Complexes of Plant Associations in the Polish Western Carpathian Mts.: An Attempt towards Symphytosociological Analysis of Vegetation Maps

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SUMMARY

Distributional pattern of plant communities in two areas of the Polish Carpathian Mts. are compared. The comparison is based on symphytosociological analysis of the existing phytosociological maps. Some methodological problems are discussed and the association complexes (sigmassociations) are described.

ZUSAMMENFASSUNG

Das Verteilungsmuster der Pflanzengesellschaften zweier Gebiete der Polnischen Karpaten wird verglichen. Der Vergleich beruht auf synsoziologischen Analysen bereits vorhandener Vegetationskarten. Einige methodische Fragen werden besprochen und die Assoziationskomplexe (Sigmassoziationen) beschrieben.

INTRODUCTION

Phytosociological studies in the Polish Western Carpathian Mts. have been carried out for more than fifty years and some of these projects also include a complete cartographic documentation. Multicoloured large scale vegetation maps have already been published for some parts of the Tatra Mts., for Mt. Babia Góra and the Pieniny Mts., as well as for two sectors of the Gorce Mts. Recently a part of the Carpathian Foothills near Cracow has also been mapped. The scope of the present paper is to compare the distributional patterns of plant communities in two parts of the Polish Western Carpathians of similar geological structure, but differing in their altitudes: the low lying sub-montane area of the Wierzbanówka Valley in the Carpathian Foothills and the Jaszcze-Jamne Valleys in the montane zones of the Gorce Mts. For the purpose of this comparison the method of symphytosociological relevés taken from the maps will be used. Some general problems of the symphytosociological area survey will also be discussed.

MAIN FEATURES OF THE WIERZBANÓWKA VALLEY AND THE JASZCZE-JAMNE VALLEYS

The Wierzbanówka Valley is situated near the northern edge of the Carpathian Foothills, ca. 25 km S.W.S. of Cracow. It runs from the west to the east and includes an area of 11 km^2, ranging from 240 to 340 m of altitude. The relief is asymmetric (the north-facing slopes being much steeper than the south-facing ones) and rather varied, with several sidevalleys and gullies.
The geological substratum is composed of flysch sandstones and covered with loess-like deposits. Warp soils, gley soils, brown forest soils as well as grey brown podzolic soils (sol lessivé) may be distinguished.
The annual sum of precipitation is ca. 630 mm, and the mean annual temperature ca. 7-8°C.
The whole area lies within the submontane zone of deciduous forests of oaks (*Quercus robur, Q. sessilis*), hornbeam (*Carpinus betulus*) and lime-trees (*Tilia cordata*) and acidophilous forests of oaks and pine (*Pinus silvestris*). The present landscape is dominated by arable fields (Fig. 1).

The Jaszcze-Jamne Valleys, bordering one another, are situated ca. 80 km S of Cracow in the south-eastern part of the Gorce Mts. (a part of the Western Beskidy Mts.), at the altitude between 600 m and 1200 m. High ridges and deeply incised valleys are the main relief forms of the area, the principal valleys running from N to S (Jamne) or from NW to SE (Jaszcze).
The rock substratum consists of flysch sandstones and shales, some of them very poor in $CaCO_3$, and the other relatively rich in carbonates. Accordingly, there is a fair variety of soil types, including raw warp soils, gley and peat soils, acid brown forest soils and sligthly to medium podzolized soils.
The annual precipitation increases with the altitude from 800 mm to 1200 mm, and the mean annual temperatures decrease from +5° to +2.5°C.
The present landscape is a picturesque mosaic of forest stands, arable fields, hay-meadows and pastures (Fig. 2). Two vegetation zones can be distinguished. The lower montane zone with beech (*Fagus silvatica*), fir (*Abies alba* and spruce (*Picea excelsa*) up to 1150 m and the upper montane zone dominated exclusively by spruce.

Fig. 1: The landscape of the Carpathian Foothills in the Wierzbanówka Valley: arable fields, meadows, orchards and forests (Phot. A. Medwecka-Kornaś).

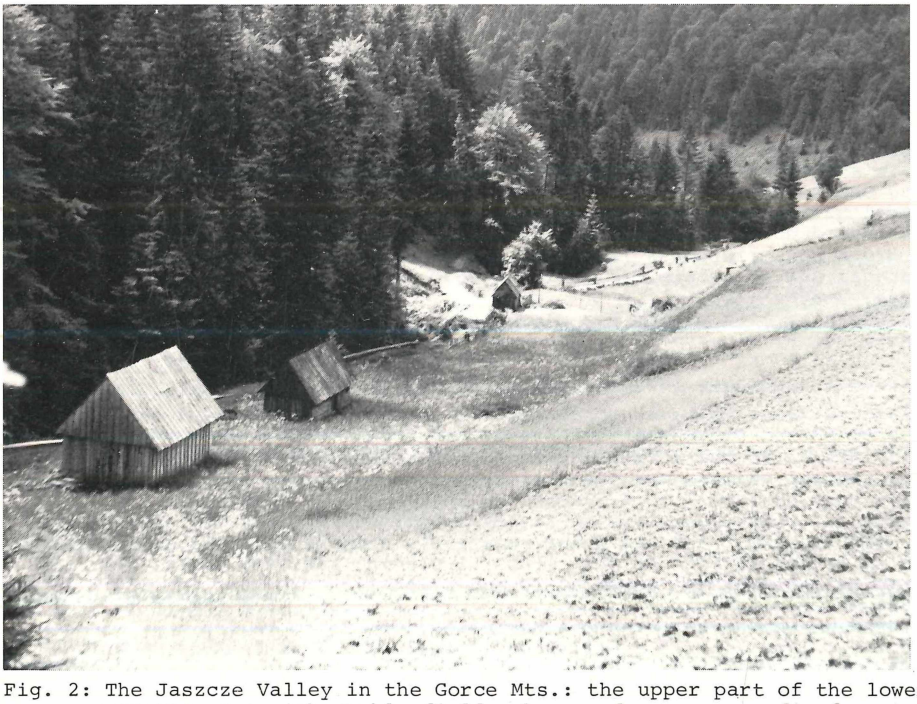

Fig. 2: The Jaszcze Valley in the Gorce Mts.: the upper part of the lower montane zone with arable fields, hay-meadows, spruce-fir forests and beech forests (Phot. A. Medwecka-Kornaś).

EARLIER PHYSIOGRAPHICAL RESEARCH AND VEGETATION MAPPING IN THE STUDY AREAS

In both study areas comprehensive surveys of environmental conditions and the plant cover were carried out by teams of various specialists. The research work in the Wierzbanówka Valley was organized by the Institute of Botany of the Jagellonian University of Cracow, through its Ecological Field Station at Polanka Haller, in the Jaszcze-Jamne Valley a research group of the Committee for Nature Conservation of the Polish Academy of Sciences was working. Both projects concerned the study of various environmental features, the geological, geomorphological, hydrological, climatological and pedological ones, and of the correlations between the plant cover and all these factors. Every element studied was mapped in a large scale. In the phytosociological studies the Central European methods were used (BRAUN-BLANQUET 1964) and the syntaxonomic system of the Polish plant associations by MEDWECKA-KORNAŚ, KORNAŚ & PAWŁOWSKI (1966) was adopted. The results of studies in the Wierzbanówka Valley are presently in the press (MEDWECKA-KORNAŚ 1984), and those from the Jaszcze-Jamne Valleys have already been published (MEDWECKA-KORNAŚ 1968, 1969).

The vegetation of the Wierzbanówka Valley was mapped in the scale of 1:5000. More than 400 phytosociological relevés were made by a half a dozen of surveyors, and 26 syntaxa were distinguished. A generalized version of the map with detailed descriptions is being published separately (MEDWECKA-KORNAŚ & DUBIEL 1984).
The vegetation of the Jaszcze-Jamne Valleys was mapped by a team of seven workers in the scale of 1:10 000, and published in the same scale (MEDWECKA-KORNAŚ 1968). The classification of plant communities used was based on earlier phytosociological papers from this region (MEDWECKA-KORNAŚ 1955, KORNAŚ & MEDWECKA-KORNAŚ 1967, KORNAŚ 1968), and on 80 additional relevés from the mapping area. The map includes 24 syntaxa; their detailed characteristics were published by MEDWECKA-KORNAŚ & KORNAŚ (1968).

On both maps the smallest stands shown are ca. 10 m x 10 m. Some few communities, occuring only on smaller areas, are indicated by dot signatures; transitional stands between two communities were marked by hatching of two colours. The term "community" was used for uniform stands clearly distinguishable in the field, but lacking characteristic species of the association. The names of syntaxa above the association level were used for fragmentary stands of those which combine the features of two or more plant associations. This was e.g. the case of the arable fields, where the vegetation changes from year to year, according to the crop rotation.

On both maps - of the Wierzbanówka Valley and the Jaszcze-Jamne Valleys - the total surface area of each syntaxon was computed and the general patterns of stand distribution were defined. On this basis the spatial community complexes (TÜXEN 1956, SCHMITHÜSEN 1968) were distinguished (Tab. 1).

Tab. 1. Spatial complexes of plant communities in Wierzbanówka Valley and Jaszcze-Jamne Valleys (according to Medwecka-Kornaś, Kornaś 1968 and Medwecka-Kornaś, Dubiel 1982)

Region	Wierzbanówka	Jaszcze-Jamne		
Altitude (m)	240 - 340	600 - 800	800 - 1150	1150 - 1240
Valley bottoms	Alno-Padion/ Tilio-Carpinetum[a]	Alnetum incanae	Dentario Fagetum	Piceetum subnormale
Slopes	Tilio-Carpinetum	Dentario-Fagetum / Abieti-Piceetum		
Uppland or mountain ridges	Pino-Quercetum			

[a] Circaeo-Alnetum + Carici remotae-Fraxinum (fragments)

SYMPHYTOSOCIOLOGICAL ANALYSIS OF VEGETATION MAPS: METHODOLOGICAL REMARKS

A new symphytosociological method has recently been introduced into the study of plant cover (TÜXEN 1973, RIVAS MARTÍNEZ 1976, GÉHU 1979), and the number of relevant publications is increasing very rapidly (cf. TÜXEN 1978). This method aims at characterizing the patterns of distribution of stands of various plant communities within the landscape units. It is based on the symphytosociological relevés, i.e. on lists of plant associations (and other syntaxa) noted directly in the field, with an estimated cover degree for each of them (in BRAUN-BLANQUET scale). By comparing a sufficient number of "relevés" the "sigmassociations" or "synassociations" are distinguished, i.e. combinations of syntaxa which regularly occur together in the field under similar environmental conditions. It has been suggested to define the "sigmassociations" rather broadly, as equivalents of the (spatial) complexes of plant communities sensu SCHMITHÜSEN (1968) or even more broadly, sensu BRAUN-BLANQUET (1964), and the "synassociations" much more narrowly, as equivalents of only one major potential (or even actual) plant association with all the minor communities which are normally connected with it (as its contact, substitute or dependent communities) - cf. the discussion in the papers by BALCERKIEWICZ & WOJTERSKA (1978) and GÉHU & GÉHU (1978).

Until now all the analytical work in symphytosociological studies has been normally conducted through direct observation in the field. The present author would like to propose an alternative aproach based on an a posteriori analysis of a phytosociological map (of the actual vegetation), which has been drawn in the field with the usual methods of vegetation mapping. Such a procedure, which of course can be applied only if the existing map is sufficiently detailed, has some limitations, but also some serious advantages.
Complete registration of all the existing community stands of an area may be made only in the field (each map being already more or less generalized), and the dependence of community types upon habitat conditions can most reliably be discovered also from direct field observations. But cartographical data can be used for the same purpose indirectly, through the comparison of vegetation maps with other maps (e.g. the geological, geomorphological, pedological and climatological ones).
On the other hand, it is very easy to assess the surface area covered by each plant community on the map, a task which becomes extremely difficult when working in the field, especially in a much diversified and covered area.

A critical question in symphytosociological studies is - like in the phytosociological ones - that of the proper selection of the study plots and that of their size. In the present study each symphytosociological relevé has been limited to possibly uniform geomorphological units (valley bottoms or slopes of uniform aspect). A complete list of syntaxa occurring under such circumstances has been noted, and the total number of individual stands has been counted, as a kind of "landscape diversity index". It turned out that the optimum area for this purpose is usually ca. 1.0 km^2 (similarly as found e.g. by RIVAS-MARTÍNEZ 1978 in the mountain areas of Central Spain). Such a large area, however, is only rarely found on both the narrow valley bottoms and the ridges of the upper montane zone, where therefore smaller relevé areas have usually to be selected. It should also be noted, that on slopes the area measured on the map is smaller than the real one. This does not matter, however, because estimates are made as percentage of the area occupied by individual syntaxa. In both study regions about 75 % of the total study areas were covered by the symphytosociological relevés, regularly scattered on the maps.

SYMPHYTOSOCIOLOGICAL DESCRIPTIONS OF THE STUDY AREAS

A. T h e W i e r z b a n ó w k a V a l l e y (Tab. 2).

Three distinct elements appear on the table which illustrates the symphytosociological differentiation of the Wierzbanówka Valley. Relevés 1-6 concern the vegetation mosaic of the bottom of the main valley and its larger tributaries. From among the syntaxa which distinguish such places the highest presence degrees are reached by the wet hay-meadow *Cirsietum rivularis*, the tall sedge reeds of the *Magnocaricion* alliance and the wet hay-meadow - *Equisetum telmateia* community of the *Calthion* alliance. This combination of hygrophilous communities is clearly limited to the wettest valley sectors; however, some drier sectors alternate with them, with a large share of less hygrophilous community types, e.g. the fresh hay-meadows of *Arrhenatheretum*

Tab. 1. Sigmassociations of the Wierzbanówka Valley

Sigmassociations:	Alno-Padion/Tilio-Carpinetum						Tilio-Carpinetum							
No of symphytosociological relevés	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Geomorphological situation	valley bottoms						slopes							land slides
Inclination (°)	0-3	0-3	0-5	3-10	5	0-3	0-15	6-15	0-15	5-10	0-10	6-10	15	10-35
Exposure	S	E	E	S	SE	NE	N	N	S	S	S	E-S	N	NE
Altitude (m)	255-270	235-250	250-300	240-265	225-245	225-235	260-330	280-330	260-300	280-315	260-310	250-310	255-330	230-290
Area of sample plots (km^2)	0.2	0.4	0.3	0.1	0.2	0.2	1.0	0.9	1.5	0.7	1.0	1.0	1.0	0.4
Tilio-Carpinetum typicum	+/3	+/1	2/10	+/1	+/2	3/1	4/1	3/7	2/2	1/4	1/2	1/3	1/1	1/2
Arrhenatheretum elatioris	3/6	+/1	2/5	4/1	1/7	2/3	+/3	+/3	+/2	+/4	1/3	1/2	+/4	2/5
Phragmition	1/2	.	.	.	.	.	.	.	.	.	.	.	.	.
Comm. of Mentha longifolia	+/1	+/2	.	.	.	.	.	.	.	.	.	.	.	.
Salicion	1/3	.	.	.	.	1/1	.	.	.	.	.	.	.	.
Comm. of Eriophorum latifolium	+/3	.	+/1	.	.	.	.	.	.	.	.	.	.	.
Scirpetum silvatici	.	1/1	.	.	.	.	.	.	.	.	.	.	.	.
Comm. of Cirsium oleraceum	+/4	1/3	.	.	.	+/1	.	.	.	.	.	.	1/6	1/6
Arrhenatheretum/Cirsietum rivularis	+/3	1/4	1/6	.	.	.	.	.	.	.	.	.	.	.
Arrhenatheretum alopecuretosum	2/3	3/3	3/5	.	.	.	.	.	1/1	.	.	.	.	.
Magnocaricion	1/4	.	1/1	+/1	2/4	.	.	.	.	+/2	.	.	.	.
Comm. of Equisetum telmateia	+/3	+/2	+/1	.	+/1	.	.	.	.	.	.	.	+/2	.
Cirsietum rivularis	4/5	1/2	2/10	1/5	4/1	1/4	.	+/2	.	.	.	.	.	.
Alno - Padion	+/3	+/3	+/5	+/1	+/2	.	1/4	+/7	.	.	.	.	.	.
Tilio - Carpinetum stachyetosum	.	2/4	+/2	.	.	.	+/5	+/4	+/1	.	.	.	.	.
Arrhenatheretalia / old fields	.	.	.	.	.	+/1	3/7	2/15	+/4	2/14	2/10	3/12	2/10	3/7
Secali - Violetalia	.	.	.	.	.	1/6	2/4	3/6	4/2	4/6	4/4	2/8	3/4	.
Lolio - Cynosuretum (incl. orchards)	+/1	.	+/2	.	.	+/1	.	1/4	+/3	2/10	2/16	3/10	.	.
Pino - Quercetum (incl. fragm.)	.	.	.	.	.	.	+/2	2/3	2/1	.	.	.	.	.
Pino - Quercetum fagetosum	.	.	.	.	.	.	/1	2/1	.	.	.	.	.	.
Dentario glandulosae - Fagetum	.	.	.	.	.	.	+/2	+/1	.	.	.	.	.	.
Pino - Quercetum/ Tilio - Carpinetum	.	.	.	.	.	.	+/1	.	+/1	.	.	.	.	.
Tilio - Carpinetum / Atropetalia	.	.	.	.	.	.	1/1	.	.	.	.	.	.	.
Succession stages / old fields	.	.	.	.	.	.	1/2	.	.	.	.	.	3/11	1/4
Prunetalia	.	.	.	.	.	.	+/6	.	.	.	.	.	2/25	+/4
Lathyro - Melandryetum	.	.	.	.	.	.	.	.	.	.	.	.	.	1/8
Arrhenatheretum brizetosum	.	.	.	.	.	.	.	.	.	.	.	.	.	2/2
Comm. of Brachypodium pinnatum	.	.	.	.	.	.	.	.	.	.	.	.	.	1/7
Rural building aggregations	+/1	.	.	.	.	1/3	.	.	.	.	3/2	2/1	.	.
Number of syntaxa	14/	11/	11/	5/	6/	8/	13/	11/	9/	6/	5/	5/	8/	9/
Number of stands	44	26	48	9	17	18	39	53	17	40	35	35	63	45

Explanation: first figure = degree of coverage, second figure = number of stands; Comm. = Community

elatioris (especially in their most moisture-requiring subassociation *A.e. alopecuretosum*). Differences between various sectors of the valley bottoms result from various depths of incission of the rivulets, presence of seepage areas under some slopes, and from the various degrees of artificial drainage of meadows.

Relevés 7-13 illustrate the vegetation patterns on slopes and the adjacent areas of the plateau. Forest stripes of the *Tilio-Carpinetum* association are present on all of them, but these are usually only very small and fragmentary

Tab. 3. Sigmassociations of the Jaszcze (JA) and Jamne (JM) Valleys

Sigmassociations:	Alnetum incanae					Abieti - Piceetum/ Dentario - Fagetum				Dentario - Fagetum									Piceetum subnormale		
No of symphytosociolog. relevés	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Locality	JM	JM	JA	JA	JA	JM	JM	JM	JA	JA	JA	JM	JA	JM	JM	JA	JA	JA	JA	JM	JA
Geomorphological situation	Bottoms of the main valleys					Slopes in the lower montane zone													Upper montane zone		
Inclination (°)	2-3	2-3	2	2	3	15	15-20	15-20	10-20	10-25	15-20	5-20	15	10-15	10-20	15-25	15-20	20	0-15	0-10	0-15
Exposure	S	S	SE	SE	E	W	E	SW	ENE	SE-NE	SW-W	E	E-S-W	SE-S	S-W-NW	S	S	NEN	S	S	N
Altitude (m)	610-700	700-800	640-700	700-770	770-880	640-900	630-900	660-900	700-950	740-980	720-1020	720-1020	840-1050	840-1100	740-1040	800-1080	880-1140	780-1060	1100-1140	1115-1200	1000-1100
Area of sample plot (km^2)	0.3	0.2	0.3	0.2	0.2	1.0	0.9	0.7	1.2	0.9	0.9	1.0	0.9	0.8	1.0	0.9	1.0	1.0	0.8	0.5	0.4
Valeriano - Caricetum	1/4	1/5	1/5	2/3	+/1	2/14	1/14	+/1	1/5	1/6	2/15	1/18	+/3	+/2	1/18	1/12	+/1	.	+/5	.	.
Gladiolo - Agrostietum	2/8	3/1	1/8	2/1	2/4	+/3	+/5	+/1	2/8	2/8	3/3	2/6	2/10	2/15	2/9	2/11	+/1	.	+/4	.	.
Secali - Violetalia	3/9	1/7	4/4	+/10	+/2	3/15	3/10	1/5	2/12	2/9	2/15	2/14	1/3	3/4	2/12	2/15	.	.	.	.	.
Lolio-Cynosuretum (incl. fragments)	+/3	+/4	+/1	2/4	+/3	+/2	+/1	+/1	1/4	1/2	+/1	+/1	+/2	+/1	+/2	.	.	.	+/1	.	.
Myricarietalia	2/1	1/1	.	+/1	+/3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alnetum incanae	.	+/3	1/2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gladiolo-Agrostietum, Trisetum flavescens var.	+/4	2/5	1/5	+/1	.	+/4	+/1	+/1	.	.	.	+/1	.	.	+/1	.	.	.	.	.	.
Vaccinio-Piceion fragments	.	+/1	.	+/2	.	2/5	2/2	3/3	3/12	+/3	1/2	.	.	.	.	.	.	.	.	.	+/1
Vaccinio-Piceion / Atropetalia	.	.	.	.	.	.	+/1	1/7	1/8	.	.	.	.	.	.	.	.	.	.	.	.
Calluno-Nardetum/Vaccinio-Piceion	.	.	.	.	.	2/6	2/3	1/4	2/9	.	+/2	.	.	.	.	+/1	.	.	.	.	.
Calluno - Nardetum + trees	+/1	.	.	.	.	1/2	2/6	2/4	1/3	+/1	+/2	+/1	.	.	1/3	.	.	.	.	.	.
Calluno-Nardetum/Gladiolo-Agrostietum	.	.	.	+/2	.	+/1	+/2	+/3	2/3	2/8	1/3	1/4	+/2	+/1	2/12	2/10	+/1	+/1	.	.	.
Calluno - Nardetum	1/5	.	+/1	+/1	.	3/4	2/5	1/3	2/14	1/2	+/2	1/3	.	1/3	2/4	1/5	+/1	+/1	.	.	.
Dentario-Fagetum, Asperula var.	.	.	.	+/2	+/1	+/1	.	2/1	2/3	3/4	2/7	2/8	3/7	2/5	3/7	3/12	3/10	3/3	.	.	.
Abieti - Piceetum	.	.	.	.	2/4	+/1	1/1	.	2/4	.	1/1	.	+/1	.	1/2	1/1	1/3	1/4	.	.	.

Calluno-Nardetum/Lolio-Cynosuretum	.	.	.	.	.	.	+/2	.	.	+/1	1/6	+/1	+/1	.	+/2	+/1	.	.	.	.	.
Dentario-Fagetum, fertile var.	.	+/1	.	+/1	+/1	.	.	.	1/2	1/2	+/1	2/4	2/8	2/6	2/3	1/5	2/9	4/2	.	.	.
Gladiolo - Agrostietum + trees	.	.	.	.	.	.	.	+/2	+/2	1/7	+/4	1/4	+/1	+/2	1/4	+/1	.	.	.	.	.
Caltha - Chaerophyllum comm.	.	.	.	.	+/5	.	.	+/1	.	+/1	+/1	+/4	1/17	+/7	.	+/1	+/4	1/28	.	.	.
Gladiolo-Agrostietum anthyllidetosum	.	+/3	.	.	.	1/5	.	.	.	.	1/5	2/6	.	+/1	1/3	1/3	.	.	.	.	.
Dentario-Fagetum, Asperula var./Atropetalia	.	.	.	+/1	.	.	.	+/1	.	1/5	.	.	1/4	+/2	.	+/1	2/7	.	.	.	.
Dentario-Fagetum, Asperula var./Piceetum subnormale	.	.	.	.	.	.	.	.	.	+/1	.	.	1/1	.	.	+/1	+/2	+/2	.	.	.
Dentario-Fagetum, Asperula var./ fertile var.	.	.	.	.	.	.	.	.	.	.	1/1	.	.	+/2	.	.	.	+/2	.	.	.
Dentario - Fagetum allietosum	.	.	.	.	.	.	.	.	.	.	.	.	+/1	1/6	.	.	.	.	.	.	.
Gladiolo-Agrostietum festucetosum	.	.	.	.	.	.	.	.	+/2	.	.	.	1/4	+/2	.	+/2	.	.	+/3	.	.
Luzulo - Fagetum	.	.	.	.	.		+/1	.	.	+/1	+/3	.	.	.	+/5	+/3	.	.	.	.	.
Abieti - Piceetum / Atropetalia	.	.	.	.	.	.	.	.	+/1	.	.	.	+/1	.	.	.	+/2	+/2	.	.	.
Dentario-Fagetum, Asperula var./ Abieti-Piceetum	.	.	.	.	1/1	.	.	.	+/1	1/2	.	.	1/3	.	.	+/1	2/11	1/5	.	.	.
Nitrophytes (Rumex alpinus etc.)	.	.	.	.	.	.	.	.	.	.	+/1	+/2	+/1	.	.	.	.	+/1	.	.	.
Petasitetum Kablikiani	.	.	.	.	+/2	.	.	.	.	.	.	.	.	.	.	.	+/4	.	.	.	.
Cirsietum rivularis	.	+/3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+/1	.	.	.
Gladiolo-Agrostietum/Hieracio-Nardetum	.	.	.	.	.	.	.	.	.	+/1	+/1	.	+/2	.	.	.	.	+/1	1/4	1/1	.
Hieracio - Nardetum	.	.	.	.	.	.	.	.	.	.	.	.	1/2	.	.	+/2	.	+/1	4/3	4/5	4/3
Hieracio - Nardetum + trees	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1/6	1/3	.
Piceetum subnormale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3/5	3/5	3/3
Piceetum subnormale/Hieracio-Nardetum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+/1	.	+/1
Piceetum subnormale / Atropetalia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+/1
Cardamino - Cratoneuretum	.	.	.	.	.	.	.	.	.	.	.	.	.	+/2	.	.	.	.	+/1	.	.
Rural buildings aggregations	2/4	2/5	2/6	+/1	+/2	+/2	+/1	.	.	.	+/3	+/3	.	+/2	+/2	.	.	.	.	.	.
Number of syntaxa	8/	11/	7/	12/	11/	13/	14/	15/	17/	18/	20/	15/	20/	16/	15/	19/	13/	14/	10/	4/	5/
Number of stands	35	34	26	29	27	63	54	38	93	64	76	77	74	61	87	88	56	54	33	14	9

Explanation: first figure = degree of coverage, second figure = number of stands, var. = variant, comm. = community

Synonyms: Dentario-Fagetum = Fagetum carpaticum, Abieti-Piceetum = Piceetum tatricum abietetosum, Piceetum subnormale = Piceetum tatricum subnormale

stands. Arable fields occupy large Area, with the communities of the *Secali-Violetalia* order (*Vicietum tetraspermae, Echinochloo-Setarietum*, and impoverished *Lamio-Veronicetum politae*), alternating according to the crop rotation (DUBIEL & TRZCINSKA-TACIK, 1984). There are some differences between the north-facing and the south-facing slopes, the former being e.g. the only sites of a few montane beech forest stands (*Dentario glandulosae-Fagetum*), as well as the *Prunetalia* hedges on balks and field terraces on steep slopes. More marked differences, however, result from the human impact. The symphytosociological relevés are much more diversified in places where forest stands have been preserved (rel. 7, 8, 9) and much poorer in the partly agricultural areas around the villages (rel. 11, 12).

Relevé 14 is quite different from all the others, it represents a small landslide area, with very peculiar habitat conditions, where flysch deposits exceptionally rich in calcium carbonate directly influence the soils of the pararendzina type and cause the occurrence of the calciphilous segetal community of *Lathyro-Melandrietum* and thermophilous grassland communities of *Brachypodium pinnatum* and the *Arrhenatheretum elatioris brizetosum mediae*.

B. The Jaszcze-Jamne Valleys (Tab. 3).

Table 3 includes mainly the symphytosociological relevés from the lower montane zone of the beech forests (rel. 1-18): data from the upper montane zone of spruce forests, which is very limited in the study area, are very scanty (rel. 19-21) and have been given only for comparative reasons.

Up to the altitude of 800(900) m the valley bottoms form a well defined landscape element with its own vegetation mosaic (rel. 1-5): *Myricaria germanica* pioneer thickets on gravel beds and the riverside alder forests *Alnetum incanae* on deeper, more mature warp soils are its exclusive components. In some places, especially on older terraces, they are accompanied by small stands of meadows, pastures, sedge mires, or even arable fields. Only very few beech stands were also noted in such places. Higher up the valley bottoms become so narrow that they nearly lose their individuality, the only plant community peculiar to them being the very rare and fragmentary tall forb community of the *Petasitetum kablikiani* association.

On the slopes in the lower part of the lower montane zone acidophilous communities are especially widespread. Secondary spruce stands of the *Vaccinio-Piceetalia* order and oligotrophic pastures and heathlands of the *Calluno-Nardetum* association display an especially high coverage and presence degree. The upper part of the lower montane zone is characterized by constant occurrence of the *Dentario glandulosae-Fagetum* beech forest, its fertile variant being especially characteristic of this altitudinal zone.

Throughout the whole vertical range of this zone the following plant associations are found in each or nearly each symphytosociological record: the euthrophic sedge-mire *Valeriano-Caricetum flavae*, the hay-meadow *Gladiolo-Agrostietum* and the arable field community *Geranio-Silenetum gallicae* (occurring in both the cereal cultures and the root-crops cultures; KORNAS, 1968).

DISCUSSION

As expected, the symphytosociological relevés have very clearly demonstrated the marked differences between the community groups in each of the study areas. Only few plant associations occur in both of them, being usually represented in each area by a different sub-unit (e.g. *Cirsietum rivularis typicum* in the Wierzbanówka Valley and *C.r. alchemilletosum* in the Jaszcze-Jamne Valleys). There are also some pairs of vicarious associations from the same alliance, e.g. the lowland hay-meadow *Arrhenatheretum elatioris* and the mountain hay-meadow *Gladiolo-Agrostietum* (*Arrhenatherion*). On the other hand, several communities in each area exist with no equivalents in the other (e.g. the *Calluno-Nardetum* association of the Jaszcze-Jamne Valleys with no equivalent in the Wierzbanówka Valley, obviously because of lack of shallow oligotrophic sites in the latter).
This comparison could be greatly refined through the use of exact methods of the numerical syntaxonomy for computing the floristic differences and similarities between various syntaxa.

None of our symphytosociological relevés lacks anthropogenous communities, which have been created and are being maintained by human activities. Even in the lower montane zone of the Jaszcze-Jamne Valleys only two relevés do not include arable fields, and in the upper montane zone man-made oligo-

trophic hay-meadows of *Hieracio-Nardetum strictae* appear constantly over vast expanses. Only very limited areas could be found for relevés with no traces of the human impact.

In both study regions the relatively highest diversity of vegetation occurs in areas where both natural (e.g. forest) communities occur side by side with the man-made ones. The diversity becomes highly increased in such places also because of the presence of transitional stands between two or more plant associations, which usually form secondary successional stages, connected with extensive land use.

The number of community types per area units are higher in the Jaszcze-Jamne Valleys (up to 20 syntaxa / 1 km^2) than in the Wierzbanówka Valley (up to 13 syntaxa / 1 km^2 - on the slopes). This is the result of more varied habitat types in the former region, especially because of the numerous seepage areas on the slopes and the contrasting eutrophic and oligotrophic soil types occurring one near another (as opposed to the uniformly meso- and eutrophic soils of the Wierzbanówka Valley).

On the grounds of our symphytosociological tables (Tab. 2, 3) several sigmassociations may be distinguished (2 in the Wierzbanówka Valley and 4 in the Jaszcze-Jamne Valleys). They correspond fairly well to the main landscape units and - with some few reservations - also to "spatial community complexes" (Tab. 1) as described earlier by the present author (MEDWECKA-KORNAŚ & KORNAŚ 1968, MEDWECKA-KORNAŚ & DUBIEL 1984). Within these sigmassociations a large number of more narrowly defined synassociations may also be seperated, each one strictly corresponding to one potential natural plant association and all its substitutive communities. However, this does not seem to be always easy or even desirable because of the highly fragmented mosaic of habitats and vegetation stands, and sometimes also because of the extremely strong human impact upon the substitutive communities, which completely blurs the original situation.

The conclusion of the present study is that an a posteriori symphytosociological analysis of the existing vegetation maps is able to reveal a lot of new information, of clearly synthetical character. It now remains to be checked how many more details could be added by a direct field survey.

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