

Vegetation and flora of the Hármas-Körös river (Hungary) with some historical remarks

Zsolt Malnár, István Bagi & Éva Kertész

Abstract

The Hármas-Körös flood plain is a typical degraded flood plain landscape of the Hungarian Great Plain, although many of the habitats are semi-natural and some are regenerating since human influence is decreasing in some areas. There are important habitats in the river valley that serve as a refuge for many wetlands communities and species.

504 species and 60 plant communities are listed. 43 species (rare, protected, invasive etc.) and 11 habitats (e.g. ancient and recent woodlands, thickets, oxbow lakes, marshes, kubiks, hay meadows, pastures, dry grasslands, alkali grasslands, river levees) are briefly described.

The effect of landscape transformations of the last 200 years on the vegetation is also described.

Keywords: landscape history, flood plain, semi-natural landscape, regeneration

Introduction

The investigated area is the presently active flood plain of the Hármas-Körös river. This area is protected and called also as the Körös Nature Reserve. Previously the flood plain was much bigger, but river control works in the 19th century and following drainage activities reduced its area as was described in detail by Biró and Tóth (1997). The presently inactive flood plain is a typical lowland cultural landscape with dominating arable fields, mostly secondary alkali steppes, remnant, drying wetlands and scattered trees and planted woodlots.

The presently active flood plain is a semi-natural landscape which has undergone many changes in the last centuries (cf. also Zólyomi 1946). Most of these transformation is also described by Biró and Tóth (1997). The landscape - based on our field observations

in the Great Hungarian Plain and on literature data - is a typical example of the lowland flood plain landscapes of the Plain. Botanical it is not a fascinating area, but there are still important habitats and populations that deserve attention.

As human society changes, the degraded habitats of the river valley may regenerate to a certain degree as is the case with some meadows, oxbow lakes and woodlands. The agricultural use is less and less intensive, and large areas have been abandoned. At the same time, recreational use is increasing. The balance between nature conservation management and recreation will be responsible for the future of the landscape.

Past botanical data from the area comes from Vince Borbás (1881), István Koren (1883), Gábor Ubrizsy (1949), Lajos Tímár (1952, 1954), László Almády (1961), Zoltán Molnár (Molnár 1979, 1994, Kovács and Molnár 1981), István Bagi (Bagi 1985, 1987a, b, Bagi and Körmöczi 1986), Attila Borhidi (1982), László Tóth (1982), Albert Tóth (1982), Éva Kertész (1986) and Zsolt Molnár (Tóth, Molnár, Biró, Forgách 1996).

Results

The vegetation

Based on our field surveys and literature data, the following plant communities are represented in the area. Nomenclature follows Borhidi (1996) with some modifications. Alliances and the belonging plant associations are listed.

- Lemnion minoris de Bolós et Masclans 1955
- Lemnetum minoris Müll. & Görs 1960
 - Lemnetum trisulcae Soó 1927
 - Lemno minoris-Spirodeletum W.Koch 1954
 - Wolffietum arrhizae Miyav. & J.Tx. 1960
 - Salvinio-Spirodeletum Slavnic 1956)
- Utricularion vulgaris Passarge 1964
 - Lemno-Utricularietum vulgaris Soó 1928
- Hydrocharition Rübél 33
 - Lemno-Hydrocharitetum morsus-ranae (Oberd.) Pass.1978
- Ceratophyllion demersi Soó1927
 - Ceratophylletum demersi (Soó) Egger 1933
- Potamion lucentis Rivas Martinez 1973
 - Elodeetum canadensis Egger 1933
 - Potamogetonetum lucentis Hueck 1931
 - Potamogetonetum crispum Soó 1927

- Myriophylletum verticillati Soó 1927
 Potametum perfoliati Koch 1926 em. Passarge 1964
 Myriophyllo-Potametum lucentis Soó 1934
 Potamion pusilli Vollmar 1947 em. Hejny 1978
 Najadetum minoris Ubrizsy 1948
 Potametum pectinati Carstensen 1955
 Najadetum marinae Fukarek 1961
 Nymphaeion albae Oberd. 1957
 Polygonetum amphibii-natantis Soó 1927
 Trapetum natantis Müll. & Görs 1960
 Nymphoidetum peltatae (All. 1922) Bellot 1951
 Nymphaeetum albo-luteae Nowinski 1928
 Phragmition australis Koch 1926
 Phragmitetum communis Soó 1927 em Schmale 1939
 Glycerietum maximae Hueck 1931
 Schoenoplectetum lacustris Chouard 1924
 Equisetetum fluviatilis Steffen 1931
 Sparganio-Glycerion fluitantis Br.-Bl. & Sissingh 1942
 Leersietum oryzoidis Egger 1933
 Sparganietum erecti Roll. 1938
 Oenanthion aquaticae Hejny ex Neuhäusl 1959
 Eleocharitetum palustris Ubrizsy 1948
 Alismato-Eleocharitetum Máthé & Kovács M. 1967
 Rorippo amphibiae-Oenanthetum aquaticae (Soó 1928) Lohm. 1950
 Butomo-Alismatetum plantaginis-aquaticae (Slavnic 1948) Hejny 1978
 Caricenion gracilis (Neuhäusl 1959) Oberd et al. 1967
 Caricetum melanostachyae Balázs 1943
 Caricetum gracilis Almquist 1929
 Carici gracilis-Phalaridetum (M. Kovács & Máthé 1967) Soó 1971 corr. Borhidi 1996
 Nanocyperion Koch ex Libbert 1932
 Cypero fuscii-Juncetum bufonii Soó et Csűrös (1927)1944
 Dichostylido micheliana-Gnaphalietum uliginosi Horvatic 1931
 Dichostylido-Heleochoetum alopecuroidis (Timár 1950) Pietsch 1973
 Puccinellion limosae Soó 1933
 Puccinellietum limosae Rapaics ex Soó 1933
 Bassietum sedoidis Ubrizsy 1947 corr. Soó 1964
 Beckmannion eruciformis Soó 1933
 Agrostio-Alopecuretum pratensis Soó (1933) 1947
 Festucion pseudovinae Soó 1933
 Achilleo-Festucetum pseudovinae Soó 1947
 Artemisio santonici-Festucetum pseudovinae Soó in Máthé 1933 corr. Borhidi 1996

- Alopecurion pratensis Soó 1971
 - Alopecuretum pratensis Soó 1971
 - Lythro-Alopecuretum pratensis Bodrogközy
- Potentillion anserinae R. Tx. 1937
 - Lolio-Alopecuretum pratensis Bodrogközy 1962
 - Potentilletum anserinae Felföldy 1942
 - Ranunculetum repentis Knapp ex Oberd. 1957
 - Rorippo austriacae-Agropyretum repentis (Timár 1947) R. Tx. 1950
 - Rumici crispi-Agrostietum stoloniferae Moor 1958
- Festucion valesiacae Klika 1931
 - Cynodonto-Poetum angustifoliae Rapaics ex Soó 1957
 - Salvio nemorosae-Festucetum rupicolae Zólyomi ex Soó 1964
- Bidention tripartiti Nordhagen 1940 em. R.Tx. in Poli & J.Tx. 1960
 - Bidenti-Polygonetum hydropiperis Lohm. in R.Tx. 1950.
 - Echinochloo-Bidentetum Soó 1971
 - Polygono lapathifolio-Bidentetum Klika 1935
 - Xanthio strumarium-Chenopodietum Pop 1968
 - Dichostylido-Chenopodietum rubri (Timár 1947) Soó 1971
- Chenopodion glauci Hejny 1974
 - Chenopodietum rubri Timár 1947
 - Echinochloo-Juncetum bufonii Felföldy 1942
 - Echinochloo-Polygonetum lapathifolii Soó & Csűrös 1947
- Salicion triandrae Th. Müll. & Görs 1958
 - Salicetum triandrae (Timár 1952) Simon 1957
- Salicion albae (Oberd. 1953) Th. Müll. et Görs 1958
 - Salicetum albae-fragilis Soó (1933) 1958

(The list of weed communities is far from complete, since these were not studied in detail.)

The most important habitats

Vegetation description does not follow the previous enumeration, but is habitat based. At this coarser scale the characteristic features of the local landscape are more evident. At the same time many of the present habitats of the landscape can not (yet) be described by plant sociological categories.

I. Woodlands

Ancient woodlands

Already in the last decades of the 18th century woodlands were very rare in the area (1st military survey). None of these survived till present except part of the so called Anna-liget and Erzsébet-liget at Szarvas. These woods may have woodland continuity since there are many rare woodland species in them: *Quercus robur* (old individuals), *Poa nemoralis*, *Loranthus europaeus*, *Parietaria officinalis*, *Listera ovata*, *Ophioglossum vulgatum*, *Geranium robertianum*, *Viola sylvestris*, *Mycelis muralis* (Ubriszy 1949, Molnár 1979, 1994).

Recent woodlands and thickets

Analysis of historical maps suggest that all of the present woods of the area are secondary plantations or partly natural regenerations (Biró and Tóth 1997). Poor species composition of the shrub and herb layer may be attributed to this fact (cf. Kertész 1989). The woods were used for grazing, and wood carving till after the 2nd World War (Tímár 1952, 1953). Past botanical descriptions by Borbás (1881) and Tímár (1952) also emphasize the characterless species composition of the woods.

Secondary hardwood riverine forests:

Secondary hardwood forests of oak and white poplar are rare and occupy a small area. Shrub layer is scarce, and non-native species are sometimes dominant. Woodland species (like *Convallaria* and *Polygonatum latifolium*) were rare and are presently probably extinct. Present site conditions (hydrology, propagulum availability and forestry) hinders regeneration.

Secondary softwood riverhine forests:

These woods regenerate much easier, older stands may resemble natural woodlands in their physiognomy, though the herb and shrub layer is often dominated by non-native species. If canopy opens up, flood plain and marshland species are dominant: *Alopecurus pratensis*, *Althaea officinalis*, *Aristolochia clematidis*, *Bidens tripartita*, *Calystegia sepium*, *Chenopodium album*, *Lysimachia vulgaris*, *Ranunculus repens*, *Rubus caesius* and *Symphytum officinale*. In some older woods *Populus nigra*, *Vitis sylvestris*, *Geum urbanum*, *Geranium robertianum* and *Rumex sanguineus* may also be present.

Thickets of non-native species:

This habitat develops on abandoned meadows, pastures and fields. Dominant species are *Amorpha fruticosa*, *Acer negundo* and *Fraxinus pennsylvanica*. It seems that none of the softwood canopy species can overgrow the shrub canopy. This causes nature conservation problems.

II. Wetlands

Wetlands are endangered throughout the Great Plain. Remnants are very important refuges for many habitats, and species. Wetland habitats of the Hármas-Körös valley are almost exclusively secondary (Bíró and Tóth 1997), and were formed at and after the river control.

Oxbow lakes

Most of the oxbow lakes lost their connection with the river, or only their lower part is connected to the "living" river. Consequently most of them are filled up with mud and become dry by summer. Oxbow lakes are surrounded by arable fields, grasslands or woodlands, which results in a wide variety of site conditions. *Sagittaria*, *Sparganium*, *Butomus* and *Equisetum fluviatile* beds are common, but *Phragmites* is rare. Most important species of this habitat are *Trapa natans*, *Salvinia natans*, *Nymphoides peltata*, *Nuphar luteum*, *Potamogeton lucens* and *Utricularia vulgaris*.

The typical zonation pattern along the shore has two variants: one below and one above Öcsöd. Geographical history may be responsible for this difference.

Zonation of oxbow lakes below Öcsöd: 1st zone: *Carex gracilis* (with some *Schoenoplectus lacustris*), 2nd zone: *Sagittaria*, *Sparganium erectum*, *Eleocharis palustris*, *Equisetum fluviatile* (*Oenanthe aquatica* is usually absent), 3rd zone: *Trapa*, *Salvinia*, and *Hydrocharis*.

Zonation of oxbow lakes above Öcsöd: 1st zone: *Glyceria maxima* and *Schoenoplectus lacustris* with some *Carex gracilis*, and/or *Phragmites*, 2nd zone: *Sparganium erectum* (with only a little *Sagittaria*), 3rd zone: *Oenanthe aquatica* (very abundant), 4th zone: *Trapa*, *Salvinia*, and *Spirodela*.

On the inactive flood plain side the zonation is much poorer: 1st zone: *Phragmites* (wide), 2nd zone: some *Trapa*, 3rd zone: open water.

Kubiks

River levees for river control were built from earth excavated from the vicinity of the new levees (on the side looking towards the river). These pits are called kubik in Hungarian. Since this habitat is a very special one in the Hungarian lowlands, we decided to keep its Hungarian name. Kubiks served as refuges for many marsh species during the last 100 years.

Differences in size (depth and area) and hydrology (drained or not, shaded or not) results in a wide variety of habitats with very distinct vegetation. One of the main controlling factors is the duration of water in the kubik. The large and water rich kubiks have a vegetation very similar to the ox-bow lakes. Physiognomy is determined largely by *Sparganio-Glycerion* species like *Sparganium erectum*, *Glyceria fluitans*, *G. maxima*, *Butomus umbellatus*, *Sagittaria sagittifolia*, *Alisma plantago-aquatica*, *A. lanceolatum*. Species of the reed beds are also important: *Iris pseudacorus*, *Typha angustifolia*, *T.*

latifolia, Eleocharis palustris, Schoenoplectus lacustris. Other higher species are Carex gracilis, Bolboschoenus maritimus, Lythrum salicaria, Sium erectum, Lysimachia vulgaris. Phragmites australis does not occur or has small cover. Species that develop terrestrial shoots after the withdrawal of the water can also be important: Polygonum amphibium, Rorippa amphibia, Oenanthe aquatica, Agrostis stolonifera, Alopecurus geniculatus.

The Gyügéri-kubik, which is connected to the neighbouring oxbow is very species rich: Agrostis alba, Alisma plantago-aquatica, Alisma lanceolatum, Batrachium aquatile, Batrachium trichophyllum, Bolboschoenus maritimus, Butomus umbellatus, Carex gracilis, Ceratophyllum demersum, Eleocharis palustris, Hippuris vulgaris, Hydrocharis morsus-ranae, Iris pseudacorus, Lemna trisulca, Lycopus exaltatus, Lysimachia vulgaris, Myriophyllum spicatum, Oenanthe aquatica, Phalaroides arundinacea, Polygonum amphibium, Potamogeton natans, Potamogeton pectinatus, Riccia fluitans, Sagittaria sagittifolia, Salvinia natans, Schoenoplectus lacustris, Sparganium erectum, Spirodela polyrrhiza, Stachys palustris, Symphytum officinale, Trapa natans, Typha angustifolia, Utricularia vulgaris.

In the deeper parts of the larger kubiks, if the denser vegetation has not colonised yet, after the withdrawal of the water species poor pioneer communities (with different structure than in the river bed) develop: Dichostylido-Heleochoetum alopecuroidis, Dichostylido-Chenopodietum rubri. More detailed descriptions can be found in Bagi (1988, 1991).

If the kubik is shaded by the neighbouring trees the Rorippo amphibiae - Onanthe aquatica community develops and survives till the end of the vegetation period.

Smaller kubiks generally dry out by the summer. Since in these kubiks algae with high biomass production live before the withdrawal of the water (e.g. Charophyta species /Nitella/, Vaucheria, Zygnema, Spirogyra), and these species die if dried, an organic web covers the surface which hinders or prevents the growth even of the ruderal species of the flood plain. It is a usual phenomenon that in these ruderal marshes zoochor Compositae (Bidens tripartita, Xanthium italicum, X. strumarium), or Polygonum species (P. lapathifolium, P. hydropiper) form monodominant stands of the communities Bidenti-Polygonetum hydropiperis, Polygono lapathifolio - Bidentetum, Xanthio strumarii - Chenopodietum, or Echinochloo-Bidentetum. Often even neighbouring kubiks have different dominant species.

Species of a typical kubik at Békésszentandrás (20 m²) are Agrostis stolonifera, Bidens tripartita, Calystegia sepium, Chenopodium polyspermum, Echinochloa crus-galli, Echinocystis lobata, Glycyrrhiza echinata, Lycopus europaeus, L. exaltatus, Lysimachia vulgaris, Mentha arvensis, Oenanthe aquatica, Plantago major, Polygonum amphibium, Sium latifolium, Sparganium erectum, Xanthium italicum.

The riverbed

This habitat is flooded for most of the vegetation period. Water level changes can cause re-floodings. As a consequence, short lived, fast growing, pioneer, annual species colonize. Though this habitat is usually only several meters wide, successional patterns are complex. In the lower parts the primary Nanocyperion communities develop into *Potentillion anserinae* (*Agropyro-Rumicion*) communities, while at higher level, where the organic debris transported by the river is deposited, the intermediate *Chenopodion glauci* community develops into *Bidention* communities. The most common community of the usually heavy substrate of the river Körös is the *Dichostylido-Gnaphalietum*, though *Cybero-Juncetum* also occurs on more sandy deposits. The *Chenopodion glauci* alliance is represented by the *Echinochloo-Polygonetum* community, while the *Bidention* by the *Echinochloo-Bidentetum* and *Polygono-Bidentetum*. *Xanthium italicum* may be dominant in all of the last three communities.

Species composition of a typical site (5x1m) at Békésszentandrás is the following: *Amaranthus lividus*, *Atriplex hastata*, *Chenopodium album*, *Ch. botryoides*, *Ch. polyspermum*, *Ch. rubrum*, *Echinochloa crus-galli*, *Gnaphalium uliginosum*, *Juncus compressus*, *Lythrum salicaria*, *L. virgatum*, *Mentha arvensis*, *Phalaroides arundinacea*, *Plantago major*, *Polygonum aviculare*, *P. hydropiper*, *P. lapathifolium*, *Portulaca oleracea*, *Rorippa silvestris*, *Salix triandra*, *Xanthium italicum*.

Typical species of the *Potentillion anserinae* community are *Agrostis stolonifera* subsp. *prorepens*, *Amaranthus lividus* subsp. *adscendens*, *Plantago major* subsp. *pleiosperma*, *Ranunculus sceleratus*, *Rorippa silvestris*, *Rumex crispus*, and *R. stenophyllus*.

The river bed communities are best studied below the barrage at Békésszentandrás.

Semi-natural marshes of very old meanders

Natural wetlands are very rare in the area. Only some of the older meanders survived the river control. *Glyceria maxima*, *Phalaroides arundinacea* and *Carex gracilis* are the dominant species.

Drying stands may be relatively species rich. The following stand (at Békésszentandrás) has 70-80 % coverage of *Phalaroides arundinacea*: *Agropyron repens*, *Agrostis stolonifera*, *Althaea officinalis*, *Aristolochia clematidis*, *Atriplex acuminata*, *A. prostrata*, *Bidens tripartitus*, *Chenopodium album*, *Cichorium intybus*, *Cirsium arvense*, *Convolvulus arvensis*, *Dipsacus laciniatus*, *Equisetum arvense*, *Euphorbia virgata*, *Glycyrrhiza echinata*, *Lactuca serriola*, *Lythrum salicaria*, *L. virgatum*, *Picris hieracioides*, *Polygonum lapathifolium*, *P. mite*, *Potentilla anserina*, *P. reptans*, *Rubus caesius*, *Rumex crispus*, *R. stenophyllus*, *Setaria pumila*, *Symphytum officinale*, *Thalictrum simplex*, *Tanacetum vulgare*, *Urtica dioica*, *Xanthium italicum*.

III. Grasslands

The following grassland types can be found on the flood plain: hay meadows, dry, loessy pastures and in some locations alkali grasslands (Tóth 1982).

Flood plain hay meadows

Flood plain hay meadows are also very important habitats in the area. The time of woodland clearance is not known, so these grasslands may be several hundred or several thousand years old. Species composition of the meadows at different locations is very similar which suggests that not only site conditions but also past human land-use was similar along the river valley (cf. Biró and Tóth 1997). Species composition of grasslands 100 years ago was very similar to the present one. This also suggests that this habitat has not changed considerably in the recent past.

The typical species composition of the present day hay meadows (*Alopecuretum pratensis hungaricum*) is the following (see also Table 1. for ecological relevés (5x5 m)):

Characteristic species of meadows: *Allium angulosum*, *Alopecurus pratensis*, *Chrysanthemum leucanthemum*, *Clematis integrifolia*, *Eleocharis palustris*, *Galium rubioides*, *Glycyrrhiza echinata*, *Gratiola officinalis*, *Lathyrus pratensis*, *Lysimachia nummularia*, *Lythrum virgatum*, *Potentilla reptans*, *Ranunculus repens*, *Scutellaria hastifolia*, *Stellaria graminea*, *Symphytum officinale*, *Thalictrum lucidum*, *Viola pumila*.

Indifferent meadow species (increased dominance of these species, however, suggests degradation): *Althaea officinalis*, *Centaurea pannonica*, *Cichorium intybus*, *Glechoma hederacea*, *Inula britannica*, *Lotus corniculatus*, *Mentha* sp., *Plantago lanceolata*, *Poa pratensis*, *Poa trivialis*, *Polygonum lapathifolium*, *Rorippa austriaca*, *Rorippa sylvestris*, *Rubus caesius*, *Rumex crispus*, *Taraxacum officinale*, *Trifolium repens*, *Vicia cracca*.

Species of wetter habitats: *Carex melanostachya*, *Euphorbia lucida*, *Iris pseudacorus*, *Lycopus exaltatus*, *Lysimachia vulgaris*, *Phalaroides arundinacea*.

Species of drier habitats: *Achillea collina*, *Asparagus officinalis*, *Carex praecox*, *Euphorbia salicifolia*, *Euphorbia virgata*, *Ranunculus polyanthemus*, *Trifolium arvense*, *Vicia hirsuta*.

Weeds: *Agropyron repens*, *Amorpha fruticosa*, *Arctium lappa*, *Aristolochia clematidis*, *Carex hirta*, *Cirsium arvense*, *Convolvulus arvensis*, *Festuca pratensis* (sown), *Lathyrus tuberosus*, *Plantago major*, *Ranunculus bulbosus*, *Tanacetum vulgare*, *Xanthium italicum*.

Species lists of some meadows of cca. 100 years ago:

1st list: *Glycyrrhiza echinata*, *Euphorbia lucida*, *Scutellaria hastifolia*, *Thalictrum lucidum*, *Potentilla reptans*, *Mentha* spp., *Eleocharis palustris*, and "csáté, káka" (Borbás 1881).

2nd list: *Carex melanostachya*, *Carex hirta*, *Thalictrum lucidum*, *Euphorbia lucida*, *Alopecurus pratensis*, *Vicia cracca*, *Potentilla reptans* (or *Ranunculus repens*?), *Cerastium*

dubium, *Iris pseudacorus*, *Scutellaria hastifolia*, *Lysimachia vulgaris*, *Allium angulosum* (Borbás 1881).

3rd list: *Glycyrrhiza echinata*, *Polygonum amphibium*, *Rorippa austriaca*, *Phalaroides arundinacea*, *Glyceria maxima*, *Artemisia pontica*, *Inula britannica*, *Carex melanostachya*, *Agrostis stolonifera*, *Trifolium repens*, *Echinochloa crus-galli*, *Xanthium strumarium*, *Viola pumila*, *Sium latifolium*, *Stachys palustris*, *Iris pseudacorus*, *Euphorbia palustris*, *E. lucida*, *Rumex acetosa*, *Conium maculatum*, *Calystegia sepium*, *Agropyron repens*, *Lolium perenne*, *Lactuca saligna*, *Plantago major*, *Matricaria maritima* spp. *inodora*, *Daucus carota*, *Trifolium repens*, *Gratiola officinalis*, *Solidago canadensis*, *Hibiscus trionum*, *Thalictrum flavum*, *Inula britannica*, *Potentilla anserina*, *Lysimachia nummularia*, *Ranunculus sardous*, *Lotus corniculatus*, *Setaria verticillata*, *Bidens tripartita*, *Gypsophila muralis*, *Althaea officinalis*, *Centaurea jacea*, *Trifolium pratense*, *Lythrum virgatum*, *Mentha pulegium*, *Vicia cracca*, *Cichorium intybus*, *Symphytum officinale* (Koren 1883).

4th list: *Achillea millefolium*, *Ajuga genevensis*, *Alopecurus pratensis*, *Aristolochia clematitis*, *Asparagus officinalis*, *Ballota nigra*, *Carex praecox*, *Cirsium arvense*, *Convolvulus arvensis*, *Euphorbia cyparissias*, *E. esula*, *E. palustris*, *E. lucida*, *E. virgata*, *Galium aparine*, *G. verum*, *Lathyrus tuberosus*, *Cardaria draba*, *Lolium perenne*, *Melandrium album*, *Lysimachia nummularia*, *Matricaria chamomilla*, *Medicago lupulina*, *M. sativa*, *Mentha arvensis*, *Myosotis stricta*, *Myosurus minimus*, *Pastinaca sativa*, *Phalaroides arundinacea*, *Poa palustris*, *P. pratensis*, *P. trivialis*, *Podospermum canum*, *Polygonum aviculare*, *P. hydropiper*, *Ranunculus arvensis*, *R. pedatus*, *Rorippa amphibia*, *R. austriaca*, *R. sylvestris*, *Agropyron repens*, *Trifolium hybridum*, *T. pratense*, *T. repens*, *Vicia cracca*, *V. lathyroides*, *V. sativa*, *Viola pumila* (Koren 1883).

Though these species lists represent probably a larger area than one meadow stand, the low number of species of drier and wetter habitats suggests that hay meadows were mainly surveyed. Thus, these lists can serve as a reference for comparison with present day grasslands.

The hay meadows of the area are species poor compared to the stands in the upper Tisza valley, and characteristic species are rare or absent (this was emphasized already by Borbás in 1881). Among the very few more interesting species are *Thalictrum lucidum*, *Clematis integrifolia*, *Allium angulosum*, *Glycyrrhiza echinata*, *Galium rubioides*, and *Viola pumila*. Absent or very rare species are *Leucosium aestivum*, *Veronica longifolia*, *Thalictrum flavum* (only at Szarvas), *Cirsium canum*, *Serratula tinctoria*, *Chrysanthemum serotinum* (only at Szarvas). These species are more common upstream (Doboz, Sarkad, Vésztő, Fás, Gyula, Nagyvárád) (Soó and Máthé 1938), thus their absence or rarity may be the consequence of habitat degradation in the Hármas-Körös valley.

Dry pastures

Dry grasslands are not common in the flood plain, since most of the drier areas are occupied by arable fields or forests. Most stands are used for cattle or sheep grazing and are degraded and characterless (*Achilleo-Festucetum pseudovinae*). More interesting

species occur mainly on more alkali sites: *Bassia sedoides*, *Peucedanum officinale*, *Aster punctatus*, *Artemisa pontica*.

In this region most of the dry grasslands - mostly steppes - had been cultivated in the Middle Ages and were abandoned during the Turkish Occupation (Molnár 1996 Biró and Tóth 1997). We know very little about the species composition of these relatively old secondary grasslands. One example may be the stand surveyed floristically by Borbás (1881) at Gyoma. Lack of specialist steppe species and abundance of generalists suggests the secondary character of the grassland. In 1783 the area is shown as a grassland (1st military survey map).

Specialist species: *Ranunculus polyanthemus*, *Salvia austriaca*, *Salvia pratensis*, *Coronilla varia*.

Generalists and weeds: *Lotus corniculatus*, *Ranunculus sardous*, *Koeleria cristata*, *Euphorbia virgata*, *Cerastium fontanum*, *C. pumilum*, *Stellaria graminea*, *Festuca pseudovina-rupicola*, *Bromus mollis*, *B. communtatus*, *B. tectorum*, *Agropyron repens*, *Taraxacum officinale*, *Falcaria vulgaris*, *Vebascum blattaria*, *Achillea millefolium*, *Linaria vulgaris*, *Podospermum canum*, *Vicia angustifolia*, *V. sativa*, *Adonis aestivalis*, *Viola arvensis*, *Capsella bursa-pastoris*, *Alyssum alyssoides*, *Lamium purpureum*, *Erodium cicutarium*, *Geranium pusillum*, *Veronica arvensis*, *Myosotis stricta*, *Arenaria serpyllifolia*, *Vicia hirsuta*, *Scleranthus annuus*, *Valerianella dentata*, *Tragopogon dubius*, *Crepis tectorum*, *Lolium perenne*, *Polygonum aviculare*, *Carduus nutans*, *Lappula squarrosa*.

Meadow species: *Trifolium repens*, *T. pratense*, *Ononis arvensis*, *Alopecurus pratensis*, *Festuca pratensis*, *Chrysanthemum leucanthemum*, *Cichorium intybus*

Alkali grassland species: *Trifolium striatum*, *Lotus tenuis*, *Gypsophila muralis*, *Trifolium fragiferum*.

Grasslands on levees

Levees are about 100 years old, but the grasslands on them may be younger as a consequence of subsequent hightening of the levees. On the wetter side, grasslands similar to the hay meadows developed, with some species that are more frequent here than in their original habitats (*Clematis integrifolia*, *Chrysanthemum leucanthemum*). Levees may serve as corridors for these species. On the drier parts, grasslands similar to loess grasslands are common. These secondary grasslands are, however, much species poorer than the natural ones (cf. Koren 1883 and Timár 1952, 1953). Non-native (often submediterranean) species migrate in this habitat (Timár 1953, 1954).

The more interesting dry habitat species are *Agropyron pectinatum*, *Allium atropurpureum*, *Alyssum alyssoides*, *Bassia sedoides*, *Centaurea solstitialis*, *Clinopodium vulgare*, *Coronilla varia*, *Falcaria vulgaris*, *Kochia prostrata*, *Koeleria cristata*, *Onobrychis viciifolia*, *Salvia austriaca*, *Salvia nemorosa*, *Sideritis montana*. Species of the moister habitats are *Allium angulosum*, *Centaurea pannonica*, *Chrysanthemum leucanthemum*, *Clematis integrifolia*, *Galium mollugo*, *Galium rubioides*, *Glycyrrhiza echinata*, *Thalictrum lucidum*.

Short description of some more interesting plant species

The protected, rare, and invasive species are briefly described, with some others that need special habitats in this landscape.

Acer negundo: 100 years ago this non-native invasive species was found only along roads and in gardens (Koren 1883). Today it is very common in many habitats.

Agropyron pectinatum: Sporadic on the drier parts of the river levees.

Allium angulosum: A typical species of the meadows of this area. Common, but not dominant in many not too degraded meadows.

Amorpha fruticosa: This non-native species was a garden plant 100 years ago (Koren 1883), but was already common 50 years ago having a typical zone on shores (Ubrizsy 1949). Today it is very common and still spreading in abandoned areas.

Asclepias syriaca: Only rarely found yet. No previous data exist.

Aster punctatus: On the outer side of the river levees on more alkali soils. On the active flood plain only rarely found (e.g. Gyüger-zug).

Aster tripolium ssp. *pannonicum*: Rarely on alkali soils.

Astragalus contortuplicatus: It was a characteristic species of the river bed (common at Szarvas - Koren 1883). In the last years nobody has seen it. Barrages may strongly affect its habitat.

Bassia sedoides: In the Szelevény area this species lives on highly alkali soils, on the Peresi-deponia and on levees (e.g. Békésszentandrás) on loessy substrate.

Bidens frondosa: New invasive adventive species. It was found at several sites in the river bed after 1992.

Chrysanthemum leucanthemum and *Clematis integrifolia*: They can be very common in the lower, wetter part of the river levees (especially below Öcsöd). On meadows only rarely found (but tens of thousands of *Clematis* were found near the Gyüger-zug). levees may serve as refugia and corridors for these species.

Cirsium furiens: Gyomaendröd, Templom-zug, on the lower, inner parts of the levees.

Clinopodium vulgare: Not rare on levees at Félhalom.

Convallaria majalis és *Polygonatum latifolium*: These woodland generalist species were sporadic previously in woodlands, presently they are probably extinct.

Dryopteris filix-mas: One individual was observed in a crack of an old willow at Békésszentandrás between 1983-1985.

Elatine alsinastrum: Only in the Szelevény area on mud surface.

Elodea canadensis: One stand was found in the Gyüger-zugi-holtág. May be the first data for the Tiszántúl region.

Equisetum fluviatile: In the more vegetated, more natural oxbow lakes, partly floating on the water small monodominant patches were found.

Fraxinus pennsylvanicus: No previous data were found, so it is unknown since when this invasive species has been common in the area. Today very common in woodlands.

Glycyrrhiza echinata: Common in hay meadows, pastures, abandoned grasslands and on levees.

Hippuris vulgaris: In the kubik near the Gyüger-zugi-holtág 2-3 small colonies were found. This species is rare in the Tiszántúl, but was found already in the area previously at Szarvas (Molnár 1994).

Kochia prostrata: Sporadic on the driest parts of the levees.

- Leersia oryzoides*: Rare on the shores of oxbow lakes.
- Listera ovata* and *Ophioglossum vulgatum*: In a secondary woodland at Szarvas (Molnár 1979).
- Lotus angustissimus*: Gyomaendrőd, Soczó-zug
- Nuphar luteum*: A small population was found in the Dan-zugi-holtág. Once common. May be spreading today.
- Nymphaea alba*: A spreading population lives in the Szarvasi-holtág. The population was big earlier (Ubrizsy 1949), became nearly extinct later (Z. Molnár pers.comm.).
- Nymphoides peltata*: Rare. A small population lives in the Szarvasi-holtág, and one in the Dan-zugi-holtág.
- Potamogeton officinale*: On the shores of the Kékes-holtág one individual was found with *Artemisa pontica* and *Aster punctatus*. Also at Békésszentandrás.
- Populus nigra*: In the Szarvas region it was only found along roads 100 years ago (Koren 1883). Today it is not a rare species occurring mainly as single individuals or small groups throughout the whole area. The origin of these individuals is unknown. The population may be an important gene bank for the species. Genetic investigations are needed to determine genetic purity of the population.
- Potamogeton lucens*: Sporadic in oxbow lakes and kubiks (e.g. Torzsás, Halásztelek).
- Rudbeckia* and *Heracleum* spp.: None of them have been found in the area yet.
- Salix cinerea*: Rare species. Found at Furugy and in the Külső-Tehenes.
- Salvinia natans* and *Trapa natans*: Very common in many oxbow lakes and younger kubiks.
- Thalictrum lucidum*: Sporadic in hay meadows and on the lower parts of the levees, but never dominant.
- Thalictrum minus*: In degraded loess grasslands at Szarvas. (Z. Molnár, pers. comm.)
- Triglochin maritimum*: In meadow at Szarvas. (Z. Molnár, pers. comm.)
- Utricularia vulgaris*: Sometimes dominant in oxbow lakes, but is not common.
- Vitis sylvestris*: Since this species is difficult to distinguish from the non-native *Vitis* species, exact distribution is unknown (Békésszentandrás, Halásztelki-holtág, Aranyosi-holtág, Gyomaendrőd).
- Wolffia arrhiza*: 40 years ago one population was known (Almády 1961). Today also only one near to the former one at Szarvas, but a different one.
- Probably extinct species of the area: *Stratiotes aloides*, *Armoracia macrocarpa*, *Marsilea quadrifolia* (it was common 50 years ago - Ubrizsy 1949), *Convallaria majalis*, *Eryngium planum*, *Sedum maximum*.
- The endangered species of this section of the Körös river are *Astragalus contortuplicatus*, *Equisetum fluviatile*, *Hippuris vulgaris*, *Listera ovata*, *Nuphar luteum*, *Nymphaea alba*, *Nymphoides peltata*, *Ophioglossum vulgatum*, *Triglochin maritimum*, *Vitis sylvestris*. The status of the other species is "not vulnerable", or unknown.

The flora of the area

(504 species)

- | | | |
|---------------------------------|------------------------------------|------------------------------------|
| <i>Abutilon theophrasti</i> | <i>Aristolochia clematitis</i> | <i>Calystegia sepium</i> |
| <i>Acer negundo</i> | <i>Arrhenatherum elatius</i> | <i>Camelina microcarpa</i> |
| <i>Achillea collina</i> | <i>Artemisia annua</i> | <i>Camphorosma annua</i> |
| <i>Acinos arvensis</i> | <i>Artemisia campestris</i> | <i>Capsella bursa-pastoris</i> |
| <i>Adonis aestivalis</i> | <i>Artemisia pontica</i> | <i>Cardaria draba</i> |
| <i>Aegilops cylindrica</i> | <i>Artemisia santonicum</i> | <i>Carduus acanthoides</i> |
| <i>Agrimonia eupatoria</i> | <i>Artemisia vulgaris</i> | <i>Carduus hamulosus</i> |
| <i>Agropyron pectinatum</i> | <i>Asclepias syriaca</i> | <i>Carduus nutans</i> |
| <i>Agropyron repens</i> | <i>Asparagus officinalis</i> | <i>Carex acutiformis</i> |
| <i>Agrostis stolonifera</i> | <i>Asperugo procumbens</i> | <i>Carex divulsa</i> |
| <i>Ajuga chamaepitys</i> | <i>Aster punctatus</i> | <i>Carex elata</i> |
| <i>Ajuga genevensis</i> | <i>Astragalus cicer</i> | <i>Carex gracilis</i> |
| <i>Alcea biennis</i> | <i>Astragalus contortuplicatus</i> | <i>Carex hirta</i> |
| <i>Alisma gramineum</i> | <i>Atriplex acuminata</i> | <i>Carex melanostachya</i> |
| <i>Alisma lanceolatum</i> | <i>Atriplex littoralis</i> | <i>Carex praecox</i> |
| <i>Alisma plantago-aquatica</i> | <i>Atriplex patula</i> | <i>Carex stenophylla</i> |
| <i>Allium angulosum</i> | <i>Atriplex prostrata</i> | <i>Carex vesicaria</i> |
| <i>Allium atropurpureum</i> | <i>Ballota nigra</i> | <i>Carex vulpina</i> |
| <i>Allium scorodoprasum</i> | <i>Bassia sedoides</i> | <i>Carlina vulgaris</i> |
| <i>Allium vineale</i> | <i>Batrachium aquatile</i> | <i>Carthamus lanatus</i> |
| <i>Alnus glutinosa</i> | <i>Batrachium trichophyllum</i> | <i>Carum carvi</i> |
| <i>Alopecurus geniculatus</i> | <i>Beckmannia eruciformis</i> | <i>Centaurea calcitrapa</i> |
| <i>Alopecurus pratensis</i> | <i>Bidens cernua</i> | <i>Centaurea pannonica</i> |
| <i>Althaea hirsuta</i> | <i>Bidens frondosa</i> | <i>Centaurea scabiosa</i> |
| <i>Althaea officinalis</i> | <i>Bidens tripartita</i> | <i>Centaurea solstitialis</i> |
| <i>Alyssum alyssoides</i> | <i>Bilderdykia convolvulus</i> | <i>Cephalanthera damasonium</i> |
| <i>Alyssum desertorum</i> | <i>Bilderdykia dumetorum</i> | <i>Cerastium brachypetalum</i> |
| <i>Amaranthus lividus</i> | <i>Bolboschoenus maritimus</i> | <i>Cerastium glomeratum</i> |
| <i>Amaranthus retroflexus</i> | <i>Bothriochloa ischaemum</i> | <i>Cerastium pumilum</i> |
| <i>Ambrosia artemisiifolia</i> | <i>Bromus arvensis</i> | <i>Ceratocephalus testiculatus</i> |
| <i>Amorpha fruticosa</i> | <i>Bromus inermis</i> | <i>Ceratophyllum demersum</i> |
| <i>Anagallis arvensis</i> | <i>Bromus mollis</i> | <i>Ceratophyllum submersum</i> |
| <i>Anchusa officinalis</i> | <i>Bromus squarrosus</i> | <i>Cerintho minor</i> |
| <i>Androsace elongata</i> | <i>Bromus sterilis</i> | <i>Chenopodium album</i> |
| <i>Anthemis austriaca</i> | <i>Bromus tectorum</i> | <i>Chenopodium botryoides</i> |
| <i>Anthriscus cerefolium</i> | <i>Bryonia alba</i> | <i>Chenopodium botrys</i> |
| <i>Arctium lappa</i> | <i>Butomus umbellatus</i> | <i>Chenopodium ficifolium</i> |
| <i>Arctium tomentosum</i> | <i>Calamagrostis epigeios</i> | <i>Chenopodium glaucum</i> |
| <i>Arenaria serpyllifolia</i> | <i>Calepina irregularis</i> | <i>Chenopodium hybridum</i> |

Chenopodium polyspermum	Eleocharis acicularis	Geum urbanum
Chenopodium rubrum	Eleocharis palustris	Glechoma hederacea
Chenopodium urbicum	Elodea canadensis	Glyceria fluitans
Chlorocyperus glomeratus	Epilobium hirsutum	Glyceria maxima
Chondrilla juncea	Epilobium parviflorum	Glycyrrhiza echinata
Chrysanthemum	Epilobium tetragonum subsp.	Gnaphalium uliginosum
leucanthemum	lamyi	Gratiola officinalis
Cichorium intybus	Epipactis helleborine	Hedera helix
Cirsium arvense	Epipactis purpurata	Heleochloa alopecuroides
Cirsium furiens	Equisetum arvense	Heliotropium europaeum
Cirsium vulgare	Equisetum fluviatile	Hibiscus trionum
Clematis integrifolia	Equisetum palustre	Hieracium bauhini
Clematis vitalba	Eragrostis pilosa	Hieracium pilosella
Clinopodium vulgare	Erigeron canadensis	Hippuris vulgaris
Conium maculatum	Erodium cicutarium	Holosteum umbellatum
Consolida orientalis	Erophila verna	Hordeum hystrix
Consolida regalis	Erucastrum nasturtiifolium	Hordeum murinum
Convallaria majalis	Eryngium campestre	Humulus lupulus
Convolvulus arvensis	Eryngium planum	Hydrocharis morsus-ranae
Cornus sanguinea	Erysimum repandum	Hyoscyamus niger
Coronilla varia	Eupatorium cannabinum	Hypericum perforatum
Crepis setosa	Euphorbia cyparissias	Inula britannica
Crepis tectorum	Euphorbia esula	Iris pseudacorus
Cuscuta australis	Euphorbia helioscopia	Juncus alpinus
Cuscuta campestris	Euphorbia lucida	Juncus articulatus
Cuscuta epithimum	Euphorbia maculata	Juncus bufonius
Cuscuta lupuliformis	Euphorbia virgata	Juncus compressus
Cynodon dactylon	Falcaria vulgaris	Juncus conglomeratus
Cyperus difformis	Festuca pratensis	Juncus effusus
Cyperus fuscus	Festuca pseudovina	Juncus gerardii
Dactylis glomerata	Fraxinus excelsior	Knautia arvensis
Datura stramonium	Fraxinus pennsylvanica	Kickxia elatine
Daucus carota	Fumaria schleicheri	Kickxia spuria
Descurainia sophia	Gagea pusilla	Kochia laniflora
Dichostylis micheliana	Galega officinalis	Kochia prostrata
Dipsacus laciniatus	Galinsoga parviflora	Koeleria cristata
Draba nemorosa	Galium aparine	Lactuca saligna
Dryopteris filix-mas	Galium mollugo	Lamium amplexicaule
Echinochloa crus-galli	Galium palustre	Lamium purpureum
Echinochloa phyllopogon	Galium rubioides	Lathyrus aphaca
Echinocystis lobata	Galium verum	Lathyrus nissolia
Echinops sphaerocephalus	Genista tinctoria	Lathyrus tuberosus
Echium italicum	Geranium pusillum	Leersia oryzoides
Echium vulgare	Geranium robertianum	Lemna minor
Elatine alsinastrum	Geranium rotundifolium	Lemna trisulca
		Leontodon autumnalis

Leonurus cardiaca	Muscari comosum	Poa pratensis
Lepidium campestre	Myosotis arvensis	Poa trivialis
Lepidium perfoliatum	Myosotis ramosissima	Podospermum canum
Lepidium ruderales	Myosotis stricta	Polygonum amphibium
Limonium gmelini subsp. hungaricum	Myosoton aquaticum	Polygonum aviculare
Limosella aquatica	Myosurus minimus	Polygonum hydropiper
Linaria angustissima	Myriophyllum spicatum	Polygonum lapathifolium
Linaria vulgaris	Myriophyllum verticillatum	Polygonum minus
Lithospermum arvense	Najas marina	Polygonum mite
Lolium perenne	Najas minor	Polygonum persicaria
Lotus angustissimus	Nigella arvensis	Populus alba
Lotus corniculatus	Nonea pulla	Populus nigra
Luzula campestris	Nymphaea alba	Populus tremula
Lycium barbarum	Nymphoides peltata	Populus x canescens
Lycopus europaeus	Oenanthe aquatica	Portulaca oleracea
Lycopus exaltatus	Oenanthe silaifolia	Potamogeton coloratus
Lysimachia nummularia	Onobrychis viciifolia	Potamogeton crispus
Lysimachia vulgaris	Ononis spinosa	Potamogeton gramineus
Lythrum hyssopifolia	Onopordum acanthium	Potamogeton lucens
Lythrum salicaria	Ornithogalum orthophyllum	Potamogeton natans
Lythrum scabrum (L. salicaria x virgatum)	Ornithogalum pyramidale	Potamogeton
Lythrum virgatum	Papaver dubium	panormitanus
Malva neglecta	Papaver rhoeas	Potamogeton pectinatus
Malva pusilla	Parthenocissus inserta	Potentilla anserina
Marsilea quadrifolia	Pastinaca sativa	Potentilla argentea
Matricaria chamomilla	Peplis portula	Potentilla impolita
Matricaria maritima ssp. inodora	Petrorhagia prolifera	Potentilla reptans
Medicago falcata	Peucedanum officinale	Potentilla supina
Medicago lupulina	Phalaris canariensis	Prunella vulgaris
Medicago minima	Phalaroides arundinacea	Puccinellia distans
Medicago rigidula	Phleum pratense	Pulicaria vulgaris
Medicago sativa	Pholiurus pannonicus	Pycreus flavescens
Melandrium album	Phragmites australis	Quercus robur
Melilous albus	Picris hieracioides	Ranunculus arvensis
Melilotus officinalis	Pimpinella saxifraga	Ranunculus lateriflorus
Mentha aquatica	Plantago altissima	Ranunculus polyanthemus
Mentha arvensis	Plantago lanceolata	Ranunculus repens
Mentha longifolia	Plantago major	Ranunculus sardous
Mentha pulegium	Plantago media	Ranunculus sceleratus
Mentha x dalmatica	Plantago tenuiflora	Reseda lutea
Mentha x dumetorum	Poa angustifolia	Robinia pseudo-acacia
Mentha x verticillata	Poa annua	Rorippa amphibia
Moehringia trinervia	Poa bulbosa	Rorippa austriaca
	Poa nemoralis	Rorippa islandica
	Poa palustris	Rorippa palustris
		Rorippa sylvestris

Rorippa x astylis	Sinapis arvensis	Valerianella locusta
Rubus caesius	Sium latifolium	Verbascum blattaria
Rumex acetosa	Solanum dulcamara	Verbascum nigrum
Rumex conglomeratus	Solanum nigrum	Verbascum phlomoides
Rumex crispus	Solidago virga-aurea	Verbascum
Rumex hydrolapathum	Sonchus arvensis	phoeniceum
Rumex palustris	Sonchus asper	Verbena officinalis
Rumex patientia	Sonchus oleraceus	Verbena supina
Rumex pulcher	Sparganium erectum	Veronica
Rumex sanguineus	Spirodela polyrhiza	anagallis-aquatica
Rumex stenophyllus	Stachys annua	Veronica arvensis
Sagittaria sagittifolia	Stachys palustris	Veronica beccabunga
Salix alba	Stellaria graminea	Veronica persica
Salix cinerea	Stellaria media	Veronica polita
Salix fragilis	Stenactis annua	Veronica scutellata
Salix triandra	Symphytum officinale	Veronica verna
Salix viminalis	Tanacetum vulgare	Vicia angustifolia
Salsola kali	Taraxacum officinale	Vicia cracca
Salvia aethiopsis	Teucrium scordium	Vicia grandiflora
Salvia austriaca	Thalictrum flavum	Vicia hirsuta
Salvia nemorosa	Thalictrum lucidum	Vicia lathyroides
Salvia pratensis	Thalictrum minus	Vicia pannonica subsp.
Salvinia natans	Thalictrum simplex	striata
Sambucus ebulus	Thesium arvense	Vicia sativa
Sambucus nigra	Thlaspi arvense	Vicia villosa
Saponaria	Thlaspi perfoliatum	Viola arvensis
officinalis	Tragopogon dubius subsp. major	Viola cyanea
Scabiosa ochroleuca	Trapa natans	Viola pumila
Schoenoplectus lacustris	Trifolium arvense	Viscaria vulgaris
Schoenoplectus mucronatus	Trifolium campestre	Vitis riparia
Schoenoplectus supinus	Trifolium dubium	Vitis sylvestris
Schoenoplectus tabernaemontani	Trifolium	Wolffia arrhiza
Sclerochloa dura	fragiferum	Xanthium italicum
Scutellaria galericulata	Trifolium hybridum	Xanthium spinosum
Scutellaria hastifolia	Trifolium micranthum	Xanthium strumarium
Sedum acre	Trifolium pratense	Zannichellia palustris
Sedum maximum	Trifolium repens	
Senecio erraticus	Triglochin maritimum	
Senecio jacobaea	Tussilago farfara	
Senecio vernalis	Typha angustifolia	
Setaria pumila	Typha latifolia	
Setaria verticillata	Ulmus glabra	
Setaria viridis	Urtica dioica	
Sideritis montana	Urtica urens	
Silene vulgaris	Utricularia vulgaris	

Acknowledgements

Zoltán Molnár, Tamás Tóth, Béla Kalivoda, László Tirják, Marianna Biró, Balázs Forgách, and Györgyi Gulyás helped during various stages of our studies in the area. This study was supported by the Körös-Maros National Park and the OTKA Grant No. F006095.

References

- Almády, L. (1961): A *Wolffia arrhiza* L. Wimm. szarvasi előfordulása. (*Wolffia arrhiza* L. Wimm. at Szarvas.) - Bot. Közlem. 1-2, 112-113.
- Bagi, I. (1985): Studies on the vegetation dynamics of Nanocyperion communities I. Characteristic indicator values and classification and ordination of stands. - Tiscia 20, 29-44.
- Bagi, I. (1987a): Studies on the vegetation dynamics of Nanocyperion communities III. Zonation and succession. - Tiscia 22, 31-45.
- Bagi, I. (1987b): Studies on the vegetation dynamics of Nanocyperion communities IV. Diversity and succession. - Tiscia 22, 47-54.
- Bagi, I. (1988): Effects of mud vegetation on the nutrient condition of flood-plain lakes. - Aquatic Botany 32, 321-328.
- Bagi, I. (1991): Edaphic factors in the development of dwarf-plant communities of mud. - Folia Geobot. Phytotax., Praha 26, 431-437.
- Bagi, I. and Körmöczy, L. (1986): Studies on the vegetation dynamics of Nanocyperion communities II. Classification and ordination of species. - Tiscia 21, 13-24.
- Biró, M. and Tóth, T. (1997): Landscape and vegetation history of the Hármas-Körös flood plain in the last 200 years. - Manuscript, Vác-rátót
- Bodrogközy, Gy. (1962): Ökologische Untersuchungen der Mähwiesen und Weiden der Mittel-Theiss. - Phytion 9, 196-215.
- Bodrogközy, Gy. (1985): Hydroecology of the plant communities at the Middle Tisza-valley I. Agropyro-Rumicion. - Tiscia 20, 55-97.
- Borbás, V. (1881): Békésvármegye flórája. (Flora of Békés county.) - Értekezések a Természettudományok Köréből 18, 1-105.
- Borhidi, A. (1982): Jelentés a Körösvölgyi Természetvédelmi Terület állapotáról, valamint a terület tájtervezésének és kezelésének néhány szempontja. (State of the Körös Nature Reserve and recommendations for management.) - Körös Research Excursion, M.S.
- Borhidi, A. (1996): Critical revision of the Hungarian plant communities. - Janus Pannonius University, Pécs.
- Kertész, É. (1986): Adatok a Körös-völgyi Természetvédelmi Terület flórájához, 1765-1986. (Data to the flora of the Körös Nature Reserve, 1765-1986.) - M.S., Munkácsy M. Múzeum, Békéscsaba.
- Kertész, É. (1989): A Dobozi ártéri ligeterdők florisztikai vizsgálata. (Floristical investigation in the riverhine woodlands at Dobozy.) - In: Réthy, Zs. (ed.): Dobozy Tanulmányok, Békéscsaba.

- Koren, I. (1883): Szarvas virányának második javított és bővített felszámolása. (Second, up-dated flora of Szarvas.) - In: Tatay, I. (ed.): Szarvasi Főgimnázium Évi Jelentése 1882-83-ról. pp. 2-54., Gyula.
- Kovács, A. and Molnár, Z. (1981): Békés megye magasabb rendű növényeinek áttekintése. (Flora of Békés county.) - Körny. Term.véd. Évkönyv. 4, 45-78.
- Molnár, Z. (1979): Az *Ophyoglossum vulgatum* termőhelye a Tiszántúlon. (Habitat of *Ophyoglossum vulgatum* in the Tiszántúl.) - Bot. Közlem. 66, 15-17.
- Molnár, Z. (1994): Szarvas vadontermő növényei. (Flora of Szarvas.) - *Natura Bekesiensis* 1, 17-57.
- Simon, T. (1969): A Körösvidék természetes növényzete. (Natural vegetation of the Körös region.) - In: Pécsi, M. (ed.) Magyarország Tájföldrajza. II. A tiszai Alföld. Akadémiai Kiadó, Budapest.
- Soó, R. and Máthé, I. (1938): A Tiszántúl flórája. (Flora of the Tiszántúl.) - Debrecen.
- Tálas, L. (1982): Növényvilág a Körös folyó alsó szakaszán. (Vegetation in the lower Körös valley.) - Körös Research Excursion, M.S.
- Tímár, L. (1952): A délkelet-Alföld növényföldrajzi vázlata. (Plant geography of the south-eastern part of the Great Hungarian Plain.) - Földr. Ért. 1, 489-511.
- Tímár, L. (1953): A Tiszamente Szolnok-Szeged közti szakaszának növényföldrajza. (Plant geography of the Tisza valley between Szolnok and Szeged.) - Földr. Ért. 2, 87-113.
- Tímár, L. (1954): Adatok a Tiszántúl (Crisicum) flórájához. (Data to the flora of the Tiszántúl.) - Ann. Biol. Univ. Hung. 2, 491-499.
- Tóth, A. (1982): A Hármaskörös hullámterének legjellemzőbb gyepársulásai. (Characteristic grassland types of the Hármaskörös.) - Körös Research Excursion, M.S.
- Tóth, T., Molnár, Zs., Biró, M. and Forgách, B. (1996): A Körös-völgyi Természetvédelmi Terület tájtörténeti, botanikai és zoológiai felmérése és értékelése. (Landscape historical, botanical and zoological survey and evaluation of the Körös Nature Reserve.) - M.S., Körös-Maros National Park, Szarvas.
- Ubrizsy, G. (1949): Adatok a Tiszántúl (Crisicum) flórájának ismeretéhez, különös tekintettel Szarvas és környékére. (Data to the flora of the Tiszántúl, especially that of the Szarvas area.) *Borbásia* 9, 7-15.
- Zólyomi, B. (1946): Természetes növénytakaró a tiszafüredi öntözőrendszer területén. (Natural vegetation in the Irrigation system of Tiszafüred) - Öntözésügyi Közl. 7-8, 62-75.

Table 1. Alopecuretum pratensis hungaricum in the Hármas-Körös valley

SPECIES / PLOT	1	2	3	4	5	6	7	8	9	10	11	12	13	K
<i>Characteristic species</i>														
Alopecurus pratensis	60	30	35	15	2	0.1	40	35	15	2	40	70	35	V
Glycyrrhiza echinata	0.5	1	1	3	2	1	8	0	2	0	10	2	0	IV
Ranunculus repens	2	2	20	1	0.1	0	10	1	0	25	2	5	3	IV
Symphytum officinale	0.1	10	0.1	20	0.1	10	1	0	0	0	0.1	1	10	IV
Thalictrum lucidum	0.5	1	0.5	0	0	0	0.5	1	0	1	1	0.1	0.1	IV
Allium angulosum	1	0	0.5	1	1	0	0.5	0	0	0.5	0	1	1.5	III
Lythrum virgatum	0.5	0	0.1	0.1	0.5	1	1	0.1	0	0	0	0.1	0	III
Potentilla reptans	1	3	2	0	0	0	0.1	0	0.1	2	0.1	5	0	III
Chrysanthemum leucanthemum	0	0	0	0	0	0	0	0	0	0	0	0.1	0	II
Gratiola officinalis	0.1	10	0	0	0	0	0	0	0	0	0	0.1	0.1	II
Lysimachia nummularia	0	25	0	0	0	0	0.1	0	0	0	0	10	0.1	II
Viola pumila	1	0	0	0	0	0	0.1	8	0	0	3	0	0	II
Clematis integrifolia	10	0.1	0	0	0	0	0	0	0	0	0	0	0	I
Eleocharis palustris	0	0	0.1	0	0	0	0	0	0	0	0	0	0	I
Galium rubioides	0	0	0	0.1	0	0	0.1	0	0	0	0	0	0	I
Lathyrus pratensis	0	0	0	0	0	0	0	0	0	0	0.1	0	0	I
Scutellaria hastifolia	0	0	0	0	0	0	0.1	0	0	0	0	0	1	I
Stellaria graminea	0	0	0	0	0	0	0.1	0	0	0	0	0	0	I
<i>Indifferent meadow species</i>														
Poa pratensis s.str.	1	1	5	2	40	0	10	35	50	30	20	2	5	V
Taraxacum officinale	4	0	2	2	4	3	2	1	2	3	3	1	2	V
Rorippa austriaca	3	10	0.1	0.1	2	1	0.1	0	0	0	0	10	3	IV
Rumex crispus	1	1	1	0.1	0.1	0	1	0	1	0	1	2	1	IV
Vicia cracca	0.1	2	2	0.1	1	2	0	0	0	1	2	0.1	0	IV
Althaea officinalis	0	1	0.5	0	0.1	0	0.5	0.1	0.1	0	0.1	0	0.1	III
Centaurea pannonica	0	0	0	0	2	0	0.1	2	2	3	1	0	0	III
Plantago lanceolata	0.1	0	0.1	0	5	0	0.5	0.1	0	15	0	0	0	III
Rorippa sylvestris	0	3	4	0.1	0	2	0	0	0	0	0	0	2	III
Cichorium intybus	0	0	0.1	0	0	0	0	0	0	0.1	0	0	0	II
Glechoma hederacea	0	2	0	0	0.1	0.1	0	0	0	4	0	0	0.1	II
Lotus corniculatus	0	0	0	0	2	0	0.1	0	6	15	2	0	0	II
Mentha sp.	0	0	0.1	0	0	0	0.1	0	0	0	0	0	0.1	II
Polygonum lapathifolium	0.1	0	0	0	0.1	0.1	0	0	0.5	0	0.1	0	0	II
Rorippa sp.	0	0	5	0	0	1	0.1	0	0	0	10	1	0	II
Rubus caesius	0.1	0	0	0	0	10	0	0	0	0	0	0	0.5	II
Trifolium repens	0	0.1	0.5	0	0.1	0	0	0	0	20	10	0	0	II
Inula britannica	0	0	0	0	0.1	0	0	0	0	0	0	0	5	I
Poa trivialis	0	0	0	0	0	0	0	0	0	0	0	0.1	0	I
<i>Marsh species</i>														
Carex melanostachya	5	15	1	1	0.1	0	10	0.1	0.1	0	1	0	2	IV
Euphorbia lucida	0.1	10	6	0.1	0.1	0.1	0.5	0	0	0	0.1	0	0.1	IV
Iris pseudacorus	0.1	3	0.1	1	0.1	0	0.1	0	0	0	0.1	0	2	III
Lysimachia vulgaris	0	0.1	0	0	0	0	0.5	0	0	0	0	0	2	II
Lycopus exaltatus	0	0	0	0	0	0.1	0	0	0	0	0	0	0	I
Phalaroides arundinacea	0	0.1	0	0	0	0	0	0	0	0	0	0	0.1	I

SPECIES / PLOT	1	2	3	4	5	6	7	8	9	10	11	12	13	K
<i>Species of drier habitats</i>														
Carex praecox	10	4	2	2	10	0	3	3	0	3	4	0	3	IV
Asparagus officinalis	0	0	0.1	0.1	0	0	0	0	0	0	0	0.1	0	II
Euphorbia salicifolia	0	0	0	0	0	0	0.5	0	0	0	2	0	0.1	II
Euphorbia virgata	0.1	0	0	1	0.1	0	0	5	0	0	0	0	1	II
Ranunculus polyanthemos	0.1	0	0	0	0	0	0	0.1	0.1	0	0.1	0	0	II
Vicia sp.	0	0	0	0	0	0	0.5	0	0	0	0.1	0	0	II
Achillea collina	0	0	0.1	0	0	0	0	0	0	0	0	0	0	I
Trifolium arvense	0	0	0	0	0	0	0	0	0.1	0	0	0	0	I
Vicia hirsuta	0	0	0	0	0	0	0	0	0	0	1	0	0	I
<i>Weeds</i>														
Agropyron repens	0	0	2	40	15	0	2	0	1	0	0	0	25	III
Cirsium arvense	2	0	1	0.1	0	10	0.1	1	0	0	0.1	0	0.1	III
Convolvulus arvensis	0.1	0	0	0.1	0	3	0	2	3	0	2	0	0.1	III
Amorpha fruticosa	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	I
Arctium lappa	0	0	0	0	0	0.1	0	0	0	0	0	0	0	I
Aristolochia clematitis	2	0	0	0	0	0	0	0	0	0	0.1	0	0	I
Carex hirta	0	0	1	0	0	0	0	0	0	0	0	0	0	I
Festuca pratensis	0	0	0	0	0	50	0	0	0	0	0	0	0	I
Lathyrus tuberosus	0	0	0	0	0	0	0	0.1	0	0	0.1	0	0	I
Plantago major	0	2	0.1	0	0	2	0	0	0	0	0	0	0	I
Ranunculus bulbosus	0	0	0	0	0	0	0	0	0	1	0	0	0	I
Tanacetum vulgare	0	0	0	0	0	0	0	0	0	0	0.1	0	0	I
Xanthium italicum	0	0	0	0	0	0.1	0	0	0	0	0	0	0	I

Zsolt Molnár
 Institute of Ecology and Botany
 H-2163 Vácrátót
 Hungary

István Bagi
 Department of Botany
 József Attila University
 H-6701 Szeged
 Hungary

Éva Kertész
 Department of Natural History
 Békés County Museum
 H-5600 Békéscsaba
 Hungary