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Evaluation of nature reserves on wetland in the middle-west part of Poland

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An inventory of wetlands in Poland was completed in 1994 and it opened the possibility of starting a planned supplementation of the reserve network on wetland. For this purpose, it is necessary to carry out an evaluation of the existing objects. The studies include 52 existing and 72 planned nature reserves on wetland in the middle-west part of Poland (area of 33 600 km^2). An original evaluation method uses seven criteria, which are evaluated in a three degree scale each. On this basis three classes (highest, medium, lowest value) were assigned. Only a small number of existing reserves are found in the extreme classes. In the highest class, there are only six nature reserves. In the lowest class there are small objects with little differentiated forest communities and high endangerment by degradation. A definite majority of the existing reserves are found on fens. Raised and transitional bogs are represented by a comparatively great number of small objects not exceeding 15 ha. The representativeness of the existing reserves in relation to the plant communities encountered on the wetland of this region is not the best one.

Key words: evaluation, nature reserve, Poland, wetland

INTRODUCTION

In Poland and in Germany (Olschowy 1978) nature reserves protecting rare ecosystems were established stepwise, as the valuable objects were gradually identified. It was not a planned action with the preservation of the representativeness of the ecosystem occurring in the given physiographic mesoregion. They are a part of a network of protected areas (national and landscape parks, protected landscape areas) which occupy actually 31.1% of the country. Nature reserves occupy now in Poland 141 200 ha and 0.5% of the country (GUS 1999). Only some of them occur on wetland. A general program for protected areas exists, but there is no a special programme for nature reserves.

An inventory of wetlands in Poland was completed in 1994 (Ilnicki 1995, Ilnicki et al. 1996), and it opened the possibility of starting a planned supplementation of the reserve network on wetland. This work is being done in different regions of the country. For this reason, it is necessary to carry out an evaluation of the existing objects, and this is the objective of the present work.

MATERIAL AND METHODS

The studies include the middle-west part of Poland covering about 33 600 km^2. The basic data are the inventory and maps of wetland made by

the author in 1994 in the scale 1:100 000, on the basis of maps in 1:25 000 scale (Ilnicki 1995). The studies include 52 nature reserves established before 31.XII.1998. For each of them, the natural conditions and the existing anthropogenic endangerments were investigated. The total area of the existing wetland reserves is 5 830.2 ha. Seventy-two planned reserves of about 13 750 ha have been taken into consideration as well. Basing on the above mentioned data, an analysis was made including the type of deposits, the area and the dominating plant communities and their representativeness in relation to the communities encountered on the wetland of the region. The natural values of each nature reserve in the wetland are primarily evaluated on the basis of the following criteria:

— area of the reserve,
— rarity of the plant communities and peat deposits occurring there,
— the occurrence of protected and endangered species of plants and animals,
— degree of wetland drainage,
— degree of endangerment by degradation caused by other anthropogenic factors,
— importance for avifauna,
— distance from another reserve with similar vegetation.

Each criterion is evaluated in a three-degree scale, and each degree has a corresponding number of scores with progressing value (1 = the lowest value, 3 = the highest value). The number of scores is multiplied by the importance factor (from 1.0 to 2.0) reflecting the degree of the criterion validity. In this way, each reserve obtains a sum of scores (min. 12, max. 39) on the basis of which it is assigned to one of three classes: Class I (the highest value) > 30 scores, Class II (medium value) 21–29 scores, Class III (the lowest value) < 20 scores.

Due to the diversity of the criteria taken into consideration, the most proper seems to be the evaluation and the importance factor of each criterion. Of course, this evaluation has a subjective character. The subjectivism refers to the type and number of the selected criteria and to their accepted importance (weight). The three degree scale for all criteria is described in Table 1.

The area of the reserve is regarded as a very important criterion (weight: 2,0). When the area is small (< 10 ha), the stability and thereby the potential value of the reserve is the lowest; when the area is great (> 30 ha), the value of the reserve is the highest, because the anthropogenic influence is much lower.

The rarity of the plant communities occurring in the reserve, and the deposits of peat have been differentiated in the following way:

— low, with the occurrence of alder swamps, communities of *Molinietalia* order and extensive reed rushes on lake banks,
— medium, with marshy forests, *Magnocarice-*

Table 1. Criteria of nature reserves evaluation.

No	Criteria	Importance factor	Degree scale (scores)		
			1	2	3
1	Area of reserve	2	< 10 ha	10–30 ha	> 30 ha
2	Rarity of the plant communities and peat deposits	2	*Alnion Molinietalia Phragmitetalia*	Marshy forest Magnocaricetalia	*Scheuchzerietalia palustris Sphagnetalia magellanici Caricetum fuscae*
3	Occurrence of protected and endangered species of plants and animals	1	Small number (1 species)	Medium number (2–5 species)	High number (> 5 species)
4	Degree of drainage	2	0.5–1.0 m	0.2–0.5 m	0.0–0.2 m
5	Degree of endangerment by other anthropogenic factors	2	strong	medium	small
6	Importance for avifauna	2	small	regional	European and domestic
7	Distance from another reserve with similar vegetation	1	< 10 km	10–100 km	> 100 km

talia communities and reeds connected with them,
— high, with the occurrence of the communities: *Caricetalia fuscae*, *Scheuchzerietalia palustris* and *Sphagnetalia magellanici*.

Because of the high importance factor (2.0), the protection of the biodiversity is taken into account.

The floristic values are aditionally increased by the presence of protected and endangered species, whereby the scoring takes into consideration their number (small, medium, high). Due to the absence of detailed lists of protected plants and animals living in the investigated nature reserves, no exact boundary lines could be used. The evaluations were based on the floristic information gathered in the inventory of plant communities.

The degree of wetland drainage informs about the potential stability of the present plant communities and about the range of the existing endangerments for the peat. A distinct drainage (ground water level 0.5–1.0 m) gives the lowest evaluation, no drainage (0.0–0.2 m) gives the highest evaluation. The dominating plant communities correspond to these classifications.

The degree of endangerment by anthropogenic factors (weight: 2.0) includes the influence of the chemization of agriculture in the surrounding of the reserve, the air pollutant concentration (NO_x, NH_4, SO_2), the activity of anglers and fishermen, tourists and vacation visitors, and the utilization method of the reserve surroundings. The endangerment degree can be strong (only 1 score), medium (2 scores), or small (3 scores).

The wetland is essential for breeding, feeding and the existence of breeding birds (weight: 2.0). The ornitological valorizations (Gromadzki et al, 1994) distinguish refuges of European and domestic importance (3 scores), refuges of regional importance (2 scores), and reserves of small importance for birds (1 score). The bird population, number of species and threatened species were taken into account.

The distance of the reserve from a similar one informs about its rarity and significance (weight: 1.0). The smaller the distance (below 10 km), the lower the value; the greater this distance (over 100 km – 3 scores), the higher the value.

RESULTS

Description of nature reserves

The characteristics of the existing and planned wetland nature reserves includes the analysis of their biocenosis and areas. Fens, transitional bogs, raised bogs and wetland on mineral soils (Table 2) have been distinguished.

Among the 52 existing reserves (Fig. 1), a definite majority of objects (29), and areas (92%) are on fens. However, it must be stressed here, that among them, there is one unproportionally big (4 242.34 ha) ornitological reserve "Słońsk", where about 40% of the area is occupied by fens, and 60% by mineral soils. Raised and transitional bogs are represented by a comparatively significant number of small objects with an area usually not exceeding 15 ha.

Table 2. Wetland nature reserves in the middle-west region of Poland (state on 31.XII.1998).

Type of wetland	Existing reserves					Planned reserves					
	Area (ha)	Number	Areas of the included reserves (ha)			Area (ha)	Number	Areas of the included reserves (ha)			
			< 10	10–30	> 30			< 5	5–15	15–50	> 50
Fens	5384.58[x]	29	7	8	14	4 714	38	0	4	12	22
Transitional bogs	101.77	9	6	2	1	118	12	7	5	0	0
Raised bogs	24.64	5	5	0	0	51	4	2	1	1	0
Wetland on mineral soils	319.21	9	3	3	3	8 875	18	0	0	1	17
Total	5830.2	52	21	13	18	13 758	72	9	10	14	39

[x] = including "Słonsk" reserve (4 244.34 ha)

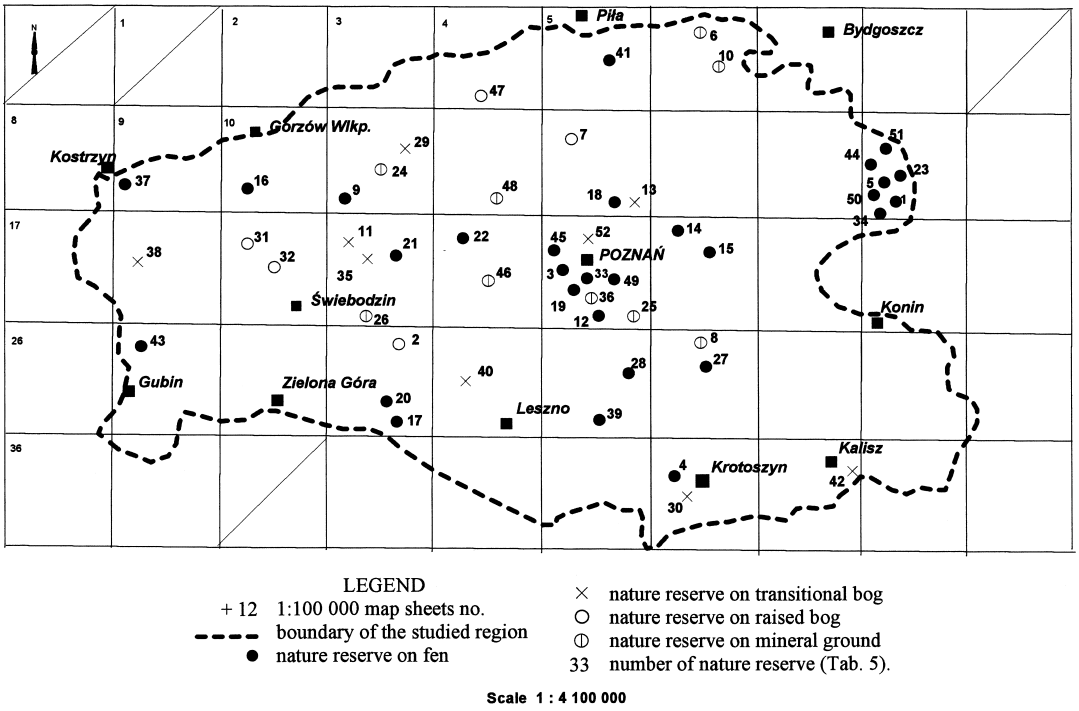

Fig. 1. Distribution of existing wetland nature reserves in the middle-west region of Poland.

In the distinguished size classes, the existing reserves are evenly distributed (Table 2.). However, their area usually is small. The contact line between the reserve and the surrounding arable land is long, and the anthropogenic influence is strong.

Among the planned 72 nature reserves, the wetland on mineral soils (8 875 ha) has a definite predominance. The area of the protected transitional and raised bogs has to be at least doubled in the future. A distinct increase of the area of planned reserves is observed. About 50% of them exceed the area of 50 ha. However, there are still 9 very small reserves (below 5 ha).

Most frequently, in the existing reserves there occur communities counted to the *Phragmitetalia* order (20 objects), and forest communities (17) where alder swamps (*Alnion*) dominate (Table 3). Small raised and transitional bogs with the communities *Scheuchzerietalia* palustris and *Sphagnetalia magellanici* are comparatively frequently covered by reserve protection (9 objects). There is a complete absence of reserves with the communities of dry meadows (*Arrhenatheretalia*). Reserves with the vegetation of the orders *Magnocaricetalia* (3 objects) and *Molinietalia* (3 objects) are rare.

The analysis of the vegetation cover of the planned reserves indicates very similar tendencies. Worth of notice is the endeavor to cover by protection bigger moist areas and marshy meadows.

The *Phragmitetalia* communities are distinctly exceedingly represented, because as many as 17.2% of their area is in the reserves. This is caused by the fact that significant areas in the valley of Warta river and the surroundings of Gopło lake, being an important refuge of breeding birds, are covered by protection (Table 4).

Raised bog communities, and particularly transitional bog communities are protected in a very high degree (8.4 and 26.3% respectively), while the meadow communities (*Molinietalia*) are protected in a minimal range (below 1%). The total area of reserves makes 1,5% of the wetland area of the region. Meadow communities, when they are excluded from agricultural utilization, they get comparatively quickly overgrown with trees and shrubs, and this explains the above situation.

Valorization of the existing nature reserves

In the highest class I, there are only 6 nature reserves: the very big ornitological valley reserve "Słońsk" situated in the landscape park "Ujście Warty", the "Sułowskie" peatland and the "Janie" lake in the region of Gorzów, the islands on the lake "Bytyń" near Poznań, a big "Wielki" lake in Pszczewski Landscape Park, as well as the peatland at "Święte" lake in the region of Leszno (Table 5, Fig. 1). As a rule, these objects have a great importance for breeding birds, they are characterized by a small drainage and a high differentiation of flora.

In class II, there is the definite majority of reserves (39 objects) with a very differentiated character. Class III is represented only by 7 objects: "Borek" and "Grocholin" in the region Bydgoszcz, Żurawiniec" a small object situated at the border of Poznań town, "Urbanowo", "Czeszewo" and "Miranowo" in Poznań surroundings, and "Baszków" near Kalisz. Most frequently they are characterized by a small area, small differentiation of vegetation, high anthropogenic endangerment and small importance for avifauna due to afforestation.

Table 3. Plant communities dominating in nature reserves including wetland in middle-west region of Poland (state in 1994).

Type of plant communities dominating in the reserve	Number of existing nature reserves within					Number of planned nature reserves within				
	Fens	Transitional bogs	Raised bogs	Mineral soils	Total	Fens	Transitional bogs	Raised bogs	Mineral soils	Total
Phragmitetalia	18	1	0	1	20	12	0	0	2	14
Magnocaricetalia	3	0	0	0	3	9	0	0	4	13
Caricetalia fuscae & davallianae	0	0	0	0	0	2	0	0	3	5
Scheuchzerietalia palustris	0	5	0	0	5	0	9	0	0	9
Sphagnetalia magellanici	0	0	4	0	4	0	0	3	0	3
Molinietalia	3	0	0	0	3	7	0	0	6	13
Arrhenatheretalia	0	0	0	0	0	0	0	0	0	0
Alnion. Salicion	5	3	2	7	17	8	3	1	3	15
Total	29	9	6	8	52	38	12	4	18	72

Table 4. Representativeness of plant communities in the existing nature reserves of the middle-west region of Poland (state in 1994).

Plant community	Wetlands in the whole region		Existing nature reserves of predominating community		Community part protected in reserves %
	ha	%	ha	%	
Phragmitetalia	11 097	2.94	1905.00[x]	32.6	17.2
Magnocaricetalia and Caricetalia fuscae & davallianae	53 934	14.30	1737.00	29.8	3.2
Scheuchzerietalia palustris	133	0.03	27.07	0.5	20.3
Sphagnetalia magellanici	426	0.11	35.88	0.7	8.4
Molinietalia	165 213	43.78	1653.00	28.3	1.0
Arrhenatheretalia	112 389	29.79	–	–	0.0
Alnion. Salicion .Pino Ledion	34 147	9.05	472.53	8.1	1.4
Total	377 339	100.00	5830.48	100.0	1.5

[x] including about 25% of open water (lakes).

Table 5. Valorization of the existing wetland nature reserves of the region.

No.	Name of reserve	Area (ha)	Valorization criteria (number of scores)							Sum of scores	Class
			Area	Rarity of plant communities	Occurrence of protected species	Drainage degree	Endangerment by degradation	Significance for breeding birds	Distance from similar reserve		
1	Bachorze	80.00	6	2	1	4	4	6	1	24	II
2	Bagna Chorzemińskie	3.76	2	6	3	6	4	2	1	24	II
3	Bagno Dębienko	21.38	4	4	1	4	4	4	1	22	II
4	Baszków	3.97	2	2	1	4	4	2	3	18	III
5	Bąbule	52.00	6	2	1	6	4	6	1	26	II
6	Borek	0.48	2	6	1	4	2	2	1	16	III
7	Chlebowo	4.42	2	6	2	4	4	2	2	22	II
8	Czeszewo	27.61	4	4	1	4	4	2	1	20	III
9	Dąbrowa na wyspie	4.40	2	4	1	4	4	6	3	24	II
10	Grocholin	12.10	4	4	1	4	2	2	1	18	III
11	Jeziora Gołyńskie	3.10	2	6	3	6	4	2	2	25	II
12	Jezioro Budzyńskie	20.90	4	4	2	6	6	4	1	29	II
13	Jezioro Czarne	17.75	4	6	3	6	4	4	2	29	II
14	Jezioro Dębiniec	37.08	6	2	1	6	6	4	2	27	II
15	Jezioro Drążynek	6.45	2	4	3	6	6	2	2	25	II
16	Jezioro Janie	51.85	6	4	2	6	4	6	2	30	I
17	Jezioro Mesze	19.85	4	4	3	6	6	4	1	28	II
18	Jezioro Pławno	16.71	4	4	3	6	6	4	2	29	II
19	Jezioro Skrzynka	6.90	2	6	3	6	6	4	2	29	II
20	Jezioro Święte	19.51	4	4	2	6	6	4	1	27	II
21	Jezioro Wielkie	236.30	6	4	2	6	4	6	2	30	I
22	Jezioro Zgierzynieckie	71.43	6	4	2	4	4	6	2	28	II
23	Kąty Kickowskie	47.00	6	2	1	6	4	6	1	26	II
24	Kolno Międzychodzkie	14.77	4	2	1	4	6	2	2	21	II
25	Krajkowo	160.46	6	4	2	4	2	6	2	26	II
26	Kręcko	65.34	6	4	2	4	4	6	2	28	II
27	Lutynia	45.58	6	4	1	4	4	2	1	22	II
28	Miranowo	4.78	2	4	1	4	2	4	2	19	III
29	Mszar nad jez. Mnich	5.83	2	6	3	6	4	2	2	25	II
30	Mszar Bogdaniec	21.98	4	4	3	4	4	2	2	23	II
31	Pawski Ług	3.67	2	6	3	6	4	2	1	24	II
32	Pniowski Ług	7.19	2	6	2	6	4	2	1	23	II
33	Pojniki	13.49	2	4	2	6	6	6	1	27	II
34	Potrzymionek	81.00	6	2	1	6	4	6	1	26	II
35	Rybojady	5.61	2	6	2	4	4	4	2	24	II
36	Sarnie Doły	2.84	2	6	2	6	6	2	1	25	II
37	Słońsk	4 244.34	6	6	2	6	4	6	3	33	I
38	Torfowiska Sułowskie	33.73	6	6	3	6	6	6	2	35	I
39	Torfowisko Gostyń	3.58	2	6	2	4	4	2	3	22	II
40	Torfowisko jez.Święte	7.59	2	6	3	6	6	4	3	30	I
41	Torfowisko Kaczory	32.77	6	6	3	4	4	4	2	29	II
42	Torfowisko Lis	4.71	2	6	2	6	2	4	3	25	II
43	Torfowisko Młodno	91.12	6	4	3	4	4	4	2	27	II
44	Trzciny Ciszewskie	53.00	6	2	1	6	4	6	1	26	II
45	Trzcielińskie Bagno	29.68	4	4	2	6	6	6	1	29	II
46	Urbanowo	7.61	2	2	1	4	4	2	1	16	III

Continued

Table 5. Continued.

No.	Name of reserve	Area (ha)	Valorization criteria (number of scores)							Sum of scores	Class
			Area	Rarity of plant communities	Occurrence of protected species	Drainage degree	Endangerment by degradation	Significance for breeding birds	Distance from similar reserve		
47	Wilcze Błoto	2.76	2	6	3	6	6	2	2	27	II
48	Wyspy na jez. Bytyn	30.84	6	4	2	6	6	6	2	32	I
49	Zalewy Nadwarciańskie	5.51	2	4	1	4	4	4	2	21	II
50	Zatoka Biała Osoba	26.00	6	2	1	6	4	6	1	26	II
51	Zatoka Sucha	58.00	6	2	1	6	4	6	1	26	II
52	Żurawiniec	1.47	2	4	2	4	2	2	2	18	III

DISCUSSION

The valorization of 910 nature reserves (including 65 peatlands) in Poland was carried out by Denisuk (1990) who presented their distribution, area, biodiversity, degree of anthropogenic transformations, touristic attractiveness, and exposure to high concentration of SO_2 in the air. The evaluation of inanimate nature reserves in Poland (Aleksandrowicz et al. 1992) was done on the basis of their subjective values, accessibility, and didactic values classifying them into three classes. The evaluation of the Polish national parks followed a similar method (Denisiuk 1992).

In Germany (Olschowy 1978), in order to distinguish protected areas, an evaluation of ecosystems was carried out taking into consideration the regional, national and international importance, and some criteria were assessed in a 5-degree scale. In the 1970's, in Germany, a general inventory of rare and endangered ecosystems were started (Biotopkartierung). Among others, that inventory aimed (through the selection of objective evaluation criteria) to obtain a representative network of nature reserves (Reidl et al. 1989). However, it did not include the valorization of nature reserves.

Ecological evaluations are always based on subjective assumptions. The subjectivism takes place in the selection of the evaluated criteria, in their 3–5 degree assessment scale and in the cumulative consideration of uncomparable parameters (Blab et al. 1994). Some evaluation parameters quoted in the literature, like genetic variability of population, stability, resistance to influences, natural development of ecosystems find no application in practice since they are difficult to define by scientific methods, or they require significant costs.

The most frequent criteria used in the evaluation include: differentiation of the structure of ecosystems, species biodiversity, rarity of occurrence, possibility of ecosystem reconstruction, the occupied area, localization in the landscape, number of species, occurrence of endangered species, habitat factors, hemeroby degree, main anthropogenic threats, representativeness, succesion trends, stability of water relations (Olschowy 1978, Reidl et al. 1989, Denisiuk 1990, Blab et al. 1994) and the presence of water fowl (Riecken 1992).

The selection of criteria used in this work has taken into consideration a significant part of the mentioned criteria as well as the range and details of data collected during the inventory of wetlands (Ilnicki 1995). It permits to perform valorizations of similar wetland ecosystems and to indicate nature reserves most endangered by degradation as well as to find objects possessing the highest natural values.

CONCLUSION

The applied method of the valorization of wetland nature reserves takes into consideration seven criteria and their importance. In the valorization of

52 reserves of middle-west Poland, only a small number of them (6–7) are found in the extreme classes of the 3-degree evaluation. The lowest evaluation is received by small objects with little differentiated forest communities and high endangerment by degradation.

The differentiated degree of the presence in the reserves of the most frequently occurring plant communities of wetland supplies some hints for the proper selection of new nature reserves. In case of meadow communities, it would require a change in the Polish actual regulations prohibiting agricultural activity in nature reserves.

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