LANDSCAPE AND VEGETATION STUDY AS A BACKGROUND FOR COMPLEX NATURE PROTECTION PROPOSAL IN THE UPPER PŁONIA R. VALLEY (WESTERN POMERANIA)

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ABSTRACT

The differentiation of vegetation and flora of the upper Płonia R. valley in Western Pomerania was discussed in relation to distribution of components of natural environment. Causes of landscape transformation and direct types of human impact on vegetation were analysed. The obtained results have shown trends in the transformation of the valley's landscape, which can be summarised as a continuous change from anthropogenic agricultural landscape to a more natural one. It was concluded, that uncontrolled continuation of the recorded processes will lead, among others, to the decrease in biodiversity. For that reason a proposal for integrated landscape and nature management has been elaborated. It combines classical methods of protection (establishment of protected areas) with administrative and managerial measures, such as active management of biotopes outside the reserves and co-operation with non-profit organisations, in achieving protection goals at the scale of the whole landscape.

KEY WORDS: agricultural landscape, brook valley, human impact, vegetation, flora, nature management

INTRODUCTION

With the continuous decrease in area of natural landscapes, the agricultural landscapes are becoming increasingly interesting for nature conservationists. This switch in interests is even more pronounced as, on the one hand, the majority of the remaining natural areas has already been protected and, on the other hand, there is a marked withdrawal of agriculture from less productive sites. The latter often concerns places of unsuitable physiography, unfeasible to farm under new economical conditions. Valleys of small lowland rivers, situated within a reach of the last glaciation (Pomeranian stage of Vistulian glaciation) belong to this category of areas (Buliński 1993; Herbach and Górski 1994). They often display a contrasting differentiation of environmental conditions over a relatively small distance, ranging from xerothermic sites on slopes to spring-water supplied ecosystems in the depressions and gorges. This, combined with the withdrawal from different forms of land utilisation, offers a unique opportunity for the controlled restitution of nature. A goal of this paper is to characterise and evaluate the vegetation of the upper part of the Płonia River valley in relation to relevant natural features and types of human impact. This should become a background for complex nature protection proposal for the area.

MATERIALS AND METHODS

Geobotanical investigations were carried out within natural, geomorphological borders of the valley, covering an area of

ca. 4432 ha (Fig. 1). Flora was studied in all habitat types (except of the segetal vegetation) during the years 1987-1993. Nomenclature of vascular plants follows Flora Europaea (1964-1980), that of mosses Corley et al. (1981), and of hepatics Frahm and Frey (1983). Phytosociological investigations were carried out according to the classical method of Braun-Blanquet (1964). Approximately 1300 vegetation records were used for identification of vegetation units and their spatial distribution. Original tables are included in the paper of Bacieczko (1995). To detect trends in transformation of flora and vegetation during ca. last 60 years, a detailed comparison of the present data with historical data of Libbert (1938), was performed. Original locations of vegetation records of Libbert were recognised in the field with maximal possible accuracy, and were used as sites of present floristic and phytosociological investigations. To enable the comparison of data, the syntaxonomic system used by Libbert has been re-interpreted, according to the present state of phytosociological knowledge.

To establish a spatial relationship between the present vegetation type and the relevant environmental conditions – in selected ecosystems, e.g. springs and mire complexes, the landscape – ecological cross-section method (Wołejko 1996b) was applied. Data were collected on the network of permanent transects established mainly across the valley bottom and the lower part of slopes. Sampling points were selected on transects subjectively, according to physiognomic change in vegetation. In each point a vegetation relevee was made. In the middle of the plot a peat boring was made with the "Russian type" sampler, and macro-rests and decomposition grade were analysed in the field. Selected samples were taken for labora-

Fig. 1. Situation of the upper Plonia R. valley and the location of investigation sites.
1 - border of geobotanical investigations; 2 - border of landscape analyses; 3 - permanent landscape-ecological transects; 4 - watercourses; 5 - lakes; 6 - build-up areas.

tory analyses which included microscope examination of plant remnants in peat, as well as ash and calcium carbonate content in peat, gyttia and travertine. All sampling points on the transects were levelled by use of optical levelling instruments. In some points on selected transects water samples were taken from spring outflows, rivulets, ditches or depressions in mire surface. Groundwater levels were measured in piezometers established in peat. Water samples were analysed by specialised hydrochemical laboratory.

Trends in transformation of landscape of the valley were analysed by use of a variety of historical cartographic materials. Analyses concerned a majority of area of the valley proper, but included also parts of the surrounding agricultural uplands (Fig. 1). Present situation was evaluated by use of maps, aerial photographs and by direct inquiry to land owners. The basic map scale used was 1:25 000. A historical topographic map from the year 1936 has been used as the background for figures presenting natural and transformed landscape elements (Figs. 2 and 4).

STUDY AREA

The study area is a headwater fragment of the Płonia River valley in Western Pomerania (NW Poland), stretching for about 18 km down from its sources. The southern limit of the valley is the Barlinek Lake, situated near the town of Barlinek, and considered to be one of the sources of the Płonia River. The northern limit has been set at the shores of the Płoń Lake. The area is situated in the north-western part of the Myślibórz Lakeland meso-region (Kondracki 1981), and, according to administrative division, it belongs to the Gorzów and Szczecin voivodeships.

Relief, geology and soils

The valley originates within a ridge of marginal moraine, that marks a maximal phase of Pomeranian Stage of the Baltic glaciation (Karczewski 1968). South from that line lies an extensive outwash plain, small fragments of which are also contained in the valley. To the north the valley dissects a ground moraine. In this part the highest denivelations are observed, reaching about 90 m between the valley bottom level and that of the surrounding, morainic uplands. Further north, the slopes are less steep, as the valley enters the more gently undulated area of the Pyrzyce ice-dammed basin, filled with sediments of the Pleistocene period.

The valley cuts through a sequence of strata, layers of which are exposed on its slopes. Relatively uniform cover of glacial till occupies flat plateaux bordering the valley and the uppermost parts the slopes. At the slopes usually fluvioglacial sands, sometimes of considerable depth, are exposed. Especially this layer is further dissected by numerous side gorges and side valleys (Koćmit 1988). In places the lower layer of till, underlying sands, is exposed in the lower part of the slope. Large part of the valley bottom is covered with fluvioglacial deposits. Northwards from about the middle of the studied valley course, the importance of Pleistocene sedimentation basin deposits increases.

Peatlands fill the remaining part of the valley bottom space. Variety of peat types have been recognised within the valley (Wolejko 1982). They all belong to fen peats, representing nutrient rich conditions during the growth of mires.

Soils which have developed from glacial till belong mostly to brown soil and luvisol (lessives) soils category. Because of their situation on slopes, often their development is not complete, and their profiles show signs of re-juvenation due to ac-

tivity of erosive forces (Koćmit 1988). At the feet of the slopes the presence of deluvial sediments is pronounced. They are relatively rich in organic matter and display high moisture content. Fluvioglacial sands form a parental material for rusty soils and podzol soils. Peat soils are mostly highly decomposed and transformed to different types of moorsh.

Historical land use and change in hydrological conditions

The investigated part of the Płonia R. Valley is situated at the verge of so-called "Pyrzyce wheat-soil region", fertile soils of which were cultivated already in the Neolithic times (Borowiec 1960). Ever since that period, human activity has been present in that area. The establishment of a Cistercian monastery in Kolbacz in the year 1173 has been associated with important changes in the hydrological system of the valley (e.g. construction of dams, rise in lake levels). These activities, material effects of which lasted for almost five centuries (until 1770), must have affected the upper course of the valley, by setting a new, higher erosion base, thus influencing the erosion / accumulation balance of wetlands along the river (cp. Wolejko et al. 1994; Wolejko 1996a). The retention in the area was further enhanced by the establishment of several water mills (Braun 1926; Brzustowicz 1995).

In the eighteenth century large drainage works were commenced in the valley. Destruction of medieval dams and construction of new channels exposed large tracts of land, to be used mostly as grasslands. By the year 1890 virtually all the wetlands on the valley bottom have been dissected with a network of drainage ditches, and the course of Płonia river has been regulated. Only some side brooks maintained their unchanged shape, however several small streams, especially those supplying watermills, have also been regulated. The conservation of the drainage system took place, among others, in 1937 (remark by Libbert 1938) and after the World War II.

The War marked important changes in the functioning of the landscape of the area. These included the disappearance of individual homesteads and the change in the ownership of land. The first factor resulted from the general depopulation of the area and the physical destruction of buildings (Fig. 4). The latter, related to the change in location of agricultural centres, resulted in abandonment of several access roads, now distinguishable in the landscape only as belts of thorny bushes. New land division and lesser agricultural pressure from individual farmers resulted in a withdrawal from cultivation of several fragments of the valley. In the 1960 ties agricultural land occupied 50.6% of the study area (including 19.7% of meadows and pastures) forests occupied 39.0 %, open water 3.2%, and the remaining 7.2% was covered with man-made infrastructure (houses, roads, etc.). Some parts of land (4.9%) already belonging to "wasteland" category, were still classified within "agricultural land" category (Bacieczko 1995).

Socio-economical changes of the eighties and nineties accelerated the speed of transformations. The complete breakdown of state farms resulted in neglecting large tracts of land in the valley. While richer, not very steep, mineral soils are still cultivated by private tenants, the poorer slopes and especially the drained peatlands are almost completely abandoned. Instead, there is a growing pressure on transforming the wetlands into fish ponds, which is usually preceded with unauthorised peat exploitation (Fig. 4). Moreover, fish-pond owners, in a quest for continuous water supply, canalise and drain the still untouched spring ecosystems in the gorges. Large quantities of water are being polluted and wasted in this process, due to improper dike construction and high permeability of the used material.

Fig. 2. Relationship between abiotic environment and distribution of selected vegetation types in the upper Plonia R. valley.

1 – morainic till; 2 – sands and gravels of outwash plain; 3 – older fluvioglacial sands; 4 – fluvioglacial valley deposits; 5 – deposits of the Pleistocene sedimentation basin; 6 – drained peatland; 7 – riverbeds and canals; 8 – lakes; 9 – erosion gorges; 10 – spring vegetation; 11 – seepage vegetation; 12 – oak-hornbeam forest; 13 – xerothermic grassland.

Fig. 3. Vegetation zonation (A) and simplified mire stratigraphy and typology (B) at Transect A, across the eastern side of Płonia R. valley bottom. 1 – small sedge – brown moss peat; 2 – tall sedge peat; 3 – spring deposits; 4 – mineralized peat; 5 – gyttia.

RESULTS

Flora and vegetation

Flora of the upper part of the Płonia R. valley consists of 745 plant species, including 91 taxa of bryophytes and 654 species of vascular plants. This represents 47.3% of Western Pomeranian flora, accounted for 1575 species (Czubiński 1950). Several of them are rare or interesting from botanical point of view, and their distribution in the valley has been presented in earlier papers Bacieczko (1992; 1993; 1996). Among 28 species protected by law, found in the investigated area, the most valuable are: 4 species of orchids, *Trollius europaeus*, *Lilium martagon*, *Galanthus nivalis* and about 400 flowering specimens of *Hedera helix*. As many as 56 species are rare in Poland (Zarzycki 1984) and another 59 occur rarely in Western Pomerania. Among them are: *Linum austriacum*, *Scutellaria altissima*, *Orobancha reticulata*, *Cicerbita alpina*, *Sonchus paluster* and *Juncus subnodulosus*. Sixteen species, registered on the endangered species list (Zarzycki and Szeląg 1992), mostly occupy sites dependent directly from hydro-ecological regime. Here belong *Parnassia palustris*, *Dianthus superbus* and *Trollius europaeus*. Regionally endangered, according to Jasnowska and Jasnowski (1977) are *Dianthus superbus*, *Blysmus compressus*, *Juncus subnodulosus*, *Parnassia palustris*, *Carex lepidocarpa*, *Hydrocotyle vulgaris*, and others. Other floristic attractions, rare on regional scale, are *Arum maculatum*, *Corydalis solida*, *C. intermedia*,

Anthericum ramosum, *Bromus erectus*, *Astragalus cicer* and *Vicia sylvatica*.

Due to specific physiographic and microclimatic conditions a relatively high number (21 taxa) of species representing mountain flora (in the wide sense) has been recorded in the valley. Their localities are mostly found in the deep, moist gorges, covered with shadowy forests. Here belong: *Alnus incana*, *Sambucus racemosa*, *Viola mirabilis*, *Cicerbita alpina*, *Stellaria nemorum* and others.

A comparative analysis of historical (Libbert 1938) and present-day floristic data revealed the disappearance of 95 plant species in the Upper Płonia valley during the last 60 years. The list of extinct species consists mostly of the rare elements of forest-, dry grassland-, mire- and water-plant communities. It includes *Grimia pulvinata*, *Riccia glauca*, *Lycopodium annotinum*, *Silene chlorantha*, *Vaccaria pyramidalis*, *Helianthemum ovatum*, *Ostericum palustre*, *Chimaphila umbellata*, *Marrubium vulgare*, and many other. The present-day flora is richer by 45 species. Among them special value for the flora of Pomerania represent: *Scutellaria altissima*, *Cicerbita alpina* and *Wolffia arrhiza*.

An anthropogenic character of the flora is stressed by the occurrence of 88 non-native species (anthropophytes). Of these the archeophytes are the most numerous (46 species). Very expansive species of anthropophytes are, among others: *Vicia grandiflora*, *Alopecurus myosuroides* and *Impatiens parviflora*.

Fig. 4. Landscape transformations in the upper Plonia R. valley (at the background of historic topographic map from 1936).

1 – extent of forests in 1890; 2 – extension of forest area until 1936; 3 – extension of forest area until 1996; 4 – newly established fish ponds; 5 – disappeared homesteads.

The present-day vegetation, consisting of 105 elementary units (Tab. 1), has been classified, according to syntaxonomic criteria into 20 classes, 26 orders and 44 alliances (Baciczko 1995). The highest share in area of vegetation cover have forest associations (39.04%), but the most numerous are associations of the *Phragmitetea* class (19 associations) and the *Molinio-Arrhenathereta* class (15 associations). The third most numerous group (15 units) form synanthropic syntaxa belonging mostly to the *Artemisietea* class. The most interesting phytocoenoses in the valley are: *Wolffietum arrhizae*, *Lemno-Utricularietum*, *Stratiotetum aloidis*, *Ranunculetum fluitantis*, *Nuphareto-Nymphaetum albae*, *Juncetum subnodulosi*, and *Asplenietum trichomano-rutae-murariae*.

According to Libbert (1938) 35 associations and plant communities were present in the valley. They represented 15 vegetation classes, 22 orders and 27 alliances, regarding the present-day syntaxonomy. The occurrence of only 22 associations has been confirmed in the present investigations, while the remaining 13 associations have disappeared. These included five water- and wetland communities (*Glycerieto - Sparganietum neglecti*; *Scirpus setaceus - Stellaria uliginosa* ass.; *Caricetum inflato - vesicariae*; *Caricetum lasiocarpae*; *Carex panicea* comm.), six syntaxa of xerothermic grasslands and warm forests (*Corynephoretum typicum*; *Brachypodium pinnatum* ass.; *Aira caryophyllea* comm.; *Rhacomitrium canescens* comm.; *Calluna vulgaris* comm., *Juniperus communis* comm.), and two field associations (*Scleranthus annuus - Myosurus minimus* ass.; *Panico - Chenopodietum polyspermi*). Associations still existing at present are missing at 34 previous locations. They are also poorer in species, and show the transformed structure (Baciczko 1995). For example *Juncetum subnodulosi*, have lost many species, recorded 60 years ago. Nevertheless, it remains the association richest in floristic rarities (Baciczko 1996).

Differentiation of vegetation in relation to natural environment and human impact

A survey of vegetation units encountered in the upper Płonia valley is presented in Table 1 in relation to their typical position in the landscape. Several typical water-, marsh, and wet forest phytocoenoses occupy habitats typical and well described in the scientific literature. Their existence in the Płonia valley is also dependent from typical forms of human impact, such as water pollution and uncontrolled recreational activities. Some new habitats for water vegetation have been created in the process of fish-pond construction. For that reason more detailed information is presented below in respect to vegetation units showing close relationship to local natural features of the valley and to prevailing human-induced processes.

A trial to associate 4 selected vegetation types with major physiographic elements is presented in Fig. 2. The chosen vegetation types represent four contrasting habitats: springs, partly-drained peatlands, mesophytic mineral soils and dry slopes.

A position of a series of communities, occupying drained mire complex, is presented at the exemplary cross-section of the valley bottom (Transect A - Fig. 3). In the stratigraphic cross-section three ecological mire types (Succow 1988) are recognisable. Parts close to the Płonia River represent a terrestrialisation mire (or basin mire), formed after filling-up with gyttia of a large basin lake. Its surface gradually merges with a soligenous sloping fen (percolating mire), developed under strong influence of the upwelling groundwater. A hanging

spring mire occupies the uppermost position. It is found in a slope gorge, directly below active spring outflows. All mire parts have been badly damaged due to direct human impact, especially drainage (visible as numerous ditches at Transect A). For that reason mires accumulate no more peat, but undergo destruction, with all known consequences for their biota (Wolejko 1996a, b). After drainage the peatlands were cultivated as grasslands, but later they have been abandoned, which initiated rapid successional changes.

Spring vegetation, represented by a group of plant communities of *Montio - Cardaminetea* class (Tab. 1) and some so-called "independent bryophyte communities" is present, almost exclusively, in the spring outflows. Such sites are found at the margins of a hanging spring mire. Active erosion processes, leading, in long-time perspective, to the destruction of spring-mire body, are enabling survival of specialized bryophytes and other stenothermic organisms (Wolejko et al. 1994).

The term "seepage vegetation" relates to a group of plant communities found in drained fens, but in places still soaked with groundwater rich in dissolved calcium. Such conditions exist in the central part of Transect A, in depressions remaining after overgrowing of previous drainage ditches. Analysis of peat stratigraphy (Fig. 3B) reveals in that place the remnants of so-called percolating mire, where original, peat-forming, small sedge - brown moss vegetation was fed by laterally inflowing groundwater. The present vegetation mosaic consists of transformed meadow communities (*Juncetum subnodulosi*, *Calthion* meadow, *Molinia coerulea* vegetation) and varieties of sedge communities (*Caricetum paniculatae*, *Caricetum acutiformis*), containing also number of meadow elements. Distribution of seepage vegetation type in the valley is marked in Fig. 2 by the localities of *Juncetum subnodulosi*. The switch from rich meadow vegetation to more uniform sedge communities must be attributed to cessation of mowing and simultaneous blocking of drainage ditches. Depending upon wetness conditions and time from abandonment different plant associations occur, including tall forb, shrub and forest margin communities. In wetter places on spring mires they tend towards spring alderwood - *Cardamino - Alnetum glutinosae*. Drier sites, occasionally inundated or receiving silty material from denuded slopes, are finally overgrown by wet forests dominated by alder (close to the river) or by ash (on previous spring fen at the foot of mineral slopes). All these communities are classified as forms of *Circae - Alnetum*, including stands of *Alnus incana*, occupying sandy mineral island in the middle of peatlands (Fig. 3A).

Heavily drained spring cupolas with strongly decomposed peat are occupied by an extremely eutrophic form of reed vegetation, resembling *Urtico - Phragmitetum* (Succow 1988) or by patches of *Urtico - Sambucetum* bush.

The distribution of the oak-hornbeam forests (*Galio sylvatici - Carpinetum*) is restricted to the denuded slopes of the valley, and especially of the side gorges. There glacial and fluvioglacial deposits are being continuously exposed on the slopes in a process of "soil re-juvenation". This position and ecological situation corresponds well with the description of similar vegetation in the valleys of Kashubian Lakeland (Herbich 1994). Secondary beechwoods (*Luzulo pilosae - Fagetum*) occupy small area on the valley slopes. The steepest gorges at the margins of the Płonia valley were the only places where mesophytic forests were present at the beginning of the XXth century (Fig. 2). Sandy soils were covered with different types of pinewoods and mixed forests. Since then a continuous growth in forest area has been observed, on the expansion of the cultivated land, and especially the slope grasslands

[illegible]

TABLE 1. Vegetation of the upper Płonia valley (cont.)

F. Mesophytic grasslands			
47.	<i>Potentilletum anserinae</i> (Rapaics 1927) Pass. 1964	roads in fields and meadows, forest roads, hills within the valley, road sides, margins of pine woods and mixed forests, meadows on peat and seepage places within soligenous fens	
48.	<i>Lolio-Plantaginetum</i> Beger 1930 em. Siss. 1969		
49.	<i>Prunello-Plantaginetum</i> Faliński 1963		
50.	<i>Junco inflexi-Menthetum longifoliae</i> Lohm. 1953		
51.	<i>Arrhenatheretum medioeuropaeum</i> (Br.-Bl. 1919) Oberd. 1952		
52.	<i>Dactylis glomerata</i> – <i>Phleum pratense</i> meadow		
53.	<i>Filipendulo-Geraniatum</i> Koch 1926		
54.	<i>Epilobium hirsutum</i> comm.		
55.	<i>Equisetum palustris</i> Steffen 1931		
56.	<i>Cirsio-Polygonetum</i> R.Tx. 1951		
57.	<i>Scirpetum sylvatici</i> Knapp 1946		
58.	<i>Juncetum subnodulosi</i> Koch 1926		
59.	<i>Epilobio-Juncetum effusi</i> Oberd. 1957		
60.	<i>Holcetum lanati</i> Issler 1936		
61.	<i>Stellario-Deschampsietum</i> Freitag 1957		
62.	<i>Alopecuretum pratensis</i> (Regel 1925) Steff 1931		
63.	<i>Junco-Molinietum</i> Prsg. 1951		
G. Forest vegetation			
64.	<i>Cardamino-Alnetum glutinosae</i> Pass. 1968	spring mires, terrestrialized lake shores and lake terraces, along the river valley verges, slopes of gorges, sunny elevations in the valley	
65.	<i>Ribo nigri-Alnetum</i> Sol.-Gorn. 1974		
66.	<i>Irido-Alnetum</i> (Bod. 1955) Pass. 1968		
67.	<i>Carici acutiformis-Alnetum</i> Pass. 1968		
68.	<i>Salicetum pentandro-cinerae</i> (Almq. 1929) Pass. 1961		
69.	<i>Quercu roboris-Pinetum</i> J. Mat. 1988		
70.	<i>Potentillo albae-Quercetum</i> Libb. 1933		
71.	<i>Circae-Alnetum</i> Oberd. 1953		
72.	<i>Galio sylvatici-Carpinetum</i> Oberd. 1957		
73.	<i>Aceri-Tilietum</i> Faber 1936		
74.	<i>Luzulo pilosae</i> – <i>Fagetum</i> Mat. 1973		
H. Shrub vegetation			
75.	<i>Urtico-Sambucetum</i> (Doing 1962) Olss. 1978		margins of <i>Carpinus</i> woods and of degraded alluvial forests; slopes withdrawn from pasturing
76.	<i>Rhamno-Cornetum</i> Pass. (1957) 1962		
77.	<i>Euonymus europaeus</i> comm.		
78.	<i>Pruno-Crataegetum</i> Hueck 1931		
H. Forest margin vegetation			
79.	<i>Campanulo-Vicetum tenuifoliae</i> Krausch 1961 em. Korneck 1974	margins of bushes in the field, along streams, by ponds in country parks, margins of deciduous forests, along forest roads, openings in pinewoods,	
80.	<i>Trifolio-Agrimonietum</i> Th. Müll. 1961		
81.	<i>Urtico-Aegopodietum</i> R. Tx. (1947) 1967 em. Drske. 1974		
82.	<i>Urtico-Calystegietum sepium</i> (Seib.) Görs et Müller 1960		
83.	<i>Aegopodio-Petasitetum hybridi</i> R. Tx. (1937) 1947		
84.	<i>Fallopia-Humuletum lupuli</i> (Pass. 1967) Brzeg 1987		
85.	<i>Anthriscetum sylvestris</i> Hadac 1978		
86.	<i>Alliario-Chaerophylletum temuli</i> (Kreh 1935) Lohm. 1949 em. 1967		
87.	<i>Epilobio-Geraniatum robertiani</i> Lohm. apud Oberd. 1967		
88.	<i>Torilidetum japonicae</i> Lohm. 1967		
89.	<i>Impatiens parviflora</i> comm.		
90.	<i>Astragalus glycyphyllos</i> comm. Balcerk. 1976 n. n.		
91.	<i>Vicia sylvatica</i> comm.		
I. Ruderal and segetal vegetation			
92.	<i>Convolvulo-Agropyretum</i> Felf. (1942) 1943		road sides, balks, silty shores of newly build ponds, roadside slopes, bush verges, rubbish dumps, rubble heaps, ancient walls (city walls and ruins of churches)
93.	<i>Reynoutria sachalinensis</i> comm.		
94.	<i>Saponaria officinalis</i> comm.		
95.	<i>Tussilago farfara</i> comm.		
96.	<i>Onopordetum acanthii</i> Br.-Bl (1923 n.n) 1936		
97.	<i>Rumici obtusifoliae-Urticetum dioicae</i> (Kulcz. 1928) Kornaś 1968 aff.		
98.	<i>Armoracia lapathifolia</i> comm.		
99.	<i>Polygono-Matricarietum matricarioides</i> (Siss. 1969) R.Tx. 1972		
100.	<i>Bryo-Saginetum procumbentis</i> Diwm., Siss. et Westh. 1940		
101.	<i>Urtico-Malvetum neglectae</i> (Knapp 1945) Lohm. 1950		
102.	<i>Leonuro-Arctietum tomentosum</i> (Felf.) Lohm. ap. R. Tx. 1950		
103.	<i>Leonuro-Ballotetum</i> R. Tx. et V. Rochow 1942 em. Pass. 1955		
104.	<i>Brometum tectorum</i> Bojko 1934		
105.	<i>Asplenietum trichomano-rutae-murariae</i> (Kuhn 1937) R. Tx. 1937 aff.

Fig. 5. Plan of the integrated landscape and nature management system for the upper Plonia R. valley.

1. border of the Landscape and Culture Park; 2 – border of protection zone; 3 – nature reserve (numbers refer to Tab. 2); 4 – ecological management zone; 5 – country estate and greenery for restoration.

TABLE 2. Proposed nature reserves in the upper Płonia R. valley.

Name	Reserve category	Protection type	Area (ha)	Protection objectives	Important vegetation types	Peculiarities of flora
1. „Źródła Płoni” ("Płonia Springs")	scenic/ mire	strict partial	3.17 29.21	eroding spring complex and spring mire with typical vegetation	<i>Cardamino – Alnetum</i> ; <i>Circae – Alnetum</i> var. <i>Mercurialis perennis</i> ; spring bryophytic communities	<i>Cratoneuron commutatum</i> , <i>Pellia fabbronia</i> , <i>Cardamine flexuosa</i> , <i>Circaea alpina</i> , <i>Lathraea squamaria</i>
2. „Grądowa Dolina” ("Hornbeam Valley")	scenic	partial	72.89	landscape complex: springs and spring mires in the gorges; mesotrophic lake; stream in an eroding brookvalley	<i>Galio sylvatici – Carpinetum</i> ; <i>Ribo nigri – Alnetum</i> ; <i>Cardamineto – Chrysosplenietum</i> ; <i>Juncetum subnodulosi</i>	<i>Conocephalum conicum</i> , <i>Carex cespitosa</i> , <i>Equisetum hyemale</i> , <i>E. pratense</i> , <i>Galium sylvaticum</i> , <i>Hedera helix</i> , <i>Juncus subnodulosus</i> , <i>Lathyrus niger</i> , <i>L. vernus</i> , <i>Nuphar lutea</i> , <i>Nymphaea alba</i> , <i>Viola mirabilis</i> f. <i>alba</i> , <i>Sanicula europaea</i>
3. „Wilcze Jary” ("Wolf's Gorges")	scenic/ floristic	strict partial	10.45 46.06	steep slopes of gorges with old trees (<i>Fagus</i> , <i>Tilia</i> , <i>Carpinus</i> and <i>Quercus</i>) and massive occurrence of flowering <i>Hedera helix</i> . Active spring complex	<i>Galio sylvatici – Carpinetum</i>	<i>Galanthus nivalis</i> , <i>Corydalis intermedia</i> , <i>Cystopteris fragilis</i> , <i>Vinca minor</i> , <i>Polygonatum odoratum</i> , <i>Valeriana sambucifolia</i>
4. „Janowskie murawy” ("Warm Grasslands by Janowo")	floristic	partial	60.94	scenic slopes of gorges and the Płonia valley with xeromorphic vegetation; hornbeam woods with rare species and wet alluvial forests	fragments of warm oakwood, thorny bushes of <i>Prunus spinosa</i> .	<i>Pulsatilla pratensis</i> , <i>Genista tinctoria</i> , <i>Ajuga genevensis</i> , <i>Bromus erectus</i> , <i>Lychnis viscaria</i> , <i>Stachys recta</i>
5. „Wąwozy pod Żydowem” ("Ravines by Żydowo")	forest	strict partial	27.61 25.35	gorges with oak-hornbeam wood with old trees (<i>Quercus</i> , <i>Fagus</i> , <i>Acer</i> and <i>Cerasus</i>) and rare herb species	<i>Galio sylvatici – Carpinetum</i>	<i>Actaea spicata</i> , <i>Cystopteris fragilis</i> , <i>Polypodium vulgare</i> , <i>Primula veris</i>
6. „Łęgi źródłkowe pod Chrapowem” ("Spring Ashwoods by Chrapowo")	scenic/ mire	strict partial	16.02 23.60	landscape complex of active springs and hanging spring mires, nutrient rich spring ashwoods and abandoned spring fen meadows	<i>Cardamino – Alnetum</i> ; <i>Circae – Alnetum</i> , <i>Juncetum subnodulosi</i>	<i>Fragaria viridis</i> , <i>Juncus subnodulosus</i> , <i>Lychnis viscaria</i> , <i>Sonchus palustris</i> , <i>Primula elatior</i> , <i>Ribes nigrum</i> , <i>Valeriana dioica</i>
7. „Skalisty Jar Libberta” ("Libbert's Rocky Gorge")	geological /scenic/ floristic	partial	33.21	deep, forested gorge with rich undergrowth. Conglomerate rocks on slopes	<i>Aceri – Tiliatum</i> , <i>Galio sylvatici – Carpinetum</i> , <i>Luzulo pilosae – Fagetum</i> , <i>Circae – Alnetum</i>	<i>Arum maculatum</i> , <i>Cicerbita alpina</i> , <i>Corydalis solida</i> , <i>C. intermedia</i> , <i>Lathyrus niger</i> , <i>Neottia nidus-avis</i> , <i>Scutellaria altissima</i> , <i>Viola mirabilis</i> f. <i>alba</i> , <i>Vicia sylvatica</i>

(Fig. 4). Xerothermic grasslands occupy typical sites: slopes exposed to a lot of sunlight. Two groups of xerothermic plant communities can be distinguished (Tab. 1) – those occupying sandy (usually lower) parts of slopes contain a number of *Sedo* – *Scleranthetea* class elements. Communities of the second group are developed on richer, loamy soils at the upper margin of slopes and contain several elements belonging to *Arrhenatheretalia* order. With the withdrawal of farming the dry grasslands are gradually overgrown with bushes and forests. This poses a serious threat to the survival of xerothermic vegetation in the Płonia valley.

Anthropogenic vegetation is scattered and covers little area in the valley. It is associated with human settlements, roads and railroads. Vegetation of previous country parks, cemeteries and ancient stone walls contributes to biological diversity of the valley. It often plays an important role as the only reminder of old farming methods and sign of old settlements (Fig. 4). Some, probably previously cultivated species, have also invaded more natural communities, where they form healthy populations of species rare in Polish flora (Bacieczko 1993).

CONCLUSIONS

NATURE MANAGEMENT IN AN ANTROPOGENIC LANDSCAPE

As it has been shown, the area of the upper Płonia valley can be classified as an old agricultural landscape. Its vegetation and environment have been undergoing dynamic changes, both in space and time. The processes, most important for the present state of nature in the valley can be summarised as follows:

- almost complete disappearance of original (peat-forming) vegetation of mires due to their drainage, exploitation and other forms of transformation;
- rapid succession, leading to the disappearance of several semi-natural communities (especially all kinds of grasslands) due to the abandonment of traditional cultivation methods, expansion of forests and change in settlement pattern;
- transformation of site conditions (e.g. eutrophication due to mineralisation of peat and by waters discharged from over-manured agrocoenoses and fish-ponds);
- creation of new habitats for selected groups of organisms (e.g. construction of new fish ponds).

For the reasons mentioned above very few places in the valley have remained natural in the strict meaning of the word. In spite of that, and due to suitable socio-economical circumstances, the variety of valley fragments represent high conservation value and should be preserved by all available means. The most valuable areas are concentrated on valley slopes and in the gorges.

To counter the negative changes in nature of the upper Płonia valley, and promote positive transformations, a complex of measures is proposed. It consists of a set of classical nature protection methods, combined with an attempt to control the situation at the scale of the whole landscape by a number of organisational and managerial activities. The proposed nature protection system, outlined in Fig. 5, consists of:

- establishment of a landscape park, covering the whole area of the upper Płonia Valley. It has been proposed that the landscape park should become an extension of the already

existing "Barlinek – Gorzów Landscape Park" (Agapow et al. 1992; 1993). Proper management policy for that area at the local level, based on ecological guidelines (Wolejko 1992), have already been included in the new commune master plan (Cykalewicz T. et al. 1993);

- creation of a network of nature reserves, containing the best preserved or regenerated elements of nature. The establishment of seven nature reserves has been proposed (Tab. 2), one of which has already been formally created (Bacieczko, Agapow 1992).
- selection of areas for active landscape management, outside of the reserves. There, proper active methods are to be applied, enabling survival of semi-natural ecosystems, dependent from traditional ways of management e.g. farming. Guidelines for management are to be formulated basing on the studies on dynamics of transformations, carried out on the network of permanent transects (Fig. 1). The ecotope concept (Naveh, Liberman 1984) should be used, and the measures should be related to the particular set of environment – human impact interactions. This form of management is especially important for wetland areas remaining in the hands of private owners. The implementation of methods should be ensured by a system of contracts between the authorities and the owners;
- promotion of local activities, such as those proposed by a heritage- and environment protection-oriented, non-profit organisation "Młyn Papiernia" in Barlinek. It includes the rehabilitation and management of previous country estates and greenery, restoration of old village cemeteries, country roads, etc. as well as the recreation of old farming methods (Cykalewicz M. 1996);
- extension of complex management and protection to the remaining parts of Płonia river valley (Szczecin District) to ensure the functioning of an ecological corridor of regional importance and the protection of drinking water supply for the city of Szczecin (Cykalewicz, Wolejko 1995).

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STUDIA KRAJOBRAZOWO – GEOBOTANICZNE JAKO PODSTAWA
KOMPLEKSOWEGO PROJEKTU OCHRONY ŹRÓDLISKOWEJ DOLINY PŁONI
NA ZACHODNIM POMORZU

STRESZCZENIE

Rozpoznano zróżnicowanie flory i szaty roślinnej źródłiskowego odcinka doliny rzeki Płoni na zachodnim Pomorzu. Przeprowadzono analizę czynników naturalnych, odpowiedzialnych za przestrzenne zróżnicowanie roślinności i krajobrazu doliny, oraz oceniono wpływ człowieka w czasach historycznych i współczesnie. Uzyskane wyniki pozwoliły określić trendy w przekształceniu środowiska doliny, wyrażające się w postępującym unaturalnianiu się dawnego krajobrazu rolniczego, poddanego w przeszłości silnej presji człowieka. Ponieważ kontynuacja stwierdzonych procesów prowadzi, w niektórych wypadkach, do negatywnych skutków dla różnorodności biologicznej doliny, zaproponowano wprowadzenie zintegrowanego programu ochrony i kształtowania krajobrazu. Uwzględnia on zastosowanie klasycznych metod ochrony (powołanie parku kulturowo-krajobrazowego i sieci rezerwatów oraz aktywne kształtowanie ich biotopów) jak też przedsięwzięć organizacyjnych (umowy z właścicielami terenu, współpraca z organizacjami nieprofesjonalnymi) na terenach poza rezerwatami, dla osiągnięcia założonych celów ochrony i kształtowania całego krajobrazu doliny Płoni.

SŁOWA KLUCZOWE: krajobraz rolniczy, dolina, antropopresja, roślinność, flora, kształtowanie krajobrazu.