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Importance of old rural areas of Lubuskie Lakeland and central Pomerania for maintenance of vegetation diversity

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Abstract. The study areas, located in northern and western Poland, comprised 30 villages of the Lubuskie Lakeland region and 18 in central Pomerania. A total number of recorded associations and local communities of similar rank was counted as 243. In the list prevailed natural and seminatural communities. The endangered associations composed about 47.3% of the whole list of communities. Altogether, 8 communities, assessed as directly endangered, occurred in the villages or their vicinity. Comparison of plant communities of both regions revealed that the structure of vegetation shows many affinities, while the differences are more of qualitative than quantitative character. The diversity of vegetation of rural landscapes was slightly higher in the central Pomerania. The rural landscape of Lubuskie Lakeland was more transformed, richer in ruderal communities, whereas in Pomerania more represented were natural and seminatural communities. The rural landscape of both studied areas is still rich and diversified but recently undergoes transformations leading to its impoverishment and unification as a result of either abandonment of land use or its intensification and new forms of human impact.

Key words: villages of medieval origin, spatial-functional complexes, diversity of vegetation, threatened plant communities, Poland

1. Introduction

The composition of vegetation of rural areas, which constitute over 52% of the area of Poland (GUS 2016), has to date been elaborated almost exclusively with regard to synanthropic plant communities, mostly segetal, however, without indication of relations with settlements (*e.g.*, Kornaś 1968a; Siciński 1974; Warcholińska 1987; Anioł-Kwiatkowska 1990; Jackowiak *et al.* 1990; Wójcik 1998). The attention paid to the ruderal communities concentrated on towns (*e.g.* Fijałkowski 1963, 1967; Rostański & Gutte 1971; Sowa 1971; Anioł-Kwiatkowska 1974; Zając 1974; Kępczyński 1975; Borysiak *et al.* 2000), whereas those occurring in villages were studied much more rarely (Pawlak 1981). The data on differentiation, frequency, distribution, threat and importance of this type of vegetation in the rural landscape are scattered in publications covering broader issues, especially syntaxonomic monographs (*e.g.*, Faliński 1963, 1966; Fijałkowski 1978; Herbich 1982; Pender 1990; Siciński 1994; Brzeg 2009; Szrama & Brzeg 2011), or totally missing in many regions. The attempts toward comprehensive characteristics of vegetation of rural landscape taking into account also natural and seminatural vegetation were scanty (Balcerkiewicz *et al.* 1996; Wojterska 2003).

The documentation concerning synanthropic vegetation of both studied areas is scattered and varies depending on the vegetation type. The segetal communities belong to those which were fairly well documented (Libbert 1932; Passarge 1963; Nowiński 1964, 1965; Borowiec *et al.* 1974, 1977; Balcerkiewicz & Pawlak 1978, 1990; Pawlak 1980, 1981; Herbich 1982; Kutyna 1988; Brzeg 1991; Sobisz 1996, 2006, 2007, 2012; Ratuszniak & Sobisz 1999, 2000, 2001, 2004, 2005). The same applies to some chosen ruderal communities (Libbert 1932; Ćwikliński 1974; Misiewicz 1976; Kępczyńska-Rijken 1977; Kępczyński & Marszałkiewicz 1977; Pawlak 1980, 1981; Herbich 1982; Brzeg & Rosadziński 2006, 2013; Brzeg *et al.* 2014a), but for the majority, the documentation is very

poor, especially from rural areas; some syntaxa were not documented at all.

Published phytosociological documentation on other types of communities observed in our study in the rural landscape (*e.g.*: meadows and pastures, swards, forests, thickets and tall forbs) is also diversified but limited to their classical habitats in more natural or seminatural landscapes and does not pertain to the surroundings of villages.

The overview of aforementioned literature indicates that rural settlements and their surroundings were so far not studied in a comprehensive way. Therefore our investigations concentrated on the total diversity of plant cover in and around villages. For our studies, we have chosen villages of medieval origin, *i.e.*, with equally long history of land use. The results of these investigations in floristic aspect were partly published (Brzeg *et al.* 2013, 2014b; Jasińska *et al.* 2015), whereas the aim of this paper was to present differentiation of all plant communities occurring in and in the direct neighbourhood of human settlements.

The detailed aims of this paper were to: (*i*) recognize the contemporary vegetation of rural areas, the history of which goes back to medieval times, with regard to the origin, frequency and the degree of threat to plant communities, taking into account the problem of conservation of plant cover diversity and recent important transformations of the rural landscape in NW Poland, (*ii*) compare two areas: central Pomerania and the Lubuskie Lakeland, in the above context, as well as (*iii*) indicate the importance of rural landscapes for the maintenance of vegetation diversity through demonstration that they are also the place of occurrence of rare and endangered natural and seminatural plant communities.

2. Material and methods

The investigations were conducted in the years 2011-2014. The study material was collected in 30 villages of the Lubuskie Lakeland (LL) region and in 18 of central Pomerania (CP) (Fig. 1, Appendix 1). Both areas were chosen due to the fact, that their history and structure of settlements were earlier thoroughly studied (Rączkowski 1995, 2002; Wojterska *et. al.* 2007).

The investigated villages were exclusively of medieval origin with preserved traditional structure of linear, oval or round shape (Burszta 1958; Szulc 1995). The study comprised villages and their surrounding fields within a buffer zone of 200 m, drawn in GIS program around the historic core area of a built-up part (Fig. 2).

Materials used in this study were collected within the following spatial-functional complexes (compare Jasińska *et al.* 2015): central green (CG), water bodies (P), built-up areas (BA; divided into BA1 – traditional, BA2 – manor, BA3 – blocks of flats), adjoining small fields (F1) and fields of different size beyond the surrounding road (F2), forest fragments (Fr), meadows and pastures (M), cemeteries (Cm), gravel pits (GP), parks (Pk) and railway (R). An example of spatial structure of one of the studied villages was shown in Fig. 2. Full material comprised complete lists of all communities observed in 361 spatial-functional complexes (224 from the Lubuskie Lakeland and 137 from Pomerania) and was further referred to as total. The single notice corresponds with the occurrence of community in one complex. The number of communities in one spatial complex varied from 1 (extremely poor P – water bodies complex) to 48 (especially rich small fields complex F1 adjoining the built up area), on average – 16. The differentiation of vegetation within these complexes will be the subject of separate publication.

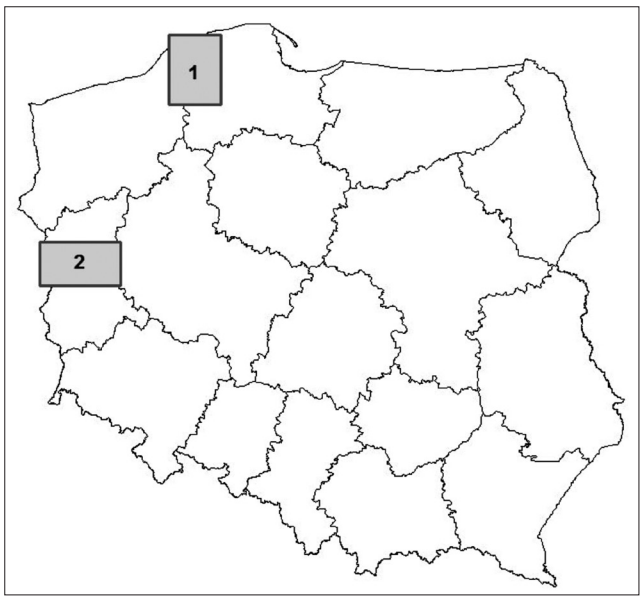

Fig. 1. Location of two studied areas: central Pomerania (1) and Lubuskie Lakeland (2)

For comparison of two regions, the data from 18 villages in Pomerania and from randomly selected 18 out 30 villages investigated in the Lubuskie Lakeland were taken into account (Appendix 1).

A full list of plant communities and their frequency in both compared areas (36 villages) was compiled in Appendix 1, with additional information concerning the syngenesis, as well as assessment of both the degree of threat and rarity in Poland. Syngenesis of syntaxa was assessed according to the concept of Faliński (1969), in which communities were divided into two main groups:

a) autogenic communities – species compositions originating from primaeval nature without any human participation, composed of native species. This group was represented in our list by natural communities, i.e., such that (contrarily to primaeval communities) bear traces of human influence:

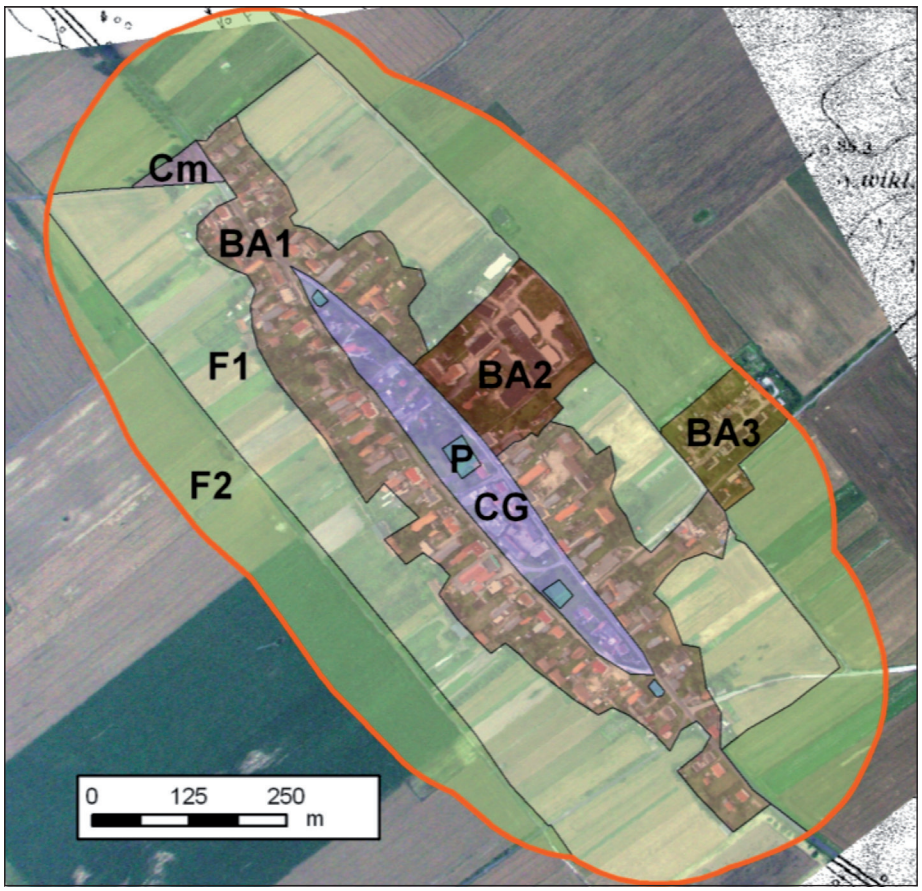

Fig. 2. Chociszewo in the Lubuskie Lakeland as an example of differentiation of spatial-functional complexes within a village and its surroundings
Explanations: BA – built-up areas (BA1 – traditional, BA2 – manor, BA3 – blocks of flats), CG – central green, Cm – cemetery, F1 – adjoining small fields, F2 – fields of different size beyond the surrounding road, P – water bodies; red line indicates the outer margin of investigated area including the 200 m broad buffer zone

- natural perdochoric; retreating under human impact (NP),
- natural stable (N),
- natural auxochoric; with increasing number of phytocoenoses, expanding their range under human impact (NA),

b) anthropogenic communities – species compositions originating in historic times under human influence, with different participation of alien species:
- seminatural; composed of native species, developed in slightly transformed habitats under the influence of repeated human activities, *e.g.*, mowing, grazing, trampling *etc*. (SN),
- synanthropic not specialised; old communities connected with cultural landscape, composed of native species and archaeophytes, occurring on transformed sites from which the natural vegetation was removed; divided into two units:
  – synanthropic segetal occurring in cultivated fields (SS),
  – synanthropic ruderal occurring within human settlements, along roads *etc*. (SR),
- synanthropic specialised; occurring in strongly transformed habitats or in habitats newly created by man and not present in nature, with significant role of kenophytes – epecophytes in the species composition; represented by:
  – synanthropic ruderal specialised (SRS);
  – xenospontaneous; composed of kenophytes – agriophytes, invading natural environments and outcompeting autogenic communities (X).

The main groups in the geographic-historical classification of the flora were adopted after Kornaś (1968b) and Tokarska-Guzik *et al.* (2011).

The syntaxonomic approach, nomenclature of communities and above mentioned additional data were taken from the work of Ratyńska *et al.* (2010). For the calculations and comparisons, conducted in Excel program, only relatively well developed phytocoenoses, *i.e.* undoubtedly recognizable after their species composition as already described units, were chosen. Fragmentarily developed and strongly impoverished communities (which could be ascribed

only to phytosociological units of higher rank) were omitted.

3. Results

A total number of recorded associations and communities of analogous rank in the studied villages was 243 (Appendix 1). They belonged to 28 classes, 35 orders and 64 alliances within the phytosociological classification. The majority of them (162) were common for rural areas of both studied regions. In the compared 18 villages from each region, 194 associations or communities were found in central Pomerania, whereas in the Lubuskie Lakeland – 180.

In all studied sets, the most numerous was a group of natural auxochoric communities, followed by synanthropic ruderal group (Fig. 3). All remaining groups classified according to their syngenesis were less numerous. Worth mentioning was, on one hand, the higher share of natural perdochoric and xenospontaneous communities in Pomerania and, on the other, ruderal communities, especially ruderal specialized – in the Lubuskie Lakeland.

The threatened associations composed about 47% of the whole list of communities (Fig. 4). The category E (directly endangered) was represented by 8 communities of different origin. Besides natural communities (partly auxochoric): *Adoxo-Aceretum pseudoplatani*, *Asplenietum trichomano-rutae-murariae*, *Cystopteridetum fragilis*, *Fragario-Campanuletum cervicariae* and *Gymnocarpietum robertiani*, there were also synanthropic ruderal, such as: *Matricario-Anthemidetum cotulae*, *Poo-Coronopodetum squamati* and *Urtico urentis-Chenopodietum boni-henrici*.

The general share of communities representing above mentioned category of threat is low and slightly higher in the Lubuskie Lakeland. The vulnerable (V) constituted 25% of the total list of communities, with an important role of a group of natural communities (45 syntaxa), and some contribution of seminatural (7), synanthropic segetal (6) and synanthropic ruderal (3). The most numerous in the first group were natural auxochoric (22), such as quite frequent: *Scirpetum sylvatici* (28 notices), *Salicetum capreae* (28) and *Filipedulo-Geranietum palustris* (20), as well as those noted less than 10 times, *e.g.*: *Airo caryophylleae-Festucetum*

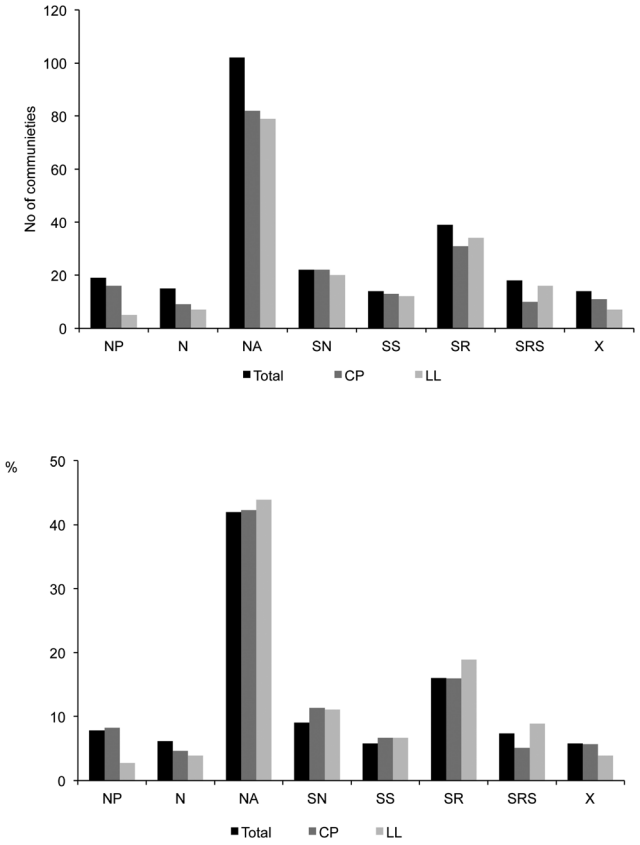

Fig. 3. The number and share of communities representing different categories of origin in central Pomerania (CP) and Lubuskie Lakeland (LL)
Explanations: N – natural, stable; NP – natural perdochoric; NA – natural auxochoric; SN – seminatural; SS – synanthropic segetal; SR – synanthropic ruderal; SSR – specialised synanthropic ruderal; X – xenospontaneous

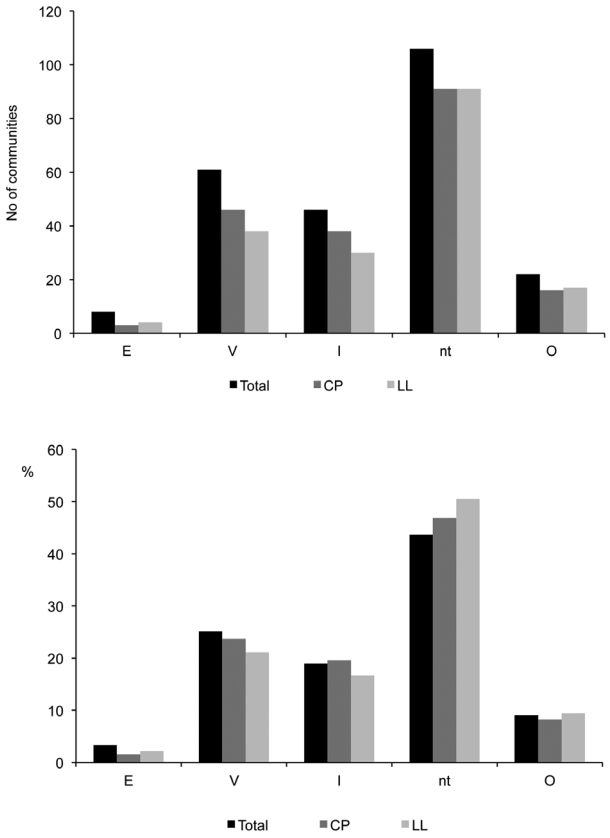

Fig. 4. The number and share of communities representing different categories of dynamic tendencies under human impact in central Pomerania (CP) and Lubuskie Lakeland (LL)
Explanations: category of threat in Poland, E – endangered, V – vulnerable, I – not determined; nt – not threatened communities, O – communities expanding their range

ovinae, *Caricetum distichae*, *Ceratophylletum submersi*, *Leersietum oryzoidis*, *Riccietum fluitantis* and *Ricciocarpetum natantis*. Among natural perdochoric (15), more frequent were only *Galio sylvatici-Carpinetum* and *Querco-Ulmetum*, whereas the others were noted rarely (*e.g. Calletum palustris*, *Caricetum lasiocarpae*, *Caricetum remotae*, *Sagittario-Sparganietum emersi*). Within the group of vulnerable communities of seminatural origin astonishingly frequent were phytocoenoses of *Arrhenatheretum elatioris* (197 notices), much more rare were *Angelico-Cirsietum oleracei* (18), *Sclerantho-Herniarietum glabrae* (15) and *Junco compressi-Trifolietum repentis* (=*Blysmo-Juncetum compressi*) – 13. Among the rarest communities of this group, *Filagini-Vulpietum* (4), *Polygalo-Nardetum* (4) and *Caretum carvi* (1) can be mentioned.

The group of vulnerable comprised also synanthropic communities, typical of the rural landscape: segetal and ruderal ones. Relatively frequent in the investigated areas were two weed associations of the sub-Atlantic range: *Aphano-Matricarietum* (noted in 43 spatial complexes) and *Veronico agrestis-Fumarietum officinalis* (23). *Sclerantho-Arnoseridetum minimae*, representing a similar type of geographical distribution, but connected with poorer habitats, occurred rarely (7), whereas *Spergulo-Chrysanthemetum segetum*, *Oxalido-Chenopodietum polyspermi* and *Ranunculo-Myosuretum* were noted only sporadically. Among ruderal communities, *Rumicetum obtusifolii* was quite frequent (82 notices), while two others: *Onopordetum acanthii* (12) and *Lactuco-Anthriscetum caucalidis* (10) – fairly rare.

The heterogenic group of syntaxa representing the category of not determined threat (I), comprised 45 associations which were either poorly documented or with not fully recognized dynamic tendencies under human impact. In this group prevailed communities of natural origin (28), synanthropic ruderal (10) were less numerous, whereas segetal (4) and seminatural (3) were sparse. Several communities stated in the studied villages were assessed as rare (R) and very rare (RR) in the Polish Lowland (Fig. 5). Data on some of them were recently published (Brzeg *et al*. 2014a). The analysis has shown that the share of rare and extremely rare communities was higher in central Pomerania, whereas common syntaxa prevailed in the Lubuskie Lakeland.

The group of 48 communities found only in the Lubuskie Lakeland included those which were frequent there (*e.g.*, *Hordeetum murini* noted in 28% of complexes, *Galio aparines-Veronicetum sublobatae* – 21.4%, and *Chaerophylletum bulbosi* – 17.9%), rare (*e.g. Falcario-Agropyretum* – 5.4%, *Lactuco-Anthriscetum caucalidis* – 4.5%, *Lycietum halimifolii* – 4.0%, *Erodio-Senecionetum vernalis* – 2.7%, *Poo-Oxalidetum corniculatae* – 2.2%, *Panico sanguinalis-Eragrostietum*

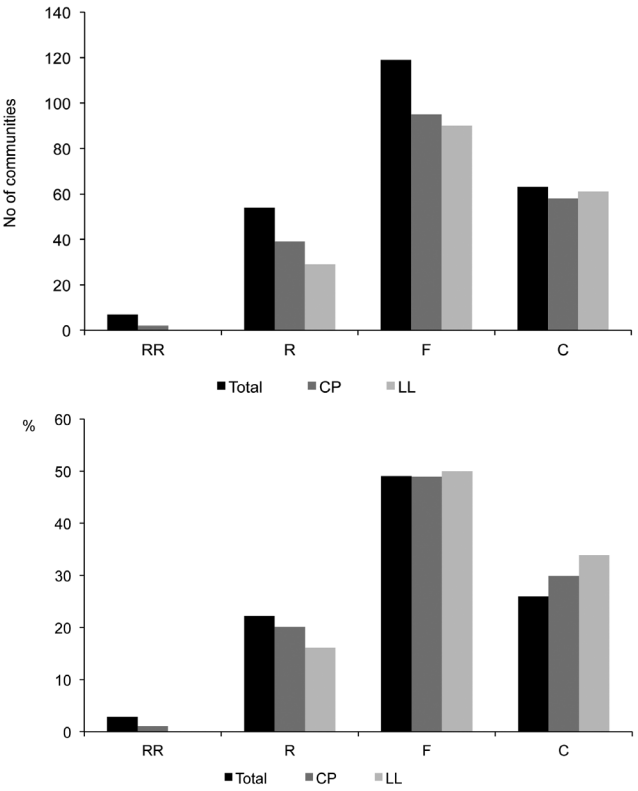

Fig. 5. The number and share of communities representing different categories of frequency in in central Pomerania (CP) and Lubuskie Lakeland (LL)
Explanations: C – common, F – frequent, R – rare, RR – extremely rare

– 2.2%, and *Asplenietum trichomano-rutae-murariae* – 1.3%), as well as those which were noted sporadically – in less than 1% of complexes (*e.g.*, *Chenopodio glauci-Puccinellietum distantis*, *Sisymbrio-Atriplicetum nitentis*, *Centaureo diffusae-Berteroetum*, *Leersietum oryzoidis*, *Poo-Coronopodetum squamati*, *Tunico-Poetum compressae*).

Among 33 communities found only in Pomerania, only *Stellario-Carpinetum* (in 10.3% of complexes) was more frequent. The others were rare, *e.g.*, *Lysimachio vulgaris-Filipenduletum* (5.5%), *Rubo-Epilobietum angustifolii* and *Stellario-Alnetum glutinosae* (2.1% each), very rare: *Asplenio-Polypodietum* and *Salicetum auritae* (1.4%), or sporadic – in less than 1% of complexes: *Ammophiletum arenariae*, *Betulo-Quercetum roboris*, *Calamagrostietum neglectae*, *Calletum palustris*, *Caretum carvi*, *Glycerio-Sparganietum neglecti*, *Helichryso-Jasionetum litoralis* and *Spergulo-Chrysanthemetum segetum*.

The group of syntaxa observed in both studied regions comprised 162 communities, out of which 10 were frequent and occurred in more than 40% of complexes. The most common were communities of trodden or grazed areas: *Lolio-Plantaginetum* (76%), *Poetum annuae* (52%), *Lolio-Cynosuretum* (50%) and

Matricario-Polygonetum arenastri (43%); mesic meadows – *Arrhenatheretum elatioris* (65%); some nitrophilous tall-herb communities: *Agropyro-Aegopodietum* (64%), *Anthriscetum sylvestris* (41%) and *Elymus repens-Urtica dioica* community (41%); nitrophilous black elder thickets *Aegopodio-Sambucetum nigrae* (53%) and ruderal grassland *Convolvulo arvensis-Agropyretum repentis* (51%).

4. Discussion

The vegetation of agricultural landscape undergoes significant transformations resulting from changing forms of human impact (Poschlod *et al*. 2005; Baessler & Klotz 2006). Among communities, which were assessed as endangered in previous regional studies (*e.g.* Brzeg & Wojterska 1996, 2001; Celiński *et al*. 1997) or on a country scale (*e.g.* Piotrowska 1986; Moravec *et al.* 1995; Rennwald 2000; Ratyńska *et al.* 2010), some were frequently noted in the studied rural sites (*e.g.*, *Arctietum lappae*, *Arrhenatheretum elatioris*, *Papaveretum argemones*). Some of them, however, albeit found in many villages, occurred either in very small, singular patches (*Aphano-Matricarietum*, *Arctietum lappae*, *Chenopodio-Descurainietum sophiae*, *Rumicetum obtusifolii, Scirpetum sylvatici, Veronico agrestis-Fumarietum officinalis*) or with an impoverished floristic list (*Airo caryophylleae-Festucetum ovinae, Filipendulo-Geranietum palustris, Junco compressi-Trifolietum repentis, Leonuro-Ballotetum*), as well as with a disturbed floristic structure (the majority of patches of *Arrhenatheretum elatioris*).

The comparison of plant communities of both regions indicates that the structure of their vegetation shows many affinities and the differences are more of qualitative than quantitative character.

Some natural and endangered communities can find refuge in anthropogenic habitats in settlements, especially in the central green area, on old walls, in ponds and ditches, on wastelands and abandoned fields and in gravel pits. Similar phenomena concerning both vegetation and flora have been reported by Bosiacka & Pieńkowski (2004); Nowak (2005, 2006a, 2006b, 2009); Nowak & Nowak (2006); Nowak *et al.* (2007).

In the years 2010-2014, repeated surveys in some villages revealed that some, mainly ruderal communities with diagnostic archaeophytes, distinctly decreased – both in the number of patches and their size (*e.g.*, *Hyoscyamo-Malvetum neglectae*, *Leonuro-Ballotetum, Matricario-Anthemidetum cotulae*, *Onopordetum acanthii, Urtico urentis-Chenopodietum boni-henrici*). There are several reasons for this phenomenon: 1) giving up raising poultry and other farm animals resulting in the decrease of eutrophication and small scale disturbances, 2) new forms of human impact in villages, *e.g.*, frequent and detailed mowing of lawns, laying of pavements, implementation of herbicides against spontaneous vegetation, intensification of car traffic, and 3) decline of traditional rural habitats: roadsides, linear areas along fences and farm buildings, large unpaved courtyards *etc.*

At the same time, it can be observed an increase in the share of more thermophilous ruderal communities with expansive kenophytes, such as: *Erigeronto-Bryetum*, *Erigeronto-Lactucetum serriolae*, *Panico sanguinalis-Eragrostietum*, *Polygono arenastri-Portulacetum oleracei*, *Poo-Oxalidetum corniculatae*, and communities connected until now mainly with towns: *Bryo-Saginetum procumbentis*, *Hordeetum murini* and *Polygonetum calcati* (Balcerkiewicz 2000; Borysiak *et al.* 2000; Brzeg 2009; Szrama 2009).

Some of plant communities, considered as common or frequent on a national scale (Ratyńska *et al.* 2010), were rare in the study areas. To this category belonged, *e.g.*: *Chaerophylletum aromatici*, *Chenopodio-Descurainietum sophiae*, *Onopordetum acanthii*, *Oxalido-Chenopodietum polyspermi, Torilidetum japonicae* and *Vicietum tetraspermae.* On the other hand, rare in the Polish lowland *Matricarietum discoideo-recutitae* was quite frequent there. The status of threat to selected seminatural, segetal and ruderal communities should be therefore reconsidered. Insignificant representation of communities of poor habitats, *e.g.*: *Cornicularo-Corynephoretum, Digitarietum ischaemi, Linario-Brometum tectorum* or *Sclerantho-Arnoseridetum minimae,* indicates that mediaeval villages were located exclusively in richer habitats. This observation confirms opinions of Burszta (1958) and Szulc (1995) formulated upon analysis of abiotic conditions.

In spite of the long lasting human impact, rare and endangered plant communities still constitute an important part of the list of stated syntaxa. Similar observations were published from German villages (Steube & Brandes 2004) and from other types of anthropogenically transformed habitats in Pomerania (Bosiacka, Pieńkowski 2004) and Silesia (Nowak 2006a; Nowak *et al.* 2007). The importance of anthropogenic habitats in the preservation of diversity of plant cover is therefore the subject of current interest.

5. Conclusions

- The rural landscape of both studied areas is still rich and diversified, it hosts many different types of communities, among them natural perdochoric, very rare and endangered, but they constitute only a small percentage of presented lists.
- New forms of human impact (*e.g.*, intensive mowing of lawns, implementation of herbicides along

fences and buildings, introduction of pavements on farmyards and roadsides), as well as abandonment of cultivation or its intensification are leading to the transformations of the rural landscape, its unification and impoverishment in natural and synanthropic ruderal elements replaced by synanthropic ruderal specialised ones.

- The comparison of both studied regions – central Pomerania and the Lubuskie Lakeland has shown: (*i*) similar pattern of vegetation differentiation in relation to the origin and degree of threat; (*ii*) slightly higher vegetation diversity in the villages of central Pomerania.
- Ruderal communities were noted in all types of spatial-functional complexes, whereas segetal communities were restricted to meadows, fields and built up areas.
- The rural landscape of the Lubuskie Lakeland was more transformed, richer in ruderal communities, whereas in central Pomerania, natural and seminatural communities were more represented.
- Data gathered from, until now, very scarcely studied landscapes give foundations for the verification of frequency categories and threat to communities in Poland.

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Appendix 1. List of plant communities occurring in the studied complexes in villages and their surroundings

No	1	2	3	4	5	6	7
	Number of villages	48	18	18			
	Area	Total	CP	LL			
	Forest and shrub communities						
1	*Carici elongatae-Alnetum*	5	3	1	N	nt	F
2	*Salicetum cinereae*	55	33	10	NA	nt	F
3	*Salicetum auritae*	2	2	0	NA	I	R
4	*Salicetum albae*	9	1	5	NP	V	R
5	*Salicetum triandro-viminalis*	3	1	1	NA	nt	F
6	*Calamagrostio arundinaceae-Quercetum petraeae*	7	7	0	NP	I	F
7	*Molinio caeruleae-Quercetum roboris*	1	1	0	NP	V	R
8	*Betulo-Quercetum roboris*	1	1	0	NP	V	R
9	*Fraxino-Alnetum*	13	8	2	N	I	F
10	*Stellario-Alnetum glutinosae*	3	3	0	NP	V	RR
11	*Querco-Ulmetum*	33	11	11	NP	V	F
12	*Galio sylvatici-Carpinetum*	17	0	6	NP	V	F
13	*Stellario holosteae-Carpinetum*	16	16	0	NP	V	F
14	*Deschampsio flexuosae-Fagetum*	1	0	0	NP	I	F
15	*Melico uniflorae-Fagetum*	2	1	0	NP	V	F
16	*Adoxo-Aceretum pseudoplatani*	1	0	0	NP	E	RR
17	*Chelidonio-Robinietum*	39	2	21	SR	nt	F
18	*Euonymo-Prunetum spinosae*	75	20	31	NA	nt	C
19	*Aegopodio-Sambucetum nigrae*	165	51	67	NA	nt	C
20	*Euonymo-Cornetum sanguinei*	3	1	1	NA	I	F
21	*Euonymo-Coryletum*	11	4	5	NA	I	F
22	*Pruno-Ligustretum*	3	0	2	N	V	R
23	*Rosetum rubiginoso-dumalis*	4	1	2	NA	V	R
24	*Rubo plicati-Sarothamnetum*	14	8	2	NA	I	F
25	*Agrostio-Populetum tremulae*	18	7	5	NA	nt	F
26	Comm. *Rubus gracilis-R. plicatus pro ass.*	13	2	6	NA	nt	F
27	Comm. *Ammophila arenaria-Rosa rugosa*	1	1	0	X	nt	R
	Communities of stages of forest development and clear cuttings						
28	*Calamagrostietum epigeji*	8	2	1	NA	nt	C
29	*Rubo-Epilobietum angustifolii*	3	3	0	NA	nt	F
30	*Salicetum capreae*	28	8	10	NA	V	R
31	*Rubetum idaei*	32	17	7	NA	nt	C
	Water and swamp communities						
32	*Lemnetum minoris*	38	17	15	NA	nt	C
33	*Lemnetum trisulcae*	11	3	4	NA	nt	F
34	*Callitricho-Lemnetum minoris*	5	3	2	NA	I	F
35	*Lemno-Spirodeletum polyrhizae*	11	6	1	NA	nt	C
36	*Riccietum fluitantis*	3	1	2	NA	V	R
37	*Ricciocarpetum natantis*	1	0	0	NA	V	RR
38	*Lemno-Hydrocharitetum morsus-ranae*	2	2	0	NA	I	F
39	*Lemno-Utricularietum vulgaris*	5	2	2	NA	I	F
40	*Ceratophylletum demersi*	9	1	6	NA	nt	C
41	*Ceratophylletum submersi*	2	0	2	NA	V	R
42	*Myriophyletum spicati*	1	0	0	N	I	F
43	*Potametum crispi*	1	0	0	NA	I	F
44	*Zannichellietum palustris*	1	0	0	N	V	R
45	*Elodeetum canadensis*	6	6	0	X	O	F
46	*Polygonetum natantis*	5	0	3	NA	nt	F
47	*Potametum natantis*	12	5	6	NA	nt	F
48	*Nymphaeo albae-Nupharetum luteae*	7	3	0	N	V	F
49	*Hottonietum palustris*	1	0	0	NA	I	F
50	*Beruletum submersae*	1	0	1	NA	V	R

No	1	2	3	4	5	6	7
	Number of villages	48	18	18			
	Area	Total	CP	LL			
51	*Caricetum remotae*	1	1	0	NP	V	R
52	*Scirpetum lacustris*	2	0	1	NA	nt	C
53	*Typhetum angustifoliae*	4	2	2	NA	nt	C
54	*Typhetum latifoliae*	58	26	18	NA	nt	C
55	*Sparganietum ramosi*	6	0	3	NA	nt	C
56	*Phragmitetum communis*	45	15	19	NA	nt	C
57	*Equisetetum limosi*	1	1	0	NA	I	F
58	*Glycerietum maximae*	13	10	2	NA	nt	C
59	*Acoretum calami*	18	8	3	X	nt	C
60	*Cicuto-Caricetum pseudocyperi*	5	3	2	NP	V	F
61	*Thelypterido-Phragmitetum*	1	1	0	NP	nt	F
62	*Iridetum pseudoacori*	16	12	1	NA	I	C
63	*Caricetum acutiformis*	21	6	5	NA	nt	C
64	*Caricetum distichae*	9	6	2	NA	V	R
65	*Caricetum elatae*	12	8	4	N	I	F
66	*Caricetum gracilis*	21	12	7	NA	nt	C
67	*Caricetum paniculatae*	4	2	2	N	V	F
68	*Caricetum ripariae*	7	0	3	NA	I	F
69	*Caricetum rostratae*	7	5	2	NA	V	R
70	*Caricetum vesicariae*	7	5	1	NP	V	R
71	*Caricetum vulpinae*	3	0	2	N	V	R
72	*Oenantho aquaticae-Rorippetum amphibiae*	3	1	0	NA	nt	F
73	*Glycerio-Oenanthetum aquaticae*	3	1	1	NA	I	F
74	*Sagittario-Sparganietum emersi*	1	1	0	NP	V	R
75	*Butometum umbellati*	2	1	0	NA	nt	F
76	*Eleocharitetum palustris*	16	6	6	NA	nt	F
77	*Glycerio-Sparganietum neglecti*	1	1	0	NA	V	R
78	*Glycerietum fluitantis*	33	17	7	NA	nt	C
79	*Glycerietum plicatae*	8	5	2	NA	V	R
80	*Cardamino amarae-Beruletum erecti*	8	5	3	NA	I	F
81	*Leersietum oryzoides*	1	0	0	NA	V	R
82	*Phalaridetum arundinaceae*	56	29	18	NA	nt	C
83	*Caricetum lasiocarpae*	1	1	0	NP	V	R
84	*Calletum palustris*	1	1	0	NP	V	R
85	*Calamagrostietum canescentis*	3	2	0	NA	I	F
86	*Carici canescentis-Agrostietum caninae*	2	1	1	NA	I	F
87	*Calamagrostietum neglectae*	1	1	0	NA	V	R
88	*Caricetum paniceo-lepidocarpae*	2	1	1	NA	V	R
	Ephemerous therophytic communities on periodically flooded sites						
89	*Ranunculo-Myosuretum*	1	0	0	SS	V	F
90	*Juncetum bufonii*	8	6	1	NA	nt	C
91	*Bidenti-Polygonetum hydropiperis*	20	11	2	NA	nt	C
92	*Rumici-Alopecuretum aequalis*	8	1	5	NA	I	F
93	*Bidenti-Rumicetum maritimi*	2	0	0	NA	nt	C
94	*Bidentetum cernui*	8	5	3	NA	I	F
95	*Bidenti-Ranunculetum scelerati*	12	3	6	NA	nt	F
96	*Chenopodietum rubri*	1	1	0	NA	nt	F
	Communities of xerothermophilous swards and tall herbs						
97	*Ammophiletum arenariae*	1	1	0	NP	V	R
98	*Helichryso arenarii-Jasionetum litoralis*	1	1	0	N	V	R
99	*Cornicularo-Corynephoretum*	3	1	2	NA	nt	C
100	*Filagini-Vulpietum*	4	1	3	SN	V	R
101	*Airo caryophylleae-Festucetum ovinae*	8	2	4	NA	V	R
102	*Sclerantho polycarpi-Herniarietum glabrae*	15	9	3	SN	V	F
103	*Armerio elongatae-Festucetum ovinae*	15	3	9	SN	nt	C

No	1	2	3	4	5	6	7
	Number of villages	48	18	18			
	Area	Total	CP	LL			
104	Comm. *Erophila verna-Cerastium semidecandrum*	32	1	19	NA	nt	F
105	*Arenario-Sedetum acris*	24	5	7	SR	nt	F
106	*Erodio-Senecionetum vernalis*	6	0	6	SR	O	C
107	*Saxifrago-Poetum compressae*	1	0	0	SR	I	R
108	*Sileno otitae-Festucetum trachyphyllae*	3	0	1	NA	V	F
109	*Tunico-Poetum compressae*	1	0	1	NA	V	R
110	*Trifolio medii-Agrimonietum*	11	3	0	NA	nt	C
111	*Agrostio-Agrimonietum procerae*	5	2	2	NA	I	R
112	*Trifolio-Melampyretum nemorosi*	1	0	0	NA	nt	F
113	*Fragario vescae-Campanuletum cervicariae*	1	1	0	N	E	RR
114	*Agrimonio-Vicietum cassubicae*	9	4	3	NA	V	F
115	*Sedo maximi-Peucedanetum oreoselini*	15	3	9	NA	nt	F
116	*Lathyro-Melampyretum pratensis*	2	2	0	NA	nt	F
117	Comm. *Agrostis tenuis-Holcus mollis*	11	4	5	NA	nt	F
	Meadow, pasture and heathland communities						
118	*Filipendulo-Geranietum palustris*	20	14	3	NA	V	F
119	*Lysimachio vulgaris-Filipenduletum*	8	8	0	NA	nt	F
120	*Scirpetum sylvatici*	28	12	6	N	V	F
121	*Angelico-Cirsietum oleracei*	18	12	4	SN	V	F
122	*Caricetum cespitosae*	1	0	0	N	V	R
123	*Ranunculo repentis-Alopecuretum pratensis*	51	36	9	SN	nt	F
124	*Stellario palustris-Deschampsietum cespitosae*	21	11	6	SN	nt	C
125	*Epilobio-Juncetum effusi*	36	25	6	SN	nt	F
126	Comm. *Ranunculus acris-Lychnis flos-cuculi*	19	13	4	SN	nt	F
127	Comm. *Equisetum palustre*	3	3	0	NA	I	R
128	Comm. *Holcus lanatus*	21	9	11	SN	nt	C
129	*Arrhenatheretum elatioris*	195	59	83	SN	V	C
130	*Chrysanthemo leucanthemi-Rumicetum thyrsiflori*	40	17	13	SN	I	F
131	Comm. *Poa pratensis-Festuca rubra*	92	16	41	SN	nt	C
132	*Lolio perennis-Cynosuretum cristati*	143	58	51	SN	I	F
133	*Caretum carvi*	1	1	0	SN	V	R
134	*Lolio-Plantaginetum*	224	76	88	SN	nt	C
135	*Prunello-Plantaginetum*	5	1	3	NA	I	F
136	*Juncetum macri*	3	2	1	X	O	F
137	*Potentillo-Festucetum arundinaceae*	24	10	11	SN	I	F
138	*Ranunculo repentis-Alopecuretum geniculati*	24	18	2	SN	nt	F
139	*Junco compressi-Trifolietum repentis*	13	3	6	SN	V	R
140	*Ranunculetum repentis*	119	39	45	SN	nt	C
141	*Mentho longifoliae-Juncetum inflexi*	5	3	2	NA	V	R
142	*Potentilletum anserinae*	103	33	46	SN	nt	C
143	*Potentilletum reptantis*	67	3	36	SN	nt	C
144	*Polygalo-Nardetum*	4	3	0	SN	V	R
	Communities of rock crevices and walls						
145	*Asplenietum trichomano-rutae-murariae*	3	0	2	NA	E	R
146	*Cystopteridetum fragilis*	1	0	0	NA	E	RR
147	*Gymnocarpietum robertiani*	1	0	0	N	E	RR
148	*Asplenio-Polypodietum*	2	2	0	N	V	R
149	Comm. *Ceratodon purpureus-Syntrichia ruralis*	33	8	16	SRS	nt	C
	Nitrophilous perennial tall herb communities						
150	*Epilobio hirsuti-Convolvuletum sepium*	26	17	7	NA	nt	F
151	*Eupatorietum cannabini*	2	2	0	NA	nt	F
152	*Urtico-Convolvuletum sepium*	29	12	10	NA	nt	F
153	*Fallopio-Humuletum lupuli*	41	2	18	NA	nt	C
154	*Carduo crispi-Rubetum caesii*	7	2	1	NA	nt	F

No	1	2	3	4	5	6	7
	Number of villages	48	18	18			
	Area	Total	CP	LL			
155	*Rudbeckio-Solidaginetum*	51	8	27	X	O	C
156	*Calystegio-Asteretum lanceolati*	1	1	0	X	nt	F
157	*Impatienti glanduliferae-Calystegietum sepium*	8	4	0	X	O	F
158	*Polygonetum cuspidati*	12	2	7	X	O	F
159	*Sicyo-Echinocystietum lobatae*	1	1	0	X	O	F
160	*Helianthetum decapetali*	13	3	4	X	O	F
161	*Agropyro repentis-Aegopodietum podagrariae*	200	65	75	NA	nt	C
162	*Aegopodio-Petasitetum hybridi*	16	5	4	NA	nt	F
163	*Anthriscetum sylvestris*	115	48	40	NA	nt	C
164	*Chaerophylletum aromatici*	3	3	0	NA	I	F
165	*Chaerophylletum bulbosi*	40	0	21	NA	nt	F
166	*Aegopodio-Heracleetum mantegazziani*	1	0	0	X	O	F
167	*Aegopodio-Reynoutrietum sachalinensis*	2	0	0	X	O	R
168	Comm. *Agropyron repens-Urtica dioica*	130	35	56	NA	nt	C
169	*Alliario-Chaerophylletum temuli*	22	13	3	NA	nt	C
170	*Myosotido sparsiflorae-Alliarietum petiolatae*	1	0	1	NA	nt	F
171	*Geo urbani-Chelidonietum majoris*	87	4	43	NA	nt	F
172	*Torilidetum japonicae*	6	1	4	NA	I	F
173	*Galio aparines-Veronicetum sublobatae*	48	0	27	NA	nt	F
174	*Impatientetum parviflorae*	18	3	12	X	O	C
175	*Epilobio montani-Geranietum robertiani*	5	0	1	NA	V	F
176	*Stachyo sylvaticae-Impatientetum noli-tangere*	1	0	1	NA	V	F
177	*Onopordetum acanthii*	12	1	5	SR	V	F
178	*Potentillo argenteae-Artemisietum absinthii*	24	4	6	SR	nt	F
179	*Artemisio vulgaris-Echinopetum sphaerocephali*	2	1	1	SR	I	R
180	*Berteroetum incanae*	12	1	5	SR	nt	C
181	*Centaureo diffusae-Berteroetum incanae*	1	0	0	SRS	I	R
182	*Artemisio campestris-Oenotheretum rubricaulis*	3	2	1	SRS	nt	F
183	*Melilotetum albo-officinalis*	15	2	7	SR	nt	F
184	*Poo compressae-Tussilaginetum*	10	4	4	NA	nt	F
185	*Dauco-Picridetum hieracioidis*	29	1	19	SR	nt	F
186	*Cerintho-Vicietum villosae*	25	1	13	SR	O	F
187	*Tanaceto-Artemisietum*	72	35	21	SR	nt	C
188	*Sedo acri-Poetum compressae*	4	1	2	SRS	nt	R
189	*Convolvulo arvensis-Agropyretum repentis*	145	45	61	SR	nt	C
190	*Lepidietum drabae*	3	0	1	SRS	nt	F
191	*Falcario-Agropyretum*	12	0	7	SR	nt	F
192	*Chondrillo-Agropyretum*	1	0	0	SR	I	R
193	*Convolvulo-Brometum inermis*	39	14	14	SR	O	F
194	*Elymo-Rubetum caesii*	52	4	24	SR	nt	C
195	*Rubo caesii-Calamagrostietum epigeji*	40	7	24	SR	O	F
196	Comm. *Lathyrus tuberosus*	1	0	0	SR	nt	F
197	Comm. *Saponaria officinalis*	15	5	8	SR	nt	F
198	*Arctietum lappae*	100	38	36	SR	I	C
199	*Leonuro-Ballotetum nigrae*	93	1	58	SR	I	C
200	*Urtico urentis-Chenopodietum boni-henrici*	7	2	2	SR	E	R
201	*Rumicetum obtusifolii*	82	31	26	SR	V	F
202	*Hyoscyamo nigri-Conietum maculati*	1	1	0	SR	I	F
203	*Lactuco-Anthriscetum caucalidis*	10	0	6	SR	V	R
204	*Lycietum halimifolii*	9	0	5	SR	nt	F
205	Comm. *Armoracia rusticana*	10	5	2	SR	I	F
206	Comm. *Bromus carinatus*	62	13	25	SR	O	F
	Annual segetal and ruderal communities						
207	*Spergulo arvensis-Scleranthetum annui*	11	7	2	SS	nt	C
208	*Echinochloo-Setarietum pumilae*	8	2	4	SS	O	C
209	*Spergulo-Echinochloetum cruris-galli*	20	1	12	SS	I	R

No	1	2	3	4	5	6	7
	Number of villages	48	18	18			
	Area	Total	CP	LL			
210	*Digitarietum ischaemi*	6	2	2	SS	nt	F
211	*Setario-Lycopsietum arvensis*	11	7	4	SS	I	R
212	*Spergulo-Chrysanthemetum segetum*	1	1	0	SS	V	R
213	*Sclerantho-Arnoseridetum minimae*	7	3	1	SS	V	F
214	*Papaveretum argemones*	53	15	24	SS	I	C
215	*Vicietum tetraspermae*	14	3	10	SS	I	C
216	*Aphano arvensis-Matricarietum chamomillae*	39	13	16	SS	V	F
217	*Veronico agrestis-Fumarietum officinalis*	24	8	8	SS	V	F
218	*Oxalido-Chenopodietum polyspermi*	9	5	1	SS	V	F
219	*Euphorbio peplidis-Galinsogetum ciliatae*	77	15	37	SS	nt	C
220	*Chenopodietum stricti*	44	17	14	SR	nt	C
221	*Chenopodio-Descurainietum sophiae*	16	6	5	SR	I	F
222	*Erigeronto-Lactucetum serriolae*	77	3	46	SRS	nt	F
223	*Sisymbrio-Atriplicetum nitentis*	1	0	1	SRS	nt	F
224	*Elymo repentis-Sisymbrietum loeselii*	6	1	2	SRS	O	C
225	*Hordeetum murini*	63	0	42	SRS	O	F
226	*Hyoscyamo nigri-Malvetum neglectae*	54	11	24	SR	nt	C
227	*Matricario discoideae-Anthemidetum cotulae*	9	6	1	SR	E	R
228	*Matricarietum discoideo-recutitae*	25	14	7	SR	I	R
229	Comm. *Euphorbia peplus-Stellaria media*	30	2	15	SR	nt	F
230	*Panico sanguinalis-Eragrostietum*	5	0	1	SRS	O	C
231	*Erigeronto-Bryetum*	53	6	33	SRS	O	C
232	*Linario vulgaris-Brometum tectorum*	7	2	3	SRS	nt	C
233	*Conyzo-Senecionetum viscosi*	1	0	0	SRS	nt	RR
234	*Poetum annuae*	162	41	70	NA	nt	C
235	*Matricario matricarioidis-Polygonetum arenastri*	134	37	55	SRS	nt	C
236	*Poo-Coronopodetum squamati*	1	0	1	SR	E	R
237	*Polygono arenastri-Lepidietum ruderalis*	10	1	8	SRS	nt	C
238	*Chenopodio glauci-Puccinellietum*	2	0	2	SRS	O	F
239	*Bryo argentei-Saginetum procumbentis*	59	8	25	SR	nt	C
240	*Rumici acetosellae-Spergularietum rubrae*	9	1	5	SR	nt	F
241	*Herniarietum glabrae*	4	1	0	SR	nt	F
242	*Poo-Oxalidetum corniculatae*	5	0	2	SRS	nt	F
243	*Polygonetum calcati*	3	1	2	SRS	O	F

Explanations: 2* – the number of occurrences in the complexes of all 48 studied villages, 3 – the number of occurrences in the complexes of 18 villages of central Pomerania (CP), 4 – the number of occurrences in the complexes of randomly selected 18 villages of Lubuskie Lakeland (LL), 5 – syngenesis (for explanation see text), 6 – category of dynamic tendencies under human impact in Poland – category of threat (E – endangered, V – vulnerable, I – not determined, nt – not threatened communities, O – communities expanding their range), 7 – frequency in Poland (RR – extremely rare, R – rare, F – frequent, C – common)

*List of studied villages

in Pomerania (18): Chotkowo, Gardna Mała, Kluki, Królewo, Kwasowo, Łącko, Łąkie, Marszewo, Marwice (the only village situated beyond the area marked on the map), Nosalin, Noskowo, Radosław, Rzyszczewo, Sierżno, Staniewice, Ścięgnica, Tągowie and Wrząca;

in the Lubuskie Lakeland: (a) randomly selected 18 villages for comparison with the villages in Pomerania – Bielice, Chociszewo, Glińsk, Jemiołów, Jeziory, Lisów, Lubiechnia Wielka, Lubień, Lubin, Lubinicko, Lutol Suchy, Łagowiec, Mierczany, Radówek, Rogoziniec, Rusinów, Żelechów; (b) other villages (12): Koryta, Laski Lubuskie, Łagówek, Międzylesie, Niedźwiedź, Ojerzyce, Opalewo, Rzeczyca, Starków, Templewo, Wielowieś and Wolimirzyce.