

***CARICI REMOTAE-FRAXINETUM* KOCH 1926 EX FABER 1936 IN OPOLE SILESIA**

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**ABSTRACT:** Submontane riverside carr forest *Carici remotae-Fraxinetum* belongs to the rarest wood communities and occupies the smallest area in the Opole Silesia region. It is supposed to be a retreating plant association within the region. Therefore, during 2008-2010 geobotanical studies were undertaken to present the current distribution and conservation status of the *Carici remotae-Fraxinetum* association in Opole Silesia.

The study was carried out by using the Braun-Blanquet method in the southern part of the region, mainly in the Opawskie Mountains and on the Głubczyce Plateau. Occurrence of 11 patches of this plant community on the Chrobry Mount (Przednia Kopa), on the northern slopes of Olszak Hill, in the Bystry Potok valley and in the upper parts of the Biskupia Kopa (Opawskie Mountains), as well as in the Rozumice Nature Reserve in south-eastern part of the Głubczyce Plateau were noticed.

The *Carici remotae-Fraxinetum* association was recorded primarily at water tricklings or water-head areas of the small brooks. The community is characterized by the dominance of *Fraxinus excelsior* in the tree-stand. It is also a significant share of *Acer pseudoplatanus*. Additionally, *Picea abies*, *Betula pendula*, *Fagus sylvatica*, *Ulmus glabra* and *Acer platanoides* were observed. In the undergrowth, numerous species considered as characteristic for the studied association were noticed, e.g.: *Carex remota*, *Equisetum telmateia*, *Carex pendula*, *Carex strigosa*, *Veronica montana*. High constancy have *Oxalis acetosella*, *Circaea lutetiana*, *Mercurialis perennis*, *Galeobdolon luteum*, *Carex sylvatica*, *Aegopodium podagraria*, *Dryopteris carthusiana*, *Senecio ovatus* and *Petasites albus*.

**KEYWORDS:** *Carici remotae-Fraxinetum*, mountain vegetation, endangered phytocoenoses, Opawskie Mountains.

### **Introduction**

The submontane ash wood *Carici remotae-Fraxinetum* is one of the most interesting forest communities within Opole Silesia. That is because the regional range of the phytocoenosis is relatively small and also due to long lasting anthropogenic pressure and forest management causing considerable changes in species composition, cover and extension of the association. The human impact is mainly responsible for listing of *Carici remotae-Fraxinetum* amongst the retreating plant association in Opole Silesia (Nowak and Nowak 2008).

It is a species-rich association with apparent predominance of *Fraxinus excelsior* and *Acer pseudoplatanus* in the tree layer. The shrub layer consists mainly of *Corylus avellana*, *Euonymus europaea* and *Fraxinus excelsior*. The species-rich undergrowth is dominated by plants typical for fertile deciduous woods, i.e.: *Chaerophyllum hirsutum*, *Equisetum telmateia*, *Impatiens noli-tangere*, *Allium ursinum* and *Petasites albus*. *Carex remota*, *Circaea intermedia*, *Equisetum telmateia* and *Rumex sanguineus* are considered to be characteristic taxa for this association. As differential species *Carex pendula*, *Carex strigosa*, *Chrysosplenium oppositifolium* and *Veronica montana* were proposed (Pott 1995; Matuszkiewicz W. 2001).

The phytocoenosis develops on fertile and wet soils. The average ground water level is ca. 60 cm beneath terrain surface. It often develops alongside water tricklings or small brooks which could disappear during the dry period (Matuszkiewicz W. 2001). Until now, the *Carici remotae-Fraxinetum* association has been reported in Poland from the Sudetes Mts.: the Śnieżnik Kłodzki Massif (Fabiszewski 1968), the Opawskie Mts. (Kuczyńska 1972, 1973), the Karkonosze Foreland (Kuczyńska and Berdowski 1976; Świerkosz 1994), the Kaczawskie Foothills (Kwiatkowski 2001), from the Rozumice Nature Reserve in the Głubczyce Plateau (Celiński and Wika 1974-1975), and from the Carpathians range: the Beskid Śląski Mts. (Wilczek 1995; Wilczek and Cabała 1989), the Strzyżowskie Foreland (Towpasz 1990) and the Wielickie Foreland (Stachurska 1998). *Carici remotae-Fraxinetum* has been also noticed in the Silesian and the Małopolska Uplands (Cabała 1990; Hereźniak 1993). Some lowlands stations of this association have been also documented in the northern part of Poland (Celiński 1962; Tokarz 1961; Brzeg and Wojterska 1996).

It is assumed that in Poland this forest type covers an area of some 5,4 km<sup>2</sup> (Matuszkiewicz J.M. 2001; Pawlaczyk 2004). The association of *Carici remotae-Fraxinetum* occupies slopes and small river valleys with inclinations between 5 and 35% (ca. 20% on average), variously exposed but mostly NW, N and NE, and also S, SW, SE, at altitudes between 50-900 m a.s.l. (ca. 500 on average; Matuszkiewicz J.M. 2001; Pawlaczyk 2004).

The *Carici remotae-Fraxinetum* association was reported from Opole Silesia as a result of geobotanical works conducted between 1970-1975. Therefore, the main goal of the study was to describe the present condition of this forest community in the region.

### **Methods**

The geobotanical studies were conducted in the southern part of the Opole Silesia region within the area of the most different geomorphology and relatively high elevation: the

Głubczyce Plateau (Silesian Lowland) and the Opawskie Mts. (eastern Sudetes) (Fig. 1). Studies were carried out in 2008-2010. As phenological aspects were also considered in the fieldwork, basic investigations were conducted from June to August. Generally, six sites and eleven vegetation plots with submontane ash forests were sampled using the phytosociological Braun-Blanquet approach (1964). The species nomenclature follows Mirek et al. (2002). The syntaxonomical classification was done according to Matuszkiewicz W. (2001).

## Results

The researches confirm the presence of the *Carici remotae-Fraxinetum* association within the southern part of Opole Silesia. Six sites of this phytocenosis were found, five of them located in the Opawskie Mts. near Głuchołazy in the Sarni Potok (Stream) valley, in Jarnołówek - on the northern slopes of Olszak and at the Biskupia Kopa Massif. Only one location was found outside mountainous areas on the Głubczyce Plateau in the Rozumice Nature Reserve. In most cases the patches of *Carici remotae-Fraxinetum* occupy small areas alongside small tricklings or brooks within larger forest complexes (Fig. 1).

*Carici remotae-Fraxinetum* develops on small surfaces, ca. 0,5-5 ha in long lowerings, mainly on slopes close to small water brooks with slowly flowing water, often within watershed zones. The elevations were between 270-273 m a.s.l. (Rozumice), 320 m (Głuchołazy), 343-350 m (Sarni Potok (Stream) valley)), 345 (Olszak), 360 m (Przednia Kopa), and 662-740 m (Biskupia Kopa). The largest area of the association was noted on the north-eastern slopes of the Biskupia Kopa Massif and in the Sarni Potok (Stream) valley near Głuchołazy in the Opawskie Mountains. Other patches do not exceed a surface of a 1-2 hectares. Species richness in sampled plots was between 27 and 44 (Table 1).

The patches of the association studied are rather species-rich, abundant and with high total cover rate of undergrowth with apparent predominance of *Carex remota*, *Carex pendula*, *Mercurialis perennis*, *Galeobdolon luteum*, *Petasites albus* and *Aegopodium podagraria*. The share of *Carex sylvatica*, *Circaea lutetiana*, *Senecio ovatus* and *Dryopteris carthusiana* is relatively high. Among the characteristic species noted for the association *Carex remota* reaches the highest constancy. Another diagnostic taxon with a high cover rate was *Carex pendula*. Other diagnostic plant species, such as: *Veronica montana*, *Carex strigosa* and *Equisetum telmateia* were sporadically noted. Significant, albeit not abundant, were *Lysimachia nemorum* and *Chaerophyllum hirsutum*.

In the tree layer *Fraxinus excelsior*, *Acer pseudoplatanus* and *Picea abies* predominate and in the shrub layer - *Acer pseudoplatanus*, *Corylus avellana* and *Sambucus nigra*.

Within the patches of documented phytocoenoses, several conservation important species (Nowak et al. 2008), such as: *Blechnum spicant*, *Carex pendula*, *Equisetum telmateia*, *Lilium martagon*, *Veronica montana*, *Circaea alpina*, *Platanthera bifolia*, *Dactylorhiza fuchsii*, *Hacquetia epipactis* and *Carex strigosa* were found.

In the studied patches of *Carici remotae-Fraxinetum*, the participation of montane species is obvious. In several sites *Prenanthes purpurea*, *Carex pendula*, *Veronica montana*, *Anthriscus nitida*, *Luzula luzuloides*, *Geranium phaeum*, *Lysimachia nemorum* were documented.

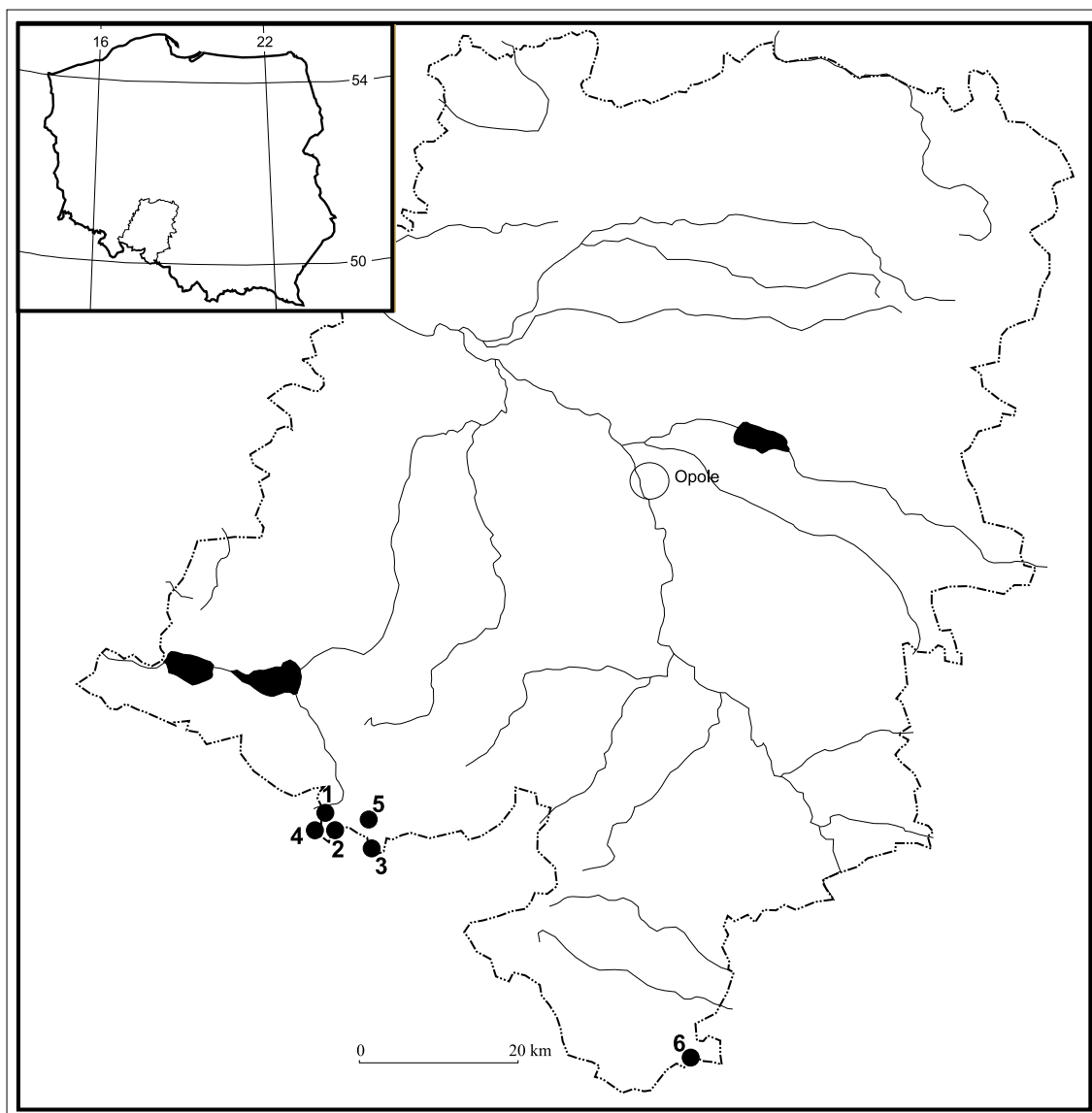
### **Discussion**

Considering the floristic composition and structure of phytocoenoses, it is clear that *Carici remotae-Fraxinetum* is fairly well developed in the southern Opole Silesia. The lack of *Alnus incana* or *Circaea intermedia* and small constancy of other characteristic species could be regarded as local specificity. The low abundance of *Alnus incana* in forest associations in the Sudetes Mts. were earlier discussed (e.g. Matuszkiewicz J.M. 2001). The most comfortable conditions for the growth of this association are found in the forest complex at the Kopa Biskupia Massif and in the Sarni Potok (Stream) valley near Głuchołazy. In some places (Przednia Kopa and Sarni Potok (Stream) valley)) the degeneration processes, mainly the pinetisation expressed by the considerable share of *Picea abies* and the lack of *Fraxinus excelsior* were observed. Long lasting changes in forest economy have led to considerable changes in habitat conditions and increased a spruce participation and acidification of the soil substrate. However, in last decades the contribution of *Picea abies* in forests decreases due to insects gradations and new ecological rules in forest administration.

The *Carici remotae-Fraxinetum* community shows the considerable stability within the Opole Silesia region. All known from the literature sites (e.g. Kuczyńska 1972, 1973; Celiński and Wika 1974-1975) were confirmed and some new patches were found. We suppose, that in the Opawskie Mts. the area of *Carici remotae-Fraxinetum* will slightly increase, mainly as a consequence of forest management and rebuilding of tree-stands, despite the illnesses of the main tree - *Fraxinus excelsior*, which is suffering in last few years from fungi infection.

The main indicator of the association surveyed in Opole Silesia seems to be the constant and abundant contribution of *Fraxinus excelsior* and *Acer pseudoplatanus* in the tree layer and the considerable participation of *Corylus avellana* in the shrub layer. Diagnostic value has also species-rich undergrowth with many taxa typical for montane and submontane zone growing on wet and fertile substrates, such as: *Carex remota*, *Carex pendula*, *Carex strigosa*, *Veronica montana*, *Equisetum telmateia*, *Petasites albus*, *Allium ursinum*, *Lysimachia nemorum*, *Matteucia struthiopteris*, *Chaerophyllum hirsutum*, *Asarum europaeum*, *Prenanthes purpurea*, *Geranium phaeum*, *Circaea alpina* and others.

The association of *Carici remotae-Fraxinetum* has great conservation importance in Opole Silesia. It develops in a restricted area in Poland as well as in Opole Silesia and needs special attention on the part of forest and nature conservation administrations.



**Figure captions:**

Fig. 1. Distribution of the *Carici remotae-Fraxinetum* Koch 1926 ex Faber 1936 association in Opole Silesia

1 – Głuchołazy, 2 – Sarni Potok Stream, 3– Biskupia Kopa (Upper part of Bystry Potok Stream), 4 – Przednia Kopa, 5 - Olszak, 6 - Rozumice

**Table 1. *Carici remotae-Fraxinetum* Koch 1926 ex Faber 1936**

Relevé number	1	2	3	4	5	6	7	8	9	10	11	C
day	16	13	9	27	16	9	9	9	12	12	27	O
Date: month	5	7	8	5	5	8	8	8	6	6	5	N
year	2009	2008	2010	2009	2009	2010	2010	2010	2009	2009	2009	S
Inclination (degrees)	5	5	10	15	10	15	15	-	-	-	5	T
Altitude (m)	360	350	343	662	725	740	675	345	270	273	320	A
Density of tree layer a <sub>1</sub> (%)	60	45	60	70	65	75	70	85	70	80	80	N
Density of tree layer a <sub>2</sub> (%)	10	5	5	-	5	-	5	-	1	10	5	C
Density of shrub layer b (%)	30	25	20	20	1	15	20	30	25	5	30	Y
Cover of herb layer c (%)	80	90	100	95	90	90	100	80	100	90	90	
Cover of moss layer d (%)	20	-	-	-	-	10	-	15	-	-	-	
Relevé area (m <sup>2</sup> )	300	400	400	400	400	400	350	300	400	400	400	
Locality	PK	SS	SS	BK	BK	BK	BK	O	R	R	G	
Number of species	27	29	30	31	36	35	30	44	29	27	35	
<b>Trees and shrubs</b>												
<i>Fraxinus excelsior</i> a <sub>1</sub>	.	.	1	3	3	3	3	4	4	4	5	V
<i>Acer pseudoplatanus</i> a <sub>1</sub>	.	.	1	2	2	3	2	.	1	1	.	IV
<i>Acer pseudoplatanus</i> b	.	.	1	.	+	1	1	2	.	1	3	IV
<i>Picea abies</i> b	2	.	.	1	+	1	1	.	.	.	1	III
<i>Picea abies</i> a <sub>1</sub>	4	3	2	1	.	.	2	.	.	.	.	III
<i>Corylus avellana</i> b	.	.	+	1	.	.	1	1	2	.	.	III
<i>Sambucus nigra</i> b	.	+	+	.	.	.	.	.	1	2	+	III
<i>Fraxinus excelsior</i> b	.	.	.	+	.	.	.	1	+	2	+	III
<i>Fraxinus excelsior</i> c	.	.	.	+	.	.	+	+	+	+	.	III
<i>Fagus sylvatica</i> a <sub>2</sub>	1	1	1	.	1	.	.	.	.	.	.	II
<i>Acer pseudoplatanus</i> c	.	.	.	.	+	.	.	+	.	.	+	II
<i>Alnus glutinosa</i> a <sub>1</sub>	.	.	3	.	.	.	.	2	.	.	.	I
<i>Frangula alnus</i> b	1	2	.	.	.	.	.	.	.	.	.	I
<i>Fagus sylvatica</i> b	.	1	2	.	.	.	.	.	.	.	.	I
<i>Rubus caesius</i> c	.	.	2	.	.	.	.	+	.	.	.	I
<i>Padus avium</i> b	.	.	.	.	.	.	.	+	.	2	.	I
<i>Ulmus glabra</i> a <sub>1</sub>	.	.	.	1	1	.	.	.	.	.	.	I
<i>Tilia cordata</i> a <sub>1</sub>	.	.	.	.	.	.	.	.	1	1	.	I
<i>Acer pseudoplatanus</i> a <sub>2</sub>	.	.	.	.	.	.	.	.	.	1	1	I
<i>Betula pendula</i> b	1	+	.	.	.	.	.	.	.	.	.	I
<i>Alnus glutinosa</i> b	.	.	+	.	.	.	.	1	.	.	.	I
<i>Sorbus aucuparia</i> b	.	+	.	.	.	.	.	+	.	.	.	I
<i>Daphne mezereum</i> c	.	.	.	+	+	.	.	.	.	.	.	I
<u>Sporadic species:</u> <i>Acer platanoides</i> b 11; <i>Acer platanoides</i> c 11; <i>Alnus glutinosa</i> a <sub>2</sub> 9; <i>Betula pendula</i> a <sub>2</sub> 7(1); <i>Carpinus betulus</i> b 11; <i>Daphne mezereum</i> b 6; <i>Euonymus europaea</i> b 11; <i>Euonymus europaea</i> c 8; <i>Fagus sylvatica</i> a <sub>1</sub> 7(1); <i>Picea abies</i> c 4; <i>Ribes grossularia</i> c 9; <i>Rubus idaeus</i> c 1(2); <i>Rubus</i> sp. c 2(1); <i>Tilia cordata</i> b 9(1); <i>Ulmus glabra</i> b 4; <i>Ulmus glabra</i> c 9; <i>Viburnum opulus</i> b 8.												
<b>Ch, D* Ass. <i>Carici remotae-Fraxinetum</i></b>												
<i>Carex remota</i>	.	2	2	1	1	1	1	1	1	+	+	V

<i>Carex pendula</i> *	3	2	2	.	.	.	.	.	+	.	.	.	II
<i>Veronica montana</i>	+	.	.	+	.	.	.	.	.	.	.	.	I
<u>Sporadic species: <i>Carex strigosa</i>* 10(1); <i>Equisetum telmateia</i> 8.</u>													
<b>DGr. Zbiorowiska górskie i podgórskie</b>													
<i>Lysimachia nemorum</i>	+	1	.	.	+	+	.	.	.	.	.	.	II
<i>Chaerophyllum hirsutum</i>	.	.	1	.	.	1	.	1	.	.	.	.	II
<b>DSAll. Alnenion glutinoso-incae</b>													
<i>Oxalis acetosella</i>	+	+	1	+	+	+	+	.	.	.	.	+	IV
<i>Lysimachia vulgaris</i>	+	+	1	.	.	.	.	+	.	.	.	.	II
<i>Chrysosplenium alternifolium</i>	1	.	.	.	1	.	.	.	.	1	.	.	II
<i>Athyrium filix-femina</i>	.	1	.	+	.	.	.	.	.	.	.	.	I
<i>Ranunculus repens</i>	.	.	+	.	.	.	.	+	.	.	.	.	I
<i>Crepis paludosa</i>	.	.	.	.	.	+	.	+	.	.	.	.	I
<u>Sporadic species: <i>Caltha palustris</i> 8; <i>Stellaria nemorum</i> 5.</u>													
<b>ChAll. Alno-Ulmion</b>													
<i>Circaea lutetiana</i>	+	+	1	.	.	.	1	1	+	r	1	.	IV
<i>Plagiomnium undulatum</i> d	2	.	.	.	.	1	.	2	.	.	.	.	II
<i>Ficaria verna</i>	.	.	.	.	.	.	.	1	.	.	1	.	I
<i>Festuca gigantea</i>	.	.	1	+	.	.	.	.	.	.	.	.	I
<u>Sporadic species: <i>Circaea alpina</i> 7(1); <i>Geranium phaeum</i> 11(1); <i>Matteucia struthiopteris</i> 11.</u>													
<b>Ch,D*O. Fagetalia sylvaticae</b>													
<i>Galeobdolon luteum</i>	.	.	1	1	+	1	+	1	+	.	2	.	IV
<i>Mercurialis perennis</i>	.	.	.	1	1	1	1	2	4	3	.	.	IV
<i>Carex sylvatica</i>	.	.	.	+	1	1	1	1	1	.	1	.	IV
<i>Lilium martagon</i>	.	.	.	+	+	1	+	.	+	+	.	.	III
<i>Asarum europaeum</i>	.	.	.	+	+	+	1	.	+	+	.	.	III
<i>Allium ursinum</i>	.	+	.	4	3	2	1	.	.	.	.	.	III
<i>Prenanthes purpurea</i>	.	1	.	+	+	1	1	.	.	.	.	.	III
<i>Dryopteris filix-mas</i>	1	1	.	+	+	.	.	.	.	+	.	.	III
<i>Impatiens noli-tangere</i>	+	.	1	.	.	+	+	.	.	.	1	.	III
<i>Stachys sylvatica</i>	.	.	+	.	.	+	.	1	.	1	+	.	III
<i>Milium effusum</i>	.	.	.	.	+	.	.	+	+	1	+	.	III
<i>Luzula luzuloides</i>	.	.	.	+	+	+	+	.	.	.	+	.	III
<i>Galium odoratum</i>	.	.	.	1	1	1	+	.	.	.	.	.	II
<i>Polygonatum multiflorum</i>	.	.	.	+	+	.	.	.	+	+	.	.	II
<i>Festuca altissima</i>	.	1	.	.	.	+	+	.	.	.	.	.	II
<i>Ranunculus lanuginosus</i>	.	.	.	.	+	.	.	.	+	+	.	.	II
<i>Paris quadrifolia</i>	.	.	.	.	.	.	+	.	+	r	.	.	II
<i>Primula elatior</i>	.	.	.	.	.	.	.	.	1	+	.	.	I
<i>Epilobium montanum</i> *	+	.	.	.	.	+	.	.	.	.	.	.	I
<i>Pulmonaria officinalis</i>	.	.	.	.	.	.	.	+	.	.	+	.	I
<i>Isopyrum thalictroides</i>	.	.	.	.	.	.	.	.	+	+	.	.	I
<u>Sporadic species: <i>Carex pilosa</i> 9; <i>Corydalis cava</i> 5; <i>Hordelymus europaeus</i> 6; <i>Phyteuma spicatum</i> 11.</u>													
<b>ChCl. Querco-Fagetea</b>													
<i>Aegopodium podagraria</i>	.	.	+	.	+	+	.	+	2	2	1	.	IV
<i>Anemone nemorosa</i>	.	+	+	+	+	.	.	+	+	+	.	.	IV

<i>Poa nemoralis</i>	.	.	.	+	+	+	.	.	.	.	+	II
<u>Sporadic species:</u> <i>Carex digitata</i> 4.												
<b>Accompanying species</b>												
<i>Dryopteris carthusiana</i>	+	1	2	1	+	1	2	1	.	.	+	V
<i>Senecio ovatus</i>	1	+	.	+	1	1	+	+	.	.	.	IV
<i>Petasites albus</i>	.	.	1	2	3	3	4	.	.	.	3	III
<i>Urtica dioica</i>	.	.	+	.	r	.	.	+	1	1	1	III
<i>Lamium maculatum</i>	+	.	.	+	+	.	.	.	1	+	+	III
<i>Impatiens parviflora</i>	.	+	+	.	.	.	.	1	.	.	1	II
<i>Maianthemum bifolium</i>	.	+	.	.	.	+	+	+	.	.	.	II
<i>Equisetum sylvaticum</i>	2	.	1	.	.	.	.	+	.	.	.	II
<i>Galium aparine</i>	.	.	.	.	.	.	.	.	1	2	+	II
<i>Mnium hornum</i> d	1	.	.	.	.	+	.	+	.	.	.	II
<i>Ajuga reptans</i>	+	+	.	.	.	.	.	.	.	+	.	II
<i>Deschampsia caespitosa</i>	.	.	.	.	r	.	+	+	.	.	.	II
<i>Stellaria uliginosa</i>	1	2	.	.	.	.	.	.	.	.	.	I
<i>Juncus effusus</i>	1	.	.	.	.	.	.	+	.	.	.	I
<i>Anthriscus nitida</i>	.	.	+	.	.	.	.	1	.	.	.	I
<i>Cardamine amara</i>	.	.	+	.	.	.	.	1	.	.	.	I
<i>Veronica anagallis-aquatica</i>	+	.	.	.	.	.	.	+	.	.	.	I
<i>Blechnum spicant</i>	.	+	+	.	.	.	.	.	.	.	.	I
<i>Dactylorhiza fuchsii</i>	.	.	.	+	+	.	.	.	.	.	.	I
<i>Cardamine flexuosa</i>	.	.	.	+	.	.	+	.	.	.	.	I
<i>Platanthera bifolia</i>	.	.	.	.	+	+	.	.	.	.	.	I
<i>Geum urbanum</i>	.	.	.	.	.	.	.	.	+	.	+	I
<i>Symphytum tuberosum</i>	.	.	.	.	.	.	.	.	.	+	+	I
<u>Sporadic species:</u> <i>Alliaria petiolata</i> 11(1); <i>Calamagrostis villosa</i> 6; <i>Cirsium palustre</i> 1; <i>Cystopteris fragilis</i> 2; <i>Dactylorhiza maculata</i> 6; <i>Galium palustre</i> 2(2); <i>Geranium robertianum</i> 11; <i>Geum rivale</i> 8; <i>Glyceria fluitans</i> 3; <i>Hacquetia epipactis</i> 9; <i>Hedera helix</i> 8; <i>Heracleum sphondylium</i> 11; <i>Moehringia trinervia</i> 1; <i>Polygonatum verticillatum</i> 7; <i>Polytrichum commune</i> d 6(1); <i>Scirpus sylvaticus</i> 8(1); <i>Solanum dulcamara</i> 8; <i>Solidago virgaurea</i> 7; <i>Vaccinium myrtillus</i> 2; <i>Vinca minor</i> 11.												
<b>Abbreviations:</b> PK - Przednia Kopa; SS - Sarni Stream; BK - Biskupia Kopa; O - Olszak; R - Rozumice; G - Głuchołazy												



## Bibliography

- Braun - Blanquet J. 1964. Pflanzensoziologie, Grundzüge der Vegetationskunde. 3 Aufl. Springer Verlag, Wien - New York.
- Brzeg A., Wojterska M. 1996. Przegląd systematyczny zbiorowisk roślinnych Wielkopolski wraz z oceną stopnia ich zagrożenia. Bad. Fizj. n. Pol. Zach., Ser. Botanika 45: 7-40.
- Cabała S. 1990. Zróżnicowanie i rozmieszczenie zbiorowisk leśnych na Wyżynie Śląskiej. Prace Nauk. Uniw. Śl. w Katowicach 1068: 5-142.
- Celiński F. 1962. Zespoły leśne Puszczy Bukowej pod Szczecinem. Monogr. Bot. 13: 3-207.
- Celiński F., Wika S. 1974-1975. Zespoły leśne projektowanego rezerwatu w Rozumicach w pow. głubczyckim. Zesz. Przyr. OTPN 14-15: 23-42.
- Fabiszewski J. 1968. Porosty Śnieżnika Kłodzkiego i Gór Bialskich. Monogr. Bot. 26: 1-116.
- Hereźniak J. 1993. Stosunki geobotaniczno-leśne północnej części Wyżyny Śląsko-Krakowskiej na tle zróżnicowania i przemian środowiska. Monogr. Bot. 75: 3-368.
- Kuczyńska I. 1972. Zbiorowiska leśne Gór Opawskich. Acta Univ. Wratisl. 149, Pr. Bot. 14: 1-60.
- Kuczyńska I. 1973. Stosunki geobotaniczne Opolszczyzny. I. Zbiorowiska leśne. Acta Univ. Wratisl. 162. Prace Bot. 15: 1-91.
- Kuczyńska I., Berdowski W. 1976. Udział *Chrysosplenium oppositifolium* L. w zbiorowiskach roślinnych Dolnego śląska. Acta Univ. Wratisl. 303, Pr. Bot. 21: 69-86.
- Kwiatkowski P. 2001. Zbiorowiska leśne Pogórza Złotoryjskiego. Fragn. Flor. Geobot. Polonica 8: 173-218.
- Matuszkiewicz J.M. 2001. Zespoły leśne Polski. Wydawnictwo Naukowe PWN, Warszawa.
- Matuszkiewicz W. 2001. Przewodnik do oznaczania zbiorowisk roślinnych Polski. Vademecum Geobotanicum 3. Wydawnictwo Naukowe PWN, Warszawa
- Mirek Z., Piękoś-Mirkowa H., Zając A., Zając M. 2002. Flowering plants and pteridophytes of Poland. A checklist. In: Mirek Z. (red.), Biodiversity of Poland 1. W. Szafer Institute of Botany, Polish Academy of Science, Kraków.
- Nowak A., Nowak S. 2008. Anthropogenic changes of Opole Silesia plant cover (Poland, Central Europe). p. 77-98. In: Nowak A., Nobis M., Kusza G. (eds). Some aspects of nature conservation and environmental protection in Poland and Tajikistan. Stow. Ochr. Przyr. BIOS, Opole, pp. 201.
- Nowak A., Nowak S., Spałek K. 2008. Red list of vascular plants of Opole province - 2008. Opol. Scient. Soc., Nature Journal, 41: 141-158.
- Pawlaczyk P. 2004. Podgórski łęg jesionowy. s. 227-230. W: Herbich J. (red.). Poradniki ochrony siedlisk i gatunków Natura 2000 - podręcznik metodyczny. Lasy i bory. Vol. 5. ss. 344.
- Pott R. 1995. Die Pflanzengesellschaften Deutschlands. 2 Aufl. Verlag Eugen Ulmer, Stuttgart.

- Stachurska A. 1998. Zbiorowiska leśne północno-wschodniej części Pogórza Wielickiego (Karpaty Zachodnie). Zesz. Nauk. UJ. 715, Pr. Bot.30: 5-78.
- Świerkosz K. 1994. Zbiorowiska roślinne Góry Chojnik – enklawy Karkonoskiego Parku Narodowego. Część 1. Zbiorowiska leśne. Parki Narodowe i Rezerваты Przyrody 13(2): 17-36.
- Tokarz H. 1961. Zespoły leśne Wysoczyzny Elbląskiej. Acta Biol. et Medica Soc. Sc. Gedan. 5.7: 121-244.
- Towpasz K. 1990. Charakterystyka geobotaniczna Pogórza Strzyżowskiego. Rozpr. Habilit. Uniw. Jagiell. 178. Uniw. Jagielloński, Kraków.
- Wilczek Z. 1995. Zespoły leśne Beskidu Śląskiego i zachodniej części Beskidu Żywieckiego na tle zbiorowisk leśnych Karpat Zachodnich. Prace Nauk. Uniw. Śl. w Katowicach 1490: 5-130.
- Wilczek Z., Cabała S. 1989. Zespoły leśne grupy Klimczoka w Beskidzie Śląskim. Cz. 2. Zespoły lasów liściastych. Acta Biol. Siles. 12(29): 79-90.

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