V. REED BEDS – PHRAGMITETALIA

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General description

Reed bed communities spread from the area of the Mediterranean Sea to Southern Scandinavia. They occur at the margins and floating rafts of lakes, rivers, and brooks and at fens and eutrophic marshes. One of the characteristic features of the community is that its habitat is flooded at least for a certain part of the vegetation period. This community is a relatively species poor. The stands are usually dense and tall; this physiognomy is influenced by strong competition and clonal growth of the edificator species. The ecological requirements of the community depend on the dominant species (Borhidi 2003).

V.1 *Glycerietum maximae* (Hueck 1931)

The association was described by Hueck in 1931 (Hueck 1931).

Habitat conditions

This community that favours the fluctuating oxigen-rich water appears primarily along the edges of lakes, oxbow lakes, slowly flowing ditches. It is tolerant of flooding and drought but sensitive to trampling. The community can be found on the watercourse zone of eutrophic waters between reed beds and large sedge communities. It replaces reed beds in strongly fluctuating waters (Borhidi 2003). Sometimes it forms stands on moving rafts e.g. in Navat stream. It can be initial state of floating mire succession (Nagy 2000, Szurdoki and Nagy 2002, Nagy *et al.* 2007).

Characterization of stands along River Tisza and its tributaries

On the basis of 34 relevés recorded along river Tisza (for details see Appendix page 171) the following results were obtained on the species composition of the community: in general it consists of a single layer but sometimes is a two- or three-layered community. The uppermost layer is formed by emergent species rooted in mud or sand, floating species with thiny rhizoshpere form the next layer and submerged species form the lowest one.

The uppermost layer is dominated by *Glyceria maxima* accompanied by several swamp species as *Sparganium erectum, Polygonum amphibium, Alisma plantago-aquatica, Carex gracilis, C. riparia* or *C. elata*. Sometimes *Lemna minor,*

L. trisulca and *Salvinia natans* form free-floating layer. The submerged layer is formed by *Ceratophyllum submersum* and *Utricularia vulgaris*. Contrary to the literature (Borhidi 2003), dominant and characteristic species of other communities like *Trapa natans* may occur in the relevés along Tisza because of the mosaic structure of the vegetation.

Protected *Salvinia natans* can be found in the stands of Lake Bence, Kengyel- and Óbodrog-oxbow-lakes, while *Marsilea quadrifolia* occurs only in the latter site.

Spatial difference can be observed in the number of layers of the stands and in the rate of additional species. Free-floating layer can be found in the stands at Navat stream, Lake Bence, Kengyel- and Óbodrog-oxbows which is dominated by *Salvinia natans, Lemna trisulca* and *L. minor* and accompanied by *Spirodela polyrrhiza, Hyrocharis morsus-ranae,* and only in the last stand *Marsilea quadrifolia.*

The submerged layer is formed by *Ceratophyllum submersum* in one of the relevés recorded at Navat stream, while in those of Kengyel- and Óbodrog-oxbows it consists of *Utricularia vulgaris* which occurs in the latter stand with only 0,1 % cover value. Other additional species are the elements of swamps, reed vegetation and large sedge communities. It is worth to mention that at certain sites of Navat stream *Eriophoro vaginati-Sphagnetum* Soó (1927) 1954 *oxycoccetosum* was the preceding community (Nagy *et al.* 1999).

Multivariate statistical analysis

Relevés recorded on percentage scale were analysed with centred principal component analysis. On the basis of the eigenvalues, 5 components are responsible for 94,49 % of the total variance. On the ordination scatterplot (Fig. 1) one large and two smaller groups can be distinguished that are separated along the first axis by the dominance of *Lemna triscula* and *L. minor*, and along the second axis by *Urticularia vulgaris, Spirodela polyrrhiza* and *Salvinia natans*. *Glyceria maxima* was not determinant as it was present in each relevés with considerable coverage. Most of the relevés of group A are similar in species composition, they have no dense free-floating layer and the accompanying species are mainly swamp and reed vegetation elements. In the free-floating layer of group B, *Lemna triscula* is dominant (80-100 %) forming a facies. Elements of group C, all are the relevés of Kengyel-oxbow, can be distinguished as *utricularietosum vulgaris*-subassociation. The free-floating layer is very dense and consists of *Lemna triscula* and *Salvinia natans*.

The groups on the ordination plot (Fig. 1) do not fit the distinguished Tisza sections. The composition and number of accompanying species show certain differences within the groups, but this phenomenon did not result the separation of units. Free-loating species were found only in two units (Lakes of Bereg, Bodrog-oxbows): *Hydrocharis morsus-ranae, Lemna minor and trisulca, Salvinia natans*

and *Spirodela polyrrhiza*. Occurrence of accompanying species can be explained by the species-pool and physiognomy of neighbouring communities.

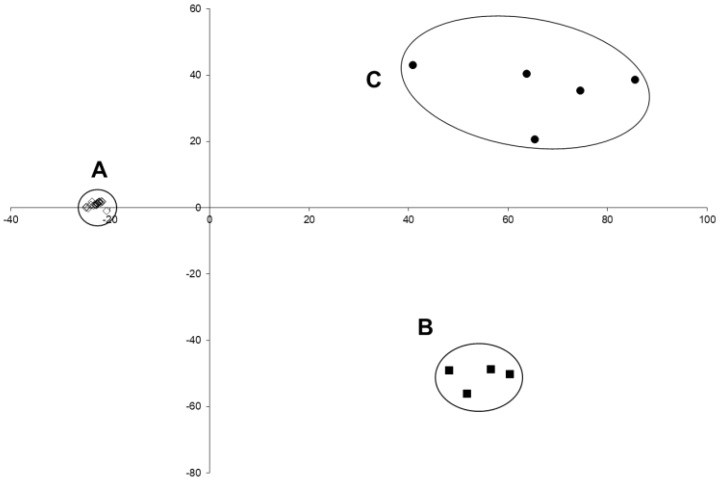

Fig. 1. PCA ordination of the samples (n=33) of *Glycerietum maximae* community recorded on percentage scale (centered PCA; for the explanation of the legends see text).

V.2 *Phragmitetum communis* (Soó 1927 em. Schmale 1939)

Syn.: *Scirpo-Phragmitetum* Koch 1926, *medioeuropaeum* Tx. 1941, *Phragmitetum communis*

The community was described by Soó in 1927 and then Schmale modified the description in 1939 (Borhidi 2003).

Habitat conditions

The stands of reed bed community can be found in the zonation of lakes in mountain region and plains and in the edge of bogs and mires. The surface water cover is generally permanent or may be missing if the thickness of rafts is 2 m or greater.

This community may be present in several types depending on the habitat type (sublitoral sedimentation area) and the type of water bodies (eutrophic, mesotrophic) which is indicated the variable species composition. The vegetation of the stands in oligotrophic habitats is sparse with many species while in eutrophic parts dense, species-poor stands are formed. In the moderately alkaline waters the occurrence of reed is growing against the other elements of reed beds. The terrestrial stands of sediment zone are more species-rich than those standing in water (Borhidi 2003).

Characterization of stands along River Tisza and its tributaries

Along river Tisza, 50 relevés have been gathered. Tventy two relevés were recorded on percentage scale from 5 stands and 28 recorded on AD scale from 26 stands; date of sampling: 1944-2005. Reed community can be considered as a multilayer association-complex. The uppermost layer is dominated by *Phragmites australis*; *Schoenoplectus lacustris, Typha angustifolia* and *T. latifolia* can associate to it. Close to the banks, swamp species are also characteristic such as *Calystegia sepium, Lycopus europaeus, Lythrum salicaria, Stachys palustris*. The free-floating *Lemna* species, *Spirodela polyrrhiza* and sometimes *Salvinia natans* form continuous carpets in less dense patches of reed. In some cases the species of the frogbit rafts may occur, for example *Hydrocharis morsus-ranae* or *Stratiotes aloides*. In the submerged layer, *Ceratophyllum demersum* and *Najas marina* can be present.

From among the protected species, *Salvinia natans* occurred in the samples of Kengyel-oxbow and Lake Tisza (Tiszavalk, Sarud, Abádszalók), *Nymphoides peltata* was present only in the stand at Sarud. *Clematis integrifolia* and *Leucanthemella serotina* were present in the stands of Maros valley.

Phragmites australis is dominant in each relevé. *Lemna* species and *Glyceria maxima* are the next most abundant. In one stand, *Festuca peudovina* is co- or subdominant. Further differences can be seen in the strata of the samples.

The historical samples recorded on AD scale do not differ significantly from the recent samples. Subordinate occurrence of certain floodplain-wood species, for example *Salix alba, S. triandra, S. viminalis, Alnus glutinosa* and even invasive elements like *Amorpha fruticosa* indicate minor difference. In certain sites along river Maros, other species may become dominant such as *Lysimachia nummularia, Schoenoplectus lacustris, Typha angustifolia.* Later species may form consociation.

Multivariate statistical analysis

On the basis of the eigenvalues, 4 components proved to be important, they accounted for 95.77 % of the total variance of data. The objects do not show clear cut aggregations in connection with the river sections. The distribution of the objects on the scatterplot (Fig. 2) is determined by the cover values of *Phragmites australis, Glyceria maxima* and *Festuca pseudovina* along the first axis, and of *Lemna minor* and *Lemna trisulca* along the second axis. The dominance of *Phragmites australis* grows from the left to the right along the first axis. Considerable occurrence of *Glyceria maxima* and *Festuca pseudovina* is associated with the lovest cover values of *Phragmites australis.* The two *Lemna species* are connected with the second axis: larger second axis scores are connected with larger cover values of duckweed species. Cover range of *Lemna trisulca* is much wider than that of *L. minor*.

Centred PCA ordination of data (Fig. 3) recorded on AD scale resulted in a considerable number of components responsible for the total variance; ten components accounted for 76.8 %, and 20 components for 95.7 % of the variance. The objects did not show clear aggregation, those belonging to river Tisza and river Maros did not separate, neither the objects from different river sections. The distribution of the points is determined again by the abundance of *Phragmites australis* along the first axis, and by that of *Lemna minor* and *Typha angustifolia* along the second axis.

The stand of Fokköz forest clearing is special, because the cover value of *Phragmites australis* is low but co- or subdominant *Festuca pseudovina* is facies forming. Beside the former taxa the following species are only present in Fokköz stand: *Achillea collina, Artemisia pontica, Centaurea pannonica, Lotus corniculatus, Peucedanum officinale, Stellaria graminea, Veronica spicata* indicating drier habitats. In the relevés of lower Tisza section (Szolnok-southern border), *Elymus repens, Agrostis alba, Calamagrostis epigeios, Lysimachia nummularia, Rubus caesius* have higher cover values that should indicate the degradation of the area. The species composition in the Maros valley is the most diverse, several weed species can be found there like *Aristolochia clematitis, Artemisia vulgaris, Cynodon dactylon, Echinocloa crus-galli*, but protected taxa are also recorded like *Leucanthemella serotina, Clematis integrifolia.*

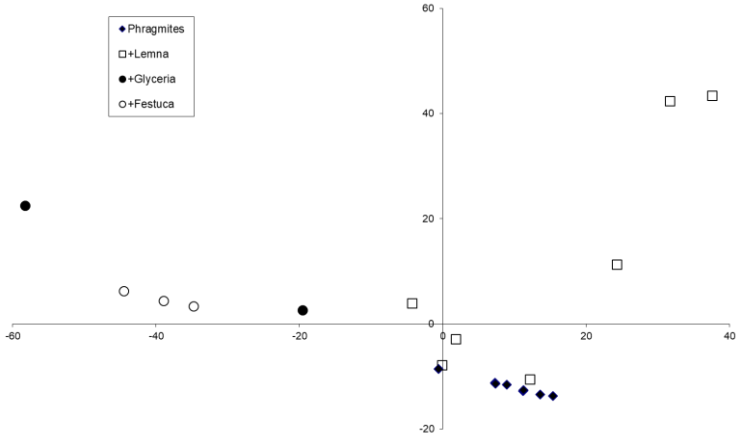

Fig. 2. PCA ordination of the samples (n=22) of *Phragmitetum communis* community recorded on percentage scale (centered PCA). The distribution of the relevés is determined by the increasing abundance of *Phragmites australis* and by the subdominant species.

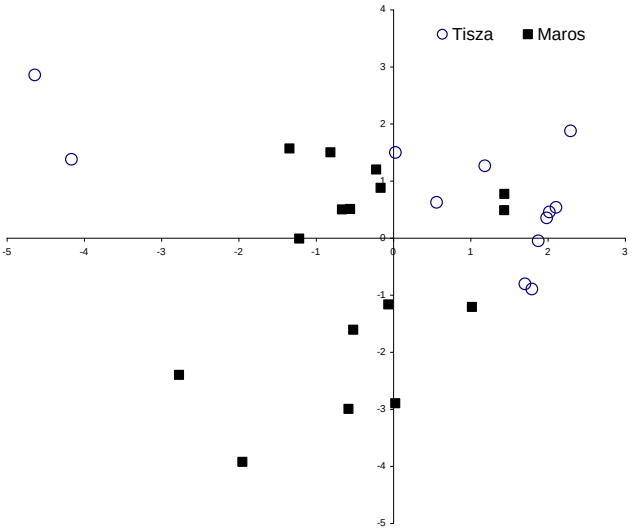

Fig. 3. PCA ordination of the samples (n=28) of *Phragmitetum communis* community recorded on AD scale (centered PCA)

V.3 *Sparganietum erecti* (Roll 1938)

The community was described by Roll in 1938 (Roll, 1938). Soó (1964) did not mention the name of the community, only that of a related one (*Sparganietum minimi hungaricum*) but with doubt. In certain cases it was treated together with *Sparganietum neglecti* Br.-Bl. 1925 em. Philippi 1973 (Rennwald, 2000).

Habitat conditions

Stands of neglected bur-reed communities usually appear on submediterranean plains along lakes, oxbow lakes and slowly flowing waters. This community is typical in oxygen-rich, eutrophic waters where thick sapropel is formed. The stands of this community are fragmented on disturbed bank areas (Borhidi 2003).

Characterization of stands along River Tisza and its tributaries

Twenty seven relevés from 10 stands were recorded on percentage scale and 1 relevé on AD-scale along river Tisza. Data were recorded between 1962 and 2005 (cf. Appendix page 181). It can be concluded from the data that this community can generally be characterised by a single layer, but sometimes it consists of two or three layers. In the uppermost layer emerging plant species are present like *Sparganium erectum, Glyceria maxima, Alisma plantago-aquatica, Sagittaria*

sagittifolia. The next layer is formed by free-floating species, and under them submerged species occur forming the lowermost layer. The relevés are mainly dominated by *Sparganium erectum*, but floating and rooting hydrophytes also associate with it such as *Lemna minor, Spirodela polyrrhiza, Hydrocharis morsus-ranae, Salvinia natans, Nymphaea alba, Nuphar lutea. Glyceria maxima* is subordinate and not very frequent species of this community. Contrary to the literature (Borhidi, 2003), submerged species like *Myriophyllum spicatum, Cerathophyllum demersum* may occur in the community even with considerable coverage.

From among the protected species, *Marsilea quadrifolia* and *Trapa natan*s were present in the stands near Pallagcsa-meadow, Óbodrog- and Kengyel-oxbows. *Salvinia natans* occurred in the stands at Lake Bence, Pallagcsa-meadow, Óbodrog- and Kengyel-oxbows and Tiszaalpár in 1982. *Nymphoides peltata* and *Nymphaea alba* were present in the samples recorded at oxbow lake of Tiszaalpár in 1982 and the latter one occurred in one of the samples in 1962.

The difference among the stands is manifested in the number of vegetation layers and in the rate of dominant and accompanying species. *Sparganium erectum* is dominant in the majority of the relevés. Free-floating species such as *Riccia flutans, Spirodela polyrrhiza, Lemna trisulca, Salvinia natans, Marsilea quadrifolia* form facies in certain relevés.

Free-floating species are present in each stand, and they may be associated by large rooted hydrophytes as *Nuphar lutea* and *Trapa natans*. *Cerathophyllum demersum* frequently forms a submerged layer sometimes accompanied or replaced by *Utricularia vulgaris, Ceratophyllum submersum* or *Myriophyllum spicatum*. *Iris pseudacorus* performs a considerable coverage in the stand of Lake Bence.

Multivariate statistical analysis

Relevés recorded on percentage scale were analysed with centred principal component analysis. On the basis of the eigenvalues, 6 components proved to be considerable, they accounted for 91.8 % of the total variance. Three distinct groups of the objects could be recognized (Fig. 4).

In the distinction of groups the dominance of *Cerathophyllum demersum, Spirodela polyrrhiza* and *Riccia fluitans* plaid essential role, but also *Lemna trisulca* and *Marsilea quadrifolia* were important. The cover values of *Sparganium erectum* grow from the left to the right along the first axis. Most of the objects are distributed in one compact group, and two very distinct groups can be found on the scatterplot (Fig. 4). Relevés of group B are dominated by *Cerathophyllum demersum*, and those of group C by *Spirodela polyrrhiza* and *Riccia fluitans*. Larger cover values of *Lemna trisulca, Salvinia natans* or *Marsilea quadrifolia* in certain relevés did not affect considerably the distribution of the objects in group A.

In the relevé recorded on AD scale and which consists only of 4 species, *Nymphaea alba* is subdominant, and *Typha lathifolia* and *Phragmites australis* occur as accessory species.

No separation of the objects was observed on the basis of the position along the river valley. Though most of the relevés originated from the upper Tisza region and only one relevé from the middle Tiszan region, the regionality seems of secondary importance in the case of this community.

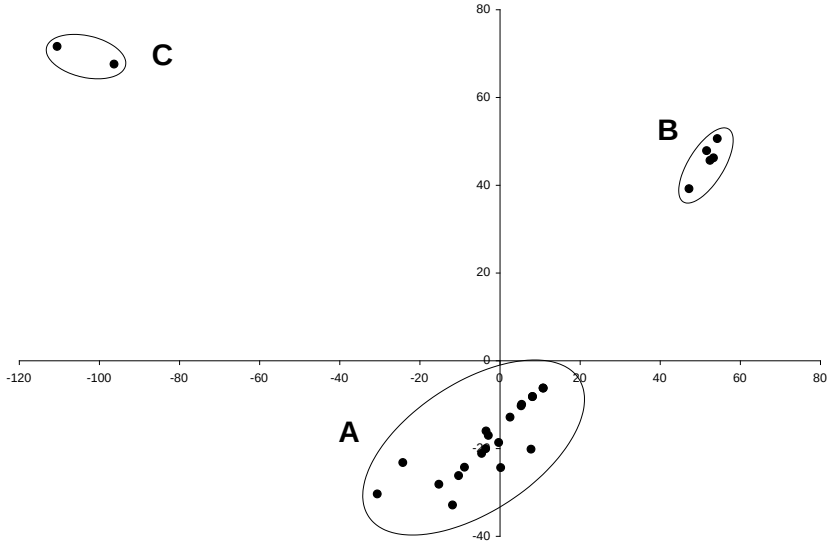

Fig. 4. PCA ordination of the samples (n=27) of *Sparganietum erecti* community recorded on percentage scale (centered PCA; for further explanation see text).

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References

Bodrogközy, Gy. (1965): Die Vegetation des Theiss-Wellenraumes II. Vegetationsanalyse und Standortökologie der Wasser- und Sumpfpflanzenzönosen im Raum von Tiszafüred. – Tiscia 1, 5-31

Bodrogközy, Gy. (1982): Ten-year changes in community structure, soil and hydroecological conditions of the vegetation in the protection area at Mártély (S. Hungary). – Tiscia 17, 89-130

Borhidi, A. (2003): Magyarország növénytársulásai. (Plant communities of Hungary.) Akadémiai Kiadó, Bp., 610 p.

Hueck, K. (1931): Erläuterung zur vegetationskundlichen Karte des Endmoränengebiets von Chorin. (Uckermark). -Beitr. Naturdenkmalpflege 14,105-214

Nagy, J., Figeczky, G., Molnár, M., Selényi, M. (1999): Adatok a beregi tőzegmohás lápok vegetációjának változásaihoz. – Kitaibelia 4, 193-195

Nagy, J. (2000) : Az úszóláp képződés legelső stádiumai a "Palást lápok", és a lápfejlődés a Beregi-síkon. – Aktuális flóra- és vegetációkutatás Magyarországon, Jósvafő

Nagy, J. (2002): Szündinamikai folyamatok vizsgálata egy tőzegmohaláp természeti értékeinek megőrzésére. (Research of syndinamicial processes for conservation of natural values of a Sphagnum mire.) PhD thesis, SZIE Department of Botany and Plant Physiology, Gödöllő

Nagy, J., Molnár, A., Cserhalmi, D., Szerdahelyi, T., Szirmai, O. (2007): The aims and results of the nature-protection management on the north-east Hungarian mires. – Cereal Research Communications 35, 813-816

Penksza, K., Gubcsó, G. (1998): Adatok a Vésztő-Mágor természetvédelmi terület és környékének flórájához és vegetációjához. (Data to the flora and vegetation of the Vésztő-Mágor nature conversation area and its environment.) Technical report, KMNP, Szarvas

Podani, J. (1993): SYN-TAX 5.0: Computer programs for multivariate data analysis in ecology and systematics. – Abstracta Botanica 17, 289-302

Rennwald, E. (2000): Verzeichnis der Pflanzengesellschaften Deutschlands mit Synonymen und Formationseinteilung. Schriftenreihe fiir Vegetationskunde 35, 121-391

Roll, H. (1938): Allgemein wichtige Ergebnisse für die Pflanzensociologie bei Untersuchungen von Fliesswassern in Holstein. – Feddes Repert. Berlin, 15,108-109

Simon, T. (2000): A magyarországi edényes flóra határozója. (Field guide to the vascular flora of Hungary.) – Nemzeti Tankönyvkiadó, Budapest. 845 p.

Simon, T. (2003): Baktérium-, alga-, gomba-, zuzmó- és mohahatározó. (Field guide to the Hungarian bacteria, algae, fungi, lichens and bryophyte.) Nemzeti Tankönyvkiadó, Budapest, 832 p.

Simon, T. (1951): Montán elemek az Észak-Alföld flórájában és növénytakarójában, II. (Mountain elements in the flora and vegetation in the North-Alföld.) – Annales Biologicae Univ. Hungariae. Budapest

Slavnic, Z. (1956): Die Wasser- und Sumpfvegetation der Vojvodina. Zborn. – Matica Srpske, Novi Sad. 10, 5-72

Soó, R. (1964): A Magyar flóra és vegetáció rendszertani-növényföldrajzi kézikönyve. (Taxonomical and Plantgeographical Handbook of the Hungarian Flora and Vegetation. I.) Akadémiai Kiadó, Budapest, 589 p.

Soó, R. (1927): Zur nomenklatur und Methodologie der Pflanzensociologie. – Forschungsarbeiten der Mitglieder des Ungarischen Insituts und des Collegium Hungaricum in Berlin 1927, 234-252

Szirmai, O., Nagy, J., Gál, B., Czóbel, Sz., Szerdahelyi, T., Cserhalmi, D., Tuba, Z., Ürmös, Zs. (2006): A magyarországi Bodrogköz jellemző vízi és vízparti növénytársulásai. (Characteristic wetland communities of the Hungarian Bodrogköz.) – Folia Historico Naturalia Musei Matraensis, 30, 75-89

Timár, L. (1950): A Tiszameder növényzete Szolnok és Szeged között. (Vegetation of the Tisza riverbed Tisza between Szolnok and Szeged.) – Annales Biologicae Universitatis Debreceniensis I.

Szitár, M. (2005): A tiszajenei Nagy-rét aktuális vegetációjának jellemzése. (Characterisation of actual vegetation of the Nagy-grassland in Tiszajenő.) MSc thesis, Department of Ecology Univ. Szeged

Szurdoki, E., Nagy, J. (2002): *Sphagnum* dominated mires and *Sphagnum* occurrences of North-Hungary. – Fol. Hist.-nat. Mus. Matr. 26, 67-84

Timár, L. (1950): A Marosmeder növényzete. (Die Vegetation des flussbettes der Maros.) – Ann. Biol. Univ. Szeged 1, 117-136

Tóth, M. (1967): A Maros hullámterének fitocönológiai jellemzése. (Phytosociologycal descripion of the Maros floodplain.) DrUniv. thesis, Makó

Vas, M., Tuba, Z. (1989): A Kiskörei vízlépcső hatása a Tisza mente Polgár Kisköre közötti szakaszának természetes növényzetére. (Influence of Kisköre barrage on natural vegetation of Tisza River bank between Polgár and Kisköre.) Manuscript, Gödöllő