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Thermophilous fringe communities as an indicator of vegetation changes: a case study of the "Murawy Dobromierskie" steppe reserve (Poland)

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Abstract: In this paper, changes of the non-forest xerothermic vegetation of the "Murawy Dobromierskie" steppe reserve which occurred in the period 1993-2012 are examined. The material comprises 50 relevés, of which 43 date from 2012 and the other 7 – from 1993. Relévés were arranged in 5 analytic tables. A synoptic table was also compiled, and for each syntaxonomical species group distinguished, values of the cover coefficient (C), the collective group share index (G), and the systematic group value (D) were estimated and compared. On the basis of the obtained results, a significant decline in abundancy and/or constancy was observed within the following groups: Ch. *Artemisietea vulgaris*, Ch. *Cirsio-Brachypodion pinnati,* Ch. *Festuco-Brometea,* Ch. *Geranion sanguinei,* Ch. *Koelerio-Corynephoretea,* and Ch. *Origanetalia* and *Trifolio-Geranietea sanguinei*, whereas for the taxa of the *Rhamno-Prunetea,* a notable increase in the share of the reserve vegetation was recorded. A sizeable expansion of the moss layer was also observed in this period. The results are discussed with special regard to differences in the methodical background of both field studies.

Key words: secondary succession, xerothermic grasslands, numerical parameters, steppe reserve, *Festuco-Brometea*, *Trifolio-Geranietea sanguinei*, Małopolska Upland, Poland

1. Introduction

Xerothermic grasslands of the *Festuco-Brometea* class in Central and Western Europe are mostly extrazonal, "steppe-type" vegetation patches, either of semi-natural (anthropogenic) or relic character (Medwecka-Kornaś & Kornaś 1972; Ellenberg 1996). A massive decline of this habitat type, ongoing since the end of 19th century, has its origin, on the one hand, in land-use intensification and, on the other, in pasture abandonment, which has led to their rapid secondary succession (Willems 2001; Poschlod & WallisDe Vries 2002). As early as in 1920s, it was reported that the latter process was occurring on a large scale (Kozłowska 1925). In the course of later investigations, various issues concerning overgrowing of dry grasslands were studied, e.g.: succession-driven changes of species richness, floristic composition, and community structure; successional stages and species turnover; limitation of microsites and seedling dispersal; and methods of effective restoration of patches (Faliński 1972; Bobbink & Willems 1987, 1993; Świerczyńska 1990; Wilmanns & Sendtko 1995; Zerbe & Schacht 1998; Kupferschmid *et al.* 2000; Bąba 2003; Dierschke 2006; Chytrý 2007; Enyedi *et al.* 2008; Schrautzer *et al.* 2009; Rusina & Kiehl 2010; Hahn *et al.* 2012; Hegedüšová Vantarová & Škodová 2014). Some studies showed that, except for trees and shrubs, calcareous grasslands can also be encroached with tall herbs, forming patches of xerothermophilous communities of the *Trifolio-Geranietea sanguinei* (Ger."Versaumung") class. Such communities should be regarded as post-terminal successional stages of abandoned calcareous grasslands (Dierschke 1985, 2006; Wilmanns & Kratochwil 1983; Kratochwil 1984; Brzeg 2005; Chytrý 2007; Brzeg & Wika 2014).

In Poland, however, such herb phytocoenoses were, for a long time, classified as specific or "successional" forms of *Festuco-Brometea* communities (e.g.

Medwecka-Kornaś & Kornaś 1963, 1972; Grodzińska 1970), contributing to a poor state of their recognition. According to the first vegetation diagnosis of the "Murawy Dobromierskie" steppe reserve (Małopolska Upland) by Olaczek *et al.* (1993), the most widespread non-forest plant community type was the xerothermic grassland association *Thalictro-Salvietum pratensis* Medw.-Korn. 1959. At the same time, the above-mentioned authors emphasized that, in terms of its origin, the object vegetation was fully anthropogenic and, since the plantation of pine in 1950s, followed by abandonment of pastures, it was undergoing rapid secondary succession changes. As a matter of fact, those *Thalictro-Salvietum pratensis* phytocoenoses were often found in their "post-terminal" development phase (Olaczek *et al.* 1993). It is highly probable though, that most of such patches actually represented fringe communities of the *Trifolio-Geranietea sanguinei*. The last research on the reserve calcareous open-area vegetation showed that it was dominated by phytocoenoses of four associations of the *Geranion sanguinei* alliance, *Trifolio-Geranietea sanguinei* class (Szygendowski 2013).

A major focus of this paper is, thus, laid on comparing the state of the object non-forest xerothermic vegetation in the years 1993 and 2012 in order to analyze the secondary succession process in the syndynamical aspect. Moreover, the work aims to characterize rare and valuable forb fringe communities of the *Geranion sanguinei* documented in the course of the last survey (Szygendowski 2013).

2. Research area

The reserve (Fig. 1) covers an area of 36.29 ha. It is located about 2 km east of the village of Dobromierz (51°00′32″N 19°55′18″E), in Kluczewsko municipality, Włoszczowa district, Świętokrzyskie Voivodship, within the area of Przedbórz Landscape Park. The reserve is situated in the Małopolska Upland sub-province, the Przedbórz Upland (342.1) macroregion, in the northwestern part of the Przedbórz-Małogoszcz Range (342.15) mesoregion (Kondracki 1998). Its area occupies south-facing slopes and summits of a Jurassic limestone hill. The most frequently occurring soil type is rendzina, turning into brown soils and – much more rarely – brown arenosol on sandy deposits at the foot of the hill. Average pH level ranges from 5.5-7.5 for rendzina to 4.5-5.0 for brown arenosols (Olaczek *et al.* 1993).

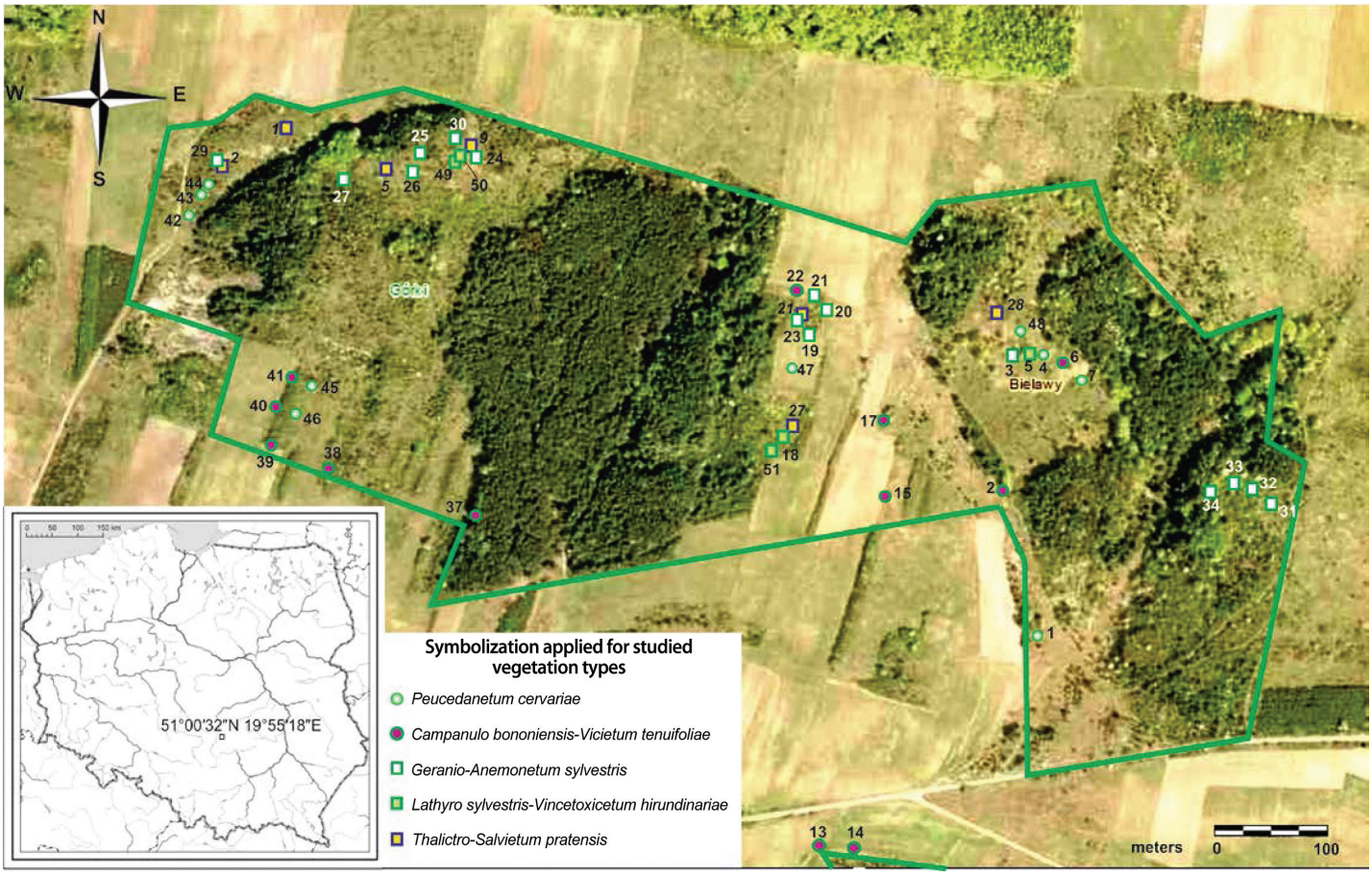

Fig. 1. Geographical location of the study area and distribution of relevés in the "Murawy Dobromierskie" reserve
Source: Esri (2014) World Topographic Map. Category: imagery with labels. 1 : 6,850. Copyright by Esri, DeLorme, HERE, TomTom [accessed 2014-03-01]

The area of today's reserve Murawy Dobromierskie has been recognized as a refuge of xerothermic flora since early 1980s (Wnuk 1981, 1984). The first full list of the reserve flora was drawn up by Olaczek *et al*. (1993). About 320 species of vascular plants and 10 species of mosses were found in the reserve area at that time. At the present time, 14 plant species under protection (pursuant to the Regulation 2014) are known to occur in the object.

Based on the first reserve vegetation diagnosis by Olaczek *et al*. (1993), the existence of 12 associations pertaining to 6 classes was stated. The authors documented the following community types occurring in the area: psammophilous swards (1 rel.), calcareous grasslands (14 rel.), xerothermic shrubs (7 rel.), forests (14 rel.), and segetal communities (21 rel.). Some grassland patches with the greatest abundance of *Aster amellus* were further recognized as a marginal form of the *Inuletum ensifoliae* association (Wnuk & Pisarek 2008)

3. Material and methods

Field studies were carried out in 2012. At the stage of data collection, the Braun-Blanquet approach (Braun-Blanquet 1964; Pawłowski 1972; Matuszkiewicz 2001; Dzwonko 2007) was applied. Areas of relevés ranged from 8 to 50 m^2; their typical localization was shrub/forest edges, formerly cultivated open areas and/or former limestone excavations. To obtain a good insight into syntaxonomic differentiation of the reserve vegetation, and to avoid involvement of vegetation mosaic (i.e. grassland accompanied by herbs and shrubs, see Müller 1962, 1978) in single relevés, the authors regarded selection of homogenous patches as one of the major principles of field work, so that relevés did not exceed 50 m^2 in area. In another study, however, (Olaczek *et al.* 1993), the area of relevés ranged from 100 to 400 m^2indicating a higher homogeneity of vegetation. To provide comparability of two data sets, the authors ensured that the total area of the compared relevé sets was nearly the same (7 relevés in 1993 – 750 m^2 and 43 relevés in 2012 – 761 m^2).

For each of the distinguished 4 associations, an analytic phytosociological table was assembled. A separate analytic table of the previously documented calcareous grassland association (*Thalictro-Salvietum pratensis*) was compiled, and it comprised 7 relevés randomly selected from the original data collected by Olaczek *et al*. (1993). In a classical synoptic table, all the associations analyzed in the paper are compared. The category tagged *G.s.* coll. took all the examined associations of thermophilous herbs (i.e. of the *Geranion sanguinei* alliance) as a whole, and enabled to better illustrate the state of the entire xerothermic non-forest vegetation of the reserve in year 2012. Spatial distribution of all relevés compared in the present paper is illustrated in Figure 1. The background was derived from the Esri® World Topographic Map.

In order to elucidate the main successional trends ongoing in the Murawy Dobromierskie reserve, a comparative table of three parameters: total mean cover coefficient (C), collective group share index (G), and systematic group value (D), estimated for the distinguished groups of taxa, was compiled. The cover coefficients and constancy degrees were calculated with the use of ©ExGrad for Windows 1.01 (Sławnikowski 1998) software. In each analytic table, the obtained results were added up within all syntaxonomical groups. For other estimations, MS Excel software was used. The D values were calculated by the formula: D = G*S/100, where G (collective group share index) and S (group constancy) were calculated as follows: G = (g/t)100; S = (g/z*n)100. The following designations were useds: g – the sum of occurrences of a given syntaxonomical group in the analytic table; t – the sum of occurrences of all taxa in the table; z – the number of taxa of a given group; n – the number of relevés in the table. For four *Geranion sanguinei* associations taken collectively, the C coefficient sums, the G indices, and the D values, obtained for each group of taxa, were averaged. In the calculation of the parameters, only vascular plant taxa were taken into account.

To precisely indicate the syntaxonomical status of the taxa listed in each analytic table, the following abbreviations were applied: A – *Artemisietea vulgaris*; B – *Brometalia erecti*; C-B – *Cirsio-Brachypodion pinnati*; F-B – *Festuco-Brometea*; G – *Geranion sanguinei*; K-C – *Koelerio-Corynephoretea*; M-A – *Molinio-Arrhenatheretea*; O – others; Q-F – *Querco-Fagetea*; R-P – *Rhamno-Prunetea*; V-P – *Vaccinio-Piceetea*. The nomenclature of syntaxonomical units is compatible with current classification by Ratyńska *et al*. (2010).

The nomenclature of vascular plants and mosses follows works by Rutkowski (2004) and Ochyra *et al*. (2003), respectively. In the 2013 study, the taxonomic approach to species was more detailed than the one applied in the preceding research, and the following microtaxa were distinguished: *Achillea millefolium s.s.* and *A. collina* (vs. *A. millefolium* s.l), none of which was taken into account in the comparison; besides: *Leontodon hispidus* s.s. and *L. hispidus* ssp. *danubialis* (vs. *L. hispidus* s.l.); *Pimpinella saxifraga* s.s. and *P. nigra* (vs. *P. saxifraga* s.l.); *Poa angustifolia* var. *setacea* (vs. *P. angustifolia* s.l.); *Pyrus pyraster* (vs. *P. communis* s.l.); and *Thymus pannonicus* s.s. and *Th. pannonicus* ssp. *marschallianus* (vs. *Th. pannonicus* s.l.), which all were treated as aggregate species. Furthermore, two species: *Polygala comosa* and *P. vulgaris* (the occurence of the latter on dry chalk sites seems very controversial) were regarded in the comparison as a single unit.

4. Results

4.1. Differentiation of the contemporary vegetation

4.1.1. Syntaxonomical classification of the distinguished units

At the present time, open areas of the steppe reserve "Murawy Dobromierskie" are overgrown predominantly by the vegetation representing the *Geranion sanguinei* R.Tx. *in* Th. Müller 1962 alliance, belonging to the *Origanetalia vulgaris* Th. Müller 1962 order and to the *Trifolio-Geranietea sanguinei* Th. Müller 1962 class. The research from 2012 showed the existence of the following four thermophilous herb associations. Three of them are locally not differentiated and represent single subassociations, whereas another one is differentiated into three subassociations:

Ass. *Peucedanetum cervariae* Kaiser 1926
Subass. *Peucedanetum cervariae brachypodietosum pinnati* Brzeg 2005
Ass. *Campanulo bononiensis-Vicietum tenuifoliae* Krausch *in* Th. Müller 1962
Subass. *Campanulo bononiensis-Vicietum tenuifoliae typicum* (Korneck 1974) Brzeg 2005
Ass. *Geranio-Anemonetum sylvestris* Th. Müller 1962
Subass. *Geranio-Anemonetum sylvestris phleetosum phleoidis* Brzeg *et* Wika 2011
Subass. *G.-A.s. typicum* (Korneck 1974) Brzeg 2002
Subass. *G.-A.s. trifolietosum medii* Th. Müller 1962 *ex* Brzeg *et* Wika 2011
Ass. *Lathyro sylvestris-Vincetoxicetum hirundinariae* (Hilbig 1971) Passarge 1979
Subass. *Lathyro sylvestris-Vincetoxicetum hirundinariae typicum* (Brzeg 2005) Brzeg *et* Wika 2011

4.1.2. *Peucedanetum cervariae*
(Table 1 – Tables 1-7 see on pages: 57-76)

Synonym: *Sileno nutantis-Libanotidetum montanae* Jeschke *ex* Passarge 1979; for more see Brzeg 2005

Occurrence conditions: In the "Murawy Dobromierskie" nature reserve, the *Peucedanetum cervariae* was the most widespread association of the *Geranion sanguinei*. It took mostly the form of the "post-terminal development stage" of xerothermic grasslands, covering relatively big areas. Its patches covered open spaces on hill summits and upper parts of slopes, the latter almost exclusively exposed to the south. On rendzina soils, phytocoenoses of this association demonstrated their exceptionally xerothermic character, compared to other communities of the mentioned alliance present in the object.

Physiognomy: Usually three vegetation layers were present. The shrub layer occurred almost always. The herb layer was generally well-developed. It was represented by dicots, grasses and sedges. The cover of the moss layer was overally significant as well.

Differentiation. All phytocoenoses of the *Peucedanetum cervariae* found in the reserve represented the *P.c. brachypodietosum pinnati* subassociation, comprising the most calciphilous forms of the unit, though lacking any differentiating species.

4.1.3. *Campanulo bononiensis-Vicietum tenuifoliae* (Table 2)

Occurrence conditions: The association is related to partially altered habitats, such as shrub edges on ex-arable lands. In the reserve, phytocoenoses of this type occurred almost exclusively on sloping lands, mainly in lower parts of slopes (due to a better development of soil levels), mostly along shrub edges on abandoned arable fields, or in clearings within the shrub formation.

Physiognomy: Usually, three vegetation layers were present. The shrub layer was well developed. The herb layer was lush, and consisted of dicots and grasses. The abundancy of the moss layer varied significantly.

Differentiation: The *Campanulo bononiensis-Vicietum tenuifoliae* was locally poorly differentiated and was represented only by the *C.b.-V.t. typicum* subassociation – showing no distinctive traits and lacking differentiating species; the subassociation included the most xerothermic forms of the association.

4.1.4. *Geranio-Anemonetum sylvestris* (Table 3)

Synonyms: *Thalictro-Geranietum sanguinei* Korneck 1974, *Adonido-Thalictretum mini* Passarge 1997
Not: *Thalictro mini-Geranietum sanguinei* Korneck 1974 *sensu* Dengler 2004

Occurrence conditions: In the reserve, patches of the *Geranio-Anemonetum sylvestris* occurred on flat, as well as on sloping areas of any exposition or inclination. Phytocoenoses found in the object generally preferred initial rendzina soils, with even higher concentration of skeleton material in their profile, compared to the substrates overgrown by e.g. the *Peucedanetum cervariae*. They could be typically encountered on shrub edges in upper parts of slopes, and in former limestone quarries.

Physiognomy: Phytocoenoses of this unit present in the reserve were characterized by a distinct three-layer structure. The shrub layer consisted of species commonly found in all studied communities. The herb layer varied widely in terms of coverage from relatively dispersed to thick and exuberant. The moss layer was always present and relatively strong.

Differentiation: In accordance with the division by Brzeg (2002, 2005), phytocoenoses of the

Geranio-Anemonetum sylvestris in the area represented the calciphilous (basiphilous) sub-association group. It included three sub-associations, and each of them was present in the reserve:

a) *G.-A.s. phleetosum phleoidis* (Table 3, rel. 1-6) – the most xerothermic sub-association, recorded by Brzeg & Wika (2014) from Kraków-Częstochowa Upland; it prefers the substrate characterized by the least concentration of humus; in the reserve it could be encountered near hilltops and, after all, in limestone excavations;
b) *G.-A.s. typicum* (Table 3, rel. 7-11) – an average, xerothermic subassociation, floristically rich, but lacking its own differentiating species;
c) *G.-A.s. trifolietosum medii* (Table 3, rel. 12-16) – a mesophilous subassociation, distinguished by addition of species coming from the *Trifolion medii* alliance; as for the phytocoenoses found in the reserve, those mesophilous traits were not clearly marked. This sub-association occurred on forest edges, in spatial complexes with *Peucedanetum cervariae* and shrubs in the northeastern part of the object, and here and there even at limestone quarries.

4.1.5. *Lathyro sylvestris-Vincetoxicetum hirundinariae* (Table 4)

Synonyms: Ass.-Gr. *Vincetoxicetum*-Säume (Kuhn 1937) Passarge 1979 *nom. inval., Artemisio campestris-Vincetoxicetum hirundinariae* Dengler *et* Krebs 2003, *Origano-Vincetoxicetum hirundinariae* Kolbek *et* Petříček 1979 *ex* M. Wojterska 2003; for others – see Brzeg 2005

Occurrence conditions: In the "Murawy Dobromierskie" reserve, phytocoenoses of this association covered slopes of moderate to high inclination, always exposed to the south, mainly in their upper parts. Rendzina soils generally similar to those overgrown by phytocoenoses of *Peucedanetum cervariae* were the preferred substrate.

Physiognomy: Patches of the *Lathyro-Vincetoxicetum hirundinariae* in the reserve were generally composed of three vegetation layers. However, the shrub layer was usually restricted to single young individuals of taxa forming adjacent patches of *Pruno-Ligustretum*, resulting from the competitiveness of the association leading herb species – *Vincetoxicum hirundinaria*. The herb layer stood out for its abundance. The moss layer was important as well.

Differentiation: The unit constituted the central association of the *Geranion sanguinei*. In the reserve, only one subassociation was found – *L.s.-V.h. typicum*. Phytocoenoses representing this unit showed lack of some xerothermic species, which are defined as differentiating for the subassociation (*Agrimonia eupatoria, Origanum vulgare, Plantago media, Scabiosa ochroleuca*, and *Veronica teucrium*, see Brzeg & Wika 2014).

4.2. Vegetation changes between 1993-2012

In the present analysis, two sets of relevés, diagnosed as: 1) the *Thalictro-Salvietum pratensis* (recorded in 1993), and 2) four communities of the *Geranion sanguinei* (documented in 2012), were compared with regard to floristic changes that accumulated over 19 years.

In the synoptic table (Table 6), floristic compositions of each association characterized in chapter 3.1. (columns 1-4), the species combination of these associations taken collectively as the *Geranion sanguinei* (column 5), and one of the above mentioned *Thalictro-Salvietum* phytocoenoses, were put together. The table shows not only the current differentiation of xerothermic forb fringe communities, but also it enables to analyze, from syndynamical and species composition-related viewpoint, changes that non-forest vegetation of the reserve were subjected to during the period 1993-2012. Among character taxa of the four *Geranion sanguinei* associations, no distinct changes were noted. The share of *Cirsio-Brachypodion* pinnati character species, on the other hand, dropped significantly (e.g. *Aster amellus*, *Seseli annuum*, *Campanula sibirica*). The role of the *Geranion sanguinei* alliance plants remained at a comparable level, except for *Anthericum ramosum* which declined considerably in the course of that period. Appearance of some important species of this group: *Campanula rapunculoides*, *Trifolium rubens*, and *Viola collina* is also noteworthy. A substantial decrease in the share of mesophilous "meadow" grassland species of the *Brometalia erecti* can be noted.

Amidst the *Festuco-Brometea* taxa, notable changes can be stated. Excluding the inexplicably abundant occurrence of the newly noted moss species *Homalothecium lutescens*, majority of plants comprising the group in 1993 declined significantly (i.e. *Anthemis tinctoria*, *Anthyllis vulneraria, Centaurea stoebe*, *Scabiosa ochroleuca*, *Stachys recta*, *Verbascum lychnitis*) or even retreated (i.e. *Acinos arvensis* and *Poa compressa*). The emergence of a few taxa diagnostic for the *Trifolio-Geranietea sanguinei* (e.g. *Agrimonia eupatoria*, *Astragalus glycyphyllos*, *Chamaecytisus ruthenicus*, *Origanum vulgare*, and *Rubus caesius var. arvalis*) should also be considered an important phenomenon. As for the *Rhamno-Prunetea* group, a prominent role of three shrub species in the composition of present communities (*Cornus sanguinea*, *Ligustrum vulgare*, and newly recorded *Rosa dumalis*) should be emphasized. Distinct changes in the species combination could also be observed within other syntaxonomical groups (the *Molinio-Arrhenatheretea*, the *Koelerio-Corynephoretea*, and the *Artemisietea vulgaris*), as well as within further accompanying taxa.

The secondary succession process manifested itself most strikingly in the vegetation structure alteration, namely, a massive development of the moss layer, which attained in 2012 a mean cover of ca. 54%, and was almost non-existent back in 1993. Simultaneously, the herb layer reasonably declined in cover, from 100% to ca. 80%.

Using selected numerical parameters, an attempt was made to verify tendencies indicated in Table 6. Table 7 shows that in the period 1993-2012, for 7 out of 11 syntaxonomic distinguished groups, an unambiguous decrease in the values of the above-mentioned indices took place. These groups constituted character taxa of the following units: *Artemisietea vulgaris* and *Geranion sanguinei* (with the values of G and D having sizeably dropped during that period), *Trifolio-Geranietea sanguinei*, *Cirsio-Brachypodion pinnati*, and *Festuco-Brometea* (with the C value substantially higher for 1993 vs. 2012), *Brometalia erecti*, *Koelerio-Corynephoretea*, and the group of other accompanying taxa (with the values of all variables considerably higher for 1993). For character taxa of only two units, i.e.: *Molinio-Arrhenatheretea* and *Rhamno-Prunetea*, the value of any parameter notably increased over that time, i.e.: D; D and G, respectively. Within the sole group of characteristic taxa of the examined *Geranion sanguinei* associations, no significant changes were stated.

The data presented above show that the reserve vegetation underwent three major successional trends. These comprised: (1) retreat of thermophilous vegetation (manifested by a drop of values, estimated for the following groups of taxa: *Brometalia erecti*, *Cirsio-Brachypodion*, *Festuco-Brometea*, *Geranion sanguinei*, *Koelerio-Corynephoretea*, and *Trifolio-Geranietea*), (2) its replacement by a xerothermic shrub formation (demonstrated by G and D coefficients growth, estimated for the *Rhamno-Prunetea* taxa), and (3) expansion of the moss layer against a decline of the herb layer.

5. Discussion

As it was mentioned earlier, the recession of calcareous grasslands resulted from gradual abandonment of pastures, meadows, and arable fields which led to increased litter deposition, moistening and shading habitats, and, consequently, colonization of grasslands by shrubs and tall dicotyledonous herbs (Perzanowska & Kujawa-Pawlaczyk 2004). This trend of changes was observed for a long time in many places of Central Europe (Kozłowska 1925; Kaiser 1926; Bornkamm & Eber 1967; Głazek 1968, 1987; Faliński 1972; Dierschke 1974, 1985, 2006; Korneck 1974; Świerczyńska 1990; Wilmanns & Sendtko 1995; Zerbe & Schacht 1998; Willems 2001; Poschlod & WallisDe Vries 2002; Bąba 2003; Babczyńska-Sendek 2005; Chytrý 2007; Hegedüšová Vantarová & Škodová 2014). However, the issue of the role of *Trifolio-Geranietea sanguinei* communities in this process has been rarely discussed so far (Bornkamm & Eber 1967; Dierschke 1974, 1985, 2006; Korneck 1974; Brzeg 2005; Brzeg & Wika 2014).

The studies on the "Murawy Dobromierskie" reserve vegetation (Szygendowski 2013) provided useful materials for analyzing this problem. It seems that xerothermic grasslands present there still in 1990s (Olaczek *et al.* 1993) underwent an advanced secondary succession. The documented grassland phytocoenoses were characterized by a high share of shrubs and xerothermic herbs; what is more, they were given a controversial syntaxonomical status. Their classification as the *Thalictro-Salvietum pratensis* seems dubious due to the lack of character species of this association (see Matuszkiewicz 2001; Ratyńska *et al.* 2010). It was related rather to the *Origano-Brachypodietum vincetoxicetosum* Medw.-Korn. *et* Kornaś 1963 or, some patches with *Aster amellus*, even to the *Inuletum ensifoliae* (Wnuk & Pisarek 2008). The authors' observations from 2012 proved that a single patch of grassland of such type was still present in the reserve, and was located in the area where special protection measures impeding secondary succession were applied (i.e. repetive shrub cutting and disturbing of soil surface).

Regarding the results of the analysis presented above, it can be assumed that phytocoenoses of thermophilous herbs were widespread in the reserve back in 1993. However, the typical area of the relevés taken at that time (Olaczek *et al.* 1993) was nearly 100 m^2, so that the vegetation mosaic, including calcareous grasslands, shrubbery tufts, and tall herb phytocoenoses, could have been incorporated. This can explain unexpectedly high values of indices, estimated for the *Geranion sanguinei*, the *Rhamno-Prunetea*, and the *Trifolio-Geranietea sanguinei*, based on the material from 1993 (Table 7). Moreover, as stated previously, two dominant moss taxa were not included in the analysis of the parameters. Taking this into account, the above-mentioned phenomenon of a rapid development of the moss layer in the period 1993-2012 could have contributed to the underestimation of all values, especially of the cover index, for the latter year. Bearing this in mind, it seems that a direct comparison of full floristic compositions of communies in a synoptic table would give a better illustration of changes than using numerical parameters, estimated on the basis of partly different groups of taxa, quality-wise.

In the face of rapidly ongoing processes of secondary succession as well as apparent ineffectiveness of undertaken protection measures, the reserve protection plan needs urgent revision. This also applies to other "steppe-type" nature reserves, whose vegetation was not been studied for decades. Firstly, the most precise recognition

of the area vegetation is needed, based on the current syntaxonomic division by Brzeg (2005), Ratyńska *et. al.* (2010), and Brzeg & Wika (2014), so that associations of the *Trifolio-Geranietea sanguinei* class are not missed anymore. Secondly, the major protection goal of the plan should also be reconsidered. Namely, thermophilous herb communities and forest ecosystems, as a refuge of rare and protected flora, deserve protection as much as calcareous grasslands and xerothermic shrubs do. Last but not least, considering such low effectiveness of protection measures so far implemented in the reserve, i.e. shrub cutting and grassland mowing, we stipulate their partial cessation. Instead, we propose rehabilitation of traditional methods of land use, such as grazing and controlled burning. Such diversification of protection activities would obviously increase implementation costs of the plan, but this is crucial for impeding the expansion of shrubs, and preserving the vegetation mosaic of forests, xerothermic shrubs, thermophilous herbs, and calcareous grasslands.

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Tables

Table 1. Floristic composition of *Peucedanetum cervariae*

Successive No.		1	2	3	4	5	6	7	8	9	10	
Field No.		48	4	1	7	44	47	45	46	43	42	
Date (2012)	day	16	2	2	2	16	16	16	16	10	10	
	month	VIII	VI	VI	VI	VIII	VIII	VIII	VIII	VIII	VIII	
Slope exposure		SWW	E	SW	SEE	SSW	-	S	SW	SSW	SSW	
Inclination [°]		7	5	7	7	10	-	8	7	10	7	
Density of shrub layer [%]		<5	10	12	10	5	+	25	10	5	15	
Cover of herb layer [%]		75	90	85	30	85	95	85	90	70	80	
Cover of moss layer [%]		50	7	10	98	65	40	65	75	75	60	
Area of relevé [m^2]		30	20	15	15	50	20	20	20	25	25	
Number of taxa		42	62	45	51	43	40	37	33	41	44	
I. Ch., *D. Ass.												
Peucedanum cervaria		2.1	3.4	3.1	4.4	2.1	3.3	3.3	3.3	3.2	4.3	V
**Aster amellus* (C-B)		+.2	+.2	.	1.2	.	.	.	.	.	+°	II
II. Ch., *D. *Geranion sanguinei*												
Fragaria viridis		+	2.1	1.2	2.1	1.1	+	r	+	+	+	V
**Galium boreale* (M-A)		2.3	3.4	1.2	+	1.2	1.2	1.1	.	+	+	V
Vincetoxicum hirundinaria		1.2	1.2	1.2	+.2	+.2	2.2	.	.	.	.	III
Anemone sylvestris		1.3	.	+	r	1.3	.	.	.	.	.	II
Anthericum ramosum		3.3	2.2	1.1	+	.	.	.	.	.	.	II
Thalictrum minus		.	.	.	.	+.2	r°	+°	r°	.	.	II
Vicia tenuifolia		.	.	.	+.2	.	+.2	+	+.2	.	.	II
Viola collina		+	.	.	.	+	.	.	r	.	.	II
Geranium sanguineum		.	.	2.2	2.2	.	.	.	.	.	.	I
Primula veris		.	+.2	2.2	.	.	.	.	.	.	.	I
III. Ch., *D. *Origanetalia*, *Trifolio-Geranietea*												
Poa angustifolia var. *setacea*		+.2	1.1	1.1	+	+.2	1.2	1.1	1.1	+	1.1	V
Galium verum fo.		+	+	1.1	1.1	+	+	+	+	+	+	V
Agrimonia eupatoria		+	+	.	.	+	2.1	+	1.1	+	+	IV
Viola hirta		.	+.2	1.2	.	.	+.2	+.2	r	+	+.2	IV
Knautia arvensis fo.		.	+	+	+°	.	+	+	+	.	+	IV
Agrimonia procera		+	+	+°	+	.	+	r	+	.	.	IV
Astragalus glycyphyllos		+	.	.	.	.	+	+	+	+	+	III
Hypericum perforatum		+	.	.	+	+	+	+	.	+	.	III
Coronilla varia		.	.	+.2	.	r	.	+	.	+	+	III
Clinopodium vulgare		.	+	+.2	.	.	1.2	.	.	+	.	II
Galium album fo.		.	+	+	.	.	+	.	.	r	.	II
Chamaecytisus ruthenicus		.	+.2	.	1.2	.	+	.	.	.	.	II
**Rubus caesius* var. *arvalis* (A)		.	1.3	.	.	.	+.2	+.2	.	.	.	II
Origanum vulgare		.	.	1.2	1.2	.	.	.	.	.	.	I
IV. Ch. *Festuco-Brometea*												
Euphorbia cyparissias		1.1	+	+°	+	1.3	+	+	1.1	1.2	1.1	V
Abietinella abietina d		3.3	1.2	+.2	3.3	3.3	3.3	+.2	2.2	4.4	3.3	V
Homalothecium lutescens d		2.2	1.2	1.2	+.2	3.3	2.2	4.4	3.3	+.2	3.3	V
Sanguisorba minor		+	+	r	+	+	+	+	+	+	+	V
Seseli annuum (C-B)		+	+°	r°	.	+	+	+	.	+	+	IV
Medicago falcata		1.1	+	+.2	1.2	1.1	.	.	1.1	1.2	1.1	IV
Potentilla arenaria		1.2	.	.	+.2	2.2	+.2	+	+.2	1.2	1.2	IV
Carex caryophyllea		+.2	.	.	+	+.2	1.1	1.1	.	1.2	1.1	IV
Veronica spicata		+	+	.	.	1.2	+.2	+.2	.	1.2	1.2	IV
Scabiosa ochroleuca		+	.	.	.	+	r	+	r	+	+	IV
Salvia pratensis		.	.	.	+.2	1.1	+	2.1	1.1	2.1	2.1	IV
Achillea collina		.	+°	.	+	.	+°	.	+	+	1.1	III
Anthyllis vulneraria		+	.	.	+	.	.	.	.	+	+	II
Carlina vulgaris (B)		.	.	+°	+	r	.	.	.	.	+	II
Melampyrum arvense (C-B)		.	.	.	.	r	r	.	.	+	+	II

Constancy 1-10

Polygala comosa (B)	.	+.2	.	+.2	.	.	.	r	.	+	II
Thymus pulegioides (B)	+.2	+.2	.	+.2	.	+.2	.	.	.	.	II
Carex flacca (B)	.	1.2	.	+.2	.	.	.	.	.	+.2	II
Achillea pannonica	+	.	.	.	+	.	+	.	.	.	II
Salvia verticillata (C-B)	.	.	.	.	.	.	r	+	.	r	II
Centaurea scabiosa	.	.	.	.	.	.	+	1.1	.	1.1	II
Brachypodium pinnatum (B)	.	.	4.4	.	3.3	.	.	.	.	.	I
Centaurea stoebe	r	.	.	.	+.2	.	.	.	.	.	I
Allium oleraceum	.	.	.	.	.	.	+	+	.	.	I
Petrorhagia prolifera	r	.	.	.	.	.	r	.	.	.	I
V. Ch. *Molinio-Arrhenatheretea*											
Arrhenatherum elatius	.	1.2	.	1.1	1.1	1.1	1.1	+	2.1	+	IV
Dactylis glomerata	+	+	+	.	+	+.2	.	.	+.2	+.2	IV
Plantago lanceolata	.	.	.	+	.	+	+.2	.	+	+	III
Veronica chamaedrys	.	r°	r	.	.	+	.	+	.	.	II
Briza media	.	1.2	.	2.2	.	.	.	.	3.2	.	II
Carex hirta	.	.	+	.	.	.	.	.	+	+.2	II
Achillea millefolium	.	.	.	r	r	.	.	+	.	.	II
Leontodon hispidus s.s.	.	.	.	+	.	.	.	.	.	r	I
Stachys officinalis	2.2	.	.	.	.	.	.	.	.	.	I
VI. Ch. *Artemisietea vulgaris*											
Medicago lupulina	+	.	.	.	.	r	.	.	.	.	I
VII. Ch. *Koelerio-Corynephoretea*											
Sedum acre	+	.	.	.	.	.	.	.	.	+.2	I
VIII. Ch. *Rhamno-Prunetea*											
Prunus spinosa b/c	.	+	+	+	1.1	+	2.1	2.1	1.1	2.1	V
Cornus sanguinea b/c	+	+	2.1	1.2	.	.	+	+	.	+	IV
Ligustrum vulgare b/c	+	1.2	1.2	1.2	+.2	.	.	+.2	.	+	IV
Rhamnus catharticus b/c	.	+	+	.	+	+	+	.	.	.	III
Rosa canina b/c	.	1.1	+.2	+	+	.	.	.	.	.	II
Rosa dumalis b/c	+	r	.	.	.	+	.	+	.	.	II
IX. Ch. *Querco-Fagetea*											
Carex montana	.	2.2	.	1.2	.	.	.	.	.	.	I
Melica nutans	.	+.2	+.2	.	.	.	.	.	.	.	I
X. Ch. *Vaccinio-Piceetea*											
Juniperus communis b/c	+	+	+	1.2	+.2	.	1.2	+	1.2	+	V
Pinus sylvestris b/c	.	+	+	.	.	.	.	.	r	.	II
XI. Others											
Hieracium pilosella	1.1	+	.	.	.	.	+	.	+	+	III
Linum catharticum	+	.	.	.	r	.	.	.	+	+	II
Cruciata glabra	.	.	+	.	r	.	.	.	r	.	II
Quercus robur b/c	.	1.1	.	+	.	.	.	.	.	.	I
Convolvulus arvensis	.	.	.	.	r	.	.	.	r	.	I
Pteridium aquilinum	.	.	2.2	+.2	.	.	.	.	.	.	I
Plagiomnium affine d	.	.	+	+	.	.	.	.	.	.	I
Thuidium philibertii d	.	+.2	+.2	.	.	.	.	.	.	.	I

Sporadic taxa: II. *Trifolium alpestre* 2(+); *Trifolium rubens* 2(+.2); **III.** *Fragaria vesca* 2(+.2); *Senecio jacobaea* fo. 9(r); **IV.** *Alchemilla glaucescens* (B) 5(+); *Arabis hirsuta* 3(r); *Orobanche caryophyllacea* 4(r); *Phleum phleoides* 4(+.2); *Pimpinella saxifraga* 3(r); *Plantago media* (B) 2(+); *Ranunculus bulbosus* (B) 2(+); *Stachys recta* 2(+); *Thymus pannonicus* ssp. *marschallianus* 6(1.2); **V.** *Centaurea jacea* 5(+); *Festuca rubra* 10(+); *Leontodon hispidus* ssp. *danubialis* 2(+); *Lotus corniculatus* 4(+); *Trifolium pratense* 1(+.2); *Vicia cracca* 3(+); **VI.** *Elymus repens* 2(r); *Falcaria vulgaris* 10(r); *Picris hieracioides* 9(+); **VII.** *Sedum sexangulare* 4(+.2); **VIII.** *Crataegus monogyna* b/c 9(+); *Frangula alnus* b/c 2(r); *Populus tremula* b/c 2(+); **IX.** *Euonymus verrucosus* b/c 3(+); *Fagus sylvatica* b/c 2(r); **X.** *Pleurozium schreberi* d 2(+.2); *Pseudoscleropodium purum* d 2(+.2); *Rubus saxatilis* 3(1.2); **XI.** *Agrostis capillaris* 4(+.2); *Brachythecium rutabulum* d 5(+.2); *Cimicifuga europaea* 2(+.2); *Fissidens cristatus* d 2(+.2); 4(+.2); *Silene vulgaris* 1(+); *Tragopogon* sp. 4(r)

Table 2. Floristic composition of *Campanulo bononiensis-Vicietum tenuifoliae*

Successive No.	1	2	3	4	5	6	7	8	9	10	11	12	
Field No.	14	13	17	15	6	2	39	40	41	22	37	38	
Date (2012) day	3	3	3	2	2	29	29	29	14	29	29	3	
Date (2012) month	VI	VI	VI	VI	VI	VII	VII	VII	VII	VII	VII	VI	
Slope exposure	NW	N	SE	SE	SE	S	SSE	SSE	SSW	N	S	S	
Inclination [°]	5	7	5	3	7	5	10	3	10	3	3	5	
Density of shrub layer [%]	15	10	25	5	5	5	25	20	10	5	+	30	
Cover of herb layer [%]	80	85	100	100	90	90	70	75	50	100	100	60	
Cover of moss layer [%]	80	60	5	10	-	70	50	70	80	20	+	40	
Area of relevé [m^2]	15	15	25	10	20	8	15	25	20	20	25	20	
Number of taxa	47	40	35	39	33	37	28	29	34	35	30	32	
													Constancy 1-12
I. Ch., *D. Ass.													
Vicia tenuifolia	4.4	3.4	5.4	5.5	3.4	3.4	3.3	3.2	2.2	4.3	3.3	3.3	V
**Pimpinella nigra* (F-B)	1.1	1.1	+	.	+	.	.	.	.	.	.	.	II
**Falcaria vulgaris* (A)	.	+	1.1	1.1^o	.	.	.	.	.	.	.	.	II
Campanula bononiensis	.	.	.	+	.	.	.	.	.	.	.	.	+
II. Ch., *D. *Geranion sanguinei*													
Fragaria viridis	3.1	3.4	2.1	2.1	+	2.1	.	2.1	+	2.1	2.1	+	V
**Galium boreale* (M-A)	.	.	+.2	1.2	.	r	.	+	+.2	.	.	.	III
Peucedanum cervaria	.	.	1.3	.	1.1	+	+	.	.	.	.	.	II
Vincetoxicum hirundinaria	.	.	1.2	+.2	1.1	.	.	.	.	.	.	.	II
Primula veris	.	.	.	.	+	2.1	.	.	.	r	.	.	II
Thalictrum minus	.	.	.	.	.	.	+	+	+	.	.	.	II
Campanula rapunculoides	+	+.2	.	.	.	.	.	.	.	.	.	.	I
III. Ch. *D. *Origanetalia*, *Trifolio-Geranietea*													
Poa angustifolia var. *setacea*	+	1.1	1.1	1.1	+^{o}	+	1.1	2.1	.	1.1	+	+	V
**Rubus caesius* var. *arvalis* (A)	+	1.2	2.1	2.1	1.1	3.4	+.2	+.2	.	.	4.4	1.2	V
Galium verum fo.	2.1	2.1	+.2	+.2	1.1	.	.	+	+	1.1	+.2	+	V
Agrimonia procera	+	1.1	r	+	r	.	+	+	.	+	r	.	IV
Agrimonia eupatoria	+	.	.	.	.	+	+	+	+	1.1	+	+	IV
Knautia arvensis fo.	+	r	.		r^o	.	.	r	+	+	+	+	IV
Hypericum perforatum	.	.	+.2	+	+^{o}	+	+^{o}	.	.	+	r	+	IV
Viola hirta	.	.	+	.	+	1.2	+	.	.	.	.	+	III
Astragalus glycyphyllos	.	.	.	.	+.2	.	.	+	+	.	+	.	II
Galium album fo.	+	.	.	.	+	.	.	.	.	+	.	.	II
Origanum vulgare	.	+.2	.	.	.	+.2	.	.	.	.	.	.	I
Coronilla varia	+	.	.	+	.	.	.	.	.	.	.	.	I
IV. Ch. *Festuco-Brometea*													
Homalothecium lutescens d	2.2	3.3	1.2	.	.	4.4	3.4	4.4	4.4	2.2	+	3.4	V
Sanguisorba minor	1.1	+	+	+	.	.	+	+	+	+	+	+	V
Achillea collina	+	+	+^{o}	.	.	+	r^o	+^{o}	1.1	+	+	+	V
Centaurea scabiosa	1.1	2.1	+	+	.	.	+	+	+	1.1	+	1.1	V
Euphorbia cyparissias	+	.	+	.	+^{o}	.	r	+	+	+	.	+	IV
Carex caryophyllea	.	+.2	.	+	+^{o}	.	+.2	+.2	1.1	.	+.2	.	III
Melampyrum arvense (C-B)	.	.	1.2	+	.	.	+	+	r	+	.	+	III
Salvia pratensis	.	.	1.2	+	.	.	1.1	1.1	1.1	.	.	1.1	III
Abietinella abietina d	2.2	2.3	.	.	.	.	2.2	2.2	2.3	.	.	.	III
Medicago falcata	.	+.2	+.2	.	1.1	+	.	.	.	r	.	.	III
Scabiosa ochroleuca	.	.	+	.	.	.	r^o	r	+	.	+	.	III
Carlina vulgaris (B)	+	+	.	+	.	.	.	.	+	.	+	.	III
Salvia verticillata (C-B)	.	.	+.2	.	.	.	.	r	r	1.2	+	.	III
Potentilla arenaria	+.2	.	.	.	.	.	+	+.2	2.2	.	.	.	II
Seseli annuum (C-B)	+.2	.	.	r	.	+	+	.	.	.	.	.	II
Thymus pulegioides (B)	+.2	.	.	.	+.2	.	.	.	+.2	+.2	.	.	II
Ranunculus bulbosus (B)	+	+	.	+	.	.	.	.	.	.	.	.	II
Allium oleraceum	.	.	.	.	.	.	.	r	.	.	.	+.2	I
Erigeron acris	.	r	.	r	.	.	.	.	.	.	.	.	I

Successive No.		1	2	3	4	5	6	7	8	9	10	11	12	Constancy 1-12
Field No.		14	13	17	15	6	2	39	40	41	22	37	38	
Date (2012)	day	3	3	3	2	2	29	29	29	14	29	29	3	
	month	VI	VI	VI	VI	VI	VII	VII	VII	VII	VII	VII	VI	
Slope exposure		NW	N	SE	SE	SE	S	SSE	SSE	SSW	N	S	S	
Inclination [°]		5	7	5	3	7	5	10	3	10	3	3	5	
Density of shrub layer [%]		15	10	25	5	5	5	25	20	10	5	+	30	
Cover of herb layer [%]		80	85	100	100	90	90	70	75	50	100	100	60	
Cover of moss layer [%]		80	60	5	10	-	70	50	70	80	20	+	40	
Area of relevé [m²]		15	15	25	10	20	8	15	25	20	20	25	20	
Number of taxa		47	40	35	39	33	37	28	29	34	35	30	32	
Brachypodium pinnatum (B)		.	.	.	.	4.5	.	.	.	.	.	.	.	I
V. Ch. *Molinio-Arrhenatheretea*														
Arrhenatherum elatius		2.1	2.2	1.1	1.1	.	1.1	1.1	1.1	+	1.1	2.1	+	V
Dactylis glomerata		+	+	+.2	+°	+°	+.2	.	.	.	+.2	+	.	IV
Festuca rubra		1.1	1.2	2.1	.	.	+	.	.	.	.	.	+	III
Plantago lanceolata		+	+	.	.	.	.	+	.	r	+	.	r	III
Veronica chamaedrys		.	.	.	.	r	r	.	.	.	+.2	+	.	II
Festuca pratensis		+	1.2	.	.	.	.	.	.	.	.	.	.	I
Leontodon hispidus s.s.		+	+	.	.	.	.	.	.	.	.	.	.	I
Prunella vulgaris		+	r	.	.	.	.	.	.	.	.	.	.	I
Trifolium pratense		r	.	.	.	.	+°	.	.	.	.	.	.	I
VI. Ch. *Artemisietea vulgaris*														
Convolvulus arvensis				+.2	+			r			+	+	r	III
Linaria vulgaris		.	.	.	.	.	.	+	.	+°	.	+	+	II
Daucus carota		+°	+°	.	.	.	.	.	.	.	.	+	+	II
Picris hieracioides		.	.	+	+	.	.	.	.	.	.	r	+	II
Artemisia vulgaris		.	+	.	.	.	.	.	.	.	.	.	r	I
Glechoma hederacea		.	r	.	.	.	.	.	.	.	r	.	.	I
VII. Ch. *Rhamno-Prunetea*														
Prunus spinosa b/c		2.2	2.2	2.4	+	+	2.1	3.2	3.1	.	1.1	+	3.1	V
Ligustrum vulgare b/c		+	+	+	1.2	+	1.2	.	+.2	1.2	.	+	+.2	V
Cornus sanguinea b/c		1.1	1.2	+.2	1.2	+	+	.	+	+	.	.	+	IV
Rosa dumalis b/c		+	+	.	+	+	+	+	.	+	.	.	.	III
Rhamnus catharticus b/c		1.1	+	+	.	+	+	.	.	.	.	.	+	III
Rosa canina b/c		.	.	+	+	+	+	.	.	.	+	+	.	III
Crataegus rhipidophylla b/c		.	r	.	.	.	.	.	.	.	+	.	.	I
VIII. Ch. *Querco-Fagetea*														
Acer pseudoplatanus b/c		.	.	r	+	.	.	.	.	.	.	.	.	I
IX. Others														
Juniperus communis b/c		1.1	1.2	.	+	1.1	+°	.	.	2.2	.	.	.	III
Hieracium pilosella		+.2	r	.	.	.	.	.	.	1.2	.	.	.	II
Oxyrrhynchium hians d		.	.	.	1.2	.	.	.	.	.	+.2	+	.	II
Brachythecium rutabulum d		.	.	.	2.2	.	1.2	.	.	.	.	.	.	I
Malus domestica b/c		+	.	.	.	.	.	.	+	.	.	.	.	I
Prunus domestica b/c		.	.	.	.	.	.	+	.	+	.	.	.	I
Calliergonella cuspidata d		3.4	.	.	.	.	.	.	.	.	.	.	.	I
Thuidium philibertii d		2.2	.	.	.	.	.	.	.	.	.	.	.	I

Sporadic taxa: II. *Anthericum ramosum* 9(+); *Trifolium alpestre* 5(+); *Viola collina* 12(r); **III.** *Clinopodium vulgare* 10(1.2); *Senecio jacobaea* fo. 10(r); *Silene nutans* 4(+); **IV.** *Anthyllis vulneraria* 10(r); *Artemisia campestris* 10(+); *Hieracium piloselloides* 4(r); *Onobrychis viciifolia* (B) 1(+.2*); Petrorhagia prolifera* 12(+.2); *Pimpinella saxifraga* 1(+); **V.** *Carex hirta* 6(+); *Carex spicata* 6(+.2); *Climacium dendroides* d 1(+);*Taraxacum officinale* coll. 6(r); **VI.** *Cichorium intybus* 6(+); *Euphorbia esula* 2(r); *Medicago lupulina* 5(+.2); *Melandrium album* 4(r); *Pastinaca sativa* 4(+); **VII.** *Pyrus pyraster* b/c 10(+); *Viburnum opulus* b/c 1(+); **VIII.** *Carex digitata* 6(+); *Carex montana* 6(+.2); **IX.** *Anthoxanthum odoratum* 6(+); *Calamagrostis epigejos* 3(+); *Cruciata glabra* 10(1.1); *Pinus sylvestris* (V-P) 4(+); *Plagiomnium affine* d 6(+.2); *Pteridium aquilinum* 5(+); *Quercus robur* 9(+); *Silene vulgaris* 5(r); *Stachys annua* 12(r); *Trifolium arvense* (K-C) 11(r)

Table 3. Floristic composition and differentiation of *Geranio-Anemonetum sylvestris*

Successive No.		1	2	3	4	5	6		7	8	9	10	11
Field No.		24	28	23	33	34	32		27	3	26	30	31
Date (2012)	day	19	21	19	28	28	28		21	2	21	21	28
	month	VII	VII	VII	VII	VII	VII		VII	VI	VII	VII	VII
Slope exposure		-	SW	SSW	-	NW	NNE	Constancy 1 - 6	SW	SW	-	NW	-
Inclination [°]		-	15	3	-	30	30		10	15	-	5	-
Density of shrub layer b [%]		20	10	30	25	25	40		25	+	25	20	5
Cover of herb layer c [%]		90	70	70	65	50	50		75	90	85	85	90
Cover of moss layer d [%]		90	90	75	75	35	90		90	15	80	50	40
Area of relevé [m²]		15	12	9	18	10	10		12	20	16	20	15
Number of taxa		30	33	23	30	35	32		31	47	37	38	28
I. Ch., *D. Ass.													
Anemone sylvestris		3.3	2.1	3.1	3.3	3.1	2.1	V	3.3	3.4	3.3	3.3	3.1
**Sanguisorba minor* (F-B)		r°	+	+	+	+	+	V	r	1.1	r	1.1	+
Thalictrum minus		.	.	.	.	.	.	-	.	.	.	+	+
II. D. Subass.													
Achillea pannonica (F-B)		+	1.1	+	+	+	+	V				+	
Potentilla arenaria (F-B)		1.2	+.2	+	+.2	+.2	.	V	.	.	.	.	.
Veronica spicata (F-B)		+	+	1.1	+	.	.	IV	+	r	+	+	.
Knautia arvensis fo. (T-G)		.	.	+	.	+	+	III	.	.	.	.	.
Sedum acre (K-C)		+.2	.	.	.	.	.	I	.	.	.	.	.
Centaurea stoebe (F-B)		.	.	.	.	.	+	I	.	.	.	.	.
Hieracium pilosella (O)		.	.	.	.	+	.	I	.	.	.	.	.
Cruciata glabra (O)		.	.	.	r	+	.	II	+	.	+	.	.
Carex flacca (O)		.	.	.	.	.	.	-	.	.	.	.	.
*Trifolium pratense (*M-A)		.	.	.	.	.	.	-	.	.	.	.	.
III. Ch., *D. *Geranion sanguinei*													
Fragaria viridis		3.1	2.1	2.1	2.1	1.1	1.1	V	3.1	2.1	2.1	2.1	2.1
Vincetoxicum hirundinaria		1.2	2.2	2.3	.	.	+	IV	1.2	1.2	+	.	.
**Galium boreale* (M-A)		2.1	1.1	.	+	.	.	III	1.1	+	1.1	.	.
Primula veris		+	.	.	.	.	.	I	r	2.1-2	1.1	.	.
Viola collina		+	.	.	+	+	+	IV	.	1.2	.	.	.
Vicia tenuifolia		.	.	.	+	.	+	II	.	.	+	r	r
Peucedanum cervaria		.	+	.	.	.	.	I	+	2.1	.	.	.
Anthericum ramosum		.	.	.	.	.	.	-	.	1.2	+.2	.	.
IV. Ch, *D. *Origanetalia*, *Trifolio-Geranietea sanguinei*													
Poa angustifolia var. *setacea*		2.1	+	1.1	1.1	1.1	1.1	V	1.1	1.1	1.1	2.1	+
Agrimonia eupatoria		1.1	.	1.1	1.1	+	+	V	+	+	+	1.1	+
Galium album fo.		1.1	+	+	+	1.1	.	V	.	+	+	+	.
Galium verum fo.		1.1	.	1.1	1.1	1.1	+	V	.	+	.	1.1	+
Hypericum perforatum		r	.	.	.	r	.	II	.	+	+	+	.
Clinopodium vulgare		.	.	.	.	.	.	-	1.1	+	1.1	.	.
Coronilla varia		r	+	.	+	.	+	IV	.	1.1	.	1.1	+
Viola hirta		.	.	.	1.2	1.2	+	III	+	.	.	1.2	.
V. Ch. *Festuco-Brometea*													
Homalothecium lutescens d		2.2	+.2	+.2	3.3	2.4	4.4	V	3.3	1.2	2.2	3.3	3.3
Abietinella abietina d		4.4	5.4	4.3	1.2	2.3	1.2	V	3.3	2.2	+.2	+.2	.
Euphorbia cyparissias		1.1	1.1	+	+	+	.	V	1.1	+	+	+	+

Constancy 7 - 11	12	13	14	15	16	Constancy 12 - 16	Constancy 1 - 16
	20	29	21	19	25		
	3	21	14	3	19		
	VI	VII	VII	VI	VII		
	-	SW	-	N	NNW		
	-	5	-	35	6		
	10	20	10	20	5		
	75	50	60	50	80		
	20	90	80	70	60		
	8	12	8	15	15		
	34	33	31	41	27		
V	3.1-2	2.1	3.1	3.1	2.3	V	V
V	2.1	1.1	1.1	1.1	.	IV	V
II	1.2	.	.	.	.	I	I
I	+	+			+	III	IV
-	+.2	1.2	.	.	.	II	III
IV	.	.	.	.	.	-	III
-	.	.	.	.	.	-	I
-	.	.	.	.	.	-	+
-	.	.	.	.	.	-	+
-	.	.	.	.	.	-	+
II	.	r	1.2	2.1	+	IV	III
-	.	+.2	.	.	.	I	+
-	+	.	.	.	.	I	+
V	3.1	2.1	1.1	2.1	3.1	V	V
III	+	.	+	1.1	+.2	IV	IV
IV	.	+	+	1.1°	2.3	IV	IV
III	.	+	.	.	1.1	II	II
I	.	.	.	.	.	-	II
III	.	.	.	.	.	-	II
II	.	+	.	.	.	I	II
II	.	.	.	.	.	-	I
V	2.1	+	1.1	+	1.1	V	V
V	+	2.1	+	+	+	V	V
III	.	.	+	+	+	III	IV
III	2.1	1.1	1.1	.	.	III	IV
III	+	.	+	.	r	III	III
III	+	+	1.1	2.1	+	V	III
III	.	1.1	.	.	.	I	III
II	.	1.2	.	.	+	II	III
V	2.2-3	3.3	1.2	2.2	3.3	V	V
IV	1.2	3.3	4.4	4.4	3.3	V	V
V	+	1.1	1.1	1.1	1.1	V	V

Successive No.	1	2	3	4	5	6		7	8	9	10	11
Field No.	24	28	23	33	34	32		27	3	26	30	31
Date (2012) day	19	21	19	28	28	28		21	2	21	21	28
Date (2012) month	VII	VII	VII	VII	VII	VII		VII	VI	VII	VII	VII
Slope exposure	-	SW	SSW	-	NW	NNE		SW	SW	-	NW	-
Inclination [°]	-	15	3	-	30	30		10	15	-	5	-
Density of shrub layer b [%]	20	10	30	25	25	40		25	+	25	20	5
Cover of herb layer c [%]	90	70	70	65	50	50		75	90	85	85	90
Cover of moss layer d [%]	90	90	75	75	35	90		90	15	80	50	40
Area of relevé [m²]	15	12	9	18	10	10		12	20	16	20	15
Number of taxa	30	33	23	30	35	32		31	47	37	38	28
							Constancy 1 - 6					
Carex caryophyllea	1.2	+	1.2	1.2	.	1.2	V	+	+.2	+.2	1.1	1.2
Medicago falcata	1.1	2.1	2.1	2.1	+	r	V	2.3	1.1	+	.	.
Thymus pulegioides (B)	+.2	.	1.2	+.2	+.2	.	IV	.	.	+.2	+.2	.
Polygala comosa (B)	.	.	.	.	+	.	I	.	+	r	r	.
Seseli annuum (C-B)	+	.	1.1	.	.	.	II	.	.	.	.	+
Melampyrum arvense (C-B)	.	.	r	.	.	+	II	.	.	.	.	r
Achillea collina	.	+	.	.	.	.	I	+	+°	+	.	+
Carlina vulgaris (B)	.	.	.	.	.	+	I	.	.	.	.	.
Pimpinella saxifraga	+	+	.	.	r		III	.	.	.	.	.
Salvia pratensis	.	r	.	.	.	.	I	.	1.2	.	.	.
Salvia verticillata (C-B)	.	.	.	.	.	.	-	.		.	.	.
Brachypodium pinnatum (B)	.	.	+.2	.	.	.	I	.	4.4	.	.	.
Centaurea scabiosa	.	.	+.2	.	.	.	I	.	.	.	.	.
Scabiosa ochroleuca	.	.	r	.	.	.	I	.	.	.	+	.
Ranunculus bulbosus (B)	.	.	.	.	.	.	-	.	.	+	.	.
VI. Ch. *Molinio-Arrhenatheretea*												
Arrhenatherum elatius	1.1	2.1	1.1	1.1	1.1	1.1	V	1.1	+.2	1.1	2.1	3.1
Veronica chamaedrys	.	r	+	+	+	+	V	1.1	.	+	+	+
Plantago lanceolata	.	.	r°	.	+	.	II	.	.	.	.	.
Dactylis glomerata	.	.	+.2	.	.	.	I	+	+	.	.	.
Carex hirta	.	.	.	.	.	.	-	.	.	+	.	.
Taraxacum officinale coll.	.	.	.	.	r	.	I	.	r	.	.	.
Festuca rubra	.	.	.	.	+.2	.	I	.	.	.	.	.
Leontodon hispidus s.s.	.	.	.	.	.	.	-	.	.	.	r	.
Lathyrus pratensis	.	.	.	.	.	.	-	.	.	.	.	.
VII. Ch. *Artemisietea vulgaris*												
Convolvulus arvensis	.	+	.	.	.	+	II	.	.	+	.	+
Medicago lupulina	.	.	.	.	1.2	.	I	.	.	.	.	1.1
VIII. Ch. *Rhamno-Prunetea*												
Prunus spinosa b/c	2.1	1.2	2.1	+	2.1	2.1	V	+	1.2	+	+	.
Ligustrum vulgare b/c	1.1	1.2	+	2.1	.	1.2	V	2.1	1.2	+	.	+
Rhamnus catharticus b/c	.	+	+	1.1	.	2.1	IV	+	+.2	2.2	.	1.1
Cornus sanguinea b/c	+	.	2.1	2.1	.	.	III	.	.	+	2.1	+
Rosa canina b/c	.	+	.	+	+	1.1	IV	.	.	.	+	.
Rosa dumalis b/c	.	.	.	.	.	.	-	+	+	.	.	.
IX. Ch. *Querco-Fagetea*												
Euonymus verrucosus b/c	.	.	.	.	.	.	-	+	1.2	.	.	.
Carex montana	.	.	.	.	.	.	-	+.2	1.2	.	.	.

Constancy 7 - 11	12	13	14	15	16	Constancy 12 - 16	Constancy 1 - 16
	20	29	21	19	25		
	3	21	14	3	19		
	VI	VII	VII	VI	VII		
	-	SW	-	N	NNW		
	-	5	-	35	6		
	10	20	10	20	5		
	75	50	60	50	80		
	20	90	80	70	60		
	8	12	8	15	15		
	34	33	31	41	27		
V	+.2	1.2	1.2	.	1.1	IV	V
III	2.2	1.1	.	.	.	II	IV
II	+.2	+.2	+.2	1.2	.	IV	IV
III	+	.	r	1.1	.	III	III
I	1.1	+	.	.	.	II	II
I	+	.	r	.	.	II	II
IV	.	.	.	.	.	-	II
-	+	r	.	+	.	II	II
-	.	+	.	.	.	I	II
I	.	.	.	+	.	I	I
-	1.2	.	+.2	+.2	.	III	I
I	.	.	.	.	.	-	I
-	1.2	.	.	+	.	II	I
I	.	.	.	.	.	-	I
I	+	.	.	.	.	I	I
V	2.1	1.1	2.1	2.1	2.1	V	V
IV	+.2	.	.	+	+	III	IV
-	+°	.	.	+°	.	II	II
II	+°	.	.	.	.	I	II
I	.	+	.	.	+.2	II	I
I	.	r	.	.	.	I	I
-	+.2	.	.	.	.	I	I
I	.	+	.	.	.	I	I
-	.	.	+°	+°	.	II	I
II	.	.	.	.	+	I	II
I	+.2	.	r	+	.	III	II
IV	2.1	2.1	.	+	+	IV	V
IV	.	1.2	+	+	.	III	IV
IV	.	.	.	.	1.1	I	III
III	+	.	2.1	2.2	.	III	III
I	+.2	+	.	.	.	II	III
II	.	.	.	.	.	-	I
II	.	.	.	.	.	-	I
II	.	.	.	.	.	-	I

Successive No.		1	2	3	4	5	6		7	8	9	10	11
Field No.		24	28	23	33	34	32		27	3	26	30	31
Date (2012)	day	19	21	19	28	28	28		21	2	21	21	28
	month	VII	VII	VII	VII	VII	VII		VII	VI	VII	VII	VII
Slope exposure		-	SW	SSW	-	NW	NNE		SW	SW	-	NW	-
Inclination [°]		-	15	3	-	30	30		10	15	-	5	-
Density of shrub layer b [%]		20	10	30	25	25	40		25	+	25	20	5
Cover of herb layer c [%]		90	70	70	65	50	50		75	90	85	85	90
Cover of moss layer d [%]		90	90	75	75	35	90		90	15	80	50	40
Area of relevé [m²]		15	12	9	18	10	10		12	20	16	20	15
Number of taxa		30	33	23	30	35	32		31	47	37	38	28
X. Ch. *Vaccinio-Piceetea*													
Juniperus communis b/c		.	1.1			2.1	2.1	III	+	1.2°	.	2.1	.
Pleurozium schreberi d		.	.	.	.	.	.	-	.	.	+.3	.	.
Pinus sylvestris b/c		.	.	.	.	+	.	I	.	.	.	.	.
Pseudoscleropodium purum d		.	.	.	.	.	.	-	1.2	+	.	.	.
Dicranum polysetum d		.	.	1.2	.	.	.	I	.	.	.	.	.
XI. Others													
Thuidium philibertii d		+.2	.	1.2	.	.	.	II	+	.	.	.	.
Geranium pusillum		.	.	.	.	.	+	I	.	.	r	.	r
Silene vulgaris		.	.	+	.	.	+	II	r	r	.	.	.
Plagiomnium affine d		.	.	.	.	.	.	-	+	.	3.2	1.2	.
Vicia hirsuta		.	.	.	+	+	.	II	.	.	.	.	.
Quercus robur b/c		.	.	.	.	+	.	I	.	.	.	r	.
Calamagrostis epigejos		.	.	.	.	.	.	-	.	.	.	.	.

Constancy 1 - 6

Sporadic taxa: III. *Campanula rapunculoides* 8(1.2); *Trifolium alpestre* 8(+.2); **IV.** **Campanula persicifolia* (Q-F) 8(+.2); *Chamaecytisus ruthenicus* 8(+.2); **Hieracium murorum* (Q-F) 15(+.2); *Origanum vulgare* 8(1.2); **Rubus caesius* var. *arvalis* (A) 14(+); *Senecio jacobaea* fo. 14(r); *Vicia sepium* 2(r); **V.** *Allium oleraceum* 15(r); *Anthemis tinctoria* 6(+); *Anthyllis vulneraria* 5(+); *Aster amellus* (C-B) 2(1.2); *Orobanche caryophyllacea* 8(+); *Pimpinella nigra* 7(r); *Plantago media* (B) 8(+); *Verbascum lychnitis* 10(+); **VI.** *Avenula pubescens* 12(+); *Centaurea jacea* 4(+); *Climacium dendroides* d 9(+); *Festuca pratensis* 12(+); *Vicia cracca* 12(+); **VII.** *Cichorium intybus* 13(+); *Echium vulgare* 14(r); *Falcaria vulgaris* 12(r°); *Glechoma hederacea* 2(1.3); *Linaria vulgaris* 14(r); **VIII.** *Crataegus monogyna* b/c 4(+); *Pyrus pyraster* b/c 14(+); *Rosa rubiginosa* b/c 15(+); **IX.** *Ajuga reptans* 13(r); *Carex digitata* 8(+.2); *Malus sylvestris* b/c 9(+); **XI.** *Fissidens* sp. d 8(+.2); *Oxyrrhynchium hians* d 9(+); *Quercus petraea* b/c 15(r°)

Constancy 7 - 11	12	13	14	15	16	Constancy 12 - 16	Constancy 1 - 16
	20	29	21	19	25		
	3	21	14	3	19		
	VI	VII	VII	VI	VII		
	-	SW	-	N	NNW		
	-	5	-	35	6		
	10	20	10	20	5		
	75	50	60	50	80		
	20	90	80	70	60		
	8	12	8	15	15		
	34	33	31	41	27		
III	+.2	+	.	1.1	.	III	III
I	.	.	1.3	+.2	.	II	I
-	.	.	.	+	.	I	I
II	.	.	.	.	.	-	I
-	.	.	.	2.3	.	I	I
I	+.2	.	.	.	.	I	II
II	.	.	.	.	r	I	II
II	.	.	.	.	.	-	II
III	.	.	.	.	+	I	II
-	.	.	.	.	+	I	II
I	.	.	.	.	.	-	I
-	.	.	2.1	.	.	I	+

Table 4. Floristic composition of *Lathyro sylvestris-Vincetoxicetum hirundinariae*

Successive No.		1	2	3	4	5	
Field No.		51	5	18	50	49	
Date (2012)	day	2	3	18	18	18	
	month	VI	VI	VIII	VIII	VIII	
Slope exposure		S	SSE	SE	SSW	S	Constancy 1-5
Inclination [°]		45	20	7	30	7	
Density of shrub layer [%]		5	+	20	+	+	
Cover of herb layer [%]		77	95	95	100	90	
Cover of moss layer[%]		80	20	30	90	95	
Area of relevé [m^2]		10	18	15	25	20	
Number of taxa		23	39	36	27	21	
I. Ch., *D. *Geranion sanguinei*							
Vincetoxicum hirundinaria		4.4	4.4	4.4	4.3	4.4	V
Fragaria viridis		+	2.1	2.1	2.1	1.1	V
**Galium boreale* (M-A)		+	1.2	1.2	2.3	+	V
Peucedanum cervaria		r°	r	.	+°	.	III
Vicia tenuifolia		r	.	1.2	.	.	II
Anthericum ramosum		.	+	.	.	.	I
Anemone sylvestris		.	r	.	.	.	I
Geranium sanguineum		+.2	.	.	.	.	I
II. Ch. *Origanetalia, Trifolio-Geranietea*							
Hypericum perforatum		+	+	+	+	+	V
Agrimonia procera		+	+	.	+	r	IV
Poa angustifolia var. *setacea*		.	+	1.2	+	1.1	IV
Clinopodium vulgare		.	.	+	+	+	III
Agrimonia eupatoria		r	.	1.1	+	.	III
Galium album fo.		.	.	.	+	1.1	II
Coronilla varia		.	1.1	.	+	.	II
Astragalus glycyphyllos		r	(+)	.	.	.	II
III. *Ch. Festuco-Brometea*							
Abietinella abietina d		5.4	2.3	1.2	3.3	5.4	V
Potentilla arenaria		r	+.2	+.2	+.2	+.2	V
Homalothecium lutescens d		+.2	.	3.3	3.3	+.2	IV
Veronica spicata		+	+.2	.	+	+.2	IV
Carex caryophyllea		+	1.2	+.2	+	.	IV
Medicago falcata		.	1.2	.	+	r	III
Salvia pratensis		.	+.2	+.2	+	.	III
Sanguisorba minor		+	.	+	+	.	III
Centaurea scabiosa		.	.	1.1	+.2	.	II
Euphorbia cyparissias		+	+	.	.	.	II
Melampyrum arvense (C-B)		.	.	+	.	r	II
Thymus pulegioides (B)		.	+.2	+.2	.	.	II
IV. Ch. *Molinio-Arrhenatheretea*							
Arrhenatherum elatius		+	1.2	+	2.1	1.1	V
Veronica chamaedrys		+	r	+	.	+	IV
Dactylis glomerata		.	+	+°	.	+.2	III
V. Ch. *Rhamno-Prunetea*							
Rosa canina b/c		+	+	+	+	.	IV
Prunus spinosa b/c		+	+	2.2	.	+	IV
Rosa dumalis b/c		.	+	+	.	r	III
Rhamnus catharticus b/c		+	+	.	+	.	III
Cornus sanguinea b/c		.	+	1.2	.	.	II
Ligustrum vulgare b/c		.	+	+.2	.	.	II
VI. Others							
Convolvulus arvensis		.	1.1	.	.	+	II
Elymus repens		.	+	r	.	.	II

Sporadic taxa: II. *Chamaecytisus ruthenicus* 2(+.2); *Galium verum* fo. 13(1.2); *Knautia arvensis fo*. 4(+); *Origanum vulgare* 2(+); *Viola hirta* 3(+); **III.** *Achillea collina* 4(+); *Achillea pannonica* 4(+); *Brachypodium pinnatum* (B) 2(1.3); *Pimpinella saxifraga* 3(r); *Polygala comosa* (B) 3(+); *Ranunculus bulbosus* (B)3(+); *Salvia verticillata* (C-B) 5(r); *Scabiosa ochroleuca* 2(1.2); *Seseli annuum* (C-B) 3(+.2); *Thymus pannonicus* 1(+.2); **IV.** *Plantago lanceolata* 3(+°); **V.** *Crataegus monogyna* b/c 2(+); *Pyrus pyraster* b/c 2(+); **VI.** *Glechoma hederacea* 3(+); *Calamagrostis epigejos* 2(+); *Hieracium pilosella* 3(+.2); *Juniperus communis* b/c 2(+.2); *Linum catharticum* 3(+); *Plagiomnium affine* d 4(+); *Quercus robur* b/c 2(r°)

Table 5. Floristic composition of *Thalictro-Salvietum pratensis*

Successive No.		1	2	3	4	5	6	7	
Field No.		2	28	21	1	5	27	9	
Date (1993)	day	12	8	8	12	12	8	18	Constancy 1-7
	month	8	9	9	8	8	9	8	
Density of shrub layer [%]		20	10	5	10	10	10	20	
Cover of herb layer [%]		100	100	100	100	100	100	100	
Cover of moss layer[%]		5	-	1	5	-	-	-	
Area of relevé [m^2]		100	100	150	100	100	100	100	
Number of taxa		63	48	48	55	42	52	45	
I. Ch. *Cirsio-Brachypodion pinnati*									
Seseli annuum		2	2	2	2	1	1	1	V
Melampyrum arvense		2	.	1	3	2	2	.	IV
Aster amellus		1	3	1	.	1	.	.	III
Salvia verticillata		1	.	2	2	1	.	.	III
Campanula sibirica		1	1	1	.	.	.	.	III
II. Ch., *D. *Brometalia erecti*									
Thymus pulegioides		1	1	3	2	.	3	1	V
**Medicago lupulina* (A)		1	2	2	1	.	.	.	III
Brachypodium pinnatum		3	2	.	.	.	.	.	II
**Linum catharticum* (O)		+	+	.	.	.	.	.	II
Carlina vulgaris		+	1	.	.	.	.	.	II
III. *Ch. Festuco-Brometea*									
Euphorbia cyparissias		2	1	2	3	1	2	2	V
Medicago falcata		2	+	1	2	2	2	2	V
Scabiosa ochroleuca		1	1	2	2	2	2	1	V
Veronica spicata		2	1	2	2	3	3	3	V
Sanguisorba minor		2	2	2	2	1	3	+	V
Verbascum lychnitis		1	1	1	1	1	2	+	V
Anthemis tinctoria		2	.	1	+	1	1	1	V
Anthyllis vulneraria		1	2	1	+	.	1	.	IV
Centaurea scabiosa		.	.	1	1	1	2	.	III
Bromus inermis fo.		3	.	.	1	2	.	2	III
Centaurea stoebe		1	2	.	.	1	2	.	III
Senecio jacobaea		1	.	1	1	.	.	+	III
Abietinella abietina d		1	.	1	1	.	.	.	III
Pimpinella saxifraga		1	.	.	2	1	.	.	III
Carex caryophyllea		1	1	.	.	.	1	.	III
Poa compressa		.	.	+	.	+	1	.	III
Acinos arvensis		.	1	.	+	.	1	.	III
Potentilla arenaria		.	2	+	.	.	.	.	II
Achillea pannonica		1	.	.	.	.	1	.	II
Salvia pratensis		2	.	.	.	2	.	.	II
Stachys recta		.	1	.	+	.	.	.	II
Arenaria serpyllifolia		.	.	.	.	.	2	.	I
Artemisia campestris		.	.	1	.	.	.	.	I
Petrorhagia prolifera		.	.	.	1	.	.	.	I
IV. *Ch. Trifolio-Geranietea sanguinei*									
Vincetoxicum hirundinaria (G)		1	1	+	+	1	2	1	V
Hypericum perforatum		+	1	+	1	1	1	+	V
Agrimonia procera		2	1	2	2	2	1	2	V
Fragaria viridis (G)		3	2	3	3	3	3	.	V
Anemone sylvestris (G)		2	2	2	.	1	2	1	V
Poa angustifolia var. setacea		.	1	3	.	2	3	2	IV
Gallium album fo.		1	.	.	2	2	+	1	IV
Galium verum fo.		2	.	2	1	.	1	2	IV
Coronilla varia		+	.	3	2	.	2	2	IV
Anthericum ramosum (G)		1	3	1	+	.	+	.	IV
Peucedanum cervaria (G)		2	3	.	.	2	2	.	III

Successive No.			1	2	3	4	5	6	7	
Field No.			2	28	21	1	5	27	9	
Date (1993)	day		12	8	8	12	12	8	18	Constancy 1-7
	month		8	9	9	8	8	9	8	
Density of shrub layer [%]			20	10	5	10	10	10	20	
Cover of herb layer [%]			100	100	100	100	100	100	100	
Cover of moss layer[%]			5	-	1	5	-	-	-	
Area of relevé [m^2]			100	100	150	100	100	100	100	
Number of taxa			63	48	48	55	42	52	45	
Clinopodium vulgare			+	.	.	+	2	.	1	III
Thalictrum minus s.s. (G)			1	.	.	2	1	.	.	III
Vicia tenuifolia (G)			1	.	.	.	.	1	+	III
Viola hirta			+	+	.	.	.	.	.	II
V. *Ch. Molinio-Arrhenatheretea*										
Galium boreale			3	3	3	.	3	3	3	V
Arrhenatherum elatius			2	.	2	1	3	1	2	V
Knautia arvensis			.	1	1	1	.	1	+	IV
Plantago lanceolata			1	+	1	1	.	1	.	IV
Dactylis glomerata			1	.	2	1	.	+	1	IV
Achillea millefolium			1	.	2	2	1	.	.	III
Potentilla reptans			1	.	.	1	.	.	.	II
Rumex acetosa			.	.	.	+	.	+	.	II
Poa pratensis			1	.	.	2	.	.	.	II
Lotus corniculatus			.	.	1	.	.	.	.	I
Carex hirta			.	.	.	1	.	.	.	I
Crepis biennis			.	.	.	.	1	.	.	I
Inula salicina			.	.	.	.	.	.	1	I
VI. Ch. *Koelerio-Corynephoretea*										
Trifolium campestre			.	.	+	1	+	.	+	III
Trifolium arvense			.	.	.	2	.	.	.	I
Cerastium arvense			1	.	.	.	.	.	.	I
VII. Ch. *Artemisietea vulgaris*										
Convolvulus arvensis			.	.	+	+	+	+	.	III
Carduus acanthoides			+	.	.	+	1	.	.	III
Echium vulgare			.	+	1	.	.	1	.	III
Picris hieracioides			.	+	1	.	.	1	.	III
Linaria vulgaris			.	.	+	.	.	+	.	II
Elymus repens			.	.	.	1	.	.	+	II
VIII. Ch. *Rhamno-Prunetea*										
Rosa canina		b	1	1	1	.	2	2	2	V
		c	+	1	1	.	+	1	2	V
Prunus spinosa		b	2	.	.	.	+	.	.	II
		c	1	.	1	.	1	.	1	III
Rhamnus catharticus		b	.	.	.	.	.	2	1	II
		c	.	.	.	.	.	1	+	II
Crataegus monogyna		b	.	.	.	.	1	.	1	II
		c	.	.	.	.	1	+	+	III
Pyrus communis		b	.	.	.	.	.	.	+	I
		c	.	.	+	.	.	+	+	III
Rosa inodora		b	.	.	.	.	.	.	1	I
		c	.	.	.	.	.	.	2	I
Cornus sanguinea		b	.	1	.	.	.	.	.	I
		c	.	1	.	.	.	.	.	I
Rosa tomentosa		b	.	.	.	.	.	+	.	I
		c	.	.	.	.	.	+	.	I
Rosa rubiginosa		b	.	.	.	.	.	+	.	I
		c	.	.	.	.	.	+	.	I

Successive No.			1	2	3	4	5	6	7	
Field No.			2	28	21	1	5	27	9	
Date (1993)	day		12	8	8	12	12	8	18	Constancy 1-7
	month		8	9	9	8	8	9	8	
Density of shrub layer [%]			20	10	5	10	10	10	20	
Cover of herb layer [%]			100	100	100	100	100	100	100	
Cover of moss layer[%]			5	-	1	5	-	-	-	
Area of relevé [m^2]			100	100	150	100	100	100	100	
Number of taxa			63	48	48	55	42	52	45	
VIII. Ch. *Querco-Fagetea*										
Eunoymus verrucosus		b		1						I
		c		+						I
IX. Ch. *Vaccinio-Piceetea*										
Juniperus communis		b	1	2	1	.	.	1	2	IV
		c	+	+	1	.	.	+	1	IV
Pinus sylvestris		b	+	2	.	.	.	.	.	II
		c	+	2	.	.	.	.	.	II
Melampyrum pratense			.	.	.	.	.	.	2	I
X. Others										
Quercus petraea		b	.	1	.	.	.	.	.	I
		c	.	+	.	.	.	.	.	I
Silene vulgaris			1	2	2	1	1	2	1	V
Pteridium aquilinum			.	2	.	+	.	.	2	III
Hieracium pilosella			+	.	.	1	.	.	.	II
Primula veris			1	+	.	.	.	.	.	II
Geranium columbinum			.	.	.	+	1	.	.	II
Calamagrostis epigejos			.	1	.	.	.	1	.	II
Cerinthe minor			.	.	.	.	1	1	.	II
Briza media			1	.	.	.	.	.	.	I
Agrostis capillaris			.	.	.	1	.	.	.	I

Sporadic taxa: II: *Gentianella ciliata* 2(+); *Ranunculus bulbosus* 1(+); **III:** *Viola rupestris* 2(+); *Orobanche caryophyllacea* 1(+); *Erigeron acris* 1(+); **IV:** *Geranium sanguineum* 2(+); *Veronica teucrium* 7(+); *Fragaria vesca* 4(+); **V:** *Taraxacum officinale* coll. 5(+); *Rhinanthus serotinus* 7(+); *Veronica chamaedrys* 4(+); *Leontodon hispidus* s.l. 7(+); *Trifolium pratense* 2(+); **VI:** *Sedum acre* 6(+); **VII:** *Ligustrum vulgare* b 1(+); **VIII:** *Digitalis grandiflora* 5(+); **X:** *Sedum maximum* 4(+); *Myosotis arvensis* 4(+); *Convallaria majalis* 7(+); *Polygala vulgaris* 1(+); *Lychnis viscaria* 2(+); *Malus domestica* 5(+)

Table 6. Synoptic table of xerothermic communities studied in the years 1993 (col. 6) and 2012 (col. 1-5)

Successive No.	1	2	3	4	5	6
Abbreviated syntaxon name	P	C-V	G-A	L-V	G coll.	TS
Number of relevés	10	12	16	5	43	7
I. Ch., *D. Ass.						
Peucedanum cervaria	V$^{2-4}$	II^{+-1}	II^{+-2}	III^{r-+}	III^{r-4}	III^{+-3}
**Aster amellus* (C-B)	II^{+-1}	-	I^{1}	-	I^{+-1}	IV$^{1-3}$
Vicia tenuifolia	II^{+}	V$^{2-5}$	II^{r-+}	II^{r-1}	III^{r-5}	III^{+-1}
**Falcaria vulgaris* (A)	+^{r}	II^{+-1}	+^{r}	-	I^{r-2}	-
Campanula bononiensis	-	+$^{+}$	-	-	r^{+}	-
**Sanguisorba minor* (F-B)	V^{r-+}	V^{+-1}	V^{r-2}	III^{+}	V^{r-2}	V^{+-3}
Anemone sylvestris	II^{r-1}	-	V$^{2-3}$	I^{r}	III^{r-3}	V$^{1-2}$
Thalictrum minus	II^{r-+}	II^{+}	I^{+-1}	-	II^{r-1}	III$^{1-2}$
II. Ch. *Cirsio-Brachypodion pinnati*						
Seseli annuum	IV^{r-+}	II^{r-+}	II^{+-1}	I^{+}	III^{r-1}	V$^{1-2}$
Melampyrum arvense	II^{r-+}	III^{r-1}	II^{r-+}	II^{r-+}	III^{r-1}	IV$^{1-3}$
Salvia verticillata	II^{r-+}	III^{r-1}	I^{+-1}	+^{r}	II^{r-1}	III$^{1-2}$
Campanula sibirica	(I^{+})	-	-	-	(r^{+})	III^{1}
III. Ch., *D. *Geranion sanguinei*						
Fragaria viridis	V^{r-2}	V^{+-3}	V$^{1-3}$	V^{+-2}	V^{r-3}	V$^{2-3}$
**Galium boreale* (M-A)	V^{+-3}	III^{r-1}	IV^{+-2}	V^{+-2}	IV^{r-3}	V^{3}
Vincetoxicum hirundinaria	III^{+-2}	II^{+-1}	IV^{+-2}	V^{4}	III^{+-4}	V^{+-2}
Primula veris	I^{+-2}	II^{r-2}	II^{r-2}	-	II^{r-2}	II^{+-1}
Anthericum ramosum	II^{+-2}	+$^{+}$	I^{+-1}	I^{+}	I^{+-1}	IV^{+-3}
Viola collina	II^{r-2}	+^{r}	II^{+-1}	-	II^{r-2}	-
Geranium sanguineum	I^{2}	-	-	I^{+}	+$^{+-2}$	I^{+}
Campanula rapunculoides	-	I^{+}	I^{1}	-	I^{+-1}	-
Trifolium alpestre	I^{+}	+$^{+}$	+$^{+}$	-	+$^{+}$	-
Trifolium rubens	I^{+}	-	-	-	r^{+}	-
Veronica teucrium	-	-	-	-	-	I^{+}
IV. Ch., *D. *Brometalia erecti*						
Polygala comosa	II^{r-+}	-	III^{r-1}	I^{+}	II^{r-1}	-
Carex flacca	II^{+-1}	-	+$^{+}$	-	I^{+-1}	-
Thymus pulegioides	II^{+}	II^{+}	IV^{+-1}	II^{+}	III^{+-1}	V$^{1-3}$
**Medicago lupulina* (A)	I^{r-+}	+$^{+}$	II^{r-1}	-	I^{r-1}	III$^{1-2}$
**Linum catharticum* (O)	II^{r-+}	-	-	I^{+}	I^{r-+}	III^{+}
Brachypodium pinnatum	I$^{3-4}$	I^{4}	I^{+-4}	I^{1}	I^{+-4}	II$^{2-3}$
Gentianella cilliata	-	-	-	-	-	I^{+}
Carlina vulgaris	II^{r-+}	III^{+}	II^{r-+}	-	II^{r-+}	II^{+-1}
Ranunculus bulbosus	I^{+}	II^{+}	I^{+}	I^{+}	I^{+}	I^{+}
Plantago media	I^{+}	-	+$^{+}$	-	r^{+}	-
Onobrychis viciifolia	-	+$^{+}$	-	-	r^{+}	-
Alchemilla glaucescens	I^{+}	-	-	-	r^{+}	-
V. Ch. *Festuco-Brometea*						
Homalothecium lutescens d	V^{+-4}	V^{+-4}	V^{+-4}	IV^{+-3}	V^{+-4}	-
Achillea collina	III^{+-1}	IV^{r-1}	II^{+}	-	III^{r-1}	-
Allium oleraceum	I^{+}	I^{r-+}	+^{r}	-	I^{r-+}	-
Euphorbia cyparissias	V^{+-1}	IV^{r-+}	V^{+-1}	II^{+}	V^{r-1}	V$^{1-3}$
Medicago falcata	IV^{+-1}	III^{r-1}	IV^{r-2}	III^{r-1}	IV^{r-2}	V^{+-2}
Carex caryophyllea	IV^{+-1}	III^{+-1}	V^{+-1}	IV^{+-1}	IV^{+-1}	III$^{1-2}$
Abietinella abietina d	V^{+-4}	III^{2}	V^{+-5}	V$^{1-5}$	V^{+-5}	III^{1}
Potentilla arenaria	IV^{+-1}	II^{+-2}	III^{+-1}	V^{r-+}	III^{r-2}	II^{+-2}
Centaurea scabiosa	II^{+-1}	IV^{+-2}	I^{+-1}	II^{+-1}	III^{+-2}	III$^{1-2}$
Salvia pratensis	IV^{+-2}	III^{+-1}	I^{r-1}	III^{+}	III^{r-2}	II^{2}
Achillea pannonica	II^{+}	-	IV^{+-1}	I^{+}	II^{+-1}	II^{1}
Pimpinella saxifraga	+^{r}	III^{+-1}	II^{r-+}	I^{r}	I^{r-1}	III^{+-1}
Veronica spicata	IV^{+-1}	-	III^{r-+}	IV^{+}	III^{r-1}	V$^{1-3}$
Scabiosa ochroleuca	IV^{r-+}	III^{r-+}	I^{r-+}	I^{1}	II^{r-1}	V$^{1-2}$
Anthyllis vulneraria	II^{+}	+^{r}	+$^{+}$	-	I^{r-+}	IV^{+-2}

Successive No.	1	2	3	4	5	6
Abbreviated syntaxon name	P	C-V	G-A	L-V	G coll.	TS
Number of relevés	10	12	16	5	43	7
Verbascum lychnitis	-	-	$+^{+}$	-	r^{+}	V^{+-2}
Anthemis tinctoria	-	-	$+^{+}$	-	r^{+}	V^{+-2}
Centaurea stoebe	I^{r-+}	-	$+^{+}$	-	$+^{r-+}$	III^{1-2}
Bromus inermis	-	-	-	-	-	III^{1-3}
Poa compressa	-	-	-	-	-	III^{+-1}
Acinos arvensis	-	-	-	-	-	III^{+-1}
Stachys recta	I^{+}	-	-	-	r^{+}	II^{+-1}
Arenaria serpyllifolia	-	-	-	-	-	I^{2}
Viola rupestris	-	-	-	-	-	I^{+}
Petrorhagia prolifera	I^{r}	$+^{+}$	-	-	$+^{r-+}$	I^{1}
Orobanche caryophyllacea	$+^{r}$	-	$+^{+}$	-	r^{r-+}	I^{+}
Erigeron acris	-	I^{r}	-	-	r^{r}	I^{+}
Artemisia campestris	-	$+^{+}$	-	-	r^{+}	I^{1}
Phleum phleoides	I^{+}	-	-	-	r^{+}	-
Thymus pannonicus ssp. *marschallianus*	I^{1}	-	-	-	$+^{1}$	-
Thymus pannonicus	-	-	-	I^{+}	$+^{+}$	-
Hieracium piloselloides	-	$+^{r}$	-	-	r^{r}	-
Arabis hirsuta	$+^{r}$	-	-	-	r^{r}	-
VI. Ch., *D. *Origanetalia*, *Trifolio-Geranietea sanguinei*						
Agrimonia eupatoria	IV^{+-2}	IV^{+-1}	V^{+-2}	III^{r-1}	IV^{r-2}	-
**Rubus caesius* var. *arvalis* (A)	II^{+-1}	V^{+-4}	$+^{+}$	-	II^{+-4}	-
Astragalus glycyphyllos	III^{+}	II^{+}	-	II^{r-+}	II^{r-+}	-
Origanum vulgare	I^{1}	I^{+}	I^{1}	I^{+}	I^{+-1}	-
Chamaecytisus ruthenicus	II^{+-1}	-	$+^{+}$	I^{+}	I^{+-1}	-
Poa angustifolia var. *setacea*	V^{+-1}	V^{+-2}	V^{+-2}	IV^{r-+}	V^{r-2}	IV^{1-3}
Galium verum fo.	V^{+-1}	V^{+-2}	IV^{+-2}	I^{1}	IV^{+-2}	IV^{1-2}
Hypericum perforatum	III^{+}	III^{r-+}	III^{r-+}	V^{+}	IV^{r-+}	V^{+-1}
Agrimonia procera	IV^{r-+}	IV^{r-1}	-	IV^{+-1}	III^{r-1}	V^{1-2}
Galium album fo.	II^{r-+}	II^{+}	IV^{+-1}	II^{+-1}	III^{r-1}	IV^{+-2}
Knautia arvensis fo.	IV^{+-1}	IV^{r-+}	I^{+}	I^{+}	III^{r-1}	IV^{+-1}
Coronilla varia	III^{r-+}	I^{+}	III^{r-1}	II^{+-1}	III^{r-1}	IV^{+-3}
Viola hirta	IV^{r-1}	III^{+-1}	II^{+-1}	I^{+}	III^{r-1}	II^{+}
Clinopodium vulgare	II^{+-1}	I^{1}	III^{+-2}	III^{+}	II^{+-2}	III^{+-2}
Senecio jacobaea fo.	$+^{r}$	$+^{r}$	$+^{r}$	-	$+^{r}$	III^{+-1}
Fragaria vesca	I^{+}	-	-	-	r^{+}	I^{+}
**Campanula persicifolia* (Q-F)	-	-	$+^{+}$	-	$+^{+}$	-
**Hieracium murorum* (O)	-	-	$+^{+}$	-	r^{+}	-
Vicia sepium	-	-	$+^{r}$	-	r^{r}	-
Silene nutans	-	$+^{+}$	-	-	r^{+}	-
VII. Ch. *Molinio-Arrhenatheretea*						
Veronica chamaedrys	II^{r-+}	II^{r-+}	IV^{r-1}	IV^{r-+}	III^{r-1}	I^{+}
Festuca rubra	I^{+}	III^{+-2}	I^{+}	-	I^{+-2}	-
Festuca pratensis	-	I^{+-1}	$+^{+}$	-	$+^{+-1}$	-
Centaurea jacea	I^{+}	-	$+^{+}$	-	$+^{+}$	-
Vicia cracca	I^{+}	-	$+^{+}$	-	r^{+}	-
Climacium dendroides d	-	$+^{+}$	$+^{+}$	-	r^{+}	-
Stachys officinalis	I^{2}	-	-	-	I^{2}	-
Arrhenatherum elatius	V^{+-2}	V^{+-2}	V^{+-3}	V^{+-2}	V^{+-3}	V^{1-3}
Dactylis glomerata	IV^{+}	III^{+}	II^{+}	III^{+}	III^{+}	IV^{+-2}
Leontodon hispidus	II^{r-+}	I^{+}	I^{r-+}	-	I^{+}	I^{+}
Carex hirta	II^{+}	$+^{+}$	I^{+}	-	I^{+}	I^{1}
Plantago lanceolata	III^{+}	III^{r-+}	II^{r-+}	I^{+}	II^{r-+}	IV^{+-1}
Achillea millefolium	II^{r-+}	-	-	-	$+^{r-+}$	IV^{1-2}
Poa pratensis	-	-	-	-	-	II^{1-2}
Potentilla reptans	-	-	-	-	-	II^{1}
Rumex acetosa	-	-	-	-	-	II^{+}

Successive No.	1	2	3	4	5	6
Abbreviated syntaxon name	P	C-V	G-A	L-V	G coll.	TS
Number of relevés	10	12	16	5	43	7
Crepis biennis	-	-	-	-	-	I^{1}
Inula salicina	-	-	-	-	-	I^{1}
Briza media	II^{1-3}	-	-	-	I^{1-3}	I^{1}
Taraxacum officinale coll.	-	$+^{r}$	I^{r}	-	$+^{r}$	I^{+}
Trifolium pratense	-	I^{r-+}	$+^{+}$	-	$+^{r-+}$	I^{+}
Lotus corniculatus	I^{+}	-	-	-	r^{+}	I^{1}
Prunella vulgaris	-	I^{r-+}	-	-	r^{r-+}	-
Lathyrus pratensis	-	-	I^{+}	-	r^{+}	-
Avenula pubescens	-	-	$+^{+}$	-	r^{+}	-
Carex spicata	-	$+^{+}$	-	-	r^{+}	-
VIII. Ch. *Koelerio-Corynephoretea*						
Trifolium campestre	-	-	-	-	-	IV^{+-1}
Cerastium arvense	-	-	-	-	-	II^{1}
Sedum acre	I^{+}	-	$+^{+}$	-	$+^{+}$	I^{+}
Trifolium arvense	-	$+^{r}$	-	-	r^{r}	I^{2}
Sedum sexangulare	I^{+}	-	-	-	r^{+}	-
IX. Ch. *Artemisietea vulgaris*						
Glechoma hederacea	-	I^{r}	I^{1}	I^{+}	I^{r-1}	-
Linaria vulgaris	-	II^{+}	$+^{r}$	-	II^{r-+}	II^{+}
Elymus repens	$+^{r}$	-	-	II^{r-+}	$+^{r-+}$	II^{+-1}
Convolvulus arvensis	I^{r}	III^{r-+}	II^{+}	II^{+-1}	II^{r-1}	IV^{+}
Picris hieracioides	I^{+}	II^{r-+}	-	-	I^{r-+}	III^{+-1}
Echium vulgare	-	-	$+^{r}$	-	r^{r}	III^{+-1}
Carduus acanthoides	-	-	-	-	-	III^{+-1}
Anchusa officinalis	-	-	-	-	-	I^{+}
Cirsium vulgare	-	-	-	-	-	I^{+}
Daucus carota	-	II^{+}	-	-	$+^{+}$	-
Artemisia vulgaris	-	I^{r-+}	-	-	r^{r-+}	-
Cichorium intybus	-	$+^{+}$	$+^{+}$	-	r^{+}	-
Melandrium album	-	$+^{r}$	-	-	r^{+}	-
Pastinaca sativa	-	$+^{+}$	-	-	r^{+}	-
Euphorbia esula	-	$+^{r}$	-	-	r^{r}	-
X. Ch. *Rhamno-Prunetea*						
Ligustrum vulgare b/c	IV^{+-1}	V^{+-1}	IV^{+-2}	II^{+}	IV^{+-2}	$+^{+}$
Cornus sanguinea b/c	IV^{+-2}	IV^{+-1}	III^{+-2}	II^{+-1}	IV^{+-2}	I^{1}
Rosa dumalis b/c	II^{r-+}	III^{+}	I^{+}	III^{+}	II^{r-+}	-
Prunus spinosa b/c	V^{+-2}	V^{+-3}	V^{+-2}	IV^{+}	V^{+-3}	III^{+-2}
Rhamnus catharticus b/c	III^{+}	III^{+-1}	III^{+-2}	III^{+}	III^{+-2}	II^{+-2}
Rosa canina b/c	II^{+-1}	III^{+}	III^{+-1}	IV^{+}	III^{+-1}	V^{+-2}
Crataegus monogyna b/c	I^{+}	-	$+^{+}$	I^{+}	$+^{+}$	II^{+-1}
Pyrus pyraster b/c	-	$+^{+}$	$+^{+}$	I^{+}	$+^{+}$	I^{+}
Rosa rubiginosa b/c	-	-	$+^{+}$	-	r^{+}	I^{+}
Rosa inodora b/c	-	-	-	-	-	I^{1-2}
Rosa tomentosa b/c	-	-	-	-	-	I^{+}
Crataegus rhipidophylla b/c	-	I^{r-+}	-	-	r^{r-+}	-
Viburnum opulus b/c	-	$+^{+}$	-	-	r^{+}	-
Populus tremula b/c	I^{+}	-	-	-	r^{+}	-
Frangula alnus b/c	$+^{r}$	-	-	-	r^{r}	-
XI. Ch. *Querco-Fagetea*						
Carex montana	I^{1-2}	+	I^{+-1}	-	I^{+-2}	-
Euonymus verrucosus b/c	I^{+}	-	I^{+-1}	-	I^{+-1}	I^{+-1}
Acer pseudoplatanus b/c	-	I^{r-+}	-	-	r^{r-+}	-
Carex digitata	-	$+^{+}$	$+^{+}$	-	r^{+}	-
Melica nutans	I^{+}	-	-	-	r^{+}	-
Malus sylvestris b/c	-	-	$+^{+}$	-	r^{+}	-
Ajuga reptans	-	-	$+^{r}$	-	r^{r}	-

Successive No.	1	2	3	4	5	6
Abbreviated syntaxon name	P	C-V	G-A	L-V	G coll.	TS
Number of relevés	10	12	16	5	43	7
Fagus sylvatica b/c	$+^{r}$	-	-	-	r^{r}	-
Digitalis grandiflora	-	-	-	-	-	I^{+}
XII. Ch. *Vaccinio-Piceetea*						
Juniperus communis b/c	V^{+-1}	III^{+-2}	III^{+-2}	I^{+}	III^{+-2}	IV^{+-2}
Pinus sylvestris b/c	II^{r-+}	$+^{+}$	I^{+}	-	I^{+}	II^{+-2}
Pleurozium schreberi d	I^{+}	-	I^{+-1}	-	$+^{+-1}$	-
Pseudoscleropodium purum d	I^{+}	-	I^{+-1}	-	$+^{+-1}$	-
Dicranum polysetum d	-	-	I^{1-2}	-	I^{1-2}	-
Rubus saxatilis	I^{1}	-	-	-	I^{1}	-
Melampyrum pratense	-	-	-	-	-	I^{2}
XIII. Others						
Cruciata glabra	II^{r-+}	I^{1}	III^{r-+}	-	II^{r-1}	-
Plagiomnium affine d	I^{+}	$+^{+}$	II^{+-3}	I^{+}	I^{+-3}	-
Thuidium philibertii d	I^{+}	I^{2}	II^{+-1}	-	I^{+-2}	-
Quercus robur b/c	I^{+-1}	I^{+}	I^{r-+}	$+^{r}$	I^{r-1}	-
Hieracium pilosella	III^{+}	II^{r-1}	$+^{+}$	I^{+}	II^{r-1}	II^{+-1}
Calamagrostis epigejos	-	$+^{+}$	I^{2}	I^{+}	$+^{+-2}$	II^{1}
Silene vulgaris	-	$+^{r}$	II^{r-+}	-	I^{r-+}	V^{1-2}
Pteridium aquilinum	I^{+-2}	$+^{+}$	-	-	$+^{+-2}$	III^{+-2}
Cerinthe minor	-	-	-	-	-	II^{1}
Geranium columbinum	-	-	-	-	-	II^{+-1}
Malus domestica b/c	-	I^{+}	-	-	r^{+}	I^{+}
Oxyrrhynchium hians d	-	II^{+-1}	$+^{+}$	-	$+^{+-1}$	-
Geranium pusillum	-	-	II^{r-+}	-	$+^{r-+}$	-
Vicia hirsuta	-	-	II^{+}	-	$+^{+}$	-
Brachythecium rutabulum d	I^{+}	I^{1-2}	-	-	$+^{+-2}$	-
Prunus domestica b/c	-	I^{+}	-	-	r^{+}	-
Stachys annua	-	$+^{r}$	-	-	r^{r}	-
Calliergonella cuspidata d	-	I^{3}	-	-	I^{3}	-
Anthoxanthum odoratum	-	$+^{+}$	-	-	r^{+}	-
Cimicifuga europaea	I^{+}	-	-	-	r^{+}	-
Fissidens cristatus d	I^{+}	-	-	-	r^{+}	-
Fissidens sp. d	-	-	$+^{+}$	-	r^{+}	-
Tragopogon sp.	I^{+}	-	-	-	r^{+}	-
Agrostis capillaris	$+^{+}$	-	-	-	r^{+}	I^{1}
Quercus petraea b/c	-	-	$+^{r}$	-	r^{r}	I^{+-1}
Polygala vulgaris	-	-	-	-	-	I^{+}
Lychnis viscaria	-	-	-	-	-	I^{+}
Rhinanthus angustifolius	-	-	-	-	-	I^{+}
Sedum maximum	-	-	-	-	-	I^{+}
Myosotis arvensis	-	-	-	-	-	I^{+}
Convallaria majalis	-	-	-	-	-	I^{+}

Explanations: P – *Peucedanetum cervariae*, C-V – *Campanulo bononiensis-Vicietum tenuifoliae*, G-A – *Geranio-Anemonetum sylvestris*, L-V – *Lathyro sylvestris-Vincetoxicetum hirundinariae*, G coll. – all four associations of the alliance *Geranion sanguinei*, TS – *Thalictro-Salvietum pratensis*

Table 7. Chosen parameters characterising the state of non-forest xerothermic vegetation in the "Murawy Dobromierskie" reseve in the period 1993-2012

Year of study	1993			2012		
Parameters	C	G	D	C	G	D
Ch. of the examined *Geranion sanguinei* associations	2972	4,611	2,635	3089	4,886	2,219
Ch. *Geranion sanguinei*	4186	**6,916**	**4,743**	3458	3,562	1,259
Ch. *Origanetalia*, *Trifolio-Geranietea sanguinei*	**5886**	6,34	3,321	1238	5,84	2,424
Ch. *Cirsio-Brachypodion pinnati*	**4178**	3,746	1,16	98	4,18	1,019
Ch. *Brometalia erecti*	**2422**	**27,09**	**13,99**	597	19,06	8,016
Ch. *Festuco-Brometea*	**14170**	14,41	9,357	1415	19,07	9,101
Ch. *Molinio-Arrhenatheretea*	**5612**	10,66	3,523	1042	12,04	**6,295**
Ch. *Artemisietea vulgaris*	508	2,017	0,504	442	0,286	0,035
Ch. *Koelerio-Corynephoretea*	**421**	**6,628**	**2,42**	5	4,666	1,038
Ch. *Rhamno-Prunetea*	**3141**	6,628	2,178	1472	**11,65**	**5,349**
Others	**2335**	**8,069**	**2,152**	465	5,468	0,955

Explanations: C – cover coefficient, G – collective group share index, D – systematic group value (the values of a greater importance for the studied problem are typed in bold)