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## A PRELIMINARY REPORT ON A NEW TYPE OF FLOATING MIRE FROM HUNGARY

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### ABSTRACT

The authors studied the vegetation dynamics of *Sphagnum* dominated mires in the Bereg-plain (northeastern Hungary). The Braun-Blanquet method was applied and a new type of floating mire described. The authors suggest the name "skirt-mire" after its shape and preliminary present it in this paper. This widespread scraw formation process is observable on flooded willow mires, when willow trunks and branches grow long, bushy and hair-like additional roots close to the water surface. In the water, the abundant small floating dead plant debris mat not only with each other but also with the hairy-like willow roots and the plants at the bottom. The succession was very fast on its surface.

**Key words:** Floating mire, scraw, skirt-shaped mire, carr, *Sphagnum*, Hungarian-plain, temperate climate, continental climate

## RAPPORTO PRELIMINARE SU UN NUOVO TIPO DI ACQUITRINO FLUTTUANTE IN UNGHERIA

### SINTESI

Gli autori hanno condotto una serie di ricerche fitocenologiche in acquitrini della pianura di Bereg (Ungheria nord-orientale), nei quali predomina il genere *Sphagnum*. Con l'applicazione del metodo di Braun-Blanquet è stato descritto un nuovo tipo di acquitrino fluttuante. Gli autori suggeriscono il nome di "acquitrino tendato", vista la sua forma, e nel presente articolo ne danno una descrizione preliminare. In seguito ad allagamento, tutte le specie di salici studiate (*Salix cinerea*, *Salix pentandra*, *Salix fragilis*, *Salix alba*, *Salix aurita* ed i loro ibridi) formano radici avventizie che crescono sotto la superficie dell'acqua. Su queste lunghe radici ramificate si depositano enormi quantità di detriti organici provenienti da piante morte, risultando in una formazione "a tenda" che raggiunge il fondo dell'acquitrino. La successione vegetale è risultata molto veloce.

**Parole chiave:** acquitrino fluttuante, salici, acquitrino tendato, *Sphagnum*, pianura ungherese, clima temperato, clima continentale

## INTRODUCTION

There are several types of floating vegetation formation (Sculthorpe, 1985) occurring mainly as a tropical phenomenon known as sudd (sadd) or floatant, which according to Sculthorpe (1985) forms in two main ways.

Sudd may be pioneered by free floating plants, such as *Eichornia crassipes* and *Pistia stratiotes*, whose stoloniferous habit creates a compact floating mat spreading from sheltered marginal sites out over open water. This mat of living plants and organic debris provides a favourable rooting medium for emergent hydrophytes.

Sudd may also develop directly from fringing stands of emergent sedges extending from the shore in calm shallows. The rhizomes and roots do not become anchored in the substrate, but form a stable raft floating at a depth of a few centimetres.

By definition of Steffen (1931), the first type is like a **successional** formation of floating meadow, which develops where the water has steep banks and where the open water surface is gradually overgrown by floating or submerged aquatics.

The second type is a **simultaneous** formation of floating meadow (Steffen, 1931). This can be observed on shallow margins of the water, where rhizomes of waterside plants (e.g. *Phragmites australis*, *Typha angustifolia*, *Schoenoplectus lacustris* in temperate zone) are creeping on and where rooting in the bottom sediments continues into the open water as a self-supporting rhizome mat (Steffen, 1931; Kulczynski, 1949; Dansereau, 1957; Junk, 1970; Sioli, 1975; Låjer, 1998; Balogh, 2000a, b). However, data on the floating mire formation in *Sphagnum* dominated mires under temperate, continental conditions are sparse.

During our phytocoenological research between 1992 and 2002 on the *Sphagnum* dominated mires of the Northeast Plain in the continental temperate climate in Hungary we observed many similar and some different (and hitherto undescribed) processes of floating mire formation, which can also be found in other parts of Hungary. In this preliminary paper we present till now undescribed but widespread floating mire type.

## MATERIAL AND METHODS

### The study site

The investigated mires (Bence-tó 48°8'55" N, 22°25'35" E; Nyíres-tó 48°11'3" N, 22°30'6" E; Navad-patak 48°10'32" N, 22°30'45" E; Báb-tava 48°11'16" N, 22°29'0" E; Zsid-tó 48°11'87" N, 22°29'6" E) lie in the northeastern corner of the Great Hungarian Plain in Hungary on the Bereg-Szatmár Plain in Bereg-Szatmár County (East-Central Europe). These mires belong to the *Samicum* plant-geographical region. The mires have formed in abandoned riverbeds (silted oxbows), in a ring indicated

by Beregdaróc, Gelénes, Tákos, and Csaroda villages (Fig. 1). The fieldwork has been carried out since 1994.

In the Köppen (1923) system, the climate of the study area is Cbfx (between moderate warm and moderate cool). The mean annual number of sunny hours is ca 1950, while the annual mean temperature oscillates between 9.4 and 9.5 °C. Yearly precipitation is 630-660 mm, with 370-380 mm during the growing season (Marosi & Somogyi, 1990). The distribution and amount of precipitation and the ground water level can vary greatly in successive years.

## Methods

The Braun-Blanquet method (1951) was used to describe the vegetation dynamics. In the sample plots, species by species on a percentage scale was estimated in the case of higher plants in all of the associations. In the middle of the flooded willow and alder carr, we could proceed only on foot, swimming or by mud-walking.

We used an Irish word, "scraw", for floating mires. The coenological examinations were made in this way, which provided an opportunity to observe the mechanism of formation of the scraw. The size of the scraws was estimated by eye. Here we give the relevant interpretation of our observations.

Taxonomical and syntaxonomical nomenclature follows Simon (1992).

## RESULTS AND DISCUSSION

After natural or artificial floods, the peatmoss cushions were submerged in base-rich water and failed to survive. On these former peatmoss mires secondary scraw formation processes could be observed, whose first stage was named "skirt-mire" after its shape. They develop as follows (Fig. 2): all the willow species (*Salix cinerea*, *S. pentandra*, *S. fragilis*, *S. alba*, *S. aurita* and their hybrids) that can be found in the examined areas are able to develop adventitious roots from their shoots near the water surface after flooding. Root formation is independent of the age of the shoots of the willow species (Fig. 3). The dead broken fragments of plants floating in large quantities in the mire water mat with each other, with the long and bushy hair-shaped willow roots of stem origin and with the plant residues at the bottom of the lake. Thus a matted carpet forms, which falls as a "skirt" from the water surface to the bottom of the lake. The broken fragments deposited in the water enlarge mainly the bottom of the skirt, as the movement of the water erodes more strongly the parts near the water surface. In the first summer of their formation, the thickness of the skirts near the surface are therefore only a half to a third (20-30 cm) of that at the bottom of the bed (40-70 cm). These skirts average 3-6 m in diameter in the areas examined around individual *Salix cinerea* shrubs.

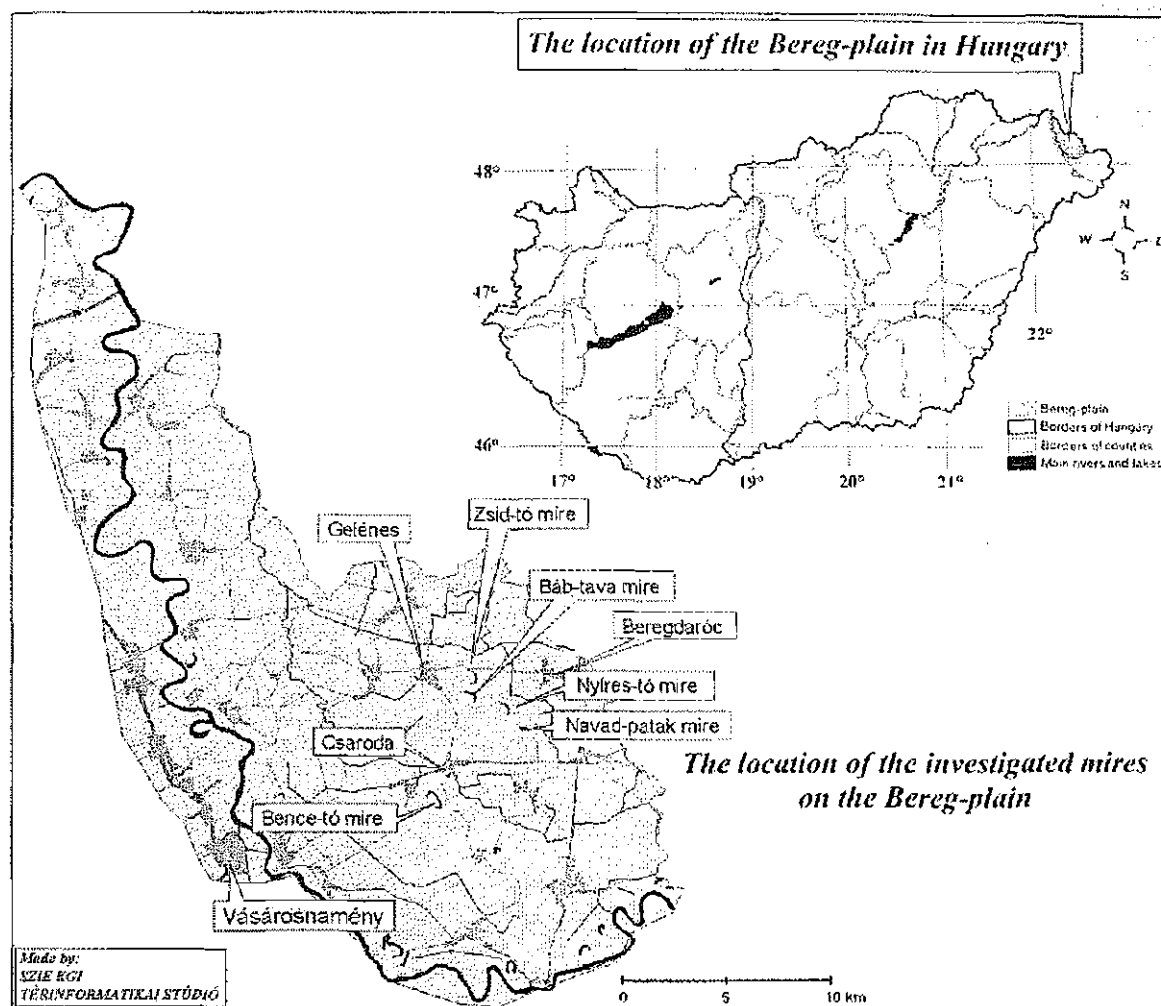


Fig. 1: Location of the studied area.  
Sl. 1: Lokacija preučevanega območja.

The skirts can be formed around numerous willows as well, forming several ten square metres large scraws. Such mat-like scraws can be observed in the dense *Glycerietum maximae* among the leaves of the bottom rooted *Glyceria maxima* specimens of the stands. Water under the skirt is much colder than around it. The first colonists that can be found on the surface of the scraw include *Cicuta virosa*, *Carex pseudocyperus*, *Galium palustre*, *Lycopus europaeus*, *Poa palustris*, *Glyceria maxima*, *Thelypteris palustris*, *Polygonum lapathifolium* or *Typha latifolia*, *Typha angustifolia*, as well as drifted *Salvinia natans*, *Hydrocharis morsus-ranae*, *Lemna minor* and sometimes *Stratiotes aloides*, and *Oenanthe aquatica*. Sometimes, *Cicuta virosa* and *Glyceria maxima* may be missing from these bare surfaces in the first year.

In the second year, the *Cicuto-Caricetum pseudocyperis* becomes almost predominant on the skirt-mires, but its dominance decreases gradually in the next few years.

For a few years, rhizomatous, emergent species, mainly *Glyceria maxima*, *Thelypteris palustris*, and *Lythrum salicaria* and occasionally *Comarum palustre* will be dominant (Tab. 1). The plants of the initial state can be seen just on the growing edge of the scraws. Concentric structure of the floating mire develops.

## CONCLUSIONS

The skirt-mire formation briefly outlined above has not been described yet in literature, although it can be observed in Hungary in many willow swamps flooded with water, and it is probably widespread where conditions (willows, water flooding, floating plant debris suitable for matting) are suitable. We found similar processes near the study site in Bodrogköz, NE Hungary. It is worthy of note that scraws can be formed in any place where peat forming-plants are able to settle, survive and propagate on living or lifeless substratum on the surface of the water.

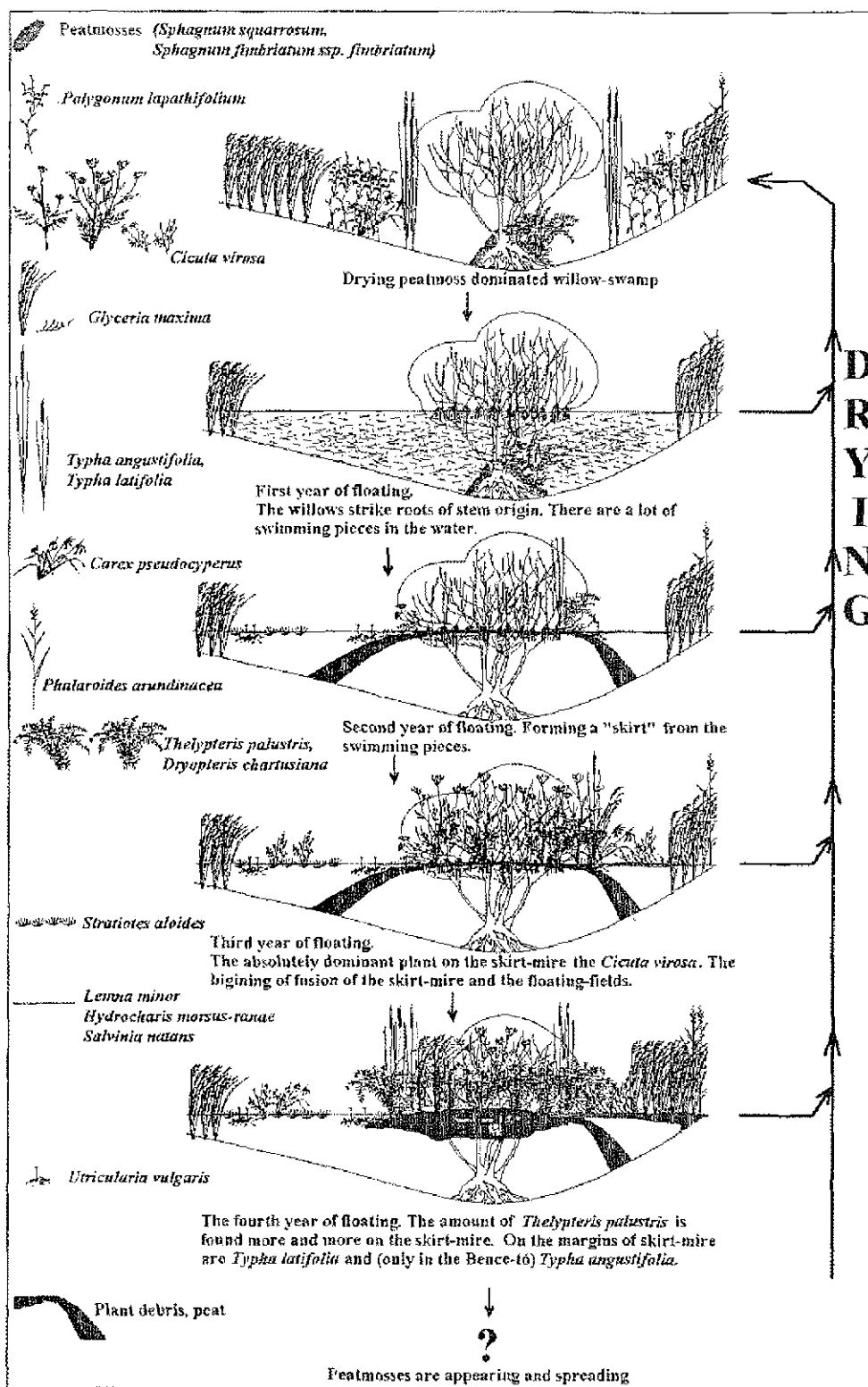


Fig. 2: Scheme of the formation and the succession of the skirt-mires in their first four years in Bence-tó mire, NE Hungary, between 1998-2002.

Sl. 2: Shema nastajanja in sukcesije "zavesastih" barij v prvih štirih letih. Barje Bence-tó, SV Madžarska, med letoma 1998 in 2002.

Tab. 1: Phytosociological relevés of different skirt-mires (Bereg-plain, NE Hungary).

Tab. 1: Fitosociološki popisi različnih "zavesastih" barij (pusta Bereg, SV Madžarska).

Place of samples	Navad-patak mire		Zsid-tó mire			Bence-tó mire	
	17.07.1997	17.07.1997	29.07.1999	29.07.1999	29.07.1999	14.07.2000	14.07.2000
Date	17.07.1997	17.07.1997	29.07.1999	29.07.1999	29.07.1999	14.07.2000	14.07.2000
Age of the skirt-mire	~ 3 years	~ 3 years	~ 5 years	~ 5 years	~ 5 years	~ 2 years	~ 2 years
Plot size	9 m <sup>2</sup>	9 m <sup>2</sup>	25 m <sup>2</sup>	25 m <sup>2</sup>	25 m <sup>2</sup>	9 m <sup>2</sup>	9 m <sup>2</sup>
Cover (%)							
Shrub level							
<i>Salix pentandra</i>				2	40		
<i>Frangula alnus</i>				3			
<i>Salix cinerea</i>	40	25	90	5	10	3 (dead)	5 (dead)
Herb level							
<i>Bidens cernua</i>							40
<i>Carex pseudocyperus</i>					1	5	10
<i>Carex riparia</i>	1						
<i>Cicuta virosa</i>					7	10	40
<i>Comarum palustre</i>					5		
<i>Galium palustre</i>						1	1
<i>Glyceria maxima</i>	5	1	7	3	5		
<i>Hydrocharis morsus-ranae</i>	2	3	5		70	7	
<i>Lemna minor</i>		0.1	10		40	20	
<i>Lythrum salicaria</i>				30			
<i>Lycopus europaeus</i>					0.1	20	1
<i>Lysimachia vulgaris</i>	2			0.5	0.1		
<i>Oenanthe aquatica</i>				1			7
<i>Polygonum lapathifolium</i>		20					
<i>Salix cinerea</i>				1			
<i>Salvinia natans</i>	2	2				5	
<i>Scutellaria galericulata</i>							10
<i>Solanum dulcamara</i>	3			2			
<i>Sparganium erectum</i>			1				
<i>Stratiotes alfoides</i>		1					
<i>Thelypteris palustris</i>	13	40		90	0.1		
<i>Typha angustifolia</i>						90	10
<i>Typha latifolia</i>	4				10		
<i>Utricularia vulgaris</i>			70				

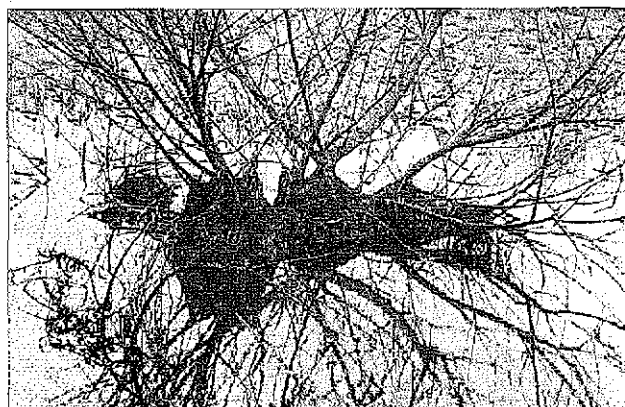


Fig. 3: First phase of the skirt-mire formation: branches of *Salix cinerea* develop adventitious roots (Bence-tó mire, NE Hungary, 30 March 2000). (Photo: J. Nagy)

Sl. 3: Prva faza oblikovanja "zavesaste" barje: veje vrste *Salix cinerea* razvijajo adventivne korenine (barje Bence-tó, SV Madžarska, 30. marec 2000). (Foto: J. Nagy)

The vegetation changes of the skirt-mires are very quick and to a great extent conditioned by the rhythm and rate of the water supply (Nagy, 2002). The water retention peat forming process takes place on terrestrial mire in dry periods and on floating mires in wet periods. When developing an adequate peat thickness, it can counterbalance the effect of fluctuation of the water supply under the established plant communities.

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## PRELIMINARNO POROČILO O NOVEM TIPU "ZAVESASTEGA" BARJA NA MADŽARSKEM

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## POVZETEK

Med letoma 1992 in 2002 sta avtorja opravila vrsto fitocenoloških raziskav barj s prevladujočim šotnim mahom *Sphagnum* (*Nyíres-tó*, *Báb-tava*, *Navad-patak*, *Zsid-tó* in *Bence-tó*) v madžarski pusti *Bereg*. V omenjenem obdobju sta preučevala doslej neopisani in v tem članku preliminarno orisani proces oblikovanja tako imenovanega "zavesastega" barja, potem ko je bila naravno ali umetno poplavljena njegova vrbovina. Vse preučevane vrste vrb (*Salix cinerea*, *S. pentandra*, *S. fragilis*, *S. alba*, *S. aurita* in njihovi hibridi) po poplavljenju poženejo adventivne korenine iz svojih poganjkov pod vodnim površjem. Oblikovanje korenin je neodvisno od starosti poganjkov in vrste vrb.

Na teh dolgih, košatih, lasastih koreninah se v vodi odmrli delci rastlin v velikih količinah prepletajo in spajajo med seboj, z vršnimi koreninami stebelstega izvora in z rastlinskimi ostanki na vodnem dnu. Tako se oblikuje nekakšna "zavesa", ki s korenin, rastočih iz vršnih stebel na vodnem površju, pada vse do vodnega dna. Med prvimi naseljenci, ki jih je mogoče najti na površju zaves, so *Cicuta virosa*, *Carex pseudocyperus*, *Galium palustre*, *Lycopus europaeus*, *Poa palustris*, *Glyceria maxima*, *Thelypteris palustris*, *Polygonum lapathifolium* ali *T. latifolia*, *Typha angustifolia* kot tudi *Salvinia natans*, *Hydrocharis morsus-ranae*, *Lemna minor* ter včasih *Stratiotes aloides* in *Oenanthe aquatica*. V prvem letu lahko s teh golih površij izgineta *Cicuta virosa* in *Glyceria maxima*. V drugem letu postane *Cicuta virosa* skorajda dominantna vrsta v teh "zavesastih" barjih, vendar se njena prevlada v naslednjih nekaj letih sčasoma zmanjša. Takrat začnejo prevladovati plezajoče (trizoidne) vrste (*Glyceria maxima*, *Thelypteris palustris*, *Lytthrum salicaria* in *Comarum palustre*). Rastline v začetnem stadiju je mogoče videti le na rastočem robu zaves, in v barju se začnejo oblikovati koncentrične strukture. Vegetacijske spremembe v "zavesastih" barjih so zelo hitre ter močno odvisne od ritma in stopnje vodnega dotoka.

**Ključne besede:** "zavesasto" barje, vrbovina, *Sphagnum*, madžarska pusta, zmerna klima, celinska klima

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