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The vegetation of the Meggyes Marsh in the starting phase of rehabilitation

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In the middle of the last century enormous water regulation works were implemented in the flood plain of the River Tisza in order to open large areas for intensive agricultural production. In the recent past (1970s) agricultural amelioration has been the most significant of human-induced factors threatening the wetlands. Fortunately, the dominant wetland types have survived these unfavourable conditions. The remains of them are still of inestimable value for nature conservation, because alkaline marshes and shallow ponds have almost completely disappeared from other parts of Europe.
Consequently, it is the basic duty of nature conservation to preserve or restore the residual natural or semi-natural wetlands, as well as to revive the one-time connections among units that have become separated from each other. Accordingly, Hortobágy National Park aims at restoring and maintaining the original water regime of the water-related habitats in order to arrive at the most natural conditions possible.
Hydrobiological research on a rehabilitated marsh was started in 1996, the year of the first flooding, while in 1997 the investigations were completed with a vegetation survey. In the present paper, information is provided on the hydrobiological conditions observed in the area, and the principal botanical transformations of the flooded marsh are summarized. In the starting phase of the rehabilitation significant changes took place as the degraded homogenous vegetation became altered by – when considering species composition and structure – a more diverse type of vegetation. Both botanical and hydrobiological data indicated an alkaline marsh character.

Key words: Wetland, nature conservation, rehabilitation, Hortobágy National Park, Hungary

Introduction

The characteristic feature of wetlands is basically determined by hydrological factors, primarily by the dominant hydrological regime. The ecotone of wetlands plays an important role as a source of habitat diversity, which is maintained by the seasonal or annual water regime reflecting relatively significant variations (DUGAN 1990). Vegetation has an es-

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sential part in the functioning of wetlands, while on the other hand water supply and water quality have major implications for vegetation type and structure. The interactions between biotic and abiotic factors dynamically change, therefore the network of interrelating factors can only be revealed by exploring and understanding the sub-processes as well (LAKATOS 1990).

Besides preserving the structure and functioning of natural and semi-natural systems in their entirety, restoring natural systems that have been damaged and are suffering from ecological malfunctions can also be regarded as an important task for nature conservation. The preservation, conservation or – when necessary and possible –rehabilitation and reconstruction of the natural state, biological diversity and mosaic structure of wetlands, formerly a typical component of the original landscape, call for purposeful solutions and immediate action. Due to the large-scale transformation of the landscape, the natural systems were restricted to small residual areas, and as a result rehabilitation and reconstruction need increasing stress in nature conservation management. Restoration activities concentrate on the accomplishment of just the most urgent works, leaving the completion, that is the majority of the favourable processes, to nature's regenerative ability. During the first years of restoration, the artificial reintroduction of species that have become extinct should be avoided. The development of the ecological framework in the habitat has to be left to nature (GÖRI et al. 1997).

The present study is aimed at investigating the vegetation in three branches of Meggyes Marsh (Hortobágy National Park) in the initial phase of rehabilitation.

Materials and methods

Hortobágy Region (Eastern Hungary) is situated in the Great Hungarian Plain, in a shallow depression of the Middle Tisza Region covering an area of approximately 2500 km². The region used to constitute a part of the flood plains of the River Tisza. As a section of Hortobágy National Park Meggyes Marsh belongs to the Egyek-Pusztakócs Marsh System (4073 ha), which once comprised over ten thousand hectares regularly inundated by the local waterways of the River Tisza. At the end of the Pleistocene, some silty-loamy materials began to accumulate on the surface. These alluvial materials originated from the depositions of several rivers, from the present-day River Tisza and its tributaries. The area is dominated by black alkaline, soil-alkali solonetz soil. The original flora of the site was probably a combination of the vegetation types characteristic of the oxbows and backwaters along the river, as well as the various types of wetlands, temporary and permanent marshes, and water meadows in the region.

On the Egyek-Pusztakócs area alkaline marshes *(Bolboschoenion maritimi continetale)* are dominated by reeds *(Scirpo-Phragmitetum)* in deeper parts, diversified by hairweeds *(Potametea)* in open-water surface patches. The marshes are surrounded by a belt of alkaline meadows *(Beckmannion erucaeformis)* and alkaline short grasslands *(Achilleo-Festucetum pseudovinae)* representing a transition between the aquatic and terrestrial habitats. The boundaries show seasonal and interannual fluctuation in accordance with the changes in the water level. Nowadays, the natural levees along the marshes are cultivated and the small patches of grasslands are grazed.

Meggyes-lapos Marsh was formed by local waterways, as indicated by its riverbed descent from north to south and the natural levees bordering the marsh. The total length of this ancient riverbed is 1700 m, the maximum width is 500 m, and it covers 75 ha. The level differences are quite significant in the middle part of the site, for instance exceeding 3 m in some patches. As a result of the watercourse regulations and the subsequent drainage, the natural drainage basin of the site was fragmented and the marsh could collect water only from precipitation. After agricultural amelioration the marsh dried up. Due to regular reed harvesting, the southern reed bed (31 hectares) has become homogenous. Only some patches of *Glyceria maxima* and *Typha angustifolia* have survived from the originally diverse flora. In the north, tussocks can be found with the plant species of alkaline meadows and marshes, surrounded by marshy meadows with *Alopecurus pratensis (Agrosti-Alopecuretum pratensis)*. In spring 1997 the Meggyes-lapos Marsh was flooded as a part of the nature conservation rehabilitation of the whole marsh system.

The Meggyes Marsh consists of three parallel branches. One of these (Meggyes-lapos Marsh) had been completely dry and covered by dense reed bed for a long period, while the other two (Meggyes–I and Meggyes–II, 5 hectares both) have significant water coverage in spring, but dry up by the middle or end of summer.

Hydrobiological research was started in 1996, and in 1997 it was completed with a vegetation survey. Through a number of field visits a species list was compiled and during summer, transects were created in order to identify the extension of the dominant plant associations in all marshes. In September, aerial photographs were taken. In Meggyes-lapos and Meggyes-I marshes water samples were collected from March until October, while in summer vegetation mapping was carried out.

Results

The rehabilitation project has proposed the flooding of the dried marshes in a manner corresponding to the original pattern of water movements with early spring inundation. In the case of the Meggyes Marsh only the largest unit (the so-called Meggyes-lapos Marsh) has been flooded. The other two branches have still obtained water only from precipitation. The nature conservation management of Meggyes-lapos Marsh has aimed at maintaining a semistatic marsh type with the area being dried out only once a decade; the other two marshes represent an astatic type and dry out in summer. In the first year of the rehabilitation an outstandingly valuable bird life appeared in Meggyes-lapos Marsh, and consequently investigation on the relationship between water supply conditions and water quality is required, as well as between the nesting bird population and the vegetation structure (GÖRI et al. 1997).

The results of water chemistry analysis showing pH, conductivity values and Na-, Ca-, Cl-ion concentrations can be found in Figures 1, 2, 3 and 4.

The species list of vegetation in Meggyes-lapos, Meggyes-I and Meggyes-II marshes is summarized in Table 1. The coverage of the dominant plant communities in Meggyes I Marsh is presented in Table 2.

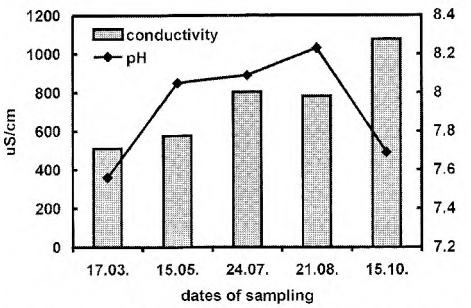

Fig. 1. pH and conductivity (Meggyes lapos, 1997)

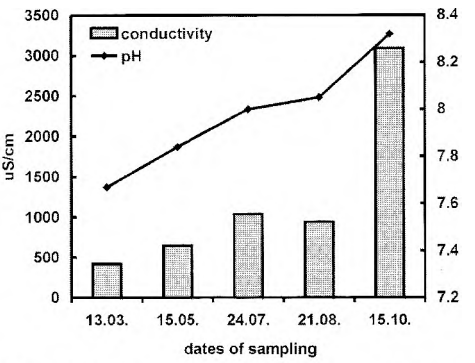

Fig. 2. pH and conductivity (Meggyes I., 1997)

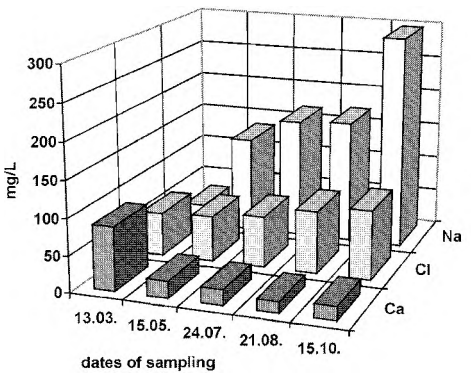

Fig. 3. Natrium, calcium and chloride concentration (Meggyes lapos, 1997)

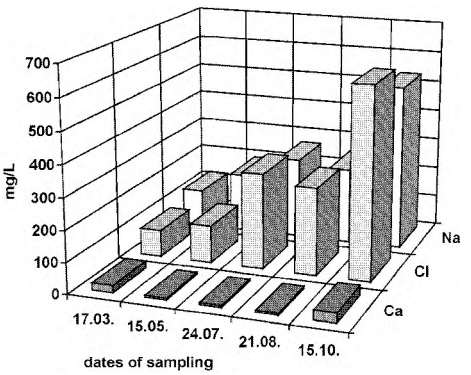

Fig. 4. Natrium, calcium and chloride concentration (Meggyes I., 1997)

Discussion

Through an integrated nature conservation management of the marsh system, the various habitat types represented by locally separated marsh units will play different nature conservation roles. This can be achieved by the integrated hydrological rehabilitation of the site. Yet it is not proposed to keep water levels stable all year in any of the marshes, but to imitate the natural water regime predominant before river regulation; for instance, during the spring inundation, marshes are flooded with different water levels and some of them are left to dry out in summer or every 5–10 years, which will maintain the temporary alkaline marsh character.

Since the originally semistatic Meggyes-lapos Marsh remained dry for decades, the most apparent changes took place in this site. After the first flooding, significant open-water patches developed in the area and hair-weed species *(Salvinia natans, Fontinalis antipyretica, Lemna minor, Lemna trisulca)* colonised them with some submerged species *(Ceratophyllum submersum). Utricularia vulgaris* appeared in remarkable density. Following the flooding of the Meggyes-lapos, the homogenous reed bed became sparser in the deepest patches, while on those parts that had formerly had temporary water cover there

Tab. 1. Hortobágy - Meggyes Marsh (August 1997), list of plants.

	Meggyes-I	Meggyes-II	Meggyes-lapos
1. *Alisma plantago-aquatica* L.		+	+
2. *Alopecurus geniculatus* L.	+	+	
3. *Alopecurus pratensis* L.	+	+	+
4. *Agrostis stolonifera* L.	+	+	+
5. *Beckmannia eruciformis* (L.) Host	+	+	+
6. *Bolboschoenus maritumus* (L.) Palla	+	+	+
7. *Carex acutiformis* Ehrh.	+	+	+
8. *Carex riparia* Curt.	+	+	
9. *Ceratophyllum submersum* L.	+	+	+
10. *Elatine alsinastrum* L.		+	
11. *Eleocharis palustris* (L.) R. et Sch.	+	+	+
12. *Glyceria fluitans* (L.) R. Br.	+	+	
13. *Glyceria maxima* (Hartm.) Holmbg.	+	+	+
14. *Lemna minor* L.	+	+	+
15. *Lemna trisulca* L.		+	+
16. *Lycopus europaeus* L.	+	+	+
17. *Lythrum salicaria* L.	+	+	
18. *Lythrum virgatum* L.	+	+	+
19. *Phalaroides arundinacea* (L.) Rauschert	+	+	
20. *Phragmites australis* (Cav.) Trin ex Steudel	+	+	+
21. *Polygonum amphibium* L.		+	
22. *Potamogeton pectinatus* L.		+	
23. *Potamogeton natans* L.		+	
24. *Rumex hydrolapathum* Huds.	+	+	+
25. *Schoenoplectus lacustris* (L.) Palla	+	+	+
26. *Schoenoplectus tabernaemontani* (C. C. Gmel.) Palla	+	+	+
27. *Sparganium erectum* L.		+	
28. *Typha angustifolia* L.	+	+	+
29. *Typha latifolia* L.	+	+	+
30. *Utricularia vulgaris* L.			+
31. *Chara foetida* A. Br.		+	
32. *Fontinalis antipyretica* Hedw.			+
33. *Salvinia natans* L.			+

Tab. 2. Coverage of dominant plant communities in Meggyes-I

Plant community	Coverage	
	m^2	%
Scirpo-Phragmitetum phragmitetosum	12,019	23.3
Scirpo-Phragmitetum typhetosum	3,135	6.1
Scirpo-Phragmitetum schoenoplectosum lacustris	2,100	4.1
Scirpo-Phragmitetum eleocharitosum palustris	20	0.1
Glycerietum maximae	200	0.4
Caricetum acutiformis-riparie	480	0.9
Bolboschoenetum maritimi	17,790	34.5
Open water surface	15,756	30.6
Total	51,500	100.0

was no change observed. In patches previously without permanent water cover (the meadow zone of the eastern shore, alkaline meadows), the vegetation started to decay, mud vegetation or shallow open-water surface began to develop. The transformation of these patches is expected to take place in the future. No change on the steep western side occurred. In July the reeds started to recover in the sparser patches, and the 50–60 cm increase – as compared to the previous spring water level – did not caused damage to the reeds. Nevertheless, a continuous alteration of the vegetation can be predicted and it is probably *Bolboschoenus maritimus* that will grow in the zone of decayed meadow vegetation.

The results of water chemistry analyses indicate seasonal changes (Figs. 1, 2, 3, 4), graduations, as well as the increase of the alkaline character in water, especially in the case of Meggyes-I, as the measured conductivity was higher than 3000 μS/cm (Fig. 2). Only two species of hair-weeds were found here, as opposed to the 6–6 species of the other two wetlands. According to vegetation mapping performed in Meggyes-I, the *Bolboschoenetum maritimi* association was dominant in this wetland with 35% coverage, while various sub-associations of the *Scirpo-Phragmitetum* association covered 34% and 31% was open-water surface. Meggyes-I particularly represents the astatic marsh type dominated by emergent macrophytes.

Botanical changes were accompanied by significant changes in the avifauna of the marshes. Before flooding the nesting bird communities of the area were characterized by very low species and individual numbers. This was replaced by a more diverse bird life. All the four grebe species nesting in Hungary appeared in the Meggyes-lapos Marsh *(Tachybaptus ruficollis, Podiceps nigricollis, Podiceps griseigena, Podiceps cristatus)*, as well as three tern species *(Chlidonias hybrida, Chlidonias niger, Chlidonias leucopterus)*. Flooding Meggyes-lapos has also had a favourable influence on the bird life of the other two marshes, where grey-lag geese, ducks, snipes and terns have started to feed.

Conclusions

The survival of protected areas and the preservation of their values can only be achieved by serious measures of an active nature conservation based upon the results of grounded research and investigation.

Thorough preliminary works are indispensable in the case of fragile wetland habitats that have been able to survive only in small remnants.

When assessing the effect of a rehabilitation work, full information on the vegetation of the starting phase can be regarded as a basic requisite, while the continuation of the investigations must constitute our primary future duty.

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