VEGETATION COVER
IN AN ANCIENT AGRICULTURAL LANDSCAPE:
THE PROSZOWICE PLATEAU (SOUTHERN POLAND)
AS A CASE-STUDY

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ABSTRACT

The investigations on vegetation cover in the Proszowice Plateau (Małopolska Upland, southern Poland) in 1997-1999 were carried out. This vast area (770 sq. km), hitherto not in this respect investigated, is covered with arable fields in 80%. This area has been used for agriculture since the Neolithic age. The aim of the paper is to show the present state of the vegetation and flora in face of the growing man's impact upon living biotas and their environment. The Braun-Blanquet phytosociological method was used, yielding 1030 relevés. In effect, a total of 48 plant associations and communities were found. Plateaux and gently slopes are covered with arable fields. In the cereal communities *Vicietum tetraspermae* and in the root crops *Echinochloo-Setarietum* are mostly found. In the wide and shallow stream valleys moist and wet meadows (*Calthion*, *Magnocaricion*) predominate, and the stands of the xerothermic grassland (*Festuco-Brometea*) occur in places not used for agriculture: on steep escarpments between fields and on steep slopes of hills, gullies and stream banks. Small and scarce forests (*Quercus-Fagetum*) are preserved on plateaux and on gently slopes. In the stream banks they consist of willow thickets (*Salicion*) and fragments of riverside carr (*Alno-Padion*). Basing on the relevé material and floristic checklists a total of 860 vascular plant species was recorded, in this 19.2% of rare and endangered. The flora is of lowland character; c. 80% are native species. The characteristic feature of the Proszowice Plateau is the occurrence of the xerothermic grassland and wet meadows, in which species rare in other regions of the country flourish.

KEY WORDS: land-use, plant communities, human impact, vascular flora, ecological groups of species, rare and endangered species.

INTRODUCTION

Vegetation cover of Earth undergoes continuous changes in effect of either natural factors, or human activity. Along with the development of agriculture and spreading of settlement it has been changed both structurally and spatially (Loster 1991); in Central Europe dated back to the Neolithic (Ellenberg 1988). It is manifested in decreasing of the area and number of natural plant communities, together with increasing of secondary anthropogenic ones: arable fields, pastures and meadows. As an effect a diversified cultural landscape is created – mosaics of anthropogenic and natural stands characterized by an extraordinary species richness (Fukarek 1979; Kornaś 1983).

In recent decades, especially in 1950-1980, the process of rapid changes in vegetation cover was amplified in a

scale of the whole globe, resulting in decreasing of ecosystems biodiversity (e.g. Mooney et al., 1995a, b). Also in Central Europe, in the effect of several factors: abandoning of the traditional agriculture management practices, intensification of arable production, introducing of mechanization, chemical treatments and specialization in production, together with the increasing of field crops area by land drainage, growing urbanization and industrialization of rural territories, the remnants of natural and semi-natural vegetation diminish. They consist of small stands of forests, thickets among fields, vegetation of escarpments, gullies and wet meadows and boggy areas. All of them are habitat islands among fields being the refugia for many plant and animal species from various taxonomic groups (Faliński 1976; Loster, Dubiel 1985; Forman 1983; Dąbrowska-Prot 1987).

In face of continuously decreasing natural resources in effect of various threats the joining the nature protection with economic-social development processes becomes an urgent task. Nevertheless, the introduction of sustainable development rules and protection measures for sites of special interest (regional hot spots) deserve the knowledge on the present state of nature (Ryszkowski 1996).

The area of investigations – Proszowice Plateau – is a typical agricultural region in which settlement activity and traditional agriculture is dated back to the Neolithic (Kruk 1980; Kruk et al. 1996). According to Faliński (1975) the region belongs to areas in which natural vegetation was completely replaced by the synanthropic one. Probably because of its agricultural character and strong transformation the Proszowice Plateau, notwithstanding its close vicinity to Kraków, was not hitherto intensively botanically explored. Some scarce data from its southern border were given by Berdau (1869), and from northern – by Tacik (1959). Also other publications: geographic-physiographic by Kostrowicki (1966) and monographs on natural environment of the Nida Basin (Bednarz 1987; Szwagrzyk 1987) give only preliminary information on flora of this vast region. In spite of this it were not any phytosociological investigations carried out here. Thus, the aim of the work is to fill this gap and to know the present state, diversity and site conditions of occurrence of plant communities, paying a special attention to rare and endangered plants and their habitats.

MATERIALS AND METHODS

Study area

The Proszowice Plateau is situated near Kraków (Fig. 1) on the Małopolska Upland (50°03'–50°23'N, 20°07'–20°46'E) and is one of the Nida Basin regions (Kondracki 1978). This area of c. 770 sq. km is of typical agricultural character. Vast, deforested hills up to 300 m above sea level, and shallow, wide depressions of river valleys domi-

nate there. It is built of Miocene deposits overlaid with loess and on the uncoverings on steep slopes and erosion gullies of chalk or, locally, gypsum. In many places fertile chernozem was either created of loess, or brown soils, lessivage soils, and on the rock substratum rendzinas may also be found (Olszewski et al. 1965). The pattern of rendzinas in some places is affected by deluvial loess deposits (Langer, mscr.). This is visible in increased, in comparison with typical rendzinas, percentage of silt fraction. The typical feature of soils at almost all stations under study is a very high content of metallic base cations, occurring both in available and exchangeable forms. The content of magnesium and calcium is particularly high. Calcium occurs as a rule in carbonate form. It is a reason of the high reaction value of the soils under study (pH in water suspension ranges from 6.5 to 7.5). Saturation by bases of soil sorption complex amounts to c. 100%. Comparing these soil characteristics with data available for the Proszowice community (Turzański, Godzik 1996) it may be stated that soils of chosen stations, being agriculturally used, are within the group of the most fertile soil genetic units. The soil fertility makes the region one of the most valuable agricultural areas in terms of either soil evaluation classes or agricultural suitability, even in the nation-wide scale (Turzański, Godzik 1999).

In respect of the climate the region belongs to the area of low precipitation (below 550 mm year per), high insolation and higher, in comparison to adjacent regions, mean temperatures of June and July (Paszyński 1966; Paszyński, Kluge 1986). The main climatic characteristics (basing on the State Hydro-Meteorological Institute (PIHM) data for 1955–1964) are plotted according to the Gaussen-Walter method (Fig. 2).

Generally favourable physiographic conditions have formed the Proszowice Plateau in to an old agriculture and settlement region. Nowadays the area is almost totally deforested (the remnants of forests cover 2% of area). Plateaux and gentle slopes are covered with arable fields (c. 80% of area), while the wide and shallow river valleys are mainly

Fig. 1. Situation of the Proszowice Plateau and localization of phytosociological reléves in a grid of ATPOL quadrats of 2 × 2 km.

Fig. 2. Gaussen-Walter diagram based on data from the Institute of Hydro- and Meteorology (PIHM), the station Sielec (50°19'N, 20°25'E, 202 m above sea level); a – monthly mean of air temperature, b – monthly sum of precipitation, c – wet period of a year, d – monthly precipitation above 100 mm, e – duration of frost, f – duration of ground frost, g – period without ground frost.

covered by wet meadows (13% of area). In places not put under cultivation: on boundary strips among fields, steep escarpments of rivers and on erosion gullies, the xerothermic grassland develops (less than 5% of area). Land-use forms in the Proszowice Plateau in 1996 according to Central Statistical Office (GUS) (1997) are shown in Fig. 3.

Fig. 3. Percentage of particular land use forms in 7 rural districts in the Proszowice Plateau; 100% = 57549 ha; 1 – arable fields, 2 – grassland, 3 – forests, 4 – others.

Methods

To study the present vegetation of the Proszowice Plateau, field investigations in the years 1997-1999 were carried out by means of a cartogram method: 2 × 2 km ATPOL grid square system (Zajac, Zajac 1998). 103 representative units were studied (Fig. 1). In that period 1030 relevés were performed using the Braun-Blanquet's (1964) concept of association. Associations were determined with the help of the observational-comparative method (Pawłowski 1972) and numerical classification according to the procedure by Wildi (1989). A MULVA-4 package (Wildi, Orloci 1990) was used and Minimum Variance Clustering based on Euclidean Distance measure were regarded as program options. The similarity between the particular

relevés was also displayed by an ordination method of a Detrended Correspondence Analysis (DCA – Hill, Gauch 1980). DCA was done using the program package CANOCO version 3.10 (ter Braak 1987, 1990).

The ecological groups of species were established on the basis of own observations and according to literature data (Medwecka-Kornaś et al. 1982; Matuszkiewicz 1982). The synanthropic species groups were distinguished according to the geographical-historical classification by Kornaś and Medwecka-Kornaś (1986) and Zajac and Zajac (1992). The threat categories were established according to recommendations of IUCN (1994).

Nomenclature and syntaxonomy is used following Medwecka-Kornaś et al. (1972), supplemented by Matuszkiewicz (1981), plant species nomenclature is used after Mirek et al. (1995).

RESULTS

The characteristics of main groups of plant communities

Based on the phytosociological survey on the Proszowice Plateau the occurrence of 48 plant associations of 9 classes was recorded (see Appendix).

As a result of ordination of the relevés along Axes I and II 6 distinct groups of plant communities may be recognized: arable fields, xerothermic grasslands, meadows and swamps, scrubs, remnants of alder-carrs and lowland forests (Fig. 4). Their spatial distribution is closely related to site conditions, typical for particular landforms. Plateaux and gentle slopes are covered with arable fields. Wide and shallow river valleys are mainly occupied by wet and moist meadows (*Calthion*, *Magnocaricion*), boundary strips among fields, escarpments in river valleys and steep erosion gullies are covered with the xerothermic grassland (*Festuco-Brometea*). On plateaux and gentle slopes some patches of forest are preserved (mainly of *Quercus-Fagetum*).

Weed communities of arable fields

In cereal cultivations the most frequent association is *Vicetum tetraspermae*. It is diversified according to type of soil into three subassociations: typicum being the most frequent, rare subassociation with *Spergula arvensis* and *Scleranthus annuus* on more acid soils and a frequent subassociation with *Avena fatua* and *Neslia paniculata*. Only rarely, on south-facing slopes thermophilous association of *Lathyro-Melandrietum* can be found. On sandy, but fairly fertile soils, plant communities corresponding to *Papaveretum argemones* (due to the presence of *Veronica triphyllos*) develop; and on poor and sandy stubble fields and one-year fallows *Digitaria ischaemum* may grow, forming communities corresponding to *Digitarietum ischaemi*, a plant association described from northern and western Poland. A very characteristic feature of cereal fields in the Proszowice Plateau is the occurrence of ruderal species as *Descurainia sophia*, *Atriplex patula* and *Artemisia vulgaris*. Most likely they are connected with common cultivations of vegetables, e.g. celery, onion. Also, the phenomenon of ecological compensation, i.e. mass occurrence of one or two weed species, which choke both cultivated plants and other weeds, is often found. In cereal fields they are *Avena fatua* or *Apera spica-venti*, in root crops *Galinsoga ciliata* and/or *G. parviflora* and

Fig. 4. Main groups of plant communities demarcated on the basis of a Detrended Correspondence Analysis (DCA): 1 – segetal, 2 – xerothermic, 3 – fresh, wet and boggy meadows, 4 – scrub (successional stages), 5 – fragments of alder-carr, 6 – oak-hornbeam forest.

Echinochloa crus-galli. The compensation is often a consequence of use of herbicides.

In root crops and tobacco fields the most often found plant community is *Echinochloa-Setarietum*. The inner diversification of the association is similar to *Vicietum tetraspermae*. The particular feature of the Proszowice Plateau is the occurrence of *Echinochloa-Setarietum* with admixture of ruderal species as *Solanum nigrum*, *Amaranthus retroflexus*, *A. chlorostachys* and *Sisimbrium officinale*. They are found relatively often on chernozems, and also in places far away from villages and farms. Phytocoenoses of *Lamio-Veronicetum politae* are scarce; they may be found on the steepest loess slopes and in outcrops of krakowiecki clay. The transitional stands between *Echinochloa-Setarietum* and *Lamio-Veronicetum* are relatively often on alluvial soils at the contact zone of river valley with slope, and near villages.

Ruderal communities

In the area under study among ruderal communities stands of *Plantagini-Lolietum* and *Leonuro-Arcietum tomentosum* may often be found, rarely in places overmanured – *Urtico-Malvetum neglectae*, in ditches the communities of *Bidention* alliance and scarce in the area *Onopordietum acanthii*, and also the community with *Conium maculatum*.

Meadow communities

The largest meadow areas may be found in the Szreniawa river valley and its tribute the Ścieklec stream, and in the Nidzica valley and its tribute the Małoszówka stream. Relatively small areas are covered with typical fresh meadows of *Arrhenatheretum elatioris*. They occur at slope-foots, on higher terraces, on balks and in small, gentle escarpments among fields, and also in drained places. Fresh meadows are regularly mown, and sometimes intensively grazed. On the other hand, the pastures representing *Lolio-Cynosuretum* are very rare. They occur in river and stream valleys. Sometimes the meadows are grazed after the first mowing; while intensively grazed they turned into pastures with *Deschampsia caespitosa*.

More widespread are wet meadows representing *Cirsietum rivularis*, the stands of which can be found in local terrain depressions. However, the largest area in wide and shallow river valleys occupies the community of wet

meadow with *Cirsium canum*, *Symphytum bohemicum* and *Trifolium patens*. A part of stands of this community may be identified with described from western Poland *Cirsio-Polygonetum bistortae* assoc. Wet meadows are as a rule regularly mown.

In sites of cut alder-carrs the community of *Filipendulo-Geraniatum palustre* develops. In one locality in the Szreniawa valley, fragments of *Molinietum europaeae* with *Trollius europaeus* were found. In more wet places narrow strings of sedge swamp of *Magnocaricion* alliance: *Caricetum gracilis*, *C. acutiformis* and *C. distichae* occur. Sometimes they cover large areas, and are mown like the neighboring wet meadows. Very rare and only fragmentary developed are eutrophic lowland bogs of *Caricetalia davallianae*. Only in a few places stands of bogs with *Eriophorum latifolium* may be found.

Generally, meadows in the Proszowice Plateau are regularly mown, extensively grazed and sporadically burnt. In Poland, as well as in whole Europe, a degradation of semi-natural plant communities in result of abandoning the traditional management practices is observed (Hansson, Fogelfors 2000). Wet meadows are drained, intensively fertilized with synthetic fertilizers, sown with high-yielding grasses, and sometimes ploughed and sown, or even abandoned. The drainage of meadows has brought about the changing of the typical form of the communities, e.g. by the withdrawing in stands the characteristic species of either fresh, or wet meadows. Intensive fertilization and sowing decrease the species diversity. The abandonment of meadows initiates secondary succession – they get overgrown by shrubs and nitrophilous herbs, e.g. *Urtica dioica*, and then by shrubs.

Communities of ditch edges and water bodies

On edges of drainage ditches and in small ponds, rushes with *Glyceria maxima*, *Phragmites australis* or *Typha latifolia* can be found. In drainage ditches, in places slightly deeper or cleaned, plant communities with *Callitriche polymorpha*, *Batrachium aquatile*, *Veronica beccabunga* and *Berula erecta* develop. On rarely occurring wet sands or in furrows of sandy fields, plant communities of *Nanocyperion flavescentis* may be found. The water-plant communities of *Lemnetalia* and *Potamogetonalia* alliances are connected with scarcely occurring small water bodies.

Xerothermic plant communities

Xerothermic grassland is one of the most characteristic plant community of the Proszowice Plateau. It occupies steep escarpments and strips of among-fields balks, steep slopes of hills and erosion and bank-river gullies. This community is rich in species, distinguished by occurrence of many rare plants, even in the country scale, endangered by extinction. It forms specific habitat islands in the agricultural landscape (Towpasz, Kotańska 1999b; Kotańska et al. 2000). They are best developed on the south-, south-west- and south-east-facing slopes. The most often found is *Thalictro-Salvietum pratensis*. This plant association occurs on deeper soils than other communities of this type: on rendzinas, pararendzinas and shallow brown soils developed on chalk or loess. It occupies places of various inclination (often even to 70°) and exposure. In its stands *Agropyron intermedium* (= *Elymus hispidus*) dominates (Towpasz et al. 1999), here grows *Salvia pratensis*, and sometimes *Salvia nemorosa*. A rare plant association in the Proszowice Plateau, found only in gypsum outcrops in Gniazdowice, is *Sisimbrio-Stipetum capillatae*. Along with abundant *Stipa capillata* another very rare species in country scale, the *Sisimbrium polymorphum* grows here (Towpasz, Trzcińska-Tacik 1998). Somewhat more often found is *Inuletum ensifoliae*, growing on shallow rendzinas and on chalk outcrops, on steep, eroded escarpments. Many interesting and rare species occur there, e.g. *Reseda phyteuma* (Towpasz, Kotańska 1999a), *Aster amellus*, *Linum flavum* and *L. hirsutum*. In less steep slopes, in their lower sectors, the stands with the domination of a more mesophilous grass *Brachypodium pinnatum* develop. The community with the abundant occurrence of *B. pinnatum* and other relatively mesophilous species, develop both on chalk and loess substrata, and is enough widespread in the study area. There are also here the intermediate stands corresponding to *Thalictro-Salvietum*. The xerothermic grassland in the Proszowice Plateau is developed owing to favourable physiographic conditions: rock parental material, steepness of escarpments, balks and gullies, and due to human intervention: burning (mainly in early spring and sometimes in late autumn), rarely in result of grazing. The mentioned factors prevent succession, and for this reason a characteristic feature of the area is the almost complete absence of the xerothermic scrubs. Escarpments, gullies and balks, in which burning has been ceased, are overgrown with *Rubus caesius*, and in the next stage with *Prunus spinosa*.

Scrub and forest communities

The scrubs of *Prunetalia* with occurrence of *Prunus spinosa* and species of *Rosa* and *Crataegus* are relatively rare. Most often singular scrubs on balks, escarpments and forest edges can be found. Among hawthorns the very rare in Poland *Crataegus macrocarpa* occurs here. Merely in few places in the Vistula river valley, on its steep, loess escarpments, just below the plateau, xerothermic scrubs developed with *Cerasus fruticosa* and *Rosa gallica*.

On the Proszowice Plateau only a few, relatively small forest complexes persist. The most often is the lowland oak-hornbeam forest *Tilio-Carpinetum*. In its stands some legally protected species grow: *Lilium martagon*, *Daphne mezereum* and *Vinca minor*. In the eastern part of the territory a very rare mixed oak-pine forest *Pino-Quercetum* of

the wet, as well as, the dry variants may be found. In valleys of the Szreniawa and Nidzica rivers the riverside carrs spread, only fragmentally developed. The most often are willow-poplar carrs of *Salici-Populetum* spread in narrow strips along the rivers. Their characteristic feature is the poorly developed herb-layer. In spite of quite abundant *Artemisia vulgaris* or *Festuca gigantea* there occur here also such rare species as *Senecio fluvialis* or *Ficaria nudicaulis*. Along the watercourses narrow strings of willow thickets of *Salicion* alliance and fragments of alder-ash carrs of *Alno-Padion* alliance may be found.

Vascular Flora

The flora of the Proszowice Plateau, is relatively rich in species. There were found here 860 taxa, in that 80% are native species, and the rest are the synanthropic ones (175 species). The species characteristic for the area, especially abundantly occurring here in comparison to adjacent regions are, for example *Salvia nemorosa*, *Symphytum bohemicum*, *Cirsium canum* and *Ficaria nudicaulis*. The flora is of typical lowland character. Due to the lack of proper sites, the percentage of montane species is negligible. The characteristic feature of the Proszowice Plateau flora is the high number of xerophilous species. They amount to over 180, what constitutes ca. 22% of the total flora (Fig. 5A). Within this group especially abundant are representatives of the Pontic-Pannonian geographical element, e.g. *Adonis vernalis*, *Linum hirsutum*, *Agropyron intermedium*, *Inula ensifolia*, *Oxytropis pilosa*. Abundant are also plants of fertile and shady broad-leaved forests, in spite of their rarity. In their herb-layer *Lilium martagon*, *Asarum europaeum*, *Paris quadrifolia*, *Vinca minor*, *Convallaria majalis* grow abundantly. To rare and possessing a few stations belong *Corydalis solida*, *Isopyrum thalictroides*, *Stellaria neglecta*, *Hedera helix*. The number of meadow species is quite large (150 species). On the meadows species common in the whole area of Poland grow, e.g. the occurring in fresh meadows: *Arrhenatherum elatius*, *Ranunculus acer* or *Trifolium pratense*, as well as, the common in the investigated area, but rare in the rest of Poland: *Cirsium canum*, *Symphytum bohemicum* (in Poland not recognized so far) or rare and endangered *Trollius europaeus*. Also plants connected with water sites are scarce, e.g. *Potamogeton crispus*, *Batrachium aquatile*, *Spirodela polyrhiza*, *Lemna minor*, and boggy species: *Menyanthes trifoliata*, *Ranunculus lingua*, *Cicuta virosa*. On wet sites most widespread are rush species, covering sometimes large areas, e.g. *Carex disticha*, *C. acutiformis*, *Glyceria plicata*, *Phragmites australis*. There is the lack of typical bogmoor species.

Wealthily represented are synanthropic species (Fig. 5B). The archaeophytes are ones of the most often found. To this group belong *Adonis aestivalis*, *Neslia paniculata*, *Melandrium noctiflorum*. Among archaeophytes two rare in country scale species were found: *Asperugo procumbens* and *Coronopus squamatus*. Some other species belonging to archaeophytes declined, as e.g. *Hyoscyamus niger*, *Agrostemma githago* and *Bromus secalinus*. The strong anthropogenic impact is reflected in kenophytes' occurrence (50 species), especially epecophytes. To this group belong species recently spreading in other areas, where they gain the status of hemi- or holoagriophytes, e.g. *Echinocystis lobata*, *Impatiens glandulifera*.

Fig. 5. Percentage of particular plant groups in the flora of the Proszowice Plateau; A – ecological groups: 1 – water, 2 – forest and scrub, 3 – xerothermic grassland, 4 – arable fields and ruderal, 5 – meadow and swamp, 6 – others; B – antrophophytes (100% = 175 species): 1 – archaeophytes, 2 – epicophytes, 3 – kenophytes, 4 – holoagriophytes, 5 – apophytes; C – threatened (100% = 165 species): 1 – EN, 2 – VU, 3 – LR, 4 – EX, 5 – CR.

Some of the mentioned above rare and endangered species belong to a large group, which amounts to 19.2% of the total flora (Fig. 5). Detailed information is to be found elsewhere (Towpasz, Kotafńska 2001, in press).

DISCUSSION

The character of vegetation cover in the Proszowice Plateau depends mainly on kind of the substratum: loess deposits, alluvial soils in the river valleys, outcrops on the slopes of chalk deposits. On the other hand, its present state, depends on, the lasting from the Neolithic, human management (Kruk et al. 1996), which in comparison to adjacent regions of the Nida Basin has imprinted a particular mark. Flora of the region (860 species), in comparison with the flora of the whole the Nida Basin, is relatively rich (Table 1), but owing to small diversification of habitats, it is less numerous than the flora of a smaller region, as for example that of the Ojców National Park (Michalik 1978).

The comparison of the archaeobotanical data from the Roman Iron Age with the present-day flora, carried out by Trzcińska-Tacik and Lityńska-Zajac (1999) in a locality in

TABLE 1. Number of species found in the Proszowice Plateau and in adjacent regions.

Region	Area (km ²)	No. of vascular plants	Source
Proszowice Plateau	770	860	present paper
Nida Basin	2500	1166	Szwagrzyk (1987)
Western part of the Niepołomice Forest	250	870	Dubiel (2000)
Ojców National Park	35	950	Michalik (1978)

Jakuszowice, points to the similarity of ecological diversity of the ancient and contemporary floras, the presence of many archeophyte weeds and species of the mowing meadows and the xerothermic grassland, alongside with the absence of archaeobotanical remnants of forest flora. Its proves the negligible role of forests in this area even in the Roman period. Nevertheless, the gathered material points to changes in flora, e.g. to the decline of some weed species growing in the Roman times. The presence of reconstructed plant communities, based on subfossil material, was presently in most cases confirmed.

In theoretical considerations on the potential natural vegetation, based on the present site diversification and the found successional tendencies, one can expect that most of the sites presently occupied by fields, meadows and xerothermic grassland could be replaced by various variants of the oak-hornbeam forest. On very steep slopes, covered with shallow, strongly eroded calcareous soils the xerothermic grassland should persist for some time, and in the river valleys the stands of *Alno-Padion* recover. This view is supported by others, e.g. Kostrowicki (1966) and authors of a map of the potential vegetation of Poland (Matuszkiewicz et al. 1984).

The results presented in the paper prove the high value of the traditional agricultural landscape in terms of nature conservancy and point to its threats in face of the strong socio-economical pressure toward larger production units and more intensive agricultural practices. On the other hand, there is an urgent need to maintain a great diversity at the level of the agricultural landscape as possible, and at the same time to practise agriculture in a sustainable and cost-effective manner for the benefit of future generations (Hietala-Koivu 1999). In the agricultural landscape this task may be reached by balancing the environmental pattern with the agricultural pattern (Alard, Poudevigne 1999). It is obvious that on the Proszowice Plateau this task has been reached by use of the traditional agriculture. The advances in technology and intensification of management agricultural measures may disrupt this equilibrium and cause a loss of its organization.

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SZATA ROŚLINNA W STARYM KRAJOBRAZIE ROLNICZYM: PRZYKŁAD BADAŃ NA PŁASKOWYŻU PROSZOWICKIM (POŁUDNIOWA POLSKA)

STRESZCZENIE

W latach 1997-1999 na terenie Płaskowyżu Proszowickiego (Wyżyna Małopolska), dotychczas słabo zbadanego, przeprowadzono badania fitosocjologiczne metodą Braun-Blanqueta. W siatce ATPOL o boku 2×2 km w 103 kwadratach wykonano 1030 zdjęć fitosocjologicznych. Ten rozległy teren (770 km²), znany z czarnoziemów, pokryty jest w 80% przez pola uprawne. Sprzyjające warunki przyrodnicze sprawiły, iż jest on intensywnie użytkowany już od neolitu. Celem pracy jest przedstawienie aktualnego stanu roślinności i flory obszaru, który podlega w ostatnich dziesięcioleciach znacznym przemianom, zwłaszcza w wyniku zaniechania tradycyjnych metod gospodarowania. Wyróżniono 48 zespołów i zbiorowisk roślinnych. Zbiorowiska naturalne i na wpół naturalne zajmują niewielkie powierzchnie. Główne grupy zbiorowisk to segetalne, łąkowe, murawowe i leśne. Rozmieszczenie ich jest ściśle związane z poszczególnymi jednostkami krajobrazu. Wierzchowiny i łagodne zbocza pokrywają pola. Szerokie i płaskie doliny potoków zajmują wilgotne i mokre łąki (*Calthion*, *Magnocaricion*), między łąkami, skarpy nadrzeczne i strome zbocza wąwozów zajmują murawy kserotermiczne (*Festuco-Brometea*). Niewielkie i nieliczne kompleksy leśne (*Quercus-Fagetum*) zachowały się na wierzchowinie i łagodnych zboczach, a nad brzegami potoków – zarośla wierzbowe (*Salicion*) i fragmenty łąk z klasy *Alno-Padion*. W uprawach zbożowych najczęściej spotykanym zespołem jest *Vicietum tetraspermae*, w okopowych *Echinochloa-Setarietum*. Ogółem stwierdzono występowanie na tym terenie 860 gatunków roślin naczyniowych, w tym 19,2% to gatunki rzadkie i zagrożone. Flora ma charakter niżowy, około 80% stanowią gatunki rodzime. Charakterystycznym rysem obszaru jest występowanie muraw kserotermicznych i wilgotnych łąk, w których obficie rosną gatunki rzadkie w innych regionach kraju.

SŁOWA KLUCZOWE: użytkowanie ziemi, zbiorowiska roślinne, wpływ człowieka, flora roślin naczyniowych, grupy ekologiczne gatunków, gatunki rzadkie i zagrożone.

APPENDIX

The checklist of classes, orders, alliances and plant associations found on the Proszowice Plateau

Class: *Rudero-Secalieta* Br.-Bl. 1936

Order: *Bidentetalia tripartitae* Br.-Bl. et R. Tx. 1943
Alliance: *Bidention tripartitae* Nordh. 1940

Assoc.: *Polygono-Bidentetum*
(Koch 1926) Lohm. 1950

Order: *Secali-Violetalia arvensis* Siss. (1943 ap. Br.-Bl. et R. Tx.) 1946

Suborder: *Polygono-Chenopodietalia* (R. Tx. et Lohm. 1950) J. Tx. 1961

Alliance: *Panico-Setarion* Siss. 1946

Assoc.: *Echinochloo-Setarietum*
Krussem. et Vlieg.
1939/1940

Alliance: *Eu-Polygono-Chenopodion polyspermi* Koch 1926 em. Siss. 1946

Assoc.: *Lamio-Veronicetum politae*
Kornaś 1950

Suborder: *Centaureetalia cyanii* (R. Tx. 1937) R. Tx., Lohm. et Prsg. 1950

Alliance: *Aperion spicae-venti* R. Tx. ap. Oberd. 1949

Assoc.: *Vicetum tetraspermae*
(Krausem. et Vlieg. 1939)
Kornaś 1950

Alliance: *Caucalidion daucoide* R. Tx. 1950
Assoc.: *Lathyro-Melandrietum*
Oberd. 1957

Order: *Onopordetalia acanthii* Br.-Bl. et R. Tx. 1945

Alliance: *Sisymbrium* R. Tx., Lohm. et Prsg. 1950

Assoc.: *Urtico-Malvetum neglectae*
(Knapp 1945) Lohm. 1950
Assoc.: *Sisymbrietum sophiae*
Kreh. 1935

Alliance: *Onopordion acanthii* Br.-Bl. 1926

Assoc.: *Echio-Melilotetum* R. Tx. 1942

Alliance: *Arction lappae* R. Tx. 1937 em. Siss. 1946

Assoc.: *Leonuro-Arctietum tomentosii* Lohm. ap. R. Tx. 1950
Assoc.: *Tanaceto-Artemisietum vulgaris* Br.-Bl. (1931) 1949

Alliance: *Alliarion* Oberd. (1957) 1962

Assoc.: *Chaerophylletum bulbosi*
R. Tx. (1931) 1937

Order: *Potentillo-Polygonetalia* R. Tx. 1947

Alliance: *Polygonion avicularis* Br.-Bl. 1931
Assoc.: *Lolio-Plantaginetum*
(Lincola 1921) Beger 1930

Order: *Convolvuletalia sepium* R. Tx. 1950

Alliance: *Senecion fluviatilis* R. Tx. (1947) 1950

Assoc.: *Cuscuta-Convolvuletum sepii* R. Tx. 1937

Assoc.: *Rudbeckio-Solidaginetum*
R. Tx. et Raabe 1950

Class: *Isoëto-Nanojuncetea* Br.-Bl. et R. Tx. 1943

Order: *Cyperetalia fusci* (Klika 1935) Muller-Stoll et Pietsch

Alliance: *Nanocyperion flavescentis*

Assoc.: *Centunculo-Anthocerotum*
(Koch 1926) Moor. 1936

Class: *Potamogetonetea* R. Tx. et Prsg. 1942

Order: *Lemnetalia* Koch et R. Tx. 1954

Alliance: *Lemnion* R. Tx. 1955

Assoc.: *Lemno-Spirodeletum polyrrhize* Koch 1954 em. Mull. et Gors 1960

Order: *Potamogetonetalia* Koch 1926

Alliance: *Potamogetonion* Koch 1926 em. Oberd. 1957

Assoc.: *Potamogetonetum lucentis*
Hueck 1931

Assoc.: *Myriophyllo-Nupharetum*
Koch 1926

Class: *Phragmitetea* R. Tx. et Prag. 1942

Order: *Phragmitetalia* Koch 1926

Alliance: *Phragmiton* Koch 1926

Assoc.: *Scirpo-Phragmitetum* Koch 1926

Assoc.: *Acoretum calami* Kobendza 1948

Assoc.: *Glycerietum maximae*
Hueck 1931

Alliance: *Glycerio-Sparganion* Br.-Bl. et Siss. 1942

Assoc.: *Glycerietum plicatae*
(Kulcz. 1928) Oberd. 1954

Alliance: *Magnocaricion* Koch 1926

Assoc.: *Caricetum ripariae* Soó 1928
Assoc.: *Caricetum acutiformis*
Sauer 1937

Assoc.: *Caricetum distichae*
(Nowiński 1928) Jonas 1933

Assoc.: *Caricetum gracilis*
(Graebn. et Hueck 1931) R. Tx. 1937

Assoc.: *Phalaridetum arundinaceae*
Libb. 1931

Class: *Scheuchzerio-Caricetea fuscae* R. Tx. 1937

Order: *Caricetalia Davallianae* Br.-Bl. 1949

Alliance: *Caricion Davallianae* Klika 1934
Community with *Eriophorum latifolium*

Class: *Molinio-Arrhenatheretea* R. Tx. 1937

Order: *Molinietalia* Koch 1926

Alliance: *Filipendulo-Petasition* Br.-Bl. 1947
Assoc.: *Filipendulo-Geranium*
palustre Koch 1926

Alliance: *Calthion* R. Tx. em. Oberd. 1957

Assoc.: *Cirsio-Polygonetum bistortae* R. Tx. 1951

Assoc.: *Cirsietum rivularis* Ralski 1931

Assoc.: *Scirpetum silvatici* Knapp 1946

Alliance: *Molinion* Koch 1926
 Assoc.: *Molinietum medioeuropaeum* Koch 1926
 Order: *Arrhenatheretalia* Pawł. 1928
 Alliance: *Arrhenatherion elationis* (Br.-Bl.) Koch 1926
 Assoc.: *Arrhenatheretum medioeuropaeum* (Br.-Bl. 1919) Oberd. 1952
 Alliance: *Cynosurion* R.Tx. 1947
 Assoc.: *Lolio-Cynosuretum* R. Tx. 1937
 Class: *Festuco-Brometea* Br.-Bl. et R. Tx. 1943
 Order: *Festucetalia valesiaceae* Br.-Bl. et R. Tx. 1943
 Alliance: *Festuco-Stipion* (Klika 1931) Krausch 1961
 Assoc.: *Sisymbrio-Stipetum capillatae* Dziub. 1925/6, Kozł. 1928
 Alliance: *Cirsio-Brachypodion pinnati* Hadač et Klika 1944 em. Krausch 1961
 Assoc.: *Inuletum ensifoliae* Kozł. 1925
 Assoc.: *Thalictro-Salvietum pratensis* Medw.-Kor. 1959
 Community with *Brachypodium pinnatum*

Class: *Quercio-Fagetea* Br.-Bl. Vlieg. 1937
 Order: *Populetales albae* Br.-Bl. 1931
 Alliance: *Salicion* Soó
 Assoc.: *Salicetum triandro-viminalis* (R. Tx. 1931) Lohm. 1952
 Assoc.: *Salici-Populetum* (R. Tx. 1931) Meier Drees
 Order: *Fagetalia silvaticae* (Pawł. 1928 n.n.) R. Tx. et Diemont 1936
 Alliance: *Alno-Padion* Knapp 1942 em. Medw.-Korn. ap Mat. et Bor. 1957
 Assoc.: *Circae-Alnetum* Oberd. 1953
 Alliance: *Carpinion betuli* Oberd. 1953
 Assoc.: *Tilio-Carpinetum* Traczyk 1962
 Order: *Prunetalia spinosae* R. Tx. 1952
 Alliance: *Rubion subatlanticum* R. Tx. 1952
 Community with *Rosa canina-Prunus spinosa*
 Alliance: *Prunion* R. Tx. 1952
 Community with *Cerasus fruticosa*
 Class: *Vaccinio-Piceetea* Br.-Bl. 1939
 Order: *Vaccinio-Piceetalia* Br.-Bl. 1939
 Assoc.: *Pino-Quercetum* Kozł. 1925