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CONCEPTION OF A RED LIST OF TERRESTRIAL PLANT COMMUNITIES IN GDAŃSK POMERANIA

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Abstract: A red list of terrestrial plant communities in Gdańsk Pomerania has been compiled (Pomerania, northern Poland). This list is based on the concept of a two-part scale of threats to plant communities, which defines the threat of loss of their territory (quantitative changes) and threats resulting from qualitative changes in their phytocoenoses. Moreover, the list comprises information regarding genesis, regeneration periods, types of threats and methods for protecting particular communities.

Key words: red list, plant communities, nature conservation, northern Poland.

INTRODUCTION

The role of red lists and red books in modern nature conservation is unquestionable, and their application is a matter of commonly observed standards, especially in reference to species. In this light, it is of great concern that progress concerning work on red lists of plant communities or different types of biotopes exemplified by them is incomparably lower and poses a large contrast. Among several attempts concerning plant associations, it is necessary to mention the first published red lists prepared in Schleswig-Holstein (Dierssen 1983, 1988) and Czech (Moravec et al. 1983; Moravec 1986) and some next prepared soon (e.g. Bohn 1986; Knapp et al. 1986). Until now the only red list compiled in Poland related to plant communities in the Wielkopolska Province (Brzeg and Wojterska 1996). On the other hand, red lists of biotopes have been elaborated in Germany (Riecken et al. 1994), Waddensee (von Nordheim et al. 1996) and the marine and coastal zone of the Baltic Sea (HELCOM 1998). Within the confines of the latter, the first Polish study was prepared (HELCOM 1998; Herbich and Warzocha 1999). The following conception comprises the author's proposal to create threat criteria for plant communities and illustrates the possibility of their application in Gdańsk Pomerania as an example.

Those studies directly connected with the red list of plant communities conducted thus far were financed from several sources, namely grants from the University of Gdańsk (grant BW-1100-5-0115-6), the Nature Conservation and Water Management Provincial Fund in Gdańsk (WFOŚ/D/210/46/2001) and grant KBN 6P04F 049 21. The latter, which is currently being realised, is supposed to lead to the establishing of a red book for the communities of Gdańsk Pomerania based, among others, on a detailed penetration of the region, which will lead to learning about the complete register, diversity and distribution of plant communities, their origins and dynamics, as well as forms and degeneration grades of phytocoenoses. This data will serve to describe hemeroby grades based on definite changes observed in the phytocoenoses (comp. Sukopp et al. 1981).

STUDY AREA

The materials used in this article were gathered in the Gdańsk Pomerania region, which is approximately identical to the area of the former Gdańsk Province. As interpreted by Kondracki (1978), this region includes the eastern part of South Baltic Coastland (Żarnowiec Highland, Kashubian Coastland, the eastern part of the Słowińskie Coastland, Reda-Łeba Pradolina

= Reda-Łeba Ice Marginal Valley), the Vistula Delta, the northern part of the Lower Vistula Valley, Kashubian Lakeland, Starograd Lakeland and the northern part of Tuchola Forests and Charzykowy Plain. This area is strongly varied as concerns natural conditions, such as the duration, intensity and character of human impact; the mutual overlapping of both those groups of factors results in an especially interesting contemporary diversity of plant cover (quoted from Herbich and Herbichowa 1998 and lit.).

MATERIAL AND METHODS

The collection of data concerning threatened plant communities of this region intended for the creation of a red list was inspired by Dierssen (1983). In this study, the author's own experience and knowledge of the area was used, gained over thirty years of research and observation of the plant cover of Gdańsk Pomerania. Numerous regional localities of the most precious and endangered phytocoenoses were visited repeatedly in order to observe and describe changes in time, as well as their reaction to applied conservation measures (Herbich 1994, 2001, unpubl. data; Budyś and Doborzyńska 1999; Szawdzin and Woźniak 1999).

Due to the preconceived conceptional character of the article, as well as the author's scientific specialisation, the record of those communities presented has been limited to terrestrial phytocoenoses. Moreover, such an approach results from the fact that the complete register of water communities in this region has not been known up until now (Szmeja oral inf.), and the literature points to considerable gaps in the knowledge of the distribution of common water communities (comp. Tomaszewicz 1979). Another very little-known group of communities is the ruderal vegetation in cities. However, in regard to the goal of this study, it is a problem of marginal importance.

RESULTS

The author's concept of the red list comprises a double scale of threats and some selected features of threatened plant communities, which are essential for the estimation of threats and effective conservation. They are syngenesis, regeneration ability of a totally destroyed phytocoenosis and biotope, main anthropogenous threat factors and conservation methods. One detailed endangerment scale defines quantitative threats connected, among others, with the number of localities and the loss of their territory, while the other defines endangerment resulting from qualitative changes taking place inside a phytocoenosis or a locality (deterioration, degradation, destabilisation of the structure, etc.). Besides the two detailed scales, a sumarial assessment was established, which is adjusted to a higher level of threat. The author's own scale, presented in this paper, in relation to the loss of area criterion, is mainly based on red lists of biotopes (Blab et al. 1995; Riecken et al. 1994; HELCOM 1998; Nordheim et al. 1996; Herbich and Warzocha 1999), whereas the criteria of the qualitative changes were mainly taken from Dierssen (1983, 1988) and, to a certain extent, correspond with the scale of the loss of biotope quality (Blab et al. 1995; Riecken et al. 1994; HELCOM 1998; Nordheim et al. 1996; Herbich and Warzocha 1999). The syngenesis of communities was developed by means of Faliński's conception (1969), extended by the author. The other criteria are of the author's own innovation.

The inventive scale proposes digital marking of threat categories. Partial application of the letter scale was considered, which is commonly used in reference to species. However, such solution was abandoned because the criteria of inclusion into definite threat categories, applied in the new IUCN formulation (IUCN 1994; Głowaciński 1997), correspond with the strictly defined sizes of populations of endangered species and the area occupied by them. Correspondingly, implementation of these categories in reference to plant communities could be misleading. Perhaps the application of such scale could be possible after completing work on the red data book of plant communities of the Gdańsk region. The use of digital symbols was also prompted by the comparability of contents of the symbols used in red lists of communities and biotopes constructed in Western Europe according to assumptions similar to those in the author's list, which constitutes their continuation and development.

A complete explanation of the applied categories is appended below, and Table 1 constitutes the components of red list with their implementation. The table includes exclusively threatened land communities with proven occurrence in the region.

CONCEPT OF CRITERIA FOR THREAT ASSESSMENTS AND SELECTED FEATURES OF THREATENED PLANT COMMUNITIES (used in Tables 1-4)

Syngenesis of plant communities

Classification criteria were taken from Faliński (1969) and extended by the author, whereas classification of particular communities was carried out according to Brzeg and Wojterska (1996) and the author's unpublished data.

NP perdochoric natural community (disappearing under the influence of man)

NA auxochoric natural community (spreading under the influence of man)

NN natural "neutral" community (partly spreading, party disappearing)

SNP semi-natural perdochoric community (disappearing under the influence of man)

SNA semi-natural auxochoric community (spreading under the influence of man)

SN semi-natural "neutral" community (partly spreading, party disappearing)

X xenospontaneous community (built by strange species on non-degraded habitats)
SS synanthropic segetal community
SR synanthropic ruderal community

Regeneration ability
The phytocoenosis' and its biotope' ability to regenerate after destruction is its notable feature, characteristic of particular types of plant communities and their biotopes. It also depends to a great extent on local factors such as, for example, a distance between the localities of species capable of recolonising destroyed areas. The assessment is supposed to provide rough guidelines, because the regeneration period depends on the extent of destruction, and also on whether or not the change has had a direct effect on either the plants or the biotope. The following criteria concern the regeneration period of a biotope; they have been taken from Riecken et al. (1994) and Nordheim et al. (1996) and modified in order to fit plant communities. The regeneration period of a phytocoenosis in a locality that has not been destroyed can be much shorter.

N Regeneration impossible. Plant communities connected with biotopes whose regeneration is not possible in historical times. It includes for example raised bogs and primeval forests
K Regeneration hardly possible, the time of which can only be defined in historical time (>150 years)
S Regeneration difficult (lasting 15–150 years). Occupancy by some typical plant and animal species may last longer
B Regeneration conditionally possible (< 15 years in favourable circumstances, but certain typical species may take longer to return)
X Classification not meaningful. It concerns spreading anthropogenous communities and succession or dynamic stages of a very short-term occurrence

Threat of direct destruction – loss of area (quantitative changes) – DE
This criterion specifies direct losses of the area occupied by particular plant communities and the numbers of these localities. Criteria by Blab et al. (1995), Riecken et al. (1994), Helcom (1998), Nordheim et al. (1996), Herbich and Warzocha (1999) were altered, among others, in connection with the necessity of adjusting them to plant communities.

0 Completely destroyed (total loss of area, extinct) – was applied exclusively in relation to those communities, which are irrefutably documented to have existed in the past; this concerns the last couple of dozen years.
1 Threatened by complete destruction (dying out, immediate danger of total area loss) – the community still exists, but only in a small part of the former range. Unless protected, they are expected to become extinct in the near future and their further survival is not very probable as long as threat factors exist or if conservation activities are not undertaken.
2 Heavily endangered – the community is seriously threatened or receding in almost the whole primary range area. As long as threat factors exist, the community can find its place in category 1.
3 Endangered – a general tendency for the disappearance of the major part of the area. These may appear regionally and locally, in many places they are already extinct.
P Potentially threatened – communities with a regionally small or very small number of localities. They have not been directly endangered so far, but a small number of localities cause potential destruction risks. Rare regional communities were also taken into account, the phytocoenoses of which are protected by nature reserves.
/ Threatened some forms of communities (or the assessment concerns only some forms of communities)
* Presumably not endangered at present
? No data available or dubious information

Threat by qualitative changes – loss of quality – QU
Endangerment of existing phytocoenoses caused by qualitative changes, occurring independently of a decrease in acreage. This criterion qualifies threats to plant communities caused by qualitative changes, such as changes of habitats, phytocoenosis degeneration in the phytosociological sense (such as loss of species, neophyte invasion, structural changes, etc.) These criteria were mainly provided by Dierssen (1983, 1988)

0 Completely destroyed – typical or natural forms of plant communities are completely destroyed
1 Threatened by complete destruction – very intense disappearance of characteristic species, the strong limiting of habitat amplitude or essential changes in species composition
2 Endangered – the conspicuous disappearance of characteristic species or certain forms of the community, or the manifestation of changes in species' composition
3 Slightly endangered, scantly visible, often just local changes connected with degradation
P Potentially endangered – biotopes especially sensitive to qualitative changes. They do not belong to any other category, but their low level of immunity and the fact that they appear in few localities are deciding factors, which place them in the potentially endangered category
* Presumably not endangered at present. The lack of certain species can be caused by natural factors
? No data available or dubious information

Overall assessment – Σ

Direct destruction and qualitative changes are combined to provide an overall assessment which, in fact, ranks higher among both detailed criteria (DE and QU)

- 0 Completely destroyed
- 1 Threatened by complete destruction
- 2 Heavily endangered
- 3 Endangered
- P Potentially endangered
- * Presumably not endangered at present

Main anthropogenous threat factors

- A agriculture
- AI intensified cultivation in fields, meadows and pastures, intensified use leading to the transformation of semi-natural communities into intensively used green crops
- AA cessation of use leading to the spontaneous overtaking of meadows and fallows, depending on habitat conditions and on the former community, by tall grasses, sedges, perennial plants, shrubs or trees
- AD degeneration caused by improper use
- AG transforming of vegetable gardens into flower gardens, grass lawns, etc., often in connection with changes in building character from village type to recreation type
- AP use of herbicide within the vicinity and causing accidental sprays
- AF "wasteland" afforestation
- D coastal defence, straightening and strengthening of river banks
- B construction industry (housing, recreational, industrial, road building, etc.)
- E eutrofication (incl. eutrofication of mires caused by the air)
- F forestry (logging, changes in treestands)
- FD tree invasion leading to the development of forests, e.g. in moderately used heathlands
- M mining (of peat, sand, gravel, etc.)
- N changes within the closest vicinity (especially concerning dependent communities)
- P pollution (non-eutrofication) of air, soil and water
- R recreation (beating tracks, camping, horse riding, bicycle riding)
- S improvement of sanitary conditions of districts, tidying of areas surrounding houses, roadsides, forest edges, etc.
- W water regulation (changes in water conditions)
- WD drainage, lowering of the ground water level
- WF disappearance or shortening of the time of inundation and floods
- WM forcing or stopping horizontal water flow
- Y military activities

Conservation methods

Protection of autochtonous factors

- Habitat protection
  - BC maintenance of natural habitat conditions (passive conservation)
  - BS stabilisation of habitat conditions
  - BR reconstruction of natural (or former) habitat conditions
  - BN creating and/or management of new habitats, incl. *ex situ* protection
  - BP conservation of natural processes creating the habitat
  - BA simulation of natural factors or processes
- Protection of the phytocoenosis
  - FP passive conservation (incl. strict conservation)
  - FS stabilising protection (stabilisation)
  - FR renaturalisation
  - FA active protection (excl. stabilisation and renaturalisation), corrective measures, treestand reconstruction, removal of young trees in non-forest communities (excluding renaturalisation and stabilisation)
  - FI artificial creation of phytocoenoses (incl. *ex situ*) imitating natural ones of spontaneous origin

Protection of allochtonous factors

- AS maintenance of current forms of use, stabilisation
- AT restoring traditional, old and frequently extensive forms of use, elimination of pesticides
- AP partial maintenance of current forms of use (excluding some of their elements, e.g. fertilisation)
- AN agricultural use of neighbouring areas
- AI simulation of old forms of use (e.g. primitive small area exploitation of peat)
- / concerns some types of communities

THE RED LIST OF PLANT COMMUNITIES

The existence of 120 threatened terrestrial plant communities among the 173 terrestrial plant communities present in Gdańsk Pomerania has been proven. Natural communities prevail and, with respect to the number; they comprise 62% of threatened communities (Tab. 1, 2, 3). In the case of the destruction of phytocoenoses and biotopes, regeneration is generally either difficult or even very difficult and, in the case of some mires – impossible. The possibility and pace of regeneration depends on the degree of deformation of the phytocoenosis and, above all, on the extent of changes which have taken place in the biotope. Some communities are capable of regenerating in post-exploitation areas, unless water conditions have been changed. Some communities are locally related to various stages of development of vegetation in the former exploitation hollows; this diversity of factors concerning the transformations of vegetation and biotopes in the mires is the reason for such

Table 1. Red list and selected features of threatened terrestrial plant communities in Gdańsk Pomerania

Syntaxon	Syngenezis	Regeneration ability	DE Loss of area	QU Loss of quality	Σ Overall assessment	Main anthropogenous threat factors	Way of conservation
Ammophiletea Br.-Bl. et R.Tx 1943							
Ammophiletalia Br.-Bl. 1933							
Ammophilion borealis Br.-Bl. 1933 em. R.Tx. 1955							
Elymo-Ammophiletum Br.-Bl et De Leeuv 1936	NP	S	2	2	2	D	BP, BR, FP, FR
Cakiletea maritimae R.Tx. et Prsg 1950							
Atriplicetalia litoralis Sisingh 1946							
Atriplicion litoralis (Nordh. 1940) R. Tx. 1950							
Atriplicetum litoralis Libbert 1940	NP	B	2	2	2	D, S	BC, FP
Bidentetea tripartiti R.Tx., Lohm. et Prsg 1943							
Bidentetalia tripartiti Br.-Bl. et R.Tx. 1943							
Bidention tripartiti Nordh. 1940							
Polygono-Bidentetum (Koch 1926) Lohm. 1950	NN	B	3	3	3	D, W	BP, FP
Chenopodion fluviatile R.Tx. 1960							
Chenopodietum glauco-rubri Lohm. 1950	SR	B	3	3	3	S	
Isoeto-Nanojuncetea Br.-Bl. et. R.Tx. 1943							
Cyperetalia fusci (Klika 1935) Müller-Stoll et Pietsch 1961							
Radiolinion linoides (Rivas Goday 1961) Pietsch 1965							
Ranunculo-Radioletum (Hueck 1932) Libb. 1939	NP	S	0?	0?	0?		
Ranunculo-Myosuretum minimi Diem., Siss. et Westh. 1940	SS	S	?	?	?	A, W	
Pottietum truncatulae	SS	S	2?	2	2	A	
Stellarietea mediae R.Tx., Lohm. et Prsg 1950							
Centauretalia cyani R.Tx. 1950							
Aperion spicae-venti R.Tx. et J.Tx. 1960 (pro ord.)							
Arnoseridenion minimae Malato-Beliz, J.Tx et R.Tx. 1960 (pro all.)							
Arnoserido-Scleranthetum (Edouard 1925) R.Tx. 1937	SS	B	*	3	3	AI	BS, FS, AS, AP
Aphanenion arvensis R.Tx. et. J. Tx. 1960 (pro ord.)							
Vicietum tetraspermae (Krusem. et Vlieg. 1939) Kornaś 1950	SS	B	3	3	3	AI	BS, FS, AS, AP
Aphano-Matricarietum R.Tx. 1937	SS	B	*	3	3	AI	BS, FS, AS
Consolido-Brometum (Denissow 1930) R.Tx. et Prsg 1950	SS	B	?	?	?	AI	BS, FS, AS
Papaveretum argemones (Libb.) Krusem. et Vlieg. 1939	SS	B	*	3	3	AI	BS, FS, AS, AP
Caucalidion lappulae R. Tx. 1960							
Lathyro-Melandrietum noctiflori Oberd. 1957	SS	B	3?	3?	3?	AI	BS, FS, AS
Sileno inflatae-Linarietum minoris J. Herbich 1993	SS	B	3	3	3	AI	BS, FS, AS, AP
Polygono-Chenopodietalia (R.Tx. et Lohm. 1950) J. Tx. 1961							
Panico-Setarion Siss. 1946							
Echinochloo-Setarietum Krusem. et Vlieg. (1939) 1940	SS	B	*	2	2	AI, AG	BS, FS, AS
comm. of *Lycopsis arvensis* (*Lycopsetum* Wójcik 1983 n.n.)	SS	B	*	3	3	AI	BS, FS, AS
Digitarietum ischaemi R.Tx. et Prsg (1942) 1950	SS	B	*	3	3	AI	BS, FS, AP
Polygono-Chenopodion Siss. 1946							
Lamio-Veronicetum politae Kornaś 1950	SS	B	*	3	3	AI	BS, FS, AS
Veronico-Fumarietum officinalis (Krusem. et Vlieg. 1939) R.Tx. 1950	SS	B	*	3	3	AI	BS, FS, AS
Spergulo-Chrysanthemetum segeti (Br.-Bl. et De Leeuv. 1936) R.Tx 1950	SS	B	*	3	3	AI	BS, FS, AS
Galinsogo-Setarietum (R.Tx. et Beck 1942) R.Tx. 1950	SS	B	*	3	3	AI	BS, FS, AS
Sisymbrietalia J.Tx. 1961							
Sisymbrion officinalis R.Tx., Lohm., Prsg 1950							
Sisymbrietum sophiae Kreh 1935	SR	B	3	3	3	S	
Hordeetum murini Libb. 1933 [=***Hordeo-Brometum*** (Allorge 1922) Lohm. 1950	SR	B	?	?	?	S, B	
Urtico-Malvetum neglectae (Knapp 1945) Lohm 1950	SR	B	3	3	3	S	
Senecioni-Tussilaginetum Möller 1949	NA	B	3	3	3	S	BP
Epilobietea angustifolii R.Tx et. Prsg 1950							
Atropetalia Vlieg. 1937 (*Epilobietalia angustifolii* R.Tx. 1950)							
Atropion belladonnae Br.-Bl. 1930 em Oberd. 1957 (=*Fragarion* R.Tx. 1950)							
Arctietum nemorosi R.Tx. 1950	NA	B	?	?	?		
Sambuco-Salicion R.Tx. et Neum. 1950							
Epilobio-Salicetum capreae Oberd. 1957	NA	B	*	3	3		
Artemisietea vulgaris Lohm., Prsg et R.Tx. in R.Tx. 1950							
Onopordetalia acanthii Br.-Bl. et. R.Tx. 1943							

Table 1 cont.

Onopordion acanthii Br.-Bl. 1926							
Onopordenion acanthi Th. Müller 1981							
Potentillo-Artemisietum absinthii Faliński 1965	SR	B	3	3	3	S	BS, FS, AS
Dauco-Melilotenion Görs 1966							
Artemisio-Tanacetetum vulgaris Br.-Bl. 1931 corr. 1949	SR	B	*	3	3	AI, AP	
Berteroëtum incanae Siss. et Tiedeman in Siss. 1950	SR	B	3	3	3	S	
Artemisietalia vulgaris Lohm. in R.Tx. 1947							
Arction lappae R.Tx. 1937 em. 1950							
Leonuro-Ballotetum nigrae Slavn. 1951	SR	B	2	2	2	S	
Chenopodietum boni-henrici Th.Müller in Seybold et Müller 1972	SR	B	3	3	3	S	
Convolvuletalia sepium R.Tx. 1950							
Senecion fluviatilis R.Tx. (1947) 1950 em. R.Tx. 1967							
Calystegio-Angelicetum archangelicae litoralis (Pass. (1947) 1959	NA	B-S	2?	2?	2?	D	BS, BR, BP, FP
Cuscuto-Calystegietum sepium R.Tx. 1947	NA	B-S	2	2	2	D, W	BC, BR, BP, FP
Agropyretea intermedio-repentis (Oberd. et all. 1967) Müller et Görs 1969							
Agropyretalia intermedio-repentis (Oberd. et all. 1967) Müller et Görs 1969							
Convolvulo-Agropyrion repentis Görs 1966							
Falcario vulgaris-Agropyretum repentis Müller et Görs 1969	SR	B	?	?	?		
Utricularietea intermedio-minoris Den Hartog et Segal 1964 em. Pietsch 1965							
Utricularietalia intermedio-minoris Pietsch 1965							
Sphagno-Utricularion Müll. et Görs 1960							
Sparganietum minimi Schaaf 1925	NP	S	1	2?	1	WD	BC, BP, BN, FP, FR, FA, AP
Scorpidio-Utricularietum minoris Müll. et Görs 1960	NP	B-K	1?	2?	1?	WD	BC, BN, FP, FR, FA, AP
Montio-Cardaminetea Br.-Bl. et R.Tx. 1943							
Montio-Cardaminetalia Pawł. 1928 em. Maas 1959							
Cratoneurion commutati Koch 1928							
Cratoneureto filicinae-Cardaminetum Maas 1959	NP	K	1	2	1	WD, E, N	BC, BP, FP
Cardaminion Maas 1959							
Pellieto-Conocephaletum Maas 1959	NP	K	1	2	1	W, E, F, N	BC, BP, FP
Cardamino-Chrysosplenietum Maas 1959	NP	S	3	3	3	WD, N	BC, BR, BP, FP
comm. of *Philonotis-Cardamine amara*	NP	K-S	2	3	2	WD, N	BC, BR, BP, FP
comm. of *Helodium blandowii-Chrysosplenium alternifolium*	NP	K-S	2	3	2	WD, N, AA	BC, BR, BP, FP
comm. of *Sphagnum teres-Chrysosplenium alternifolium*	NP	K-S	2	3	2	WD, AF, AA, N	BC, BR, BP, FD
Phragmitetea R. Tx. et Prsg. 1942							
Phragmitetalia Koch 1926							
Phragmition Koch 1926							
Sagittario-Sparganietum emersi R. Tx. 1953	NP?	B-S	2?	3?	2?	CW	BC, FP
Sparganietum erecti Roll 1938	NN?	B-S	2?	3?	2?	CW	BC, FP
Magnocaricion Koch 1926							
Cladietum marisci (Allorge 1922) Zobr. 1935	NP	S	2	3	2		BC, FP, FA
Thelypteridi-Phragmitetum Kuiper 1957	NP	S	3	3	3	W, FD	BC, FP, FA
Cicuto-Caricetum pseudocyperi Boer et Siss. in Boer 1942	NP	S	2	3	2	W	BC, FP,
Caricetum ripariae Soó 1928	NP?	B-S	2	3	2	W, D	BC, BS, FP
Caricetum distichae (Nowiński 1928) Jonas 1933	NP	B-S	2	3	2	WD, AA	BC, BS, FS, AP
Caricetum gracilis (Graebn. et Hueck 1931) R. Tx. 1937	NN	B-S	3	3	3	W	BC, BS, FS, AP
Caricetum vesicariae Br.-Bl. et Denis 1926	NN	B-S	3	3	3	W	BC, FP
Caricetum caespitosae (Cajander 1905) Steffen 1931	NN	B-S	2	3	2	AA, WD	BC, BS, FS, AP
Sparganio-Glycerion fluitantis Br.-Bl. et Siss. in Boer 1942							
Glycerietum plicatae (Kulcz. 1928) Oberd. 1954	NP	S	1	2	1	D	BC, FP, FI
Asteretea tripolium Westh. at Beeft. ap. Beeft 1962							
Glauco-Puccinellietalia Westh. at Beeft. ap. Beeft 1962							
Puccinellion maritimae (Christ. 1927) R.Tx. 1937							
Puccinellio-Spergularietum salinae (Feekes 1936) R.Tx. at Volk 1937	SNP	B	2	2	2	AI, AA, WD	BS, BR, BP, FS, AS, AT
Armerion maritimae Br.-Bl. et De Leeuv 1936							
Juncetum gerardi Nordh. 19923	SNP	B	2	2	2	AI, AA, WD	BS, BR, BP, FS, AS, AT
Koelerio glaucae-Corynephoretea Klika in Klika et Novak 1941							
Corynephoretalia canescentis R.Tx. 1937							
Corynephorion canescentis Klika 1934							
Spergulo vernalis-Corynephoretum (R.Tx. 1928) Libb. 1933	NN	B	3	3	3	AF, B	BS, BP, FP, AT
Koelerion albescentis R.Tx. 1937							
Helichryso-Jasionetum Libb. 1940	NP	S	2	2	2	D, AF	BP, BR, FP
Trifolio-Anthyllidetum maritimae Cel. et Piotr. 1965	NN	S	2	3	2	D?	BP, FP
Vicio lathyroides-Potentillion argenteae Brzeg in Brzeg et M. Wojt. 1996							

Table 1 cont.

Airetum praecocis (Schwick. 1944) Krausch 1967	SNA	B	2	3?	2	AF, B	BS, FP, AS
Diantho-Armerietum elongatae Krausch 1959	SNP	S	3	3	3	AI, AF, E	BS, FS, AT, AP
Koelerion glaucae (Volk 1931) Klika 1935							
Molinio-Arrhenatheretea R.Tx. 1937							
Plantaginetalia maioris R.Tx. (1943) 1950							
Polygonion avicularis Br.-Bl. 1931 ex Aich. 1933							
Juncetum tenuis (Diem., Siss. et Wsth. 1940) Schwick. 1944 em. R.Tx. 1950	X	B	?	?	?		
Trifolio fragiferae-Agrostietalia stoloniferae R.Tx. 1970							
Agropyro-Rumicion crispi Nordh. 1940 em. R.Tx. 1950							
Rumici-Alopecuretum geniculati R.Tx. 1937	SNA	B	3	3	3	WD, WF	BC, BS, FS, AS, AT
Blysmo-Juncetum compressi (Libb. 1930) R.Tx. 1950	SNP	B	2	3	2	AI, AA, WD	BC, BS, FS, AS, AT
Molinietalia caeruleae W. Koch. 1926							
Molinion caeruleae W. Koch 1926							
Molinietum caeruleae W. Koch 1926	SNP	S	1	2	1	AI, AA, WD, WF	BC, BP, BS, BR, FS, FA, AT
Junco-Molinietum Prsg. 1951	SNP	S	2	3	2	AI, AA, WD	BC, BP, BS, FS, AT, AP
Calthion palustris R.Tx. 1936 em. Oberd. 1957							
Angelico-Cirsietum oleracei R.Tx. 1937 em. Oberd. 1967 (=***Cirsio-Polygonetum***)	SNP	S	3	3	3	AI, AA, WD	BC, BS, FS, AS
Polygono bistortae-Trollietum europaei (Hundt 1964) Bal.-Tul. 1981	SNP	S	2	2	2	AI, AA, WD	BC, BS, FS, FR, AS, AT
comm. of *Polygonum bistorta*	SNP	S	*	3	3	AI, WD	BR, BS, FS, AS
Juncetum subnodulosi W. Koch. 1926	SNP	S	2	2	2	AI, AA, WD	BC, FS, AS, AP
Junco-Cynosuretum Sougnez 1957	SNP	S	3	3	3	AI, WD	BC, BS, FS, AS
Cnidion dubii Bal.-Tul. 1966							
Violo-Cnidietum dubii Walther in R.Tx. 1954	SNP	S	?	?	?	AI, WD	BC, BS, BP, FS, AS, AT
Arrhenatheretalia Pawł. 1928							
Arrhenatherion elatioris (Br.-Bl. 1925) Koch 1926							
Arrhenatheretum elatioris Br.-Bl. ex Scheer. 1925	SNP	S	3	3	3	AI	BS, FS, AS
Scheuchzerio-Caricetea nigrae (Nordh. 1937). R. Tx. 1937							
Scheuchzerietalia palustris Nordh. 1937							
Rhynchosporion albae Koch 1926							
Caricetum limosae Paul 1910 ex Osvald 1923	NP	K-N	2	3	2	E, P, WD	BC, BR, FP
Rhynchosporetum albae Koch 1926	NP	K-N	1	3	1	E, P, WD	BC, BR, FP
Eriophoro angustifolii-Sphagnetum recurvi M. Jasn., J. Jasn., S. Mark. 1968	NA	B-S	*	3	3	E, P, WD	BC, FP
Caricion lasiocarpae Vanden Bergh. ap. Lebrun et al. 1949							
Caricetum lasiocarpae Osv. 1923 em. Koch 1926	NP	K	3/	3	3	E, WD	BC, BR, FP
Sphagno-Caricetum rostratae Steff. 1931 em. Dierssen 1982	NA	S-K	3/	3	3	E, WD	BC, FP
Caricetum diandrae Jon. 1932 em. Oberd. 1957	NP	K	2	3	2	E, WD	BC, BR, FP, FA
Caricetum appropinquatae (Koch 1926) Soó 1938	NP	K	2	3	2	E, WD, AF	BC, BR, FA, FP
Caricetalia nigrae (Koch 1926) Nordh. 1936 em. Br.-Bl. 1949							
Caricion nigrae Koch 1926 em. Klika 1934							
Calamagrostietum neglectae (Steff. 1931) Tołpa 1956	NN	B-S	2	3	2	E, WD	BC, FP, AS, AT
comm. of *Carex buxbaumi*	NP	S-K	1	2	1	AI, AA, WD, WF, WM	BC, BR
Caricetum nigrae Br.-Bl. 1915 (incl. *Carici-Agrostietum* R.Tx. 1937)	NA	S-K	2/-3	2/-3	2/-3	AI, AA, WD, WF, WM, AF	BC, BR, FP, FS, AS, AT
Menyantho trifoliatae-Sphagnetum teretis Warén 1926 em. Dierssen 1982	NN	S-K	2/-3	2/-3	2/-3	AI, AA, WD, FD, AF	BC, BS, FP, FS, AS, AT
Caricetalia davallianae Br.-Bl. 1949							
Caricion davallianae Klika 1934							
Eleocharitetum quinqueflorae Lüdi 1926	NP	S-K	1	2	1	WD, AF, FD	BC, BR, FP, FA, AT
Campylio-Caricetum dioicae Osv. 1923 em. Dierssen 1982	NP	S-K	1	2-3/	1	WD, AF, AD	BC, BR, BS, AS, AT
comm. of *Carex demissa*	NP	S-K	1	?	1	WD, AF, AD	BC, BS, AS, AT
Oxycocco-Sphagnetea Br.-Bl. et R. Tx. 1943							
Erico-Sphagnetalia Br.-Bl. 1948							
Ericion tetralicis Schwick. 1933							
Ericetum tetralicis R.Tx. 1937	NP	N(S?)	1	1	1	AF, WD, FD, E	BC, BR, BS, FP, FR, FA
Junco-Trichophoretum Oberd. 1938	NP	N(S?)	1	1	1	AF, WD, E	BC, BR, BS, FP, FR, FA
Sphagnetalia magellanici (Pawł. 1928) Kästn. et Flössn. 1933 em. Dierssen 1975							
Sphagnion magellanici Kästn. et. Flössn. 1933 em. Dierssen 1975							
Sphagnetum magellanici (Malc. 1929) Kästn. et Flösn. 1933	NP	N	2	3/	2	WD, AF, AD, M, E	BC, BR, FP, FA, FR
comm. of *Eriophorum vaginatum-Sphagnum fallax* Hueck 1928 pro ass.	NP	N	2	3	2	WD, AE, M, E	BC, BR, FP, FA, FR
Ledo-Sphagnetum magellanici Sukopp 1959 em. Neuhäusl 1969 (=*S-M pinetosum*)	NP	N	2	3/	2	WD, AF, M, E	BC, BR, FP, FA, FR

Table 1 cont.

Nardo-Callunetea Prsg 1949							
Nardetalia Prsg 1949							
Violion caninae Schwick. 1944 (= *Nardo-Galion saxatilis* Prsg 1949)							
Polygalo-Nardetum Prsg 1953	SNP	S	2	3	2	AI, AA, AF	BC, BS, FS, AT
Nardo-Juncetum squarrosi Nordh. 1920 Bük. 1942	SNP	S	3	3	3	AI, AF, FD	BC, ES, AS
Calluno-Ulicetalia (Quant. 1935) R.Tx. 1937							
Calluno-Genistion Duving. 1944							
Pohlio-Callunion Shimwell 1973 em. Brzeg 1981							
Empetrion nigri Böcher 1943							
Carici arenariae-Empetretum nigri R.Tx. et Kawamura 1975 em. Barendregt 1982	NP	S	2	3	2	D, AF	BC, FP, FS
Vaccinio uliginosi-Empetretum nigri R. Markowski 1997 n.n.	NP	S	P	*	P	D, AF	BC, FP, FS
comm. of *Empetrum nigrum-Vaccinium vitis-idaea* Mark. 1997	SNN	S	3	*	3	AF, AD	BC, FP, FS
Rhamno-Prunetea Rivas Goday et Carb. 1961							
Prunetalia spinosae R. Tx. 1952							
Pruno-Rubion fruticosi R.Tx. 1952 corr. Doing 1962 em. W. Mat. 2001							
Rubo fruticosi-Prunetum spinosae Web. 1974 n.inv. Wittig 1976	NA	S	*	3	3	AP	
Berberidion Br.-Bl. (1947) 1950							
Salicion arenariae R.Tx. 1952							
Hippophao-Salicetum arenariae (Br.-Bl. et De Leeuv 1936) R.Tx. 1937	NN	S	P	?	P	WF, D	BC
Salicetea purpureae Moor 1958							
Salicetalia purpureae Moor 1958							
Salicion albae R.Tx. 1955							
Salicetum triandro-viminalis Lohm. 1952	NP	S	2	3	2	WF, D	BC
Salicetum albo-fragilis R.Tx. 1955	NP	K	1	1	1	WF, F	BC, BR, FA, FR
Populetum albae Br.-Bl. 1931	NP	K	1	1	1	WF, F	BC, BR, FA, FR
Alnetea glutinosae Br.-Bl. et R. Tx. 1943							
Alnetalia glutinosae R.Tx. 1937							
Alnion glutinosae (Malc. 1929) Meijer Drees 1936							
Myrico-Salicetum auritae (Allg. 1922) R.tx. et Pass 1961	NP	K	2/	2	2	WD, FD	BC, FS, FA, AN
Myricetum gale Jonas 1935	NP	K	2/	2	2	WD, E	BC, FP
Sphagno squarrosi-Alnetum Sol.-Górn. (1975) 1987	NN	K	2	2	2	F, WD, WM	BC, FA, FA
Ribeso nigri-Alnetum Sol.-Górn. (1975) 1987	NN	K	3	3	3	F, WD, WM	BC, FA, FA
Vaccinio-Piceetea Br.-Bl. 1939							
Vaccinio-Piceetalia Br.-Bl. 1939							
Dicrano-Pinion Libb. 1933							
Dicrano-Pinenion Seibert in Oberd. (ed.) 1992 em. W. Mat. 2001							
Cladonio-Pinetum Juraszek 1927	NP	S-K	3	3	3	F, E	BC, FA
Peucedano-Pinetum W. Mat. (1962) 1973	NN	K	3	3	3	F	BC
Piceo-Vaccinenion uliginosi Seibert in Oberd. (ed.) 1992							
Vaccinio uliginosi-Betuletum pubescentis Libbert 1933	NP	K	2	2/-3	2	F, WD	BC, BR, FA, FR/
Vaccinio uliginosi-Pinetum Kleist 1929	NP	N	2	2/-3	2	F, WD	BC, BR, FA, FR/
Quercetea robori-petraeae Br.-Bl. et R. Tx. 1943							
Quercetalia robori-petraeae R. Tx. 1931							
Quercion robori-petraeae Br.-Bl. 1932							
Betulo pendulae-Quercetum roboris R.Tx. 1930	NP	K	3	3	3	F, WD/	BC, FA
Calamagrostio arundianceae-Quercetum petraeae (Hartm. 1934) Scam. et. Pass. 1959	NP	K	2	2	2	F	BC, FA
Querco-Fagetea Br.-Bl. et Vlieger 1937							
Quercetalia pubescenti-petraeae Klika 1933 corr. Moravec in Beg. et Theurill 1984							
Potentillo albae-Quercion petraeae Zól et Jakucs n.nov. Jakucs 1967							
Potentillo albae-Quercetum Libb. 1933	SNP	K	0	0	0	AA	FR
Fagetalia silvaticae Pawł. 1928 in Pawł., Sokoł. et Wall. 1928							
Alno-Ulmion Br.-Bl. et R.Tx. 1943							
Alnenion glutinoso-incanae Oberd. 1963							
Carici remotae-Fraxinetum Koch 1926 ex Faber 1936	NP	K	P	3/	3	F, WD	BC, FP, FA
Ulmenion minoris Oberd. 1953							
Ficario-Ulmetum campestris Knapp 1942 em. J. Mat. 1976	NP	K	3	3	3	F, WD	BC, FP, FA
Carpinion betuli Issl. 1931 em. Oberd. 1953							
Stellario holosteae-Carpinetum betuli Oberd. 1957	NP	K	*	3	3	F	BC, FP, FA
Tilio cordatae-Carpinetum betuli Tracz. 1962	NP	K	2	3	2	F	BC, FP, FA
comm. of *Acer platanoides-Tilia cordata* Jutrz.-Trzeb. 1993.	NP	K	P	3	3	F	BC, FP, FA
Fagion silvaticae R. Tx. et Diem. 1936							
Galio odorati-Fagenion (R.Tx. 1955) Th. Müller 1992							
comm. of *Fagus sylvatica-Mercuralis perennis* (=***Mercuriali-Fagetum*** Cel. 1962)	NP	K	1	3?	1	F, WD	BC, BP, FA
Cephalanthero-Fagenion R.Tx. 1955							
comm. of *Fagus sylvatica-Cypripedium calceolus*	NP	K	P	3	3	F	BC, BP, FP, FA,

Explanation of symbols in text. Syntaxonomy according to Matuszkiewicz (2001)

Table 2. Number of threatened terrestrial plant communities in Gdańsk Pomerania according to their syngenesis and regeneration ability

		Number of communities	% of threatened communities
Syngenesis			
NP	Natural perdochoric communities	51	43
NA	Natural auxochoric communities	9	7
N	Natural "neutral" communities	14	12
SNP	Seminatural perdochoric communities	15	13
SNA	Seminatural auxochoric communities	2	2
SN	Seminatural "neutral" communities	1	1
X	Xenosponataneous communitities	1	1
SS	Synanthropic segetal communities	16	13
SR	Synanthropic ruderal communities	10	8
	Total	120	100
Regeneration ability			
N	Regeneration impossible	7	6
K	Regeneration hardly possible (>150 years)	30	25
S	Regeneration difficult (15-150 years)	41	34
B	Regenaration conditionally possible (<15 years)	42	35
	Total	120	100

Explanations in text

divergence as far as the length of time necessary for their regeneration is concerned (e.g. *Scorpido-Utricularietum* in a natural reservoir and in an exploitation hollow). In relation to the exceptional specificity of biotopes, their size and diversity in changes and frequently natural rarity of occurrence, raised bog communities and their organically-mineral edges and calcareous fens, as well as water bodies of various origins within the mires, belong to those most endangered. The group under heaviest threat also consists of willow and poplar alluvial forests, the remaining of which occur in one locality in the Vistula River valley; the changes occurring after disconnecting from floods by flood embankment suggest that they will soon be transformed into different types of communities, most probably of the humid oak-horbeam forest type.

Three groups of natural plant communities are discernible as regards reaction to the activity of man; these are communities disappearing under the influence of man (perdochoric, in particular those cited above and coastal dune vegetation), spreading (auxochoric – numerous forest edge and clearing communities) and "neutral" ones. The latter are disappearing in some localities, but are developing in others; the most characteristic of this group are numerous phytocoenoses of reed and sedge rushes (*Phragmition* and *Magnocaricion*). These, among others, are disappearing due to changes in water conditions, while their occurrence results, among other reasons, from the abandonment of the use of wet meadows, often located on peat. This second group of communities was not classified into either of the two categories defined by Faliński (1969); however, it is fully justified to single them out similarly as *plantae hemeradiaephore* defined by Linkola (1916, 1921) in reference to plant species. A similar categorisation can be conducted within the range of semi-natural communities: among

Table 3. Number of plant communities of Gdańsk Pomerania according to threat categories

Threat categories	DE loss of area		QU loss of quality		Σ overall assessment	
	number	%	number	%	number	%
0 Completely destroyed (extinct)	2	1	2	1	2	
1 Threatened by complete destruction	16	9	4	3	16	9
2 Heavily endangered (DE), endangered (QU)	43	25	26	15	43	25
3 Endangered (DE), slightly endangered (QU)	30	17	77	44	50	29
P Potentially theratened	5	3	-	-	2	1
* Presumably not endangered at present	70	41	55	32	52	30
? No data available	7	4	9	5	8	5
Total	173	100	173	100	173	100

Table 4. Comparison of vulnerability of plant communities in selected regions

Region	Total number of communities	Extinct communites		Threatened comunities	
		number	%	number	%
Gdańsk Pomerania *	173	2	1	118	68
Poland (only lowland & uplands) [1]	280	3	1	182	65
Wielkopolska [2]	380	4	1	258	68
Czech & Slovakia [3]	548	18	3	342	62
Schleswig-Holsten [3]	330	16	5	241	73
Lower Saxony [3]	373	14	4	308	82

* only terrestrial plant communites, overall assessment taken into account
[1] Piotrowska (1986)
[2] Brzeg, Wojterska (1996)
[3] acc. to Bohn, Fink (1986)

those disappearing are the phytocoenoses of halophilous meadows and pastures, meadows' changeable humidity level belonging to the *Molinion* and *Cnidion* and some *Calthion* wet meadows while, among those spreading, are various pasture communities and trodden areas such as roads or yards belonging to *Polygonion avicularis* and *Agropyro-Rumicion* as well as *Alopecurion* meadow communities. The latter frequently occur as a result of the degeneration of dried peat biotopes, caused by improper meadow management such as, for example, agricultural wastelands dominated by the *Deschampsia caespitosa*. Supplementing Faliński's (1969) classical categorisation with categories of semi-natural auxochoric communities and semi-natural perdochoric communities, in a similar way as with natural „neutral" ones, is hence justified.

The inclusion of particular types of communities in particular threat categories confirms, to a large extent, facts discovered in other areas (Tab. 4; comp. Piotrowska 1986; Brzeg and Wojterska 1996). Therefore, among definitely extinct communities, there is only one association – the *Potentillo albae-Quercetum*, whose last phytocoenoses of undoubtedly antropogenous origin were observed 25 years ago in the nature reserve of Wiosło Duże (Herbich 1974). There are many hints suggesting that willow and poplar alluvial forests from the *Salicion albae* alliance will become extinct in the near future.

Among those communities threatened by complete destruction (threat category 1) are associations characterised by very specific biotope demands, whose phytocoenoses, which are small in terms of the area, occur in few localities. These are mostly communities of the *Sphagno-Utricularion* alliance, some spring communities, calciphilous mires from *Caricion davallianae* and *Molinietum caeruleae*. It is conspicuous that, although the localities of these associations occur in small numbers, and this is the major cause of such a high degree of threat, the majority of the phytocoenoses show relatively smaller changes connected with degeneration (category 2). Hence, it seems that the sole securing of localities and, in the case of just one locality of *Molinietum,* the continuation and intensification of conservation activities would enable saving those communities from extinction.

Among heavily threatened communities (category 2), the largest group consists of various natural mire phytocoenoses from the classes of *Scheuchzerio-Caricetea nigrae* and *Oxycocco-Sphagnetea*, most spring communities and those associated with coastal dunes and some forms of marshy coniferous forests and, among the semi-natural ones – halophilous communities and some wet meadows. As concerns their endangerment, it is characteristic that the role of the loss of area is bigger than that of changes connected with degeneration. This is especially characteristic of the non-forest phytocoenoses – many of those still existing are of a relatively natural character, and their heaviest threat is their suppression by other vegetation types, e.g. forests, scrubs or communities of tall grasses, sedges or perennials.

The least endangered category (category 3) consists of the majority of segetal and forest communities located on mineral soils. Their phytocoenoses take up extensive areas in total and are not threatened by the loss of area (category*). In most cases, changes connected with degeneration do occur (category 3) but, compared with the total area of their occurrence; these changes do not seem to constitute a significant threat.

No serious threat has been observed concerning ruderal, forest edge, and clearing communities, or those connected with roads, meadows and pastures, which originated as a result of biotope degradation.

DISCUSSION

In studies concerning red lists of plant communities, two different approaches are used. The first approach implies the transfer of scales applied to plant and animal species, with modifications associated with the adjustment of these scales to the specifics of a higher form of organisation, namely phytocoenoses. Such solution has been exemplified by the conceptions of Piotrowska (1986) and Brzeg and Wojterska (1996). Piotrowska assumed a five-stage scale applied in Germany with reference to species (Haeupler et al. 1985;

Sukopp et al. 1978; Blab et al. 1984; Fukarek 1985). The rating of syntaxa among particular threat categories took into account the following features of those communities: geographism, historical character (e.g. relic character), occurrence frequency, ecological demands, size of the area of particular phytocoenoses, location in successive sequences (e.g. initial or climax stages), reaction to the activity of man (e.g. regression, spreading). Natural features of the communities (e.g. geographism, specificity, relic character), as well as anthropogenous factors expressed, among others, in degeneration grades of phytocoenoses, were taken into account in the rating of syntaxa among particular degeneration grades. In this scale, a clear presupposition can be seen that the rarer the community (regardless of the reasons), the more endangered it is. Unfortunately, the author quoted doesn't rate particular plant communities among any specific threat categories, just defines the criteria of syntaxa classification in particular threat groups and presents a synthetic combination of threats of entire ecological groups of plant communities in lowland Poland. Consequently, one cannot use definite examples in the discussion. However, it is difficult to agree, for example, with the rating of all spring communities as very heavily threatened. Whilst they are very specific and usually encompass extremely small areas, and no dramatic changes have taken place in the neighbouring phytocoenoses, the vegetation of the springs is relatively safe (the author's own years-long research testifies clearly to this). Their threat is most frequently due to the size of the area and the rarity of the occurrence of their phytocoenoses, and accidental destruction of particular patches (e.g. by the wallowing of wild animals) are short-lasting and temporary. It should also be added that some spring communities appear frequently in the region and sometimes they even spread.

The conception of Brzeg and Wojterska (1996) is free of the above-mentioned defects. In their conception, which consists of separate criteria, Brzeg and Wojterska isolated such features of plant communities as their syngenesis, frequency of occurrence and geographism. In this manner, they added crucial information concerning the scope of knowledge about communities in the region. However, in the face of very frequent lack of information concerning the former state of numerous plant communities, especially small and recently distinguished syntaxa, they relied, to a large extent, on the threat grades of species characteristic of those communities in the evaluation of their endangerment. Moreover, in their conception, they combined in one scale criteria concerning the disappearance of localities, as well as qualitative changes in the range of particular phytocoenoses. Another flaw of this scale, according to the author, apart from judging the value of the types of threats discussed above to one standard, is the fact that the criteria of communities are based upon the endangerment categories of their characteristic species. Such solution can, to a major extent, be an attempt to discount the fact that there is insufficient knowledge of the frequency of occurrence of communities and their threats. The author's critical remark results from yet another fact. Namely, those plant communities connected to specific habitat conditions, threatened by various influences of man, can be built through a peculiar combination of relatively frequent species, none of which is recorded on the red list. The type of endangerment defined on the basis of the species does not comply with the real threat to the plant community and its habitat conditions.

In the author's opinion, information drawn to one value simultaneously concerning the frequency of the community's occurrence and threats to its structure and biotopes in particular localities, defined by means of a single symbol depicting the threat grade, is too simplified for the assessment of the threat from the perspective of the need for effective conservation of phytocoenoses. The author's own experience supports this as well. It was gained while working on the red list of coastal biotopes (HELCOM 1998; Herbich and Warzocha 1999), as well as over many years of research on the red list of plant communities of the Gdańsk region. This reservation ensues from the fact that, in numerous instances, plant association is relatively widespread as a syntaxon, but its structure is unstable, and the species composition and biotope, altered. In such case, despite various negative changes in composition and biotope in the entire area of the occurrence of the syntaxon, the entity as such may not yet often occur. However, after transgressing a certain qualitative threshold of changes taking place inside the phytocoenoses, it suddenly begins to die out in the entire area of occurrence. An instance of an association in Poland, which became extinct in this manner, is the narrowly specialised *Spergulo-Lolietum*, connected with flax cultivation. The author's own observations suggest that succeeding plant associations will undergo a similar experience because, due to various influences, they are endangered in all of the quite numerous localities. Their number is not yet dramatically diminishing (so it is commonly believed that the threat to the association is in fact non-existent), but phytocoenoses are undergoing a fast-advancing degeneration; this process consequently leads to the extremely fast-paced disappearance of the community in all the localities (or in a substantial part thereof). Judging the value to one standard in one scale of information which, at the same time, concerns the diminishing frequency of occurrence and alterations in the structure of phytocoenoses, may hence provide a general view of endangerment, which is very misleading. In its substantial part, it may depend on an arbitrarily assumed criterion of importance of particular quantitative and qualitative factors constituting the threat criterion.

This imperfection in determining plant associations may be avoided by means of a double scale, applied exclusively so far in relation to the red list of plant communities of Szleswig-Holstein (Dierssen 1983, 1988) and red lists of biotopes (Blab et al. 1995; Riecken et al. 1994; HELCOM 1998; Nordheim et al. 1996; Herbich and Warzocha 1999). The first of these seems to still be the only red list of communities to use two scales of threat. One of several reservations concerning the construction of the scale by Dierssen (1983, 1988) that can be mentioned, includes classifying communities that are rare by nature into category 1 – "threatened", not undergoing negative quantitative or qualitative changes, the endangerment of which results solely from their rarity of occurrence (in a similar way as category R in relation to species). This defect was removed in more recently formed biotope threat criteria (Blab et al. 1995; Riecken et al. 1994; Nordheim et al. 1996; HELCOM 1998; Herbich and Warzocha 1999), namely a "potentially threatened" category was introduced, corresponding to category R (rare) used in the red lists of species. Other noteworthy information included in the red lists discussed herein takes into account the time necessary for regeneration in the case of biotope destruction (Blab et al. 1995; Riecken et al. 1994; Nordheim et al. 1996). According to the authors quoted, regeneration ability is an individual feature, characteristic of particular types of biotopes but, to a large extent, also dependent on local factors such as, for example, distances between localities of species capable of recolonising destroyed areas. The basic criterion of defining the biotope's regeneration ability is the time of the reconstruction process, as long as it is contemporarily possible at all. Accordingly, certain types of biotopes such as, for example, raised bogs and primeval forests, were acknowledged as being incapable of regenerating.

A comparison of the general participation of endangered plant communities in Pomerania and Wielkopolska, the two regions being quite similar in this respect (Tab. 4, comp. Brzeg and Wojterska 1996), is very interesting. It seems that the most notable reason for such a state of affairs is not only a similar degree of real threat to the existing communities (especially natural and semi-natural ones), but also a relatively larger number of ruderal and xenospontaneous associations, the occurrence of which has been confirmed in Wielkopolska. In this region they are not threatened and, through this, they "improve the statistics" of unthreatened communities, but the sole fact of such numerous occurrences thereof unambiguously testifies to the profound changes affecting native vegetation.

The existence of 173 terrestrial plant communities has been confirmed in Gdańsk Pomerania. On the basis of the occurrence of characteristic species and biotopes, it can be estimated that a further 59 are present; these are mainly ruderal and forest edge communities and psammophilous and thermophilous grasslands. The number of water communities may be estimated at a further 20-30. Following their identification in the area, some results concerning these statistics may change, but the numerous conclusions will still be valid.

SUMMARY AND CONCLUSIONS

The double scale of threats to plant communities used by the author (quantitative changes – loss of area and qualitative changes – loss of quality) enables a much better evaluation of endangerment than in the case of a single scale adopted from red lists of species. The additional enrichment of the classical red list with some features of threatened communities (syngenesis, regeneration ability, threat factors and conservation methods) enables a better estimation of threats and definition of main conservation methods.

In Gdańsk Pomerania, natural communities prevail with respect to the number; they comprise 62% of 120 threatened terrestrial plant communities. Semi-natural communities comprise 16%. The ratio of threatened synanthropic syntaxa is surprisingly high at 21%.

Among those communities threatened by complete destruction (threat category 1) are associations characterised by very specific biotope demands, the small phytocoenoses of which occur in few localities. These are mostly communities of the *Sphagno-Urticularion* alliance, some spring communities, *Caricion davallianae* and *Molinietum caeruleae* calciphilous mires. Among the heavily threatened communities (category 2), the largest group consists of various natural mire phytocoenoses from *Scheuchzerio-Caricetea nigrae* and *Oxycocco-Sphagnetea* classes, most spring communities and those associated with coastal dunes and some forms of marshy coniferous forests and, among the semi-natural ones – halophilous communities and some wet meadows. The least endangered category (category 3) consists of the majority of segetal and forest communities located on mineral soils. No serious threat has been observed concerning ruderal, forest edge, and clearing communities nor those connected with roads, meadows and pastures, which have originated as a result of biotope degradation.

It seems that, following a full recognition of the state of terrestrial plant communities of Gdańsk Pomerania, the fundamental proportions of the endangered and not endangered communities may undergo significant changes. Such conclusion is suggested by the fact that, in this group of phytocoenoses, whose existence has not been proven, there are numerous unspecific ruderal, forest edge communities and scrub communities, while only much fewer phytocoenoses of psammophilous and thermophilous grasslands can be rare and threatened.

Translated by Agnieszka Herbich

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