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The forest communities in the Przemyśl Foothills, south-east Poland

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ABSTRACT: The work involved the natural and near-natural forest communities present in the Przemyśl Foothills. Material gathered proved possible to identify and describe plant communities belonging to the associations *Carici remotae-Fraxinetum, Tilio-Carpinetum* of the submontane form and *Dentario glandulosae-Fagetum* of the Eastern Carpathians vicariant and their montane and submontane forms. There communities were compared with those of the Góry Słonne range immediately to the south of the study area. Analysis centred on the manner in which oak-lime-hornbeam forests intergrade with beech forests at increasing altitude, and it was noted that the transition was continuous in character, entailing the steady loss of the species from lower elevations and warmer habitats. Two types of forested landscape – the submontane and lower montane belts – were described.

KEY WORDS: forest communities, Przemyśl Foothills, phytosociology, vegetation belts.

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INTRODUCTION

The diversity of the forest communities on the Przemyśl Foothills has not yet been subject to study. All that are available are old references to the species of plant occurring there (Batko 1934, 1938), as well as a small number of unpublished phytosociological relevés from beechwoods and floodplain forests which formed part of the typological studies on the forest communities of the Carpathians (Dzwonko 1986) and Poland (W. Matuszkiewicz & A. Matuszkiewicz 1973; J. Matuszkiewicz 1976). The present work therefore seeks to fill the existing gap in knowledge on the forest communities of the extreme north-eastern edge of the Polish Carpathians. It confines itself to the natural or little-altered forests, omitting those with highly-distorted secondary communities, or scrub communities arising as a result of the degeneration of forest.

The vegetation cover of the Foothills was in fact changed markedly many centuries ago. This is reflected not only in the deforestation of very large areas – above all in the broad valleys of the rivers San and Wiar – but also in the anthropogenic transformation of the forests that have so far been retained. Amongst these changes are the monocultural

cultivation of Scots pine or more rarely Norway spruce, the artificial favouring of natural components of stands like fir or beech at the expense of multi-species forest, and the self-sowing of pine which is particularly marked on dry, south-facing slopes. Most of these transformations were already described by Schramm (1913, 1930, 1958).

The typological affinities of the forest communities of the Polish Carpathians were the subject of research by Dzwonko (1986). This work led to the designation of a boundary between the Eastern and Western Carpathian communities, as well as between *Tilio-Carpinetum* and *Dentario glandulosae-Fagetum*. The result was the Przemyśl Foothills's inclusion within the hitherto-existing scheme addressing the diversity of Carpathian forests. Reference to earlier work from Góry Słonne Range on the subject of forests (Dzwonko 1977) and altitudinal zonation of the vegetation (Dzwonko 1976) also offered an opportunity for material presented here to be compared with that from an area directly to the south. Although points of reference already existed, the present study provided a further insight into a problem signalled by Dzwonko (1976, 1977) regarding the identification and separation of lime-oak-hornbeam and beech forests in the Eastern Carpathians. This problem has its source not only in the regional specifics of this part of the Carpathians, but also in the transitional character of an area that is on the borderline between the submontane and lower montane belts as well as the narrowly-conceived typological units that have been identified locally.

The earlier studies of Zarzycki (1963), Dzwonko (1977) and Michalik and Szary (1997) laid emphasis on the presence in the lower montane beech forests of the Eastern Carpathians (and most notably the dry sub-association thereof) – of such species from lower altitudinal belts as the *Stellaria holostea* and *Corylus avellana* noted from lime-oak-hornbeam forest. In contrast, a feature of the area studied was the widespread presence in all types of forest community (and especially the fertile and moist) of *Dentaria glandulosa* – a species characteristic of Carpathian beech forest. In recognition of the regional specifics and altitudes of the area under consideration, the main subjects of this study will be a spatial and typological analysis of the manner in which lime-oak-hornbeam forest intergrades with beech forest in the Przemyśl Foothills, a comparison with the situation in Góry Słonne as portrayed in published materials from Dzwonko (1977).

Study area

The study area takes in the Przemyśl Foothills, and most precisely its northern and central parts, to the north of Góry Słonne (Fig. 1). The area is confined to the north and east by the arc of the Carpathians. To the west it extends as far as the San Valley, although most of the material is in fact more concerned with the eastern part. The term of the Przemyśl Foothills is here taken in the sense imparted to it by Pawłowski (1972), i.e. as a sub-district within the Forested Capathians district of the Eastern Carpathians Division. The present-day, phytogeographical division of the Polish Eastern Carpathians (Zemanek 1991) shifts their northern limits to the east-west line taken by the course of the River Wiar, and hence divides the study area into two units with a divisional-rank boundary

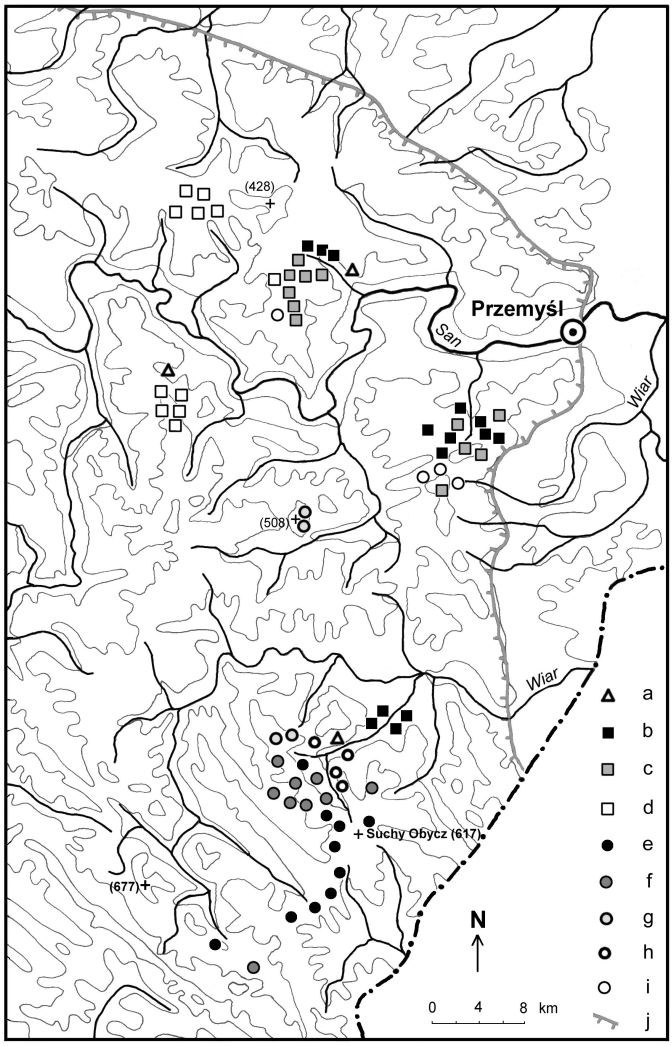

Fig 1. Location of phytosociological relevés in the Przemyśl Foothills. a – *Carici remotae-Fraxinetum*; b – *Tilio-Carpinetum corydaletosum*; c – *Tilio-Carpinetum typicum*, variant with *Carex pilosa*; d – *Tilio-Carpinetum typicum*, variant with *Senecio fuchsii*; e – *Dentario glandulosae-Fagetum*, montane form; f – *Dentario glandulosae-Fagetum*, submontane form; g – *Dentario glandulosae-Fagetum*, submontane form, degenerate form; h – *Dentario glandulosae-Fagetum*, submontane form, transitional to *Tilio-Carpinetum*; i – *Dentario glandulosae-Fagetum*, submontane form, variant with *Impatiens noli-tangere*; j – Carpathians rim.

running between them. These are the Western Carpathians (Strzyżów-Dynów sub-district after Towpasz 1990) and the Eastern Carpathians (Low Bieszczady Mountains sub-district).

The authors of physico-geographical divisions (Starkel 1972; Kondracki 1998) make greatest use of geological and geomorphological criteria emphasising the genesis of the area, the elevation above sea level and the continuity of the mountain chains. Both of the

workers referred to have divided the study area into two parts. The Foothills part lying to the north of the east-west section of the Wiar Valley is included in the Przemyśl Foothills by Kondracki (1998), or else in the eastern part of the Dynów Foothills according to Starkel (1972), within the Interior Western Carpathians. The southern mountainous part is included within the Eastern Carpathians and classified with the Sanok-Turka range (Kondracki 1998), or else the Wańkowa Elevation (Starkel 1972).

The division into submountain and mountain parts has habitat-related significance linked to the occurrence at different altitudes of two climatic and vegetational zones, namely the submontane belt and the lower montane belt. In line with the criteria adopted by Michna and Paczos (1972), the topoclimate of areas at altitudes between 250 and 500 m a.s.l. is described as warm temperate. In turn, areas between 500 m and the highest summits (of 685 m a.s.l. on the Chwaniów massif) have a topoclimate considered cool temperate. Microclimatic conditions are in turn very diverse, depending as they do on slope exposure and gradient. Both the submontane and montane parts are contiguous in character. The mountains are grape-like, consisting of alternated pararell-aranged ridges, with the Foothills part taking on this character in a south-easterly direction. The valleys in the area are narrow and deeply-incised.

The study area is built from flysch of the skolska unit, of sandstones and inoceramic shales, with patches of boulder clay in the northern part. The soils generated from these are shallow and skeletal acid and leached brown earths, whose fertility and depth is greater on the lower parts of the slopes enriched by runoff. Stream valleys have alluvia and alluvial-gleyed soils. Shales, and in places karstic limestone, are exposed in erosive cuts – usually on stream floors.

Study methods

Phytosociological relevés were obtained for well-preserved, near-natural forests using methods of the Central European Braun-Blanquet school. The locations of the relevés were marked on 1 : 25 000 scale topographical maps. The fieldwork was done in the years 1992–1997, with the organisational support of the Bolestraszyce Arboretum. Relevés were generated in the summer season, and subsequently augmented by geophyte species in spring. In the latter case, the cover value given is for the spring maximum. The areas of relevés ranged from 60–100 m, in the case of communities occurring in a narrow belt along a stream, to between 200 and 400 m in the case of large-scale communities on slopes. A total of 73 relevés were obtained, among which 72 have been brought together in Tables 1–8 published here. The grouping of relevés in the tables was achieved using a numerical classification method (Dzwonko 1986). For the purposes of comparison, use was made of the tables for Góry Słonne in Dzwonko (1977). The botanical nomenclature was after Mirek *et al.* (1995), while the syntaxonomical system applied is that of W. and J. M. Matuszkiewicz (1996).

A review of plant communities

Within the study area, the following types of forest communities within the class *Quercо-Fagetea* Br.-Bl. & Vlieg. 1937 were distinguished:

1. *Alno-Padion* Knapp 1942

Carici remotae-Fraxinetum Koch 1926, Eastern Carpathian vicariant with sub-associations: *C. r.-F. equisetetosum telematei, C.r.-F. typicum, C.r.-F. typicum*

2. *Carpinion betuli* Oberd. 1953

Tilio-Carpinetum Traczyk 1962, Małopolska vicariant, submontane form with sub-associations: *T.-C. corydaletosum, T.-C. typicum*

3. *Fagion sylvaticae* Tx. & Diem. 1936, sub-alliance *Eu-Fagenion* Oberd. 1957 (= *Asperulo-Fagenion*)

Dentario glandulosae-Fagetum Klika 1927 *em*. Mat. 1964, Eastern Carpathian vicariant; montane form with sub-associations: *D.g.-F. lunarietosum, D.g.-F. typicum* submontane form.

Submontane forb-rich ash forest along the streams and little rivers – *Carici remotae-Fraxinetum* Koch 1926

This is an ash or ash-alder forest occurring in narrow valleys and by the sources of fast-flowing Foothills streams on a substratum of river alluvia. It is represented by 3 phytosociological relevés from the valleys of the Turnica and Hołubla Rivers, as well as by the stream between the Prymiatyna and Na Orlińskim summits (Table 1). The required habitat is much more frequent, but the degree of anthropogenic transformation of stream-valley forests makes the discovery of more than a few well-preserved patches impossible.

To be noted among the species characteristic of the association is *Equisetum telemateia*, while the species distinguishing it as regards *Alnetum incanae* are *Fraxinus excelsior, Carpinus betulus, Chrysoplenium alternifolium, Circaea lutetiana* and *Carex remota*. Relevé no. 1 represents the sub-association *Carici remotae-Fraxinetum equisetetosum telematei*, relevé no. 2 the typical sub-association and relevé no. 3 the community transitional to lime-oak-hornbeam forest.

The streamside forest vegetation of the Przemyśl Foothills is rather similar to the sycamore variant of *Alnetum incanae* distinguished by Dzwonko (1977) from Góry Słonne.

Lime-oak-hornbeam forests – *Tilio-Carpinetum* Traczyk 1962

The forests of this kind present within the study area should be categorised within the Małopolska vicariant and the submontane form (W. and A. Matuszkiewicz 1981).

These are communities with multi-species stands formed from hornbeam and beech occurring in lime-oak-hornbeam forests of the Małopolska vicariant throughout its range and with the participation of *Quercus robur* and *Cerasus avium*. *Tilia cordata* also finds its optimum here, though it occurs rarely in beech forests as well, especially where these are of the submontane form. Among the species of shrub encountered are *Crataegus monogyna, Viburnum opulus, Cornus sanguinea* and (rarely) *Staphylea pinnata*. Characteristic of the *Carpinion* alliance are *Stellaria holostea, Ranunculus cassubicus* and *Galium schultesi*. The lime-oak-hornbeam forests are also identified by the frequent occurrence of such species characteristic of *Fagetalia* and *Querco-Fagetea* as: *Hepatica*

Table 1. *Carici remotae-Fraxinetum.*

Number	1	2	3
Field no.	6	7	13
Altitude a.s.l.	290	230	340
Aspect	N	SE	–
Slope	+	+	–
Cover of tree layer [%]	95	80	95
Cover of shrub layer [%]	20	20	+
Cover of herb layer [%]	100	90	100
Cover of bryophyte later [%]	10	30	
Number of species	45	62	47
Trees and shrubs			
Ch. Alno-Padion, D. Carici remotae-Fraxinetum			
Fraxinus excelsior a	5	3	4
Fraxinus excelsior b	2		
Fraxinus excelsior c	+	+	
Alnus incana a		2	
Alnus incana b	+	2	
Ulmus campestris c			+
Ch. Fagetalia, Querco-Fagetea			
Acer pseudoplatanus a	+		2
Acer pseudoplatanus b	+		
Acer pseudoplatanus c		1	+
Carpinus betulus b	+		1
Carpinus betulus c		+	
Fagus sylvatica b	+		
Acer platanoides c			+
Corylus avellana b	1		
Cerasus avium a		2	
Cerasus avium b		+	
Companion species:			
Acer campestre a			1
Acer campestre b	+		+
Acer campestre c		+	
Herbs			
Ch., D. Carici remotae-Fraxinetum			
Chrysosplenium alternifolium	1	+	+
Circaea lutetiana	1		1
Carex remota	+		
Equisetum telemateia	2		
Ch. Alno-Padion			
Ficaria verna	1	+	2
Stachys sylvatica	1	+	1
Festuca gigantea	+	+	
Ch. Fagetalia, Querco-Fagetea			
Anemone nemorosa	1	+	2

Table 1. Continued.

Number	1	2	3
Asarum europaeum	1	+	1
Corydalis cava	1	1	1
Dentaria bulbifera	2	+	2
Galeobdolon luteum	+	1	1
Lysimachia nemorum	+	+	+
Pulmonaria obscura	1	+	+
Veronica montana	1	1	1
Impatiens noli-tangere	1	1	
Dentaria glandulosa	2		+
Aegopodium podagraria		1	2
Brachypodium sylvaticum		+	+
Isopyrum thalictroides		+	+
Mercurialis perennis		+	1
Ranunculus lanuginosus		+	+
Salvia glutinosa		+	1
Scilla bifolia		+	1
Accompanying species:			
Chaerophyllum temulum	1	+	+
Geranium phaeum	1	+	+
Petasites albus	3	1	3
Urtica dioica	2	2	1
Eupatorium cannabinum	2	+	
Geranium robertianum	+	1	
Myosotis palustris	+	1	
Ranunculus repens	+	1	
Rubus idaeus	+	+	
Cirsium oleraceum	2		+
Galeopsis pubescens	+		+
Valeriana officinalis	+		+
Campanula rapunculoides		+	+
Chaerophyllum aromaticum		+	1
Petasites hybridus		3	+
Senecio fuchsii		+	+
Stellaria nemorum		3	1

Sporadic species: Ch. *Fagetalia*, *Querco-Fagetea*: *Galium odoratum* 2(+); *Carex pilosa* 2(+); *Carex sylvatica* 2(1); *Catharinea undulata* 2(1); *Epilobium montanum* 2(+); *Euphorbia amygdaloides* 2(+); *Poa nemoralis* 2(+); *Primula elatior* 2(+); *Sanicula europaea* 2(+); *Scrophularia nodosa* 2(+); *Corydalis solida* 3(+); *Lunaria rediviva* 3(+); *Stellaria holostea* 3(+).

Accompanying species: *Chaerophyllum hirsutum* 1(+); *Geranium palustre* 1(+); *Hypericum hirsutum* 1(+); *Juncus effusus* 1(+); *Lysimachia nummularia* 1(+); *Marchantia* sp. 1(+); *Mnium* sp. 1(1); *Scirpus sylvaticus* 1(+); *Solanum dulcamara* 1(+); *Valeriana simplicifolia* 1(+); *Ajuga reptans* 2(+); *Alliaria petiolata* 2(+); *Arctium lappa* 2(+); *Cerastium sylvaticum* 2(2); *Equisetum arvense* 2(+); *Fragaria vesca* 2(+); *Galium aparine* 2(1); *Mycelis muralis 2(+); Mycelis muralis* 2(+); *Oxalis acetosella* 2(+); *Prunella vulgaris* 2(+); *Vicia sepium* 2(+); *Entodon schreberi* 2(2); *Cornus sanguinea* c 3(+); *Crepis paludosa* 3(+); *Ulmus laevis* a 3(+); *Valeriana sambucifolia* 3(+); *Vinca minor* 3(+).

Location of relevés: 1. by the stream between the Prymiatyna and Na Orlińskim summits; 2. valley of Hołubla stream; 3. valley of Turnica stream.

nobilis, Phyteuma spciatum, Carex digitata, Astrantia major and *Neottia nidus-avis.* The lime-oak-hornbeam forests of this area feature high species richness (36–50 species on average). The share of *Aposeris foetida* is notable, and this species is taken to distinguish the Eastern Carpathian vicariant (Kornaś1968). All the sub-associations feature *Dentaria glandulosa* and *D. bulbifera*, sometimes en masse, along with other species characteristic of the *Fagion* alliance present sporadically. The presence of the aforementioned recognitary features for lime-oak-hornbeam forest is interpreted as a sign of the affinity of these communities with the submontane vicariant.

The lime-oak-hornbeam communities determine the vegetational landscape of the submontane belt, being its predominant component. In the submontane area, this kind of forest occurs to the north of the Wiar Valley, creating a series of sub-associations that are conditioned by the fertility and humidity of the substratum. In the southern part of the study area, these encroach upon the montane beech forest landscapes, though they are confined to the most extensive stream valleys, where they are present in a mosaic with *Carici remotae-Fraxinetum* and create transitional forms with beech forest communities.

Tilio-Carpinetum corydaletosum

Altitudes of between 245 and 380 m a.s.l in stream valleys, on the flat land of higher terraces, more rarely on slopes have a sub-association similar to alluvial forest in terms of its species composition (Table 2). This is the most species-rich sub-association of lime-oak-hornbeam forest with an average of 50 species. Distinguishing it is the occurrence of *Fraxinus excelsior* and *Acer pseudoplatanus*, as well as the abundant presence of spring geophytes like *Corydalis cava, Scilla bifolia, Ficaria verna, Isopyrum thalictroides* and other species of fertile and moist habitats like *Asarum europaeum, Mercurialis perennis, Circaea lutetiana* and *Astrantia major. Dentaria glandulosa* and *D. bulbifera* are the most abundant in this sub-association in spring. The habitats are fertile and moist, being enriched by runoff from surrounding slopes. A similar unit was described from Góry Słonne and termed *T.-C. stachyetosum* (Dzwonko 1977).

Tilio-Carpinetum typicum

Typical lime-oak-hornbeam forest in a variant with *Carex pilosa* (Table 3, relevés 1–12) is present in the submontane belt on the plateaus and slopes of poorer and drier habitats than are noted for the previous sub-association. Patches are located at altitudes of between 310 and 430 m a.s.l. (356 m a.s.l. on average). The stands are formed by *Fagus sylvatica* with an admixture of *Carpinus betulus*. Particular patches may also have *Tilia cordata, Acer pseudoplatanus* and *Fraxinus excelsior.* A small admixture is also accounted for by *Acer platanoides, A. campestre* and *Abies alba*. The community is given its aspect by the presence of *Carex pilosa*. The sub-association has no shortage of species of fertile habitats, including spring geophytes, and there is also a constant presence on the part of *Maianthemum bifolium* and *Rubus hirtus*. The mean number of species is 47.

Two sub-variants may be distinguished within this unit. The more fertile and moister sub-variant with *Scilla bifolia* is typified by its greater share of species that are charac-

Table 2. *Tilio-Carpinetum corydaletosum*.

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	Constancy (C)
Field no.	12	32	29	27	51	52	66	8	59	50	60	61	62	
Altitude	340	330	380	325	255	245	295	320	330	290	330	320	300	
Aspect	–	NW	–	–	–	–	N	E	–	E	–	N	N	
Slope	–	+	–	–	–	–	+	+	–	20	–	10	+	
Cover of trees [%]	80	100	95	95	100	100	80	95	95	70	80	90	90	
Cover of shrubs [%]	+	10	15	10				+	+	+	+	5	+	
Cover of herbs [%]	95	60	100	80	100	50	85	80	60	75	40	60	40	
Cover of bryophytes [%]			+	+	+		10							
Number of species	53	55	56	73	57	43	68	47	49	47	32	38	33	
Trees														
Ch. Carpinion														
Carpinus betulus a	+	4	1	2	1	2	2	3	3	2	4	5	3	V
Carpinus betulus b	+	+		1		+				+				
Carpinus betulus c										+		+		
Tilia cordata a				1	1		2	+	+	+	1	1	1	IV
Tilia cordata b									+					
Tilia cordata c							+				+			
Cerasus avium a											+			I
Cerasus avium c									+					
Ch. Fagion														
Acer pseudoplatanus a	1	+	3	2	3	1	2	2		1	+			V
Acer pseudoplatanus b		+												
Acer pseudoplatanus c	+	+		+				+		1			+	
Fagus sylvatica a	1		1	+	2	3		1	+	2		1	3	IV
Fagus sylvatica b	+		1									+		
Fagus sylvatica c			+							+				
Ch. Fagetalia, Querco-Fagetea														
Corylus avellana a3		1	1	1	2	1	1	+						IV
Corylus avellana b	+		1						+					
Corylus avellana c	+	+			+		+	+						
Fraxinus excelsior a	3	1	2	1	2									IV
Fraxinus excelsior b			1	+										
Fraxinus excelsior c		1	2		+	+	+	+						
Ulmus glabra a				+	1								+	III
Ulmus glabra b			+				1							
Ulmus glabra c			+			+	+							
Acer platanoides a		+												II
Acer platanoides b		+												
Acer platanoides c		+		+			+							
Accompanying species														
Acer campestre a	+	+	1	3	1	1	+	+	1		+		+	V
Acer campestre b				1			+							
Acer campestre c				+	+		+		1	+	1	+		
Quercus robur a		3	1		2	3	2		2	3	+		1	IV
Quercus robur b		+												
Quercus robur c									+	+			+	
Abies alba a	+	2	1		+									II
Abies alba c	+	+		+										

(cont.)

Table 2. Continued.

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	C
Shrubs														
Crataegus monogyna b			+	2		+								III
Crataegus monogyna c		+						+	+			+		
Euonymus europaeus b									+					II
Euonymus europaeus c		+				+	+		+					
Sambucus racemosa b			+	+										II
Sambucus racemosa c				+							1		+	
Cornus sanguinea c			+	+	+									II
Cornus sanguinea b				+										
Herbs														
Ch. Carpinion														
Stellaria holostea	2	1	+	1	1	1	1	1		2		+		IV
Ranunculus cassubicus	+	+				+	+	+	+			+	+	III
Carex pilosa		3					+	3	+	1		1		III
Ch. Fagion														
Dentaria glandulosa	+	+	+	+	2	1	1	2	+	1	2	5	5	V
Dentaria bulbifera	1	1		1	2	1	1	1	1	2				IV
Symphytum cordatum	+		(+)	1					+				1	II
Lunaria rediviva	+		1	1										II
Festuca altissima					+					+				I
Ch. Fagetalia, Querco-Fagetea														
Aegopodium podagraria	3	1	+	2	2	2	1	3	2	3	1	+	+	V
Anemone nemorosa	2	3	3	2	2	3	3	3	3	3	1	2	1	V
Aposeris foetida	2	1	+	+	1	+	+	+	1	1	+	+	+	V
Asarum europaeum	1	1	3	2	+	1	2	1	2	1	1	1	2	V
Ficaria verna	1	3	2	2	2	2	2	+	2	2	3	+	2	V
Galeobdolon luteum	1	1	2	1	+	+	3	2	2	+	2	2	2	V
Primula elatior	+	+	+	+	+	+	2	1	2	+	1	1	1	V
Scilla bifolia	1	+		1	2	1	2	2	2	1	1	2	2	V
Salvia glutinosa	1	+	2	1	1	+	1	+	+	+	+			V
Dryopteris filix-mas	+	+	+	+	+		+		1	+	+	2	1	V
Circaea lutetiana	+	+	1	+	+	1	1		1	+	+			IV
Euphorbia amygdaloides	+	+	+	+			+	+	+	+	+	+		IV
Pulmonaria obscura	+		2	+	1	1	2	1	+			+	+	IV
Ranunculus lanuginosus	+			+	+	+	+	1	+	+	+			IV
Paris quadrifolia	+	+	+	+		+	+			+		+	1	IV
Polygonatum multiflorum	+	+		+		+	+	+	+			+	+	IV
Galium odoratum		1	+	+	1	+			+	1	1	2		IV
Astrantia major		+	(+)	+	+		+	+	1	(+)				IV
Corydalis cava	1				2	1	1	2	1		4		3	IV
Daphne mezereum	+	+	+		+	+	+	+	+					IV
Mercurialis perennis	1	+		+	3		2	2		+				III
Hepatica nobilis	+						1	+	+	+		1	+	III
Stachys sylvatica		+	2	1	2	+	+			1				III
Anemone ranunculoides					1	1	2			+	1	+	+	III
Impatiens noli-tangere	+		1	+			2	+		1				III
Milium effusum				+	+	+	+	+		+				III
Brachypodium sylvaticum		+	1	1	+				+					II

Table 2. Continued.

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	C
Corydalis solida	+				+	+					1	1		II
Isopyrum thalictroides				1			1	1				1	2	II
Veronica montana	2	1	+	+				+						II
Viola reichenbachiana	+			+						+	+	+		II
Carex sylvatica	+				+		+		+		+			II
Lathyrus vernus							+	+	+	+				II
Melica nutans			+	+					+			+		II
Sanicula europaea		+							+	+			+	II
Campanula trachelium				+			+		+					II
Lilium martagon	+						(+)		+					II
Festuca gigantea			+		+					+				II
Poa nemoralis				+	+		+							II
Accompanying species														
Geranium phaeum	+		1	+	2	+	+	+	+					IV
Geum urbanum	+		+	+	+		+		+	+	+			IV
Oxalis acetosella	1	1	+				+	+	+	+		+		IV
Athyrium filix-femina		+	1	+	+	+				1		+		III
Chaerophyllum temulum	1	+	+	1	+								+	III
Senecio fuchsii	+	+	1	1			+			+				III
Urtica dioica	+		1	+	2	1	+							III
Stellaria nemorum			+	+	+	+	+			+				III
Hedera helix							1	+	1		+	+	+	III
Alliaria petiolata			+	+		+	+				+			II
Geranium robertianum	+			+			+				+			II
Ajuga reptans		+	1	+			+							II
Petasites albus				1	1			+		+				II
Anthriscus sylvestris	+						2		+					II
Galeopsis pubescens		+	+					+						II
Maianthemum bifolium		+								+		+		II
Chaerophyllum hirsutum			1	+			+							II
Brachythecium sp.				+	+		2							II

Sporadic species: *Ch. Fagetalia, Querco-Fagetea: Alnus incana* a 3(1), 4(+), b 3(+), 4(+); *Arum alpinum* 5(+), 6(+); *Actaea spicata* 6(+), 13(+); *Adoxa moschatellina* 12(1), 13(1); *Phyteuma spicatum* 1(+), 2(+); *Brachypodium sylvaticum* 1(1), 8(+); *Chrysosplenium alternifolium* 5(1), 12(1); *Carex digitata* 12(+); *Carex remota* 7(+); *Epilobium montanum* 10(+); *Epipactis helleborine* 2(+); *Lonicera xylosteum* 2(+); *Lysimachia nemorum* 10(+); *Neottia nidus-avis* 2(+); *Ulmus minor* a 1(2); b 1(+); c 1(+), 8(+).

Accompanying species: *Robinia pseudacacia* a 12(+), 13(+), b 13(+); *Ulmus laevis* a 1(1); *Pinus sylvestris* a 2(+); *Staphylea pinnata* c 7(+); *Viburnum opulus* b 9(+), c 2(+); *Prunella vulgaris* 1(+), 7(+); *Dactylis glomerata* 1(+), 9(+); *Rubus idaeus* 2(+), 4(+); *Epipactis atrorubens* 2(1), 12(+); *Melandrium rubrum* 3(+), 4(+); *Cirsium oleraceum* 4(+), 5(+); *Eupatorium cannabinum* 4(+), 5(+); *Lysimachia nummularia* 4(+), 7(+); *Equisetum pratense* 4(+), 8(+); *Deschampsia caespitosa* 5(+), 8(+); *Cerastium sylvaticum* 1(+); *Plathanthera chlorantha* 1(+); *Hypericum maculatum* 2(+); *Veratrum lobelianum* 2(+); *Fragaria vesca* 3(+); *Mnium* sp. 3(1); *Rosa* sp. 3(+); *Rumex obtusifolius* 3(+); *Astragalus glycyphyllos* 4(+); *Cardamine impatiens* 4(+); *Equisetum hyemale* 4(+); *Taraxacum officinale* 4(+); *Valeriana sambucifolia* 4(+); *Vicia sepium* 4(+); *Glechoma hirsuta* 5(+); ; *Lycopus europaeus* 5(+); *Myosotis palustris* 5(+); *Anthriscus nitida* 6(+); *Glechoma hederacea* 7(+); *Moehringia trinervia* 7(+); *Symphytum tuberosum* 7(+); *Vicia dumetorum* 7(+); *Chaerophyllum aromaticum* 8(+); *Dryopteris austriaca* 8(+); *Polytrichum commune* 10(+); *Tussilago farfara* 11(+).

Location of relevés: 1–4. valley of Turnica stream; 5–6. valley of Hołubla stream; 7. Iwanowa summit; 8. Korytniki forest; 9. Wapielnica summit; forest between Średnia and Wapowce; 11–13. Wapielnica summit.

teristic of the *Carpinion* alliance and order *Fagetalia*. The patches of this unit usually occur on steep slopes facing north, north-east or north-west. A drier and rather less fertile sub-variant has *Betula pendula* and *Abies alba* in the stand, as well as a greater abundance of *Rubus hirtus, Athyrium filix-femina* and *Hedera helix*. This occurs at flat or gently-sloping south-facing sites and may be linked with the *T.-C. caricetosum* described by Dzwonko (1977).

The variant with *Senecio fuchsii* (Table 3, relevés 13–23) occurs at similar altitudes to the previous unit, but over a narrower range (330–400 m a.s.l.). The stand is formed from beech and hornbeam, and fir is also present. The mean number of species is 36. There is a near lack of species characteristic of the *Carpinion* alliance, while species typical of the order and class are present less constantly and in lesser numbers. On the other hand, *Rubus hirtus* and *Senecio fuchsii* occur constantly and in some numbers. Apart from these, permanent components of the forest floor vegetation are *Maianthemum bifolium* and *Oxalis acetosella,* while *Galeopsis pubescens* is also frequent. The phytocoenoses belonging to this unit in its typical sub-variant occur on flat sites on plateaus, while the sub-variant with fir is characteristic of slopes of between 15 and 20%. This variant would seem to be under the influence of human economic activity, as attested to by the setting of firs beneath the canopy and the abundance of *Rubus hirtus* and *Senecio fuchsii.* The geological substratum is the same as in the case of the typical sub-association with *Carex pilosa* (1 : 50 000 geological map; *Szczegółowa mapa geologiczna Polski* 1986, 1991), so there are no grounds on which to impute habitat differences although soil studies are in fact lacking. When set against data from Góry Słonne, a similarity is noted with the beech form of *Tilio-Carpinetum caricetosum pilosae.*

Beech forests – *Dentario glandulosae-Fagetum* Klika 1927 *em*. Mat. 1964 – Eastern Carpathian vicariant

The part of the study area in which beech forests predominate comprises the mountains to the south of the Wiar Valley where altitudes rise to more than 600 m a.s.l. *Fagus sylvatica* predominates in the stand, while *Acer pseudoplatanus* is well represented and *Abies alba* and *Ulmus glabra* are also present. The species of the lower altitudinal belts (*Carpinus betulus, Acer platanoides, Tilia cordata* and tree forms of *Corylus avellana*) are encountered even in the montane form of beech forest – in a feature characteristic of the Eastern Carpathians. There is a clearly smaller share of species characteristic of *Carpinion* (like *Stellaria holostea, Ranunculus cassubicus* and *Galium* schultesi), while the proportion of species from the *Fagion* alliance or typical of mountains increases (as in the cases of *Symphytum cordatum, Polystichum aculeatum, Gentiana asclepiadea, Polygonatum verticillatum* and *Prenanthes purpurea*). However, the proportions involved are still small in comparison not only with the beech forests of the Bieszczady Mountains (Zarzycki 1963) or Low Beskids (Grodzińska & Pancer-Kotejowa 1965), but also with those of Góry Słonne (Dzwonko 1977). This is connected with the altitude of the highest peaks in this area, which exceed 600 m a.s.l. (as at Suchy Obycz – 614 m a.s.l. and Chwaniów-Brańcowa – 685 m a.s.l.), as well as with the location at the far end of the

Table 3. *Tilio-Carpinetum typicum*.

Variants	Variant with *Carex pilosa*												Variant with *Senecio fuchsii*											Constancy: relevés 1–12 (C_1)	Constancy: relevés 13–23 (C_2)
Subvariants	Subvariant with *Scilla bifolia*						Subvariant with *Rubus hirtus*						Typical subvariant								Subvariant with *Abies alba*				
Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Field no.	68	63	64	65	18	9	5	11	45	47	48	49	56	54	53	55	46	57	58	4	3	2	1		
Altitude a.s.l.	370	355	360	350	390	310	340	430	375	335	330	325	385	355	360	355	355	400	400	330	390	330	335		
Aspect	NWW	W	NW	NNW	W	NE	S	NE	–	S	SE	E	E	N	–	EES	S	–	NNE	SE	N	W	W		
Slope	10	10	+	+	15	20	+	5	–	+	+	10	+	+	–	+	+	–	+	5	15	15	20		
Cover of trees [%]	80	85	80	95	95	95	95	90	100	90	90	85	95	95	90	95	85	85	80	85	90	90	95		
Cover of shrubs [%]	+	5	5	5	+	10	5	+	+	+			5	40	+	5	+	+	+	20	20	5	5		
Cover of herbs [%]	70	80	70	60	60	50	50	70	80	70	70	80	80	35	25	50	50	50	55	70	40	65	40		
Cover of bryophytes [%]					+				10				+			+		+			+	+	+		
Number of species	47	61	57	50	66	42	41	47	48	32	36	38	31	21	21	40	37	39	46	42	27	41	50		
Trees and shrubs																									
Ch. Carpinion																									
Carpinus betulus a		3	2	2	1		3	+	1	1	1	1	3	2	2	+	1	1	1	2	1	4	3		
Carpinus betulus b					+	+								1								1		V	V
Carpinus betulus c		+			+	+		+	+	+	1	+			+	+	+					+			
Cerasus avium a		1	1	1			+										+	1	1						
Cerasus avium b		+										+												III	II
Cerasus avium c		+	+								+					+		+							
Tilia cordata a		1	3		2			+			+				+	+									
Tilia cordata b		1	1	1	+																			III	I
Tilia cordata c		+		+	+																				
Ch. Fagion																									
Fagus sylvatica a	5	1	3	5	3	5	4	4	5	5	5	5	5	5	5	5	4	5	5	4	5	3	5		
Fagus sylvatica b	+	1	1	1	+	1				+					+		+		+	2	1	+		V	V
Fagus sylvatica c	+		+	+	+		+	+		+		+				+	+	+	+		+				
Acer pseudoplatanus a	+	2					+	+	1			+													II
Acer pseudoplatanus b						+														+				V	
Acer pseudoplatanus c	1	1	1	+	+	+	1	1	2	1	1	1					+					+			
Ch. Fagetalia, Querco-Fagetea																									
Fraxinus excelsior a		1							1															III	II
Fraxinus excelsior c	1	1	+		+	1			+							+	+	+				+			

(cont.)

Table 3. Continued.

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	C_1	C_2
Corylus avellana b					+															+		+	+	II	II
Corylus avellana c			+						+									+				+	+		
Ulmus glabra a	+								+									+	+					III	I
Ulmus glabra c	+		+	+					+		+							+	+						
Acer platanoides a	+									+														III	
Acer platanoides c	+				+	+				+	+														
Accompanying species																									
Abies alba a							1	1	+					2	2	1	+		+		3	3	3	II	V
Abies alba b									+				1	1		1	+	+	+	+		+	2		
Abies alba c										+			+	+		+		+	+		+	+			
Quercus robur a		2	1	1		1						1	1		1	+			+					III	II
Quercus robur c			+	+	+		+						+												
Betula pendula a							1	+		+	+	+					+	+	+	2		1	2	III	
Acer campestre a								+	+															III	I
Acer campestre c	+	+	+	+	+				+								+			+					
Sambucus racemosa b																+									III
Sambucus racemosa c													+			+		+	+		+		+		
Crataegus monogyna c		+	+	+	+																			II	
Euonymus europaeus c		+	+		+				+															II	
Pinus sylvestris a													1		+			+		+					II
Staphylea pinnata c	+		+		+																			II	
Herbs																									
Ch. Carpinion																									
Carex pilosa	3	3	3	3	2	3	1	3	3	2	3	2	1	2	1	2	2	1	2	2	1	3	2	V	V
Stellaria holostea		+	+		+	+	1		1	+	+	2	1				+							IV	I
Galium schultesii	+	+	1	(+)	+			1																III	
Ranunculus cassubicus		+	+	+	+																			II	
Ch. Fagion																									
Dentaria bulbifera	2		1	2	2	2	2	2	1	2	2	2	1	1	2	1	2	2	2	2	4	2	2	V	V
Dentaria glandulosa	+	1	+	1		3	1	2	2	2	2		1	2	2	3	1	2	2	2	2	1	3	V	V
Festuca altissima									+		+					+			+				+	I	II
Hordelymus europaeus									+															I	
Symphytum cordatum					+																			I	
Melica uniflora																		+						I	

Ch. Fagetalia, Querco-Fagetea																									
Anemone nemorosa	2	2	1	3	2	2	3	2	4	3	3	3	4	2	3	3	3	1	1	1	1	2	2	V	V
Galium odoratum	1	2	1	1	3	2	(+)	2	1	2	2	1	+	1	+	1	1	2	2	1	1	3	3	V	V
Dryopteris filix-mas	+	+	+	1	+		1	1	1	1	1	1	2	1	+	1	1	+	1	1	+	2	1	V	V
Galeobdolon luteum	1	2	2	1	2	1	3	2		2	2	1	1	1	+	1	2	2	1	2	2	1	2	V	V
Circaea lutetiana	+	+		+	+	+	+	+	+	+	+	+	+	+		+	+	+	1	+	+	+	+	V	V
Polygonatum multiflorum	+	+	+	+	+	+	+	+	+	+		+	+	+		+	+		+		+	+	+	V	IV
Milium effusum		+	+	+	+	+	+	+	+		+	+	1	+		+	1	+	+		+	1	+	V	V
Asarum europaeum	1	2	1	2	1	1	+	1	1	1	1	1				+		1	1	1		2	2	V	III
Salvia glutinosa	1	1	1	+		+		1	+		+	+				+	+	+	+	+	1	1	1	IV	IV
Pulmonaria obscura		1		+	+	+	+	+	1	+	+	+					+	+	+	1	+	2	1	V	IV
Euphorbia amygdaloides	+	+	+	+	+	+		+	1	+	+					+		+	+	+		+	+	V	III
Sanicula europaea	+	+	+		+	+	+	+				+				+	+	+	+	1	+	1	1	IV	IV
Ficaria verna			+	2	2	1	2	1	2	1	1	+		2			+		+		1	+	+	V	III
Daphne mezereum	+		+	+		+	+	+	+		+					+			+	+		+	+	IV	III
Carex sylvatica		+	+	+	+	+	+	1				+				(+)	+	+		+	+			IV	III
Aegopodium podagraria		+	+	+	1	1	2	1	2	1	+	+	1											V	I
Aposeris foetida	+	1	+	+	1	+	+	1	+			+					+		+					V	I
Paris quadrifolia		+	+	+	+		+		+			+	+	+		+		+		+				III	III
Impatiens noli-tangere		+		+		+		+	+			3		+		+			1	+	+		+	III	III
Corydalis cava	+	1			2	1	2		2	2	2	+		3				+						IV	I
Lathyrus vernus	+	+	+	+	+	+		+	+			+					+							IV	I
Actaea spicata	+					+	+	+			+								+	+		+	+	III	II
Viola reichenbachiana	+	+					+		+			+							+			+	+	III	II
Isopyrum thalictroides	+	2	1		+	1	2		+															III	
Scilla bifolia	1	2	2	1	2	1			1															III	
Scrophularia nodosa		+			+	+					+	+				+	+							III	I
Stachys sylvatica		(+)	+		+	+						+				(+)		+						III	I
Primula elatior		1		1	+					+	+								+			+		III	I
Veronica montana							+						+	(1)				+	+	+		(+)		I	III
Lysimachia nemorum								+					+	+	+	+	+			+				I	III
Hepatica nobilis	+	1	1	1	+			+																III	
Anemone ranunculoides	+								+	1	1	+		+										III	I
Brachypodium sylvaticum	+	+	+											+						+			+	II	II
Mercurialis perennis	+	+						1										2	1		1			II	II
Catharinea undulata					+				2							+		+			+	+	+	I	III
Melica nutans	+			+	+			+															+	II	I
Carex digitata		+			+			+						+								+		II	I

(cont.)

Table 3. Continued.

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	C_1	C_2
Phyteuma spicatum			+	+	+																	+	+	II	I
Lilium martagon	+	+	+		+																			II	
Astrantia maior		1	+	(+)																				II	
Accompanying species																									
Athyrium filix-femina	+	+	+	+	+	1	2	2	1	2	1	1	2	1	2	1	1	1	+	2	2	1	2	V	V
Rubus hirtus	+	+	+	+	+	+	1	2	+	1	1	+	2	2	2	2	2	1	+	1	+	1	1	V	V
Senecio fuchsii	+		+	+	+	+	+	1	+	1		+	2	+	+	+	+	+	+	1	1	+	+	V	V
Maianthemum bifolium	+	+	1	+	+	+	+	+	+	+		+	+	+	+	+	1	+		+		+	+	V	V
Oxalis acetosella	+	+		+	+	+	+	+					+	+	+	+	+	+	+			+	+	III	V
Hedera helix	1	+		+	+	+	2	+	1	1	+	1	+			+			+			+		V	II
Mycelis muralis	+		+	+	+											+	+		+	+	+		+	II	III
Ajuga reptans			+	+	+	+		+			+			(+)		+				+		+		III	II
Galeopsis pubescens													+	+	+	+			+						III
Chaerophyllum temulum				+	+			+															+	II	I
Dryopteris austriaca					+		+							+	1									I	I
Chaerophyllum aromaticum						+														+	+		+	I	II
Anthriscus sylvestris	+	+	+																					II	
Hypericum hirsutum		+						+	+															II	

Sporadic species: Ch. *Fagetalia, Querco-Fagetea:Ulmus minor* a 8(+), b 5(+); *Lathraea squamaria* 3(+), 5(+), 17(+); *Poa nemoralis* 3(+), 5(+), 20(+); *Chrysosplenium alternifolium* 9(+), 17(+), 20(+); *Campanula trachelium* 1(+), 2(+); *Adoxa moschatellina* 3(+), 5(+); *Corydalis solida* 5(+), 6(1); *Neottia nidus-avis* 9(+), 23(+); *Arum alpinum* 1(+); *Epilobium montanum* 2(+); *Melittis melissophyllum* 3(+); *Ranunculus lanuginosus* 11(+); *Cephalanthera rubra* 23(+); *Epipactis helleborine* 23(+).

Accompanying species: *Larix decidua* a 2(1), 12(+), 17(1); *Viburnum opulus* c 5(+), 13(+), 23(+); *Populus tremula* c 19(+), 23(+); *Sorbus aucuparia* a 23(1); c 22(+), 23(+); *Euonymus europaeus* c 13(+), 19(+); *Quercus rubra* a 7(+); *Quercus petrea* a 8(1); *Ulmus laevis* c 10(1); *Sambucus nigra* c 5(+); *Robinia pseudacacia* a 19(+); *Frangula alnus* b 20(+); *Cornus sanguinea* c 23(+); *Petasites albus* 2(+), 22(1), 23(+); *Glechoma hirsuta* 3(+), 18(+), 19(+); *Geranium robertianum* 5(+), 18(+), 19(+); *Luzula pilosa* 5(+), 20(+), 23(+); *Symphytum tuberosum* 1(+), 4(+); *Fragaria vesca* 1(+), 10(+); *Eupatorium cannabinum* 2(+), 9(+); *Listera ovata* 4(+), 10(+); *Moehringia trinervia* 18(+), 19(+); *Equisetum sylvaticum* 22(+), 23(+); *Arctium nemorosum* 2(+); *Rubus idaeus* 2(+); *Campanula rapunculoides* 3(+); *Deschampsia caespitosa* 7(+); *Mnium* sp. 13(+); *Gymnocarpium robertianum* 14(1); *Geranium phaeum* 19(+); *Galium verum* 20(+); *Pyrola media* 20(+); *Myosotis sylvatica* 22(+); *Solidago virgaurea* 23(+).

Location of relevés: 1. Helicha summit; 2–4. Iwanowa summit; 5. Wapielnica summit; 6–7. Korytniki forest; 8. Szybenica summit; 9. Korytniki forest; 10–12. Forest between Średnia and Wapowce; 13–16. Forest by Średnia – W; 17. Forest between Średnia and Wapowce; 18–19. Na Orlińskim summit; 20. Forest by Średnia – W; 21–23. Na Orlińskim summit.

Carpathian chain. In relation to the lime-oak-hornbeam communities, this type has a smaller number of characteristic species for the order and class.

Distinguished in the study area were local units conditioned by altitude: beech forests of the montane form, of the submontane form, of a form transitional to lime-oak-hornbeam forest and of a form with *Impatiens noli-tangere* which occurs extra-zonally in the area dominated by lime-oak-hornbeam forest to the north of the Wiar. Ecological differentiation is hard to see in the cases of the sub-associations among the units discerned, though it is possible to distinguish degenerate forms.

Dentario glandulosae-Fagetum occurs in its montane altitudinal form (Table 4, relevés 1–10) at the highest sites on Suchy Obycz and Chwaniów, where the study area borders onto Góry Słonne. The mean altitude is 530 m a.s.l., while the range of altitudes is between 660 and 450 m a.s.l. depending on exposure. The stand consists of *Fagus sylvatica* and *Acer pseudoplatanus* with an admixture of *Fraxinus excelsior* and *Abies alba*. *Symphytum cordatum* is a permanent constituent of the ground cover layer, while mountain species also present include *Gentiana asclepiadea, Polygonatum verticillatum, Prenanthes purpurea, Streptopus amplexifolius* and *Poa chaixi*. It is interesting that the montane form of beech forest includes species of lime-oak-hornbeam forest like *Stellaria holostea* and *Corylus avellana* more often than the submontane forms. The mean number of species is 47.5. The majority of the patches noted can be assigned to the typical sub-association, while relevé no. 1 belongs to the *lunarietosum* sub-association specific to the Eastern Carpathians.

The submontane form (Table 4, relevés 11–19) occurs at altitudes of 420–510 m a.s.l. (mean 455 m a.s.l.), mainly on north- or east-facing slopes. Compared with the montane form this is characterised negatively, by reference to the absence of montane species and a lesser proportion of species from the *Fagion* alliance. On the other hand, it is also characterised by a greater quantitative representation of such tree species as *Ulmus glabra, Acer platanoides* and *Tilia cordata*. *Tilia platyphyllos* also occurs. The mean number of species is lower than in the montane form, at 32.

It is possible to observed numerous degenerate forms of this type of beech forest. Table 4 relevés 20–24 depict a form with a considerable proportion of fir trees, as well as a ground cover layer in which *Rubus idaeus* or *R. hirtus* play a major role. This is most probably the result of a kind of felling plan that leaves fir in place and provides for its self-regeneration in the absence of competition with other tree species. This type of management and variously-aged stages of regrowth were often observed in the study area. The planting of fir under the existing canopy was also noted in many places.

A form of beech forest reminiscent of lime-oak-hornbeam forest (Table 4, relevés 25–28) occurs at rather lower elevations (mean 444 m a.s.l.), in the vicinity of valley bottoms where there are outcrops of shales – i.e. in the moister and more fertile habitat. This is characterised by the presence of both *Symphytum cordatum* and *Stellaria holostea, Ranunculus cassubicus* and *Crataegus monogyna*. *Asarum europaeum* and *Aegopodium podagraria* occur in abundance. In terms of habitat, these patches existing over small areas of narrow stream valleys are clearly related to the lime-oak-hornbeam forests located below. They are also the richest in terms of number of species (55 on average).

Table 4. *Dentario glandulosae-Fagetum.*

Units of lower rank	Montane form										Submontane form																				C_1	C_2	C_3	C_4	C_5	C_6
											Typical subassociation									Degeneration form					Reminiscent *Tilio-Carpinetum*				Variant with *Impatiens noli-tangere*									
Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32						
FIeld no.	23	37	26	36	35	33	21	20	19	14	22	44	43	42	41	40	39	72	34	15	16	28	24	25	38	30	31	71	10	70	69	67						
Altitude a.s.l.	660	450	450	460	550	570	540	540	480	610	510	440	440	440	445	460	440	500	420	480	470	410	510	535	425	370	490	490	310	370	385	350						
Aspect	W	EEN	–	EEN	NE	W	E	N	SW	NW	NE	E	NNE	EEN	EEN	EEN	NNE	NE	NW	W	W	ESS	N	W	N	–	NW	NE	S	NWW	SW	SSW						
Slope	10	+	–	10	+	+	50	+	30	10	40	+	5	+	20	20	5	15	+	+	5	20	5	+	+	–	5	20	15	45	20	45						
Cover of tree layer [%]	90	95	100	95	95	80	85	80	80	85	75	80	70	90	90	90	100	95	95	70	75	100	95	90	100	100	85	100	75	75	80	80						
Cover of shrub layer [%]	5	5	10		5		+	5	+		+			+				+	+	10	10	10	+	15		+	+	10	10	5	5						
Cover of herb layer [%]	70	55	50	60	55	50	40	60	40	70	40	65	50	60	50	35	35	40	50	100	100	40	50	40	65	60	40	60	100	50	65	60						
Cover of bryophyte layer [%]			+	+			+	+	+		+									10			+	+			+		5	5						
Number of species	35	43	44	53	50	45	47	53	68	37	41	33	32	26	28	30	30	34	36	43	29	39	37	34	61	59	57	46	37	39	45	27						
Trees and shrubs																																						
Ch. Fagion																																						
Fagus sylvatica a	4	3	5	3	4	5	5	4	2	4	4	5	5	5	3	5	5	5	5	1	4	5	5	5	4	2	4	5	5	5	4	5						
Fagus sylvatica b		1						+	1		+			+	1			+		1	+	2	+	2	+	+		1	+	1	1		V	V	5	4	4	V
Fagus sylvatica c		+	+		1	+	+		+	+		1	1	+	1	+		+						1	1	1	+										
Acer pseudoplatanus a	2	5	2	2	1	1	1	1	4	3	2	2	1	1	3		1		1			+			1	3				+	1	1						
Acer pseudoplatanus b																									+				1				V	V	2	4	4	V
Acer pseudoplatanus c	+		1	+	1	+		+	+		+	+	+	1	+	1	+	+	1			+		+	1		+	+	1	+	+							
Ch. Carpinion																																						
Carpinus betulus a			2	1															+	1		1	+	+	3	1	1											
Carpinus betulus b			1																+	1					1	1	+		+				I	I	4	3	1	II
Carpinus betulus c				+																					+	+	1		+									
Tilia cordata a				+	+							+	+			1		1																				
Tilia cordata b																		+												+			I	III			1	I
Tilia cordata c													+																									

Cerasus avium a																											+						I			1		I
Cerasus avium c				+	+																																	
Ch. Fagetalia, Querco-Fagetea																																						
Acer platanoides a			2						+	+		1	+	1	+	+											+				+		III	IV	2	4	2	IV
Acer platanoides b																				+										+	+							
Acer platanoides c		+		+			+	+	+			2	1	1	+	+		+				1			+	+	1	+			1							
Ulmus glabra a	+						+	+	+			1	+	2		+	2	2							1	+							III	V		3	2	III
Ulmus glabra b																									+	+				+	+							
Ulmus glabra c	+			+				+	+			+	+	+	+		+	+	+						+	1	+			+	+							
Fraxinus excelsior a	2	1					1	1		1																	1			+			V	I	1	4	3	III
Fraxinus excelsior c	+	1		1	+	+	+	+	+	1									1	+					+	1	1	+	+	+	+							
Corylus avellana b	+		+		2			1	1										1	+					1								III	I	1	2		II
Corylus avellana c					1				+																1		+											
Ulmus minor b	+										+																			+			I	I			2	I
Ulmus minor c											+																				+							
Accompanying species																																						
Abies alba a	1		+	2	2	+	1	+	1	+	2	+			+	1		1	+	3	3	3	1	2		1	1	1					V	IV	5	4		IV
Abies alba b	1						+	1												+	2							+										
Abies alba c					+	+	+		+		+		+					+			+	+	+	+	+		+											
Sambucus racemosa b											+									+													II	IV	2	2		III
Sambucus racemosa c			+	+		+	+					+		+	+	+	+	+				+				+	+											
Acer campestre a																										+							I		2	2	1	I
Acer campestre b									+											+																		
Acer campestre c																						+				+	+		+									
Populus tremula a				1							+																1						I	I		1		I
Populus tremula c											+																+											
Betula pendula a				+																				1			+						I		1	1		I
Herbs																																						
Ch. Fagion																																						
Dentaria bulbifera	2	1	2	2	2	1	2	2	2	2	3	+	1	+	1	1	1	2	2	2	2	2	2	2	2	2	1	1	1	1	2	2	V	V	5	4	4	V
Dentaria glandulosa	3	1	1	1	1	1	1	2	2	1	2				+	1	+	2	2	2	2		+		1	1	+	+	1	2	1	1	V	IV	3	4	4	V
Symphytum cordatum	+	1	1	1	1		+	+	1	+	1	+	+		+		+	+							1	1		1					V	IV		3		III
Lunaria rediviva	4	2		(+)							2		+		2											+							II	II		1		II
Polystichum aculeatum		+							+		+					+												+					I	II		1		I
Hordelymus europaeus						1	+	+				+					+																II	II				I

(cont.)

Table 4. Continued.

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	C_1	C_2	C_3	C_4	C_5	C_6
Prenanthes purpurea					+												(+)						+										I	I	1			I
Polystichum aculeatum																														1	+						2	I
Festuca altissima			1																														I					I
Melica uniflora					+																												I					I
Polygonatum verticillatum																												+								1		I
Ch. Carpinion																																						
Carex pilosa	+	1		+	+	1	1	1	+																				1	+	+		IV				3	II
Stellaria holostea			1	+	+			+	(+)																2	1							III			2		II
Ranunculus cassubicus																									+		+									2		I
Ch. Fagetalia, Querco-Fagetea																																						
Galeobdolon luteum	1	2	1	2	2	1	1	1	1	2	1	2	2	2	2	1	1	1	1		2	2	1	2	2	2	1	2	2	+	1	+	V	V	4	4	4	V
Salvia glutinosa	+	1	1	2	+	2	+	1	1	1	1	1	1	2	2	1	1	2		2	1	1	1	2	+	1	1	1	+	+	1	1	V	V	5	4	4	V
Dryopteris filix-mas	1	1	+	2	2	1	1	1	+	1	1	1	2	1	1	1	+	1	1	1	1	+	3	1	1	+	1	+		+	+		V	V	5	4	2	V
Veronica montana	+	1	1	1	+	1	1	1	1	2	+	1	+	+	+	+	+	1	+	1	1		+	+	1	1	+	+	+					V	V	4	4	1	V
Circaea lutetiana	+	+	1	1	+	+	1	+	+	+		1	1	1	1	1	1	+	+	+	+	+	+	+		+	+		1	+	1	1	V	V	5	2	4	V
Anemone nemorosa	1	1	3	1	3	1	2	1	+	1	1				+	1		1	2	2	2	+	2		3	3	3	2	1	3	3	1	V	III	4	4	4	V
Galium odoratum	1	+	2	2	2	+	2	2	+			2	1		2	2	2	2	2	1	2	2	+	2	3	+	+	3	2				V	IV	5	4	1	V
Carex sylvatica	+			+	+	+		1	+	+	+	+	+	+	+	+		+	+	+	1	+	+	2	+	1	+		+	1	+		IV	V	5	3	3	V
Mercurialis perennis	1	+	1	+	+	1	1	1	2	3		2		2	1	1	+	2	3	3				+	1	+	+	1		1	+		V	IV	2	4	2	IV
Impatiens noli-tangere	+	2	+	1	+	1	+	+	1	2	2	1	2				+		2	4	4	+	+				+		5	3	3	3	V	III	4	1	4	IV
Sanicula europaea	+	+	+	1	+	1	+	+	+	+	+					+	+	+		+		+		+	+	+	+	+		+			V	III	3	4	2	IV
Brachypodium sylvaticum			1	+			+	+	+	+		1	+		+				+		+	+	1	2	+	+	+		+				III	III	4	3	1	III
Aegopodium podagraria	+	1	1	2	1		1	1	+			1	1				+		+	+					2	1		2	+			+	IV	III	1	3	2	III
Pulmonaria obscura	+	+	+	+	+		+	+	+		+						+			+					+	1	+	+	+	+	+		IV	II	1	4	3	III
Isopyrum thalictroides	1	+	1			+	+	+		+	+							1	+		+				1	2			+	+	2	1	IV	II	1	2	4	III
Euphorbia amygdaloides		+				+	+	+	+	1				+		+	+		+			+			+	+	+	+	+				III	III	1	4	1	III
Actaea spicata	+	+		+	+			+	+		+		+	+		+	+	+		+				+	+				+				III	IV	2	1	1	III
Paris quadrifolia	+	+	+	+	+	+		+	+												+		+		+	+	+	+		+	+		IV		2	4	2	III
Asarum europaeum		2	+	1		+																+			2	2	2	+	2	1	+	+	II		1	4	4	III
Milium effusum		1	2	1	+	+											+	+		+					1	1	+	+					III	II	1	4		II
Stachys sylvatica					+		+		+	+		1		+						1	+	+		+					+		1		II	II	4		2	II
Ficaria verna		+					+	+		+	+								+		1					+			2	+	2	2	II	II	1	1	4	II

Daphne mezereum					+	+	+	+		+							+		+						+	+	+	+					III	II		4		II
Aposeris foetida		+			+	+			+	+									+			+	+			1	1		+				III	I	2	2	1	II
Ranunculus lanuginosus		+	+			+		(+)									+	+							+	+	+	+					II	II		4		II
Lysimachia nemorum					+		+	+	+	+			+							+	+	(+)	+										III	I	4			II
Catharinea undulata			+	+			+	+	+		+												+				+	+			+		III	I	1	2	1	II
Viola reichenbachiana						1	+		+		+								+		+		+			+	+				+		II	II	2	2	1	II
Polygonatum multiflorum	+		+	+			+	+												+					+			+	+				III		1	2	1	II
Carex remota						+	+		+		+								+	+	+		+										II	II	3			II
Chrysosplenium alternifolium						1		+	+		+									+										+	1	1	II	I	1		3	II
Carex pilosa																1				+		1	2	1	2		3	1						I	4	3		II
Primula elatior			1				+		+																+	+	+				+		II			3	1	II
Epilobium montanum				+					+	+				+						+				+									II	I	2			I
Melica nutans									+														1		+	+	+	+					I		1	4		I
Lathyrus vernus																			+						+		+	+	+		+			I		3	2	I
Corydalis cava																									+	1			2	1	+	2				2	4	I
Lilium martagon		+						+																	+	+							I			2		I
Scrophularia nodosa						+						+											+	+									I	I	2			I
Carex digitata																					(+)	+	+					+							3	1		I
Scilla bifolia																										1				1	1	1				1	3	I
Arum alpinum																													+	+	1	+					4	I
Festuca gigantea						+														+			+										I		2			I
Lathraea squamaria																		+							+			+						I		2		I
Poa nemoralis																								+		+	+								1	2		I
Hepatica nobilis																									+			1			+					2	1	I
Anemone ranunculoides																														1	2	2					3	I
Accompanying species																																						
Athyrium filix-femina	1	1	2	2	2		1	2	2	+	1	1	1	2	1	1	+	1	+	1	+	1		1	1		1	1		1	1	1	V	V	4	3	3	V
Geranium robertianum	+	+	(+)	+	+	1	+	+	+	+	+	+	+	+	+	+		+	+		+	+		+		+	+	+	+	+	1	+	V	V	3	3	4	V
Senecio fuchsii		+	+	+	1	+	+	1	1	1		1	1	+	+		+	+	1	2	+	1	1	+	1	+	+	+		+	+	+	V	IV	5	4	3	V
Oxalis acetosella	+	1		1	1	+	+	1	+	+	+	+	1	+	+	+		+	+	+	+	+		+	1	+	+	+		1	+	+	V	V	4	4	3	V
Mycelis muralis				+	+	+	+	+	+	+	+	+	+			+		+	+		+	+	+	+	+	+	+	+	+			+	IV	IV	4	4	2	IV
Petasites albus		1	1	1	1	(+)	+	1	1	+		1	1	1	1		1	+							+	1		+					V	IV		3		III
Rubus hirtus				+	1	+	+	+	+	+	+	1	+	+		+				+		+	3	2			+	+					IV	III	4	2		III
Chaerophyllum temulum					+	+		+	1	+	+	+		+	+	+	+			+					+	1	+	1					III	IV	1	4		III
Urtica dioica	+	+	+	+		+			+			+	+	+					+	+	1		+	+			+						III	III	4	1		III
Dryopteris carthusiana				+	+							+	+	(+)	+	+	+								+								I	IV		1		II

(cont.)

Table 4. Continued.

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	C_1	C_2	C_3	C_4	C_5	C_6
Valeriana sambucifolia	+	+	+		+			+	+		+															+								III	I		1		II
Glechoma hirsuta			(+)			+				+					+									+					1	1	+	II	I	1		3	II
Stellaria nemorum				+			+	+	+	+	+									+									+				III	I	1		1	II
Ajuga reptans									+		+											+		+	+		+	+				+	I	I	2	3	1	II
Hedera helix													+									+			+			+	+	+	1	+		I	1	2	4	II
Moehringia trinervia		+			+														+			+	+	+			+						I	I	3	1		II
Maianthemum bifolium				+		+		+														+	1			+	+						II		2	2		II
Alliaria petiolata																						+				+			+	1	1	+			1	1	4	I
Polygonatum verticillatum	+				+		+	+	+																								III					I
Galeopsis pubescens				+		+	+				+															+							II	I		1		I
Melandrium rubrum									+		+															+		+			+		I	I		2	1	I
Rubus idaeus			+						+											2	2												I		2			I
Geranium phaeum			1																						+	+			+				I			2	1	I
Dryopteris austriaca							+	+	1												(+)												II		1			I
Phegopteris dryopteris													+			1							1	1										II	2			I
Gentiana asclepiadea				+	+				+																								II					I
Fragaria vesca																								+	+		+								1	2		I
Euonymus europaeus c																									+	+	+									3		I

Sporadic species: Ch. Fagetalia, *Querco-Fagetea*: *Tilia platyphyllos* a 11(+); *Tilia platyphyllos* b 11(+); *Alnus incana* a 26(+); *Lonicera xylosteum* c 5(+), 25(+); *Campanula trachelium* 26(+), 27(+); *Cephalanthera rubra* 9(+); *Circaea alpina* 9(+); *Phyteuma spicatum* 9(+); *Epipactis helleborine* 25(+); *Equisetum telemateia* 25(+); *Epilobium montanum* 29(+); *Adoxa moschatellina* 32(+); *Gagea minima* 32(+).

Accompanying species: *Picea abies* a 4(1), 5(+); *Pinus strobus* a 8(+); *Pinus sylvestris* a 22(1); *Sorbus aucuparia* c 23(+); *Myosotis sylvatica* 2(+), 9(+), 11(+); *Equisetum sylvaticum* 5(+), 9(+), 18(+); *Cystopteris fragilis* 7(+), 9(+), 11(+); *Valeriana simplicifolia* 3(+), 9(+); *Phegopteris connectilis* 5(+), 9(+); *Cardamine impatiens* 18(+), 22(+); *Geum urbanum* 19(+), 25(+); *Luzula pilosa* 18(+) 28(1); *Brachythecium* sp. 30(1), 31(1); *Poa chaixii* 2(+); *Cirsium oleraceum* 3(+); *Hypericum hirsutum* 3(+); *Myosotis palustris* 3(+); *Rosa* sp. 6(+); *Luzula sylvatica* 9(+); *Polytrichum commune* 9(+); *Streptopus amplexifolius* 9(+); *Cardamine flexuosa* 11(+); *Rumex obtusifolius* 19(+); *Juncus effusus* 20(+); *Mnium* sp. 20(1); *Rumex conglomeratus* 20(+); *Angelica sylvestris* 23(+); *Juncus compressus* 23(+); *Vicia sepium* 24(+); *Chaerophyllum hirsutum* 25(+); *Galeopsis tetrahit* 25(+); *Lapsana communis* 25(+); *Equisetum pratense* 26(+); *Anthriscus sylvestris* 31(+).

Location of relevés: 1. Truszowska summit; 2. By Turnica stream, between Arłamów and Makowa; 3. Dział summit; 4. By Turnica stream, between Arłamów and Makowa; 5–6. Suchy Obycz summit; 7–8. Braniów summit; 9. Between Arłamów and Kwaszenina; 10. Suchy Obycz summit; 11. Jureczkowa summit; 12–18. Kiczora summit; 19. Suchy Obycz summit; 20–21. Panieński Czub summit; 22. Kanasin summit; 23–24. Dział summit; 25–28. By Turnica stream, between Arłamów and Makowa; 29. Korytniki forest; 30–32. Helicha summit.

Where areas of the landscape of lime-oak-hornbeam forests are on steep slopes in narrow shady valleys, submontane beech forests occur extrazonally (Table 4, relevés 29–32). Patches of these communities cover limited areas and are characterised by stands with beech and an absence of *Carpinion*-alliance species. In contrast, *Polystichum aculeatum* does occur. The ground-cover layer is dominated by *Impatiens noli-tangere*, and there is no lack of geophytes (like *Ficaria verna, Corydalis cava* and *Anemone ranunculoides*). This form stands out for the presence of *Arum alpinum*. Beech forests with a more marked abundance of *I. noli-tangere* are usually regarded as a degenerate form, at least in the mountains of Central Europe, including the Eastern Carpathians (Dzwonko 1977). In the case of the materials presented here, this is rather a form specific to the habitat, occurring as it does in wet places like local channels taking runoff and giving a start to watercourses.

The forests in the Przemyśl foothills versus the forests of Góry Słonne

An overview of the studied beach and of lime-oak-hornbeam forests communities in the Przemyśl Foothills in comparison with analogous communities of Góry Słonne (Dzwonko 1977) is provided by the synoptic table (Table 5). Gathered therein are all the studied forests other than the degenerative forms.

As Table 5 shows, the conclusion to be drawn is that the forests of the Przemyśl Foothills have a character intermediate between those of the lime-oak-hornbeam forests and beech forests of Góry Słonne. This is thought-provoking when the location of the Przemyśl Foothills at the far end of the Carpathian chain, to the north of Góry Słonne, is recalled. In an area so located it might have been more reasonable to expect the increased significance of lime-oak-hornbeam forest characteristics, and a weakening of features of beech forest. It may be that microclimate plays a decisive role here, though evidence to support this presumption is still lacking.

In comparison with analogous communities of Góry Słonne, the differences and similarities of the studied lime-oak-hornbeam forests and beech forests of the Przemyśl Foothills are as follows:

– The lime-oak-hornbeam forests of the study area have a greater proportion of *Dentaria glandulosa* than those of Góry Słonne.

– The moist and fertile (*stachyetosum* and *corydaletosum*) lime-oak-hornbeam forests occur in both areas.

– The typical sub-association with *Carex pilosa* differs from *T.-C. caricetosum pilosae* of Góry Słonne in the lack of both species of the *Carpinion* alliance (e.g. *Dactylis achersohniana, Melampyrum nemorosum, Viola mirabilis)* and species of warm and dry habitats (e.g. *Melittis melissophyllum, Campanula persicifolia, Sedum maximum, Vincetoxicum officinale, Astragalus glycyphyllos).*

– *T.-C. melittetosum* has not been noted from the Przemyśl Foothills. This does not denote the total lack of this type of lime-oak-hornbeam forest in the area, but probably

Table 5. Lime-oak-hornbeam and beech forests in the Przemyśl Foothill and Góry Słonne Range (synoptic table, abbreviated).

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Region	GSR	GSR	GSR	GSR	PF	PF	PF	GSR	GSR	PF	GSR	PF	PF	PF	GSR	GSR	GSR	GSR	GSR	GSR
Community	*TC*	TC	TC	TC	TC	TC	DF smt	*TC*	TC	TC	DF	DF smt	*DF* smt	*DF* mt	*DF*	DF	DF	DF	DF	DF
Unit of lower rank	*melittetosum*	*caricetosum pilosae*	*typicum*	*stachyetosum*	*corydaletosum*	*typicum* var. with *Carex pilosa*	rem. *Tilio-Carpinetum*	*typicum beech* var.	*caricetosum pilosae* beech var.	typicum var. with *Senecio fuchsii*	*festucetosum drymeiae*	var. with *Impatiens noli-tangere*	*typicum*	*typicum*	*typicum* degen. form	*typicum* variant with *Oxalis acetosella*	*typicum* var. with *Impatiens noli-tangere*	*typicum*	*lunarietosum*	*allietosum ursini*
Number of relevés	11	14	16	15	13	12	4	14	16	11	15	4	9	10	13	12	6	17	18	5
Mean altitude a.s.l.	335	355	329	368	310	356	444	433	434	363	515	354	455	531	550	469	515	625	607	604
Carex pilosa (*C*)	2	**5**	2	2	**3**	**5**	*1*	**4**	**5**	**5**	5	***3***	1	**4**	**5**	**4**	1	2	1	
Maianthemum bifolium	**4**	**5**	**4**	**3**	2	**5**	*2*	**3**	5	5	2			2	1	**3**	1	1		
Brachypodium sylvaticum (*QF*)	2	1	1	1	**3**	2	***3***		1	2		*1*	2	**3**		1			1	
Melandrium rubrum	**3**	1	2	**3**	1		*2*	1	1			*1*	1	1	1	2	1		1	
Hedera helix	**3**	3	2	1	**3**	5	*2*	1	2	2	2	***4***	1		1		1			
Aposeris foetida (o*F*)	**5**	5	5	2	**5**	5	*2*	2	**3**	1	2	*1*	1	**3**						
Lathyrus vernus (o*F*)		**3**	4	1	2	**4**	***3***	1	1	1	2	*2*	1		1					
Melica nutans (QF)	**3**	3	3	2	2	2	***4***	2	2	1	2			1		1				
Carex digitata (*QF*)	**5**	3	2	2	2	2	*1*	2	1	1	1					1				
Phyteuma spicatum (o*F*)	2	**4**	3	2	2	2		1	**4**	1	2			1	1					
Poa nemoralis (*QF*)	**5**	4	5	2	2	1	*2*	2	**3**	1	1					1	1		1	
Carpinus betulus a (*C*)	**5**	5	5	5	5	5	***3***	**5**	5	5	1		1	1	1	**3**	1			2
Quercus robur a	**4**	3	4	2	**4**	3		**3**	3	2	1					1	1			
Ranunculus cassubicus (*C*)	1	2	**5**	5	4	2	*2*	2	2		1				1	1		1		
Stellaria holostea (*C*)	**4**	5	5	4	4	4	*2*	**4**	4	1	2			**3**	1	2				
Tilia cordata a (*C*)	**3**	2		1	**4**	3				1	1	*1*	2	1						
Cerasus avium a (*C*)	2	1	1	1	1	2	*1*	2	1	2						1				
Hepatica nobilis (*QF*)	**4**	3	4	2	**3**	3	*2*	**3**	3			*1*			1	1				
Lilium martagon (o*F*)	**4**	1	**4**	2	2	2	*2*	1						1						
Astrantia maior (o*F*)	2	2	**4**	2	**4**	2		1	1							1			1	
Symphytum tuberosum	**3**	3	4	4	1	1		2	2		1					1	1			2
Campanula trachelium (*QF*)	**5**		**5**	1	2	1	*2*		1											
Acer campestre a (*QF*)	**4**		**3**	2	**5**	1	*1*													
Crataegus monogyna b, c	**4**	1	**3**		**3**	2	*2*													

Table 5. Continued.

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Galium schultesii (*C*)	**5**	3	3	1		**3**			1		1									
Cornus sanguinea b, c	**4**	1	**3**	3	2				1	1										
Aconitum moldavicum	**3**		**3**	2				1												
Dactylis polygama (*C*)	**3**	1	2																	
Melampyrum nemorosum (*C*)	**5**	1	2																	
Viola mirabilis (*C*)	**3**		1																	
Galium vernum	**4**	4	3					1	2											
Melittis melissophyllum (*QF*)	**4**		1			1			1											
Campanula persicifolia (*QF*)	**3**	1	1					1												
Sedum maximum	**4**		1																	
Vincetoxicum hirundinaria	**4**																			
Astragalus glycyphyllos	**3**		1		1															
Solidago virgaurea	**4**							1		1										
Heracleum sphondylium	**3**		1	1					1											
Hieracium murorum	**3**	2							1											
Festuca drymeia (a*F*)		**3**															1			
Ranunculus lanuginosus (o*F*)		1	2	2	**4**	1	***4***	1					1	2	1			1	1	
Scilla bifolia (*QF*)			2	**3**	5	3	*1*	1				***3***						1		
Arum alpinum			1	**3**	2	1					1	***4***			1	1		1	1	
Corydalis solida (o*F*)			1	1	2	1		1							1			**4**	1	
Corydalis cava (o*F*)		1			**4**	4	*2*	1		1		***4***			1			**4**	2	
Betula pendula a		2		1		**3**	*1*	**3**	3	3		***4***		1		1				
Mycelis muralis	1		1	1		2	***4***	2	1	**3**	2	*2*	**3**	4	2	**4**	3			
Fagus sylvatica a (a*F*)	**4**	3	2	2	**4**	5	***4***	**5**	3	5	5	***4***	**5**	5	5	5	5	5	5	1
Dentaria bulbifera (a*F*)	**4**		1	**3**	4	5	***4***	**4**	4	5	3	***4***	**5**	5	5	5	5	5	5	5
Acer pseudoplatanus a (a*F*)				**3**	4	3	*2*	**4**	2		2	***3***	**4**	5	3		**3**	4	5	4
Dentaria glandulosa (a*F*)		1		2	**5**	5	***4***	2	2	**5**	2	***4***	**5**	5	4	3		**5**	4	2
Symphytum cordatum (a*F*)		1		**4**	2	1	***3***	**3**	1		1		**3**	5	4	3	2	**5**	5	5
Chrysosplenium alternifolium (o*F*)				**4**	2	1				1		***3***	1	2	1	**3**	4	1	1	2
Lunaria rediviva (a*F*)					2		*1*						2	2	1	1	1	1	**5**	3
Gentiana asclepiadea				1				2	2					2	2	2	1	1		
Polygonatum verticillatum				2			*1*	1	1					**3**	1					
Prenanthes purpurea (a*F*)		1	1										1	1	2	1				
Acer platanoides a (*QF*)					1	1	*1*					*1*	**3**	2						
Polystichum aculeatum (a*F*)							*1*	1				*2*	1	1	1					
Allium ursinum (o*F*)			1	1											1	1				**5**
Festuca altissima (a*F*)					1	1				2				1						
Hordelymus europaeus (a*F*)						1							1	2						
Melica uniflora (a*F*)										1				1						

Explanations: GSR – Góry Słonne Range; PF – Przemyśl Foothill; *TC – Tilio-Carpinetum*; *DF – Dentario glandulosae-Fagetum*; smt – submontane form; mt – montane form; *C – Carpinion character species*; a*F – Fagion* character species; o*F – Fagetalia* character species; *QF – Querco-Fagetea* character species.

only its removal or transformation (for example into pine stands on the southern slopes of the San or Wiar Valleys).

– The poor form of typical lime-oak-hornbeam forest on the Przemyśl Foothills is reminiscent of the beech variants of *T.-C. typicum* and *T.-C. caricetosum pilosae* in Góry Słonne.

– The montane beech forests of the Przemyśl Foothills shows a lack of full differentiation into sub-associations (confined to the typical one and rarely *lunarietosum*). This may attest to the study area's only just beginning to enter the lower montane belt in which beech forests become a zonal community covering extensive areas.

As the greater part of the study area is at lower altitudes than Góry Słonne, the moist and fertile habitats are occupied by lime-oak-hornbeam forests or communities reminiscent of them, though submontane beech forests are developed and give rise to a number of local forms.

Conclusions

The following conclusions are drawn regarding the way in which lime-oak-hornbeam forest communities intergrade with beech forest in the area considered:

– the transition is of a continuous nature, entailing the gradual loss of the species of lower elevations and warmer habitats with increasing altitude above sea level – the limiting factor here is thus climate;

– (beech forest) species of higher elevations extend into lime-oak-hornbeam forests, especially the moist ones, and in some cases very abundantly (as with *Dentaria glandulosa*) – it seems that the limiting factor here may be competitive interactions and not the habitat itself;

the smooth transition of lime-oak-hornbeam forest communities into those of beech forest hinders the identification of particular vegetation patches, which is therefore only possible against the background of material of a regional character;

– in addition to the proportion of species characteristic of the *Carpinion* alliance, the following features allow lime-oak-hornbeam forests to be separated from beech forests: 1) a stand with a high representation of *Carpinus betulus* and an admixture of *Quercus robur, Tilia cordata, Cerasus avium* and *Acer campestre;* 2) the presence of *Crataegus monogyna* and *Cornus sanguinea* in the shrub layer; 3) a share on the part of a block of distinguishing species who have the centres of gravity of their occurrence here and include *Hedera helix, Aposeris foetida, Lathyrus vernus, Melica nutans, Carex digitata, Phyteuma spicatum, Poa nemoralis, Hepatica nobilis, Lilium martagon, Astrantia major* and *Campanula trachelium.*

– the beech forests are characterised by a lack, or at best a sporadic occurrence, of the aforementioned species, as well as by the presence and more frequent participation of *Symphytum cordatum, Chrysoplenium alternifolium, Lunaria rediviva, Gentiana asclepiadea, Polystichum aculeatum, Polygonatum verticillatum* and *Prenanthes purpurea.*

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