

PHYTOSOCIOLOGICAL CHARACTERISTICS OF *QUERCUS CERRIS* L. FORESTS IN EAST SLAVONIA (CROATIA)

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Abstract

The following paper reports on the results of phytosociological research on Slavonian *Quercus cerris* forests in the woodlands of Zokovica – Đakovo and Cerik – Vučevci near Đakovo. 20 relevés were recorded in accordance with the Braun-Blanquet classical method. The relevés were set against the already published relevés of thermophilous forests of *Carpino betuli-Quercetum roboris quercetosum cerris* from the area of east Slavonia, and numerical analysis was performed. The studied *Quercus cerris* forests had developed through anthropogenic degradation of the association *Carpino betuli-Quercetum roboris quercetosum cerris* or *Carpino betuli-Quercetum roboris typicum*. Both of these stages of degradation have not been phytosociologically studied enough and have not received a defined syntaxonomic status. Conditions of the habitat have changed so much in a degraded ass. *Carpino betuli-Quercetum roboris quercetosum cerris*, that urgent efforts ought to be put into the attempt to reintroduce *Quercus robur* into the stands. These stands are described as an association of *Aceri campestri-Quercetum cerris* ass. nova. It would require far less work to reintroduce the *Quercus robur* into degraded forests of association *Carpino betuli-Quercetum roboris typicum*, where habitat conditions have not been changed to a greater extent.

Izveček

V prispevku so prikazani rezultati fitocenoloških raziskav gozdov cera (*Quercus cerris*) v Slavoniji (Zokovica – Đakovo Cerik – Vučevci pri Đakovu). Naredili smo dvajset popisov po standardni Braun-Blanquetovi metodi in jih, tudi na podlagi numeričnih analiz, primerjali z že objavljenimi popisi termofilnih gozdov asociacije *Carpino betuli-Quercetum roboris quercetosum cerris* iz vzhodne Slavonije. Cerovi gozdovi so nastali zaradi degradacije sestojev asociacije *Carpino betuli-Quercetum roboris quercetosum cerris* oziroma *Carpino betuli-Quercetum roboris typicum*. Do sedaj ti degradacijski stadiji niso bili dovolj proučeni in sintaksonomsko opredeljeni. Rastiščne razmere v degradiranih sestojih asociacije *Carpino betuli-Quercetum roboris quercetosum cerris* so se zelo spremenile in zato le težko ponovno uvedemo dob. Te sestoje smo opisali kot *Aceri campestri-Quercetum cerris* ass. nova. Znatno manj težav bo pri ponovni naselitvi vrste *Quercus robur* v degradirane gozdove asociacije *Carpino betuli-Quercetum roboris typicum*, kjer rastiščne razmere niso tako spremenjene.

Key words: *Quercus cerris* forests, vegetation, *Aceri campestri-Quercetum cerris*, Slavonia, Croatia

Ključne besede: gozdovi cera, vegetacija, *Aceri campestri-Quercetum cerris*, Slavonija, Hrvatska

1. INTRODUCTION

The most widespread phytocoenoses that can be found in the woodlands of Zokovica – Đakovo and

Cerik – Vučevci occur in the forests of associations *Carpino betuli-Quercetum roboris quercetosum cerris*, and *Carpino betuli-Quercetum roboris fagetosum*. Furthermore, the area of Zokovica – Đakovo shows the

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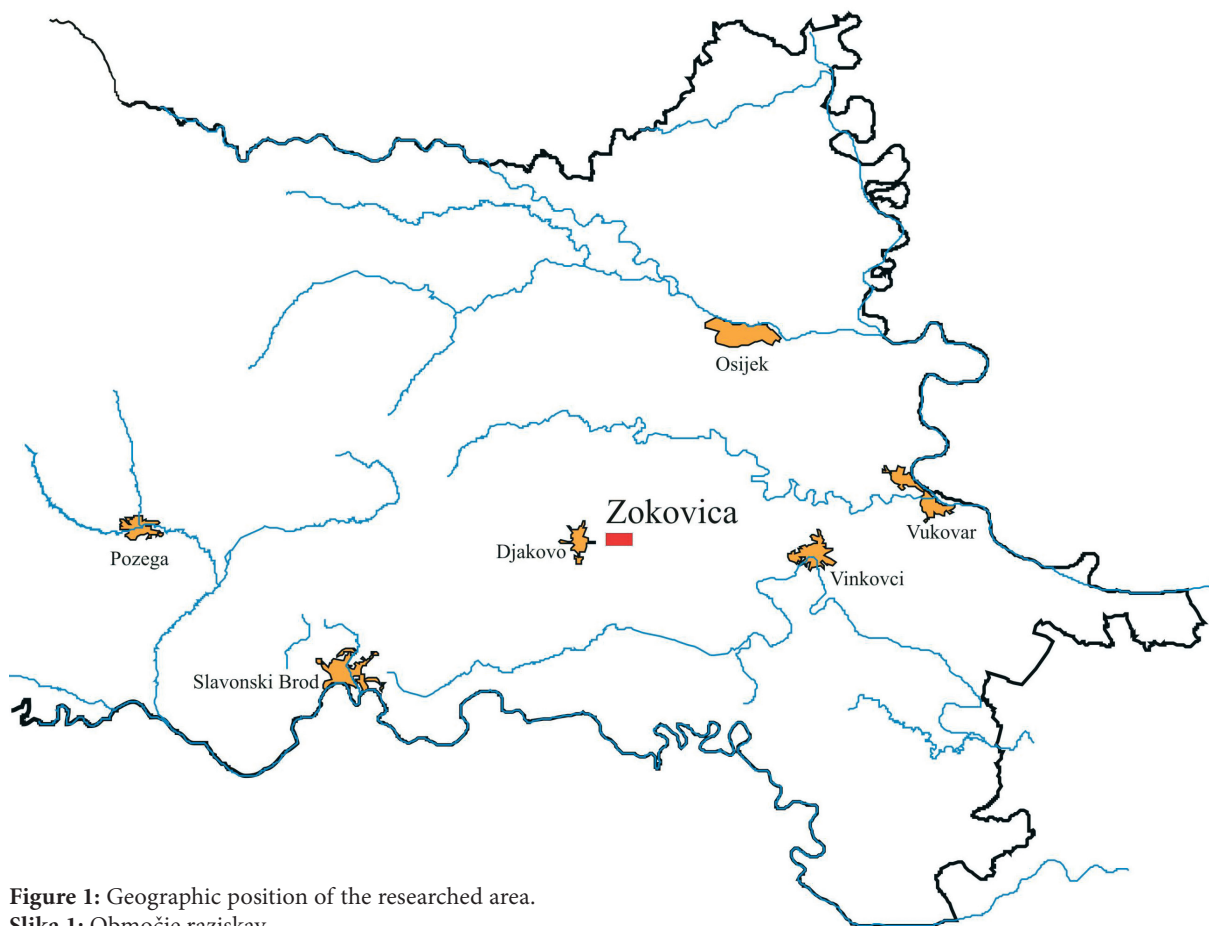


Figure 1: Geographic position of the researched area.
Slika 1: Območje raziskav.

presence of the association *Epimedio-Carpinetum betuli*. As stated by Rauš (1976), this woodland area lies on the east edge of this community's cover range – "It is our belief that we have answered the question posed by our eminent explorer I. Horvat in 1938 and determined the east frontier in the expansion of *Quercus-Carpinetum* – it lies on the Jošava creek, while Đakovačka Zokovica is the last woodland area covered by Croatian forest of Sessile oak and hornbeam". For this reason, he proposed that this woodland area be protected by law as a reserve of forest vegetation.

Ecological conditions of the habitat

The major part of the researched area stretches over the Đakovo Plain which is triangular in shape. It is 35 km long, and its base is 15 km wide. Average elevation is 111 m, which makes it 10 – 20 m higher than the surrounding plain. Northwards, the ground recedes down toward the Vuka valley, and toward the valley of the Bosut in the south. The whole Đakovo Plain is composed of loess (15 – 24 m

in width), while its base is composed of Pleistocene wetlands and older Neogene sediments (clays, sands and marl). Generally speaking, three types of geological base can be found – continental loess (Qpk), wetland loess (Qpm), and alluvial sediments (Qal). The geological base of Zokovica – Đakovo woodlands is composed of continental loess.

The climatic conditions of the area are shown in records collected by Osijek meteorological station for the 1961 – 1990 period. According to them, the average annual temperature is 10.8 °C, while the average annual precipitation amounts to 651 mm. The average annual relative humidity is 79 %. According to Köppen's classification of climates, the climate of this area belongs to the type denoted by a Cfbw"x" climatic formula. This is a temperate and warm rainy climate without a drought period; precipitation is evenly distributed throughout the year, with winter being its driest period. Summers are warm, and winters moderately cold with a sudden rise in temperature in the first part of the year (Seletković & Katušin 1992).

There are no considerable natural streams in the area encompassed by this management unit. Two small rivers flow through it – the Vuka and the Jošava. The Jošava flows through the northern fringe of the Zokovica – Đakovo forest district, separating it from the Cerik – Vučevci district. By raising embankment at the Jošava, a lake bearing the same name was formed – it is situated at the edge of the explored area.

The larger part of the researched area is situated in a lowland area where, as climate – zonal communities, they occur on beams and drier parts of association *Carpino betuli-Quercetum roboris quercetosum cerris*, together as in forests association *Carpino betuli-Quercetum roboris fagetosum*. Lower and wetter terrains are occupied by communities of *Genisto elatae-Quercetum roboris aceretosum tatarici* and *Genisto elatae-Quercetum roboris caricetosum remotae*.

2. MATERIAL AND METHODS

Studies of the vegetation were carried out in more than one turn during the 2001 – 2004 period, in

the area of Đakovo Forestry Station – or more precisely, in “Đakovački lugovi i gajevi” production unit, in the woodlands of Zokovica – Đakovo (142.45 ha) and Cerik – Vučevci (123.10 ha). This production unit covers the area between 18°12’ and 18°33’ east longitudes and 45°15’ and 45°28’ north latitudes. Forests of this production unit are spread out among approximately twenty separate forest sectors of 2–83 ha in size, and represent enclaves within farmlands. A northeastern part of the production unit expands along the temperate east slopes of Krndija, while the rest extends over the lowlands.

A total of 20 relevés were recorded and comparison was made with the published relevés of thermophilous forests of the association *Carpino betuli-Quercetum roboris quercetosum cerris* (Rauš 1976, 1980; Rauš et al. 1985) from the area of east Slavonia.

Relevés were recorded and analysed in accordance with the classical Braun-Blanquet method (1964). Numerical analysis was performed by using a SYN-TAX 2000 package, which is normally used for multivariate analyses in taxonomy and synecol-

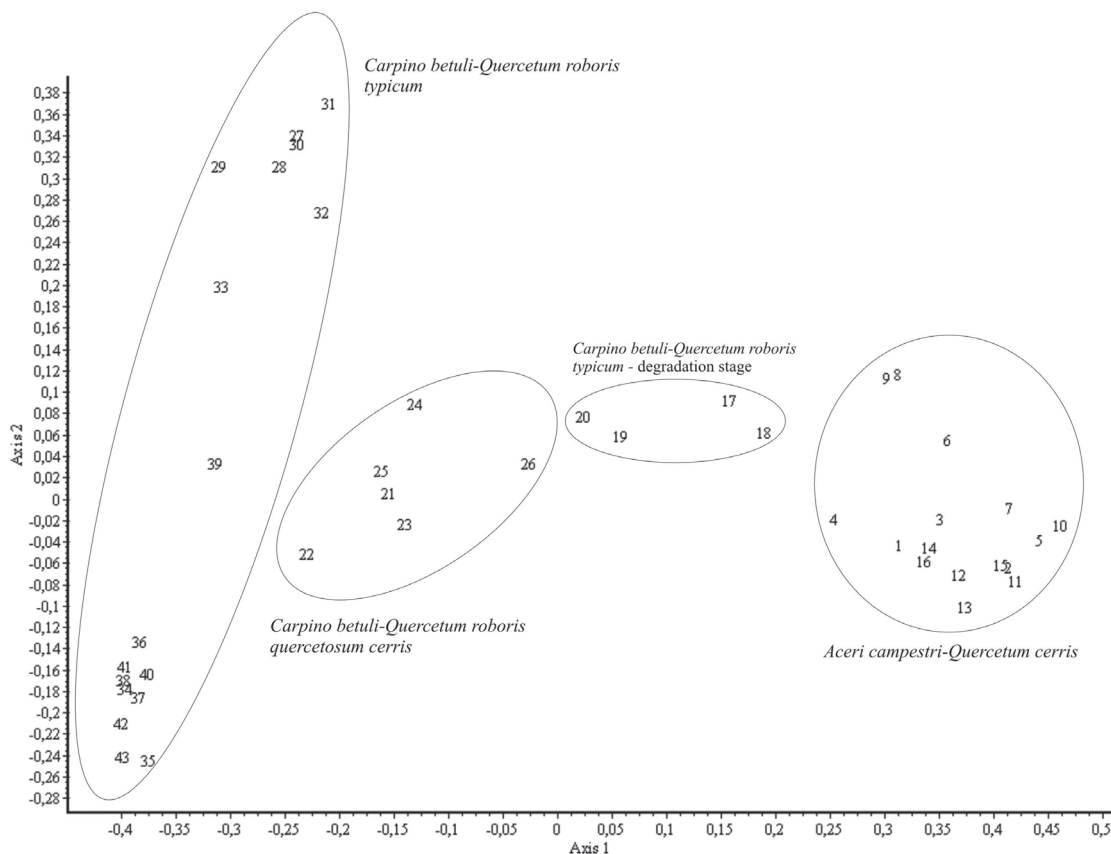


Figure 2: Multidimensional scaling of the relevés.

Slika 2: Većrazsežnostno skaliranje popisnega gradiva.

ogy (Podani 2001). During the process, Braun-Blanquet's combined scale was transformed into the van der Maarel's ordinal scale (cf. Van der Maarel 1979).

SYNTAXONOMY

Quercus-Fagetea Br.-Bl. et Vlieger ex Vlieger 1937

Fagetalia sylvaticae Pawlowski in Pawlowski et al. 1928

Carpinion betuli Isller 1931

Lonicero caprifoliae-Carpinenion betuli Vukelić 1990

Carpino betuli-Quercetum roboris typicum Rauš 1969

Carpino betuli-Quercetum roboris quercetosum cerris Rauš 1969

Aceri campestri-Quercetum cerris Franjić, Škvorc, Filipović et Vitasović Kosić ass. nova

3. RESULTS AND DISCUSSION

Since the new relevés (Tab. 1) show the state of east Slavonia's *Quercus cerris* forests that had developed as a result of degradation of *Quercus robur* forests, for the sake of comparison, the already published relevés of these forests from the area of east Slavonia were analysed (Rauš 1976, 1980; Rauš et al. 1985). Furthermore, four relevés were recorded in the stands that occur in the immediate vicinity of the studied *Quercus cerris* forests and show prevalence of *Carpinus betulus*. Based on the research conducted and results obtained, it is generally known and accepted that the *Quercus cerris* forests of east Slavonia had developed through degradation of thermophilous association *Carpino betuli-Quercetum roboris quercetosum cerris* Rauš 1969, in the area where *Quercus robur* is found at its highest altitudes. These forests have not lost their mesophilous character completely, and foster a series of species characteristic of alliance *Carpinion betuli* Isller 1931 (*Acer campestre*, *Carpinus betulus*, *Prunus avium*, *Stellaria holostea*, etc.), which differentiates them from other *Quercus cerris* forests of the forest-steppe region of alliance *Aceri tatarici-Quercion* Zólyomi 1957 (cf. Borhidi 2003).

In other parts of Croatia, Turkey oak forest also occurs in the mountainous parts of the Pannonian Region, but here, they occur through degradation of *Quercus petraea* or *Q. pubescens* forests. A similar situation can be seen in other parts of the Pannonian Plain where *Quercus cerris* forests may occur as

a result of degradation of thermophilous oak forests of the forest-steppe region (Jovanović & Mišić 1980, Stefanović 1986, Wallnöfer et al. 1993). These forests are of an also ambiguous syntaxonomic status, due to the undefined taxonomic status of the *Quercus* species in the area. Thus, for example, Wallnöfer et al. (1993) includes these forests into a broad ass. *Aceri tatarici-Quercetum roboris* Z lyomi 1957 and into an alliance *Aceri tatarici-Quercion* Zólyomi 1957, while Borhidi (2003) cites a large number of more restrictedly conceived associations that he includes in the same alliance.

The results obtained from the statistical analysis show that newly studied relevés of *Quercus cerris* and *Carpinus betulus* forests confirm their clear dissociation from a *Carpino betuli-Quercetum roboris typicum* forest and *Carpino betuli-Quercetum roboris quercetosum cerris* (cf. Fig. 2; Rauš 1976, 1980; Rauš et al. 1985) found in the vicinity of the explored area.

This type of *Quercus cerris* forests represents a relatively stable and clear stage of degradation of *Quercus robur* forests that will be rather difficult to introduce into the *Quercus robur* forest, since the whole series of mesophilous elements of a *Quercus robur* forest have been lost (*Quercus robur*, *Fraxinus angustifolia*, *Carpinus betulus* – in much smaller numbers, etc), indicating that significant changes of habitat have taken place. Maybe it would be easier to render these forests into those of *Epimedio-Carpinetum betuli*, since similar types of forest can be found in the immediate vicinity. For the reasons of the sensitive habitat and aggressiveness of *Quercus cerris*, great care will be required in carrying out certain of the cultivation procedures.

Since we are dealing with a relatively stable degradation stage, it is only just that such forests be given a defined syntaxonomic status. As this is no longer a *Carpino betuli-Quercetum roboris quercetosum cerris* forest (relevés show almost no evidence of *Quercus robur*; cf. Tab. 1), and since there have been significant changes both in habitat and floristic structure, we can no longer talk about a subassociation *Carpino betuli-Quercetum roboris quercetosum cerris*. Here, we are dealing with a stable stage of degradation that is able to sustain itself as such without human intervention, and whose future will be dominated by *Quercus cerris*, since habitat conditions are such that no other species would be able to suppress it. Taking into account that these stands represent a permanent stage of degradation, and considering the relative number of similar examples in literature (Marinček & Šilc 1999), they are described as ass. *Aceri campestri-Quercetum*

cerris Franjić, Škvorc, Filipović et Vitasović Kosić ass. nova.

With regard to its floristic composition, the community was classified into the alliance of *Carpinion betuli*. The nomenclature type of the community *Aceri campestri-Quercetum cerris* is the relevé number 14 in Table 1 (*Holotypus hoc loco*: Table 1/14).

A similar situation can be seen regarding degradation of a *Carpino betuli-Quercetum roboris typicum*, only with the difference that the conditions here are much more mesophilous and the reintroduction of *Quercus robur* is relatively easier than in the previous case. Here, *Carpinus betulus* is extremely aggressive, and without human influence, it is likely to stay in the area for a very long time (it also represents a relatively stable ecosystem without a syntaxonomic status). Since there are no differentiating species in relation to a *Carpino betuli-Quercetum roboris typicum* forest in this stage of degradation (with the exception of the *Quercus robur*), it is regarded that more significant changes of habitat have not taken place and that *Quercus robur* can be reintroduced into the habitat far more easily than in the last case. Based on these studies, it is believed that this form of vegetation does not have to be given a special syntaxonomic status.

4. CONCLUSIONS

The most recent phytosociological research of east Slavonian *Quercus cerris* forest in the woodlands of Zokovica – Đakovo and Cerik – Vučevci confirms that the studied *Quercus cerris* forest has grown through degradation of thermophilous *Carpino betuli-Quercetum roboris quercetosum cerris* forests, in a manner in which the uncontrollable deforestation has led to disappearance of the *Quercus robur*, while *Quercus cerris*, being more aggressive, survived and now makes the majority of the stand. Similar results were obtained in research of the ass. *Carpino betuli-Quercetum roboris typicum*, with the difference that degradation of such forests results in the occurrence of predominantly (or almost predominantly) *Carpinus betulus* forests. Based on the conducted research, it was established that habitat conditions in a degraded *Carpino betuli-Quercetum roboris* have changed so much that great efforts should be undertaken in order for the *Quercus robur* to return into those stands, while the reintroduction of the *Quercus robur* into a *Carpino betuli-Quercetum roboris typicum* forest would go more easily. Therefore, a degradation stage of

the *Carpino betuli-Quercetum roboris quercetosum cerris* has been given a special syntaxonomic status – ass. *Aceri campestri-Quercetum cerris* ass. nova.

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Table 1: Relevés of studied *Quercus cerris* forests
Tabela 1: Popisno gradivo obravnavanih gozdov s cerom

No. reléve:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Date:	8.2001.																			
Compartment:	83a 83a 83a 83a 83b 83b 83a 83a 83a 83b 83b 83b 83b 83b 83b 83b 83b 83a 88b 88b 88b 88b																			
Area (m ²):	500 500 500 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000																			
Altitude (m):	100-110																			
Exposition:	-																			
Inclination (°):	-																			
No. of species:	23	16	21	16	19	28	23	26	20	23	18	33	23	30	22	23	18	24	48	45
	Aceri campestri-Quercetum cerris										Carpino betuli-Quercetum roboris typicum - degradation stage									
	4.2002.										5.2004.									
	8.2001.										8.2001.									
	Z										S									
	0-5										5									
Char. Ass. <i>Aceri campestri-Quercetum cerris</i>																				
A1 <i>Quercus cerris</i>	4	4	4	2	5	4	5	4	2	4	4	4	4	4	4	4	4	4	4	3
Acer campestre	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
A2 <i>Acer campestre</i>	.	1	+	+	+	+	+	1	1	2	1	+	.	.	.	.	.	.	.	.
<i>Quercus cerris</i>	.	+	+	.	.	+	.	+	.	.	+	.	.	+	+	.	.	.	.	.
B <i>Acer campestre</i>	2	2	2	1	2	2	1	2	4	3	3	1	1	1	1	1	2	2	+	+
<i>Quercus cerris</i>	+	+	.	+	.	.	.	.	.	.	.	+	+	.	+	.	+	.	.	.
C <i>Quercus cerris</i>	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	+
Char. All. <i>Carpinion betuli</i>																				
A1 <i>Carpinus betulus</i>	.	.	.	3	.	.	.	.	3	.	.	.	.	.	.	1	1	5	5	5
<i>Prunus avium</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A2 <i>Carpinus betulus</i>	1	+	+	1	2	1	+	1	1	+	1	3	3	2	2	1	+	.	+	.
<i>Prunus avium</i>	+	.	+	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Quercus robur</i>	.	.	+	+	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.
B <i>Carpinus betulus</i>	1	1	+	1	2	2	2	+	+	+	1	3	2	2	2	3	1	1	+	.
<i>Prunus avium</i>	+	+	.	+	+	+	+	+	+	+	+	+	.	+	+	+	+	+	+	+
C <i>Stellaria holostea</i>	+	+	+	+	+	+	.	.	.	.	.	+	+	+	.	+	+	.	.	1
<i>Ranunculus ficaria</i>	.	.	.	.	1	1	1	+	+	.	+	.	.	+	+	+	.	+	+	+
<i>Vinca minor</i>	.	.	+	.	.	+	.	4	.	.	.	.	.	.	.	+	.	.	.	.
<i>Carex digitata</i>	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carpinus betulus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

No. reléve:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Date:	8.2001.																				
Compartment:	83a 83a 83a 83a 83a 83a 83a 83a 83a 83a 83b 83b 83b 83b 83b 83b 87b 87b 83a 88b 88b 88b 88b																				
Area (m²):	500 500 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 1000 500 500 1000 1000																				
Altitude (m):	100-110																				
Exposition:	Z																				
Inclination (°):	0-5																				
No. of species:	23	16	21	16	19	28	23	26	20	23	18	33	23	30	22	23	18	24	48	45	
<i>Asarum europaeum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Carex sylvatica</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Corydalis solida</i>	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Galium odoratum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Leucopodium vernum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Pulmonaria officinalis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Tamus communis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Viola reichenbachiana</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Cruciata glabra</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Dentaria bulbifera</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Primula vulgaris</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Allium ursinum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Mercurialis perennis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Moehringia trinervia</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Stachys sylvatica</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Lathyrus niger</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Potentilla micrantha</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Acer tataricum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Geranium phaeum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Veronica chamaedrys</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Comp.																					
A1 <i>Tilia tomentosa</i>	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A2 <i>Tilia tomentosa</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B <i>Ruscus aculeatus</i>	1	+	+	+	1	+	+	+	+	+	.	+	+	+	+	+	+	+	+	+	
<i>Tilia tomentosa</i>	+	.	+	+	+	+	.	+	+	+	+	+	.	.	+	+	.	.	.	+	

<i>Rubus fruticosus</i>	+	+	+	+					1						+		+	·
<i>Sambucus nigra</i>	·	·	·	·	·										+		+	·
<i>Rosa</i> sp.	+	·	·	·	·				+						+		+	·
C <i>Galium aparine</i>	·	+	+	+	+				+						+		+	1
<i>Veronica hederifolia</i>	·	·	·	·	·				2	2	3	2	2	+	+		+	+
<i>Geranium robertianum</i>	+	+	+	+	1				2	2	+	+	+	+			+	+
<i>Alliaria petiolata</i>	+	·	·	·	·				·	·	·	·	·	·			·	·
<i>Viola hirta</i>	·	·	·	·	·				·	·	·	·	·	·			·	·
<i>Galeopsis tetrahit</i>	·	·	·	·	·				·	·	·	·	·	·			·	·
<i>Lamium maculatum</i>	·	·	·	·	·				·	·	·	·	·	·			·	·
<i>Stellaria media</i>	·	·	·	·	·				·	·	·	·	·	·			·	·
<i>Calystegia sepium</i>	·	·	·	·	·				·	·	·	·	·	·			·	·
<i>Circaea lutetiana</i>	·	·	·	·	·				·	·	·	·	·	·			·	·

1: *Lysimachia nummularia* (+); 19: *Heracleum sphondylium* (+), *Prunella vulgaris* (+); 19, 20: *Ajuga reptans* (+).