	.	.	.	.	1	.	.	.	.	.	.	.	.	.
<i>Acer platanoides</i>	b	.	+	.	.	+	.	+	.	+	.	.	.	+	.
<i>Ulmus glabra</i>	a1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ulmus glabra</i>	a2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ulmus glabra</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Abies alba</i>	a1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Abies alba</i>	a2	.	.	.	.	.	+	.	.	.	.	.	.	.	.
<i>Abies alba</i>	b	.	.	.	.	.	+	1	.	.	.	.	.	1	1
<i>Carpinus betulus</i>	a2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carpinus betulus</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lonicera xylosteum</i>	.	.	.	.	.	.	+	+	.	+	.	+	.	+	+
<i>Euonymus latifolius</i>	+	.	+	.	.	+	.	.	.	.	.	.	.	+	+
<i>Rosa arvensis</i>	.	.	.	.	.	+	+	.	+	.	+	.	.	.	.
<i>Prunus avium</i>	.	+	.	.	.	.	.	.	.	.	.	+	.	+	.
<i>Acer campestre</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sorbus aria</i>	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Euonymus verrucosus</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Anemone nemorosa</i>	c	.	.	1	2	1	1	1	1	2	1	.	1	2	+
<i>Arum maculatum</i>	+	.	+	+	+	+	+	.	+	+	.	+	+	+	+
<i>Hedera helix</i>	.	+	+	+	+	.	.	.	.	.	.	.	+	.	.
<i>Polystichum aculeatum</i>	+	.	+	.	.	.	.	.	.	.	.	.	2	.	.
<i>Symphytum tuberosum</i>	.	.	.	.	.	+	.	.	.	+	+	.	+	.	.
<i>Glechoma hirsuta</i>	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.
<i>Stellaria nemorum</i>	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Luzula luzuloides</i>	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.
<i>Polystichum setiferum</i>	1	.	2	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cephalanthera damasonium</i>	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.
<i>Polygonatum verticillatum</i>	.	.	.	.	.	.	+	1	+	1	.	.	.	.	+
<i>Aruncus dioicus</i>	+	.	.	.	.	+	.	.	.	.	.	.	+	.	.
<i>Dryopteris dilatata</i>	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
<i>Galium sylvaticum</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Milium effusum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lunaria rediviva</i>	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hepatica nobilis</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Melica uniflora</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.
<i>Adoxa moschatellina</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Aconitum lycoctonum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
<i>Carex digitata</i>	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.
<i>Phegopteris connectilis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Luzula sylvatica</i>	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Stachys sylvatica</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vaccinio-Piceetea															
<i>Picea abies</i>	a2	.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Picea abies</i>	b	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
<i>Oxalis acetosella</i>	c	.	.	+	+	.	.	.	+	.	+	.	+	.	.	+
Quercetea pubescentis																
<i>Fraxinus ornus</i>	b	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cornus mas</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Acer obtusatum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Tamus communis</i>	c	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Festuca heterophylla</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Mercurialis ovata</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erico-Pinetea																
<i>Genista januensis</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
<i>Carex alba</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Epilobietea angustifolii																
<i>Senecio ovatus</i>	c	+	.	+	.	+	+	.	+	+	+	.	+	+	+	.
<i>Heracleum sphondylium</i>	.	.	.	.	+	.	+	+	+	+	+	.	.	+	+	+
<i>Geranium robertianum</i>	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Urtica dioica</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Myosotis sylvatica</i>	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+
<i>Impatiens noli-tangere</i>	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Geranium phaeum</i>	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Alliaria petiolata</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Salvia glutinosa</i>	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Silene dioica</i>	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	+
<i>Anthriscus sylvestris</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+
<i>Petasites albus</i>	.	.	.	.	.	.	.	.	+	.	1	.	.	.	.	.
<i>Geum urbanum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lamium maculatum</i>	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
<i>Atropa bella-donna</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Aegopodium podagraria</i>	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Glechoma hederacea</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Hypericum hirsutum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Eupatorium cannabinum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Fragaria vesca</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhamno-Prunetea																
<i>Sorbus aucuparia</i>	a2	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+
<i>Sorbus aucuparia</i>	b	.	.	.	.	.	.	.	+	+	2	.	.	+	+	+
<i>Rubus hirtus</i>	.	.	2	+	+	+	+	+	+	+	+	+	+	.	.	+
<i>Corylus avellana</i>	.	.	+	.	.	+	+	.	.	+	.	+	.	+	+	.
<i>Solidago virgaurea</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Robinietea																
<i>Sambucus nigra</i>	b	+	+	+	+	+	1	.	.	.	+	+	+	+	+	+
<i>Clematis vitalba</i>	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Sambucus racemosa</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rubus idaeus</i>	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+
Trifolio-Geranietea																
<i>Potentilla micrantha</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Laser trilobum</i>	.	.	.	.	.	.	.	.	+	+	.	.	.	.	+	.
<i>Veronica chamaedrys</i>	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Melampyrum pratense</i>	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Tanacetum corymbosum</i>	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.

Relevé No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mulgedio-Aconitetea															
<i>Phyteuma ovatum</i>	c	.	.	.	+	.	+	.	.	.	.	+	+	.	.
<i>Doronicum austriacum</i>	.	.	.	.	.	.	.	+	.	+	+	.	.	.	.
<i>Saxifraga rotundifolia</i>	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Thalictrum aquilegifolium</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
<i>Veratrum album</i>	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Festuco-Brometea															
<i>Veronica austriaca</i>	c	.	.	.	.	.	.	.	.	.	.	+	.	.	.
<i>Dorycnium germanicum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carex flacca</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Listera ovata</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Molinio-Arrhenatheretea															
<i>Platanthera bifolia</i>	c	.	+	.	.	.	.	.	.	.	.	+	.	.	.
<i>Gentiana asclepiadea</i>	.	+	.	.	+	.	.	.	.	.	.	+	+	.	.
Asplenetea trichomanis															
<i>Asplenium scolopendrium</i>	c	1	.	+	+	.	.	.	.	.	.	.	.	.	.
<i>Polypodium vulgare</i>	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Asplenium trichomanes</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Other species															
<i>Polystichum lonchitis</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Chrysosplenium alternifolium</i>	c	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Pteridium aquilinum</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Veronica officinalis</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rubus</i> sp.	c	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Solanum dulcamara</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Festuca</i> sp.	c	.	.	.	.	.	.	.	.	.	.	.	.	1	.

Legend: a1 – High tree layer, a2 – Middle tree layer, b – Shrub layer, c – Herb layer.

Coordinates of the relevés:

1 45.756343 15.5842277; **2** 45.7461051 15.6005391; **3** 45.7655307 15.5873577; **4** 45.7555467 15.58626;
5 45.7466483 15.5993583; **6** 45.758022 15.335857; **7** 45.758885 15.332405; **8** 45.754593 15.326137;
9 45.754607 15.32661; **10** 45.753555 15.319015; **11** 45.725893 15.36985; **12** 45.7608788 15.3679925;
13 45.7585968 15.3355357; **14** 45.7594223 15.3320524; **15** 45.7546332 15.3269713; **16** 45.7536615 15.3274339;
17 45.7543532 15.3194783; **18** 521 45.8201543 15.5186086; **19** 521 45.8197857 15.5191784;
20 521 45.8192367 15.5206333; **21** 521 45.8195734 15.5201301; **22** 521 45.8168468 15.5139762;
23 521 45.8164123 15.5142639; **24** 45.7907867 15.40765; **25** 45.7876567 15.411285; **26** 45.79328 15.4151583;
27 45.796175 15.415975; **28** 45.7751867 15.4383017; **29** 45.7753617 15.4383383; **30** 45.7646681 15.3828233;
31 45.7909205 15.4047275; **32** 45.7879779 15.4109376; **33** 45.7939337 15.4145938; **34** 45.795331 15.4174931;
35 45.7753861 15.4408889; **36** 45.7495459 15.6098554; **37** 45.7496806 15.608772.

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
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