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Landscape-scale connections between the land use, habitat quality and ecosystem goods and services in the Mureş/Maros valley

Edited by

László Körmöczi

Szeged-Arad
2012

Two countries, one goal, joint success!

Hungary-Romania
Cross-Border Co-operation
Programme 2007-2013

European Union
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Contents

NEW RESULTS OF THE HUNGARIAN-ROMANIAN ECOLOGICAL AND SOCIO-ECONOMICAL RESEARCH COOPERATION IN THE MAROS-VALLEY

László Körmöczi

Introduction

River valleys play specific role in the geological, ecological and social systems of the Carpathian Basin. They cross regions of varied basic rock and climate, connect distant habitats, therefore they may mediate several impacts across different landscapes. The rivers are also very important in landscape formation of the Great Plain. River valleys, such as the Maros valley, are often divided by political borders that manifests in social and land use differences, and as a consequence may have a strong effect on the natural communities.

In 2010, a new joint research project was organized by the Department of Ecology, University of Szeged and the Department of Ecology and Environmental protection,"Vasile Goldiş" Western University Arad. The aim of this project was to improve the ecological research activity and quality in the southern region of the Great Plain. As a result of the research activity, we completed a monograph (Körmöczi 2011) that summarized the main activities and some conclusions of the common investigations. This project was continued in 2011, focusing mainly on the nature, on the effects of the land use differences and on the role of the river in shaping the landscape and biota. We investigated the landscape and habitat structure of transboundary territories, anthropogenic background of the landscape differences, properties of animal assemblages of quickly changing habitats – islands and reefs, and the phylogenetics of certain rear animal species.

Expected results and impacts

The investigations performed parallel in the transboundary region may contribute significantly to the knowledge of the recent state of the flora and fauna. The knowledge on the structure of natural communities may reveal the effect of land use practices and that of the riparian habitats as green corridor.

With the above knowledges we may contribute to the elaboration of efficient and sustainable land use models that support and enhance the life quality of the trans-boundary region's inhabitants, and at the same time preserve the natural landscape and biodiversity.

Common implementation of this researc project may improve the research efficiency of the partner universities, and may result extended further cooperations in the fields of ecology and nature conservation.

Members of the project team

This project was carried out in the framework of *Hungary-Romania Cross-border Cooperation program 2007-2013* as a joint research activity of "Vasile Goldiş" Western University of Arad as the lead partner and of University of Szeged as the project partner.

The project "*Landscape-scale connections between the land use, habitat quality and ecosystem goods and services in the Mureş/Maros valley*" was implemented under the Hungary-Romania Cross-Border Co-operation Programme 2007-2013, and is part-financed by the European Union through the European Regional Development Fund, and the Republic of Hungary and Romania. Project code: HURO/0901/205/2.2.2.

Head of the project management team was Aurel Ardelean, Rector of "Vasile Goldiş" Western University of Arad. Supervisors were László Körmöczi for the University of Szeged and Violeta Turcuş for "Vasile Goldiş" Western University of Arad. The project was managed by Iulia Daraban and Márta Zalatnai.

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Study area

Investigations were carried out in the lowland area of river Maros. Larger section if this river runs in Romania but most of the features of the floodplain are similar in Hungary and Romania. Eight representative areas were selected along the river; the names of the study sites are: 1: Szeged (N46° 14' E20° 14'); 2: Maroslele (N46° 14' E20° 17'); 3: Makó (N46° 11' E20° 29'); 4: Magyarcsanád (N46° 8' E20° 38'); 5: Igriș (N46° 7' E20° 48'); 6: Felnac (N46° 7' E21° 6'); 7: Vladimirescu (N46° 7' E21° 25'); 8: Păuliș (N46° 5' E21° 39') (Fig. 1). Size of the selected areas was 3 × 3 km each, and represented the landscape structure and land use practices most characteristic for the target area.

The project consists of four main fields of investigation. The landscape structure of the studied region is determined by the loose alluvium and the rather variable riverbeds of Mureş/Maros. Vegetation and land use are responsible primarily for the habitat structure, so we prepared habitat maps of the eight sample sites, and recorded the recent cenological state of natural/seminatural vegetation. Floristic records completed the vegetation survey, and new data are reported on some protected plant species and on the first occurrence of a new alien species (Bátori *et al.* 2012). Natural vegetation types are characteristic elements of landscapes, and provide habitat for the elements of the fauna. Our research activities consisted of the faunistic survey resulting important information on the arthropod fauna. Special attention was paid on the fauna of islands because the ant and spider assemblages are sensitive indicators of environmental disturbances. The third main investigation focused on the phylogenetics of certain animal species that are important from evolutionary point of view. At last, the main biotic impact on the landscapes is that of the man. In the fourth project part we attempt to reveal the relationships of the local inhabitants and the habitat types, and to evaluate the ecosystem goods and services characteristic for the target areas.

According to the four areas of interest, field data collections were implemented by four groups of experts on the basis of the objects and purposes. Two groups dealt with the vegetation and fauna of the sites selected. One group was responsible for phylogenetics (some results of this investigation are reported in Pénzes 2012).The fourth group met with representatives of the local inhabitants in order to make interviews for ecosystem goods and services evaluation. Details of the methodologies are described in each chapter.

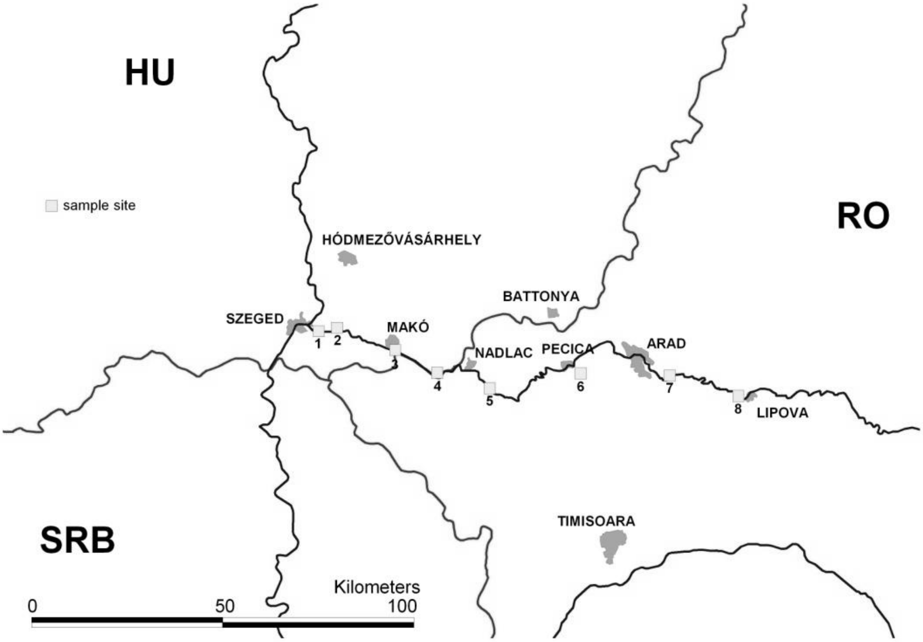

Figure 1. Location of the experimental sites in the trans-boundary region. The study sites are: 1: Szeged; 2: Maroslele; 3: Makó; 4: Magyarcsanád; 5: Igriș; 6: Felnac; 7: Vladimirescu; 8: Păuliș

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VEGETATION OF THE RIVER MAROS AND ITS SURROUNDINGS (SOUTHERN HUNGARY)

Viktória Cseh, Zoltán Bátori, László Erdős, László Körmöczi

Introduction

754 km long, with a catchment area of 30,332 km² (Somogyi 1990), river Maros plays an important role in the Great Hungarian Plain both from a nature conservation and a socio-economic perspective (cf. Andó 1995, Veress 2002, Körmöczi 2011). Therefore, knowledge on this area may be useful in conservation management and landscape planning. Formerly, we investigated the land-use history and habitat types of the Bökény area near Maros (Fodor *et al.* 2011). That work was done as part of a Hungarian-Romanian cross-border project (Körmöczi 2011). In this paper, we summarize the results of the research that was an extension of the former project, focusing on four representative areas of the Hungarian Maros section. Our aim was to prepare the habitat maps of the designated areas, carry out coenological surveys and supply some floristic data.

Material and methods

Our study area is situated around the Hungarian section of River Maros. Mean annual temperature is 10.5-10.6 ºC, mean annual precipitation is 550-600 mm (Ambrózy and Kozma 1990). Typical soils are alluvial protosoils and alluvial soils, to a lesser degree chernozems and alkaline soils (Rajkai 1990, Jakab 1995). A detailed description of the geohistory, climate and hydrography of the Maros catchment region are given by Andó (1995).

Natural vegetation of the area (before intensive human impact) included riverine forests and marshes (Zólyomi 2007). A brief description of the actual vegetation of the inundation area of the Hungarian Maros section was given by Margóczi *et al.* (2002). Generally, forests are in a bad condition: the proportion of poplar-willow forests is low, and the area is dominated by plantations (mainly hybrid poplar plantations), where natural undergrowth is eliminated, invasive species are abundant and protected species occur only sporadically. Gaskó (1999) gave a comprehensive description of the natural values of the Maros section in Csongrád county. He listed eleven protected species from the area.

During our field works, we recorded the localities of protected plants as well as occurrences of species that are rare on the Great Hungarian Plain. Based on GPS-coordinates, maps were drawn depicting the localities. For this purpose, we used ArcView 3.2. (ESRI). Localities are given according to settlements. In brackets, codes of the CEU-quadrates are also supplied (Király and Horváth 2000). Names of protected species are underlined.

Two semi-natural and one sown marsh-meadows were chosen for our investigations. The meadows are parts of the floodplain of the river Maros and are located near Makó and Magyarcsanád (cf. Fig. 1 at p. 5). Coenological relevés were taken in 2012 in 2 m × 2 m plots. Percentage cover of all vascular plant species was estimated in each plot. A total of 25 relevés were taken.

To characterize the differences between the main forest types occurring along the river Maros, we made 5 relevés in the riverine willow-poplar forests and in the planted oak-elm-ash forests, respectively. In 2012, percentage cover of all vascular plant species was estimated within each 20 m × 20 m plot.

We arranged the species in the tables into syntaxonomical groups according to Soó (1980) (Tables 1-2). The spectra of the groups were calculated using cover data. In the case of the forests, only the shrub and herb layers were considered.

In order to compare the diversity of the two marsh-meadow types and of the two forest types, we applied diversity ordering. We used Rényi's diversity function, since it is one of the most useful diversity ordering methods (Tóthmérész 1995). Rényi's function is given by the equation below:

$$H\,(R) = \left(\log \sum_{i=1}^{S} p_i^{\alpha}\right) \Big/ (1-\alpha)$$

The relationships among the species composition of the relevés were analysed with PCoA ordination using the program package SYN-TAX 2000 (Podani 2001).

Diagnostic species of the different vegetation types were determined by statistical fidelity measures (Tichý and Chytrý 2006). The phi coefficient (Φ) for all species was computed with the JUICE 7.0.25 program (Tichý 2002). This coefficient ranges from -1 to 1, but for convenience, it is multiplied by 100 in the program. The highest phi value of 1 is achieved if the species occurs in all plots of the target vegetation type and is absent elsewhere. Species with positive phi-coefficients were considered significant diagnostic species. Fisher's exact test was carried out to exclude non-significant diagnostic species.

Species names are used according to Király (2009).

Results and discussion

Floristic survey

Localities of protected and rare plants are shown in Colour plate Figures 1 and 2.

Aster sedifolius L. ssp. *sedifolius*

Klárafalva (in a backyard, used currently as a hay-meadow) [9787.4], Deszk (in an alkaline grassland) [9787.4]. It is relatively wide-spread in the area east of River Tisza (Farkas 1999).

Circaea lutetiana L.

Kiszombor (in a poplar-willow forest) [9888.2]. It is a sporadic plant on the Great Hungarian Plain (Simon 2000, Tóth 2003, Király 2009).

<u>*Clematis integrifolia* L.</u>

Szeged (near the mouth of River Maros, abundant on the dike) [9787.3]. Relatively common along the Maros (therefore, we do not show its occurrences on the map), but it was last mentioned from this locality by Erdős J. (in Soó and Máthé 1938).

<u>*Epipactis helleborine* (L.) Crantz</u>

Makó [9788.4, 9888.2], Kiszombor [9888.2] (in poplar-willow forests, oak and hybrid poplar plantations). Formerly, it was mentioned from Makó by Makra (2002), but has not been reported from Kiszombor (cf. Farkas 1999).

<u>*Iris spuria* L.</u>

Magyarcsanád (on the hay meadow near Bökény) [9889.2]. Although it was mentioned from the lower section of the Maros neither by Dragulescu (1995), nor by Farkas (1999), it was reported from the same site in an unpublished report of Penksza *et al*. (2001).

Lamium album L.

Magyarcsanád (along River Maros, near Bökény, in a poplar-willow forest and its edge) [9889.4]. The species is rare on the Great Hungarian Plain (Simon 2000), its nearest known locality is near Makó (Makra 2002).

Marchantia polymorpha L. emend Burgeff.

Deszk (on the Maros bank, on open soil surface) [9787.4]. Although it is relatively wide-spread in the Carpathian basin (Hazslinszky 1885), it is rare on the Great Hungarian Plain, where it is mostly restricted to artificial habitats (Soó 1964, Orbán and Vajda 1983).

Ranunculus ficaria L.

Deszk [9787.3, 9787.4], Magyarcsanád [9889.4], Maroslele [9787.4], Szeged [9787.1, 9787.3] (along River Maros, in poplar-willow forests, hybrid poplar plantations and oak plantations, exceptionally on hay meadows). It occurs sporadically along the river (Soó and Máthé 1938).

<u>*Salvinia natans* (L.) All.</u>

Szeged (on the left side of the Maros, in standing water within the inundated area) [9787.3]. It was known from the right side of the river (Gaskó 1999), from Algyő (Kováts F. in Soó and Máthé 1938) and from the Szeged section of River Tisza (Zsák 1941).

<u>*Scilla vindobonensis* Speta</u>

Magyarcsanád (near River Maros, in a poplar-willow forest) [9889.4]. It is very rare in the region east of River Tisza, its nearest known locality is in the proximity of Makó (Farkas 1999).

Trapa natans L.

Szeged (on the left side of the Maros, in standing water within the inundated area) [9787.3]. The species was known from the area near Algyő (Gaskó 1999).

Viola reichenbachiana Jord.

Szeged (in a poplar-willow forest on the Maros riverbank) [9787.3], Kiszombor [9888.2] (in a former orchard). Rare on the Great Hungarian Plain (Király 2009).

Habitat survey

Unfortunately, study areas are dominated by tree plantations (mainly oak, hybrid poplar and white poplar) and agricultural fields (Colour plate Figures 3-6). Almost all habitats are infected by invasive species, such as *Acer negundo*, *Amorpha fruticosa*, *Asclepias syriaca* and *Robinia-pseudo-acacia*. Poplar-willow forests are mostly restricted to a very narrow stripe along the river. In some cases, only a single tree line of white poplar remained along Maros. Area occupied by poplar-willow forests should be increased. As a minimum, a considerably wider stripe of these forests should be restored along the river, since they are by far more valuable than plantations. Marsh meadows, which are also valuable from a nature conservation perspective, have a high proportion in the Bökény and Makó area. In the other two study areas, semi-natural grasslands are mostly limited to the dikes. Their slopes facing towards the river are moister, with typical marsh species such as *Clematis vitalba*. Their dryer slopes, facing the other direction, support grassland more similar to the degraded loess grasslands. Orchards of the study region are small, but they may be valuable both from conservation and from a cultural point of view, thus their detailed study would be necessary.

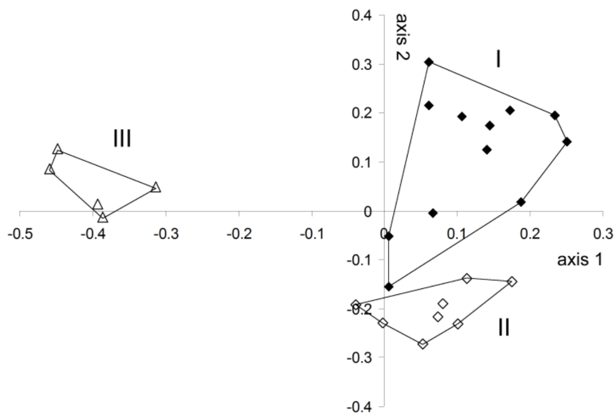
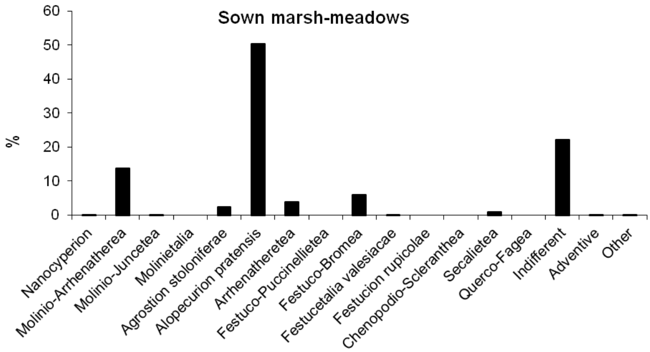


Figure 1. PCoA ordination diagram of the relevés of different meadow types along the river Maros. I: semi-natural marsh-meadows near Maroslele; II: semi-natural marsh-meadows near Makó; III: sown marsh-meadows near Magyarcsanád.

Ecological survey

The PCoA shows remarkable differences among the relevés made in the different marsh-meadow types along the river Maros (Fig. 1).



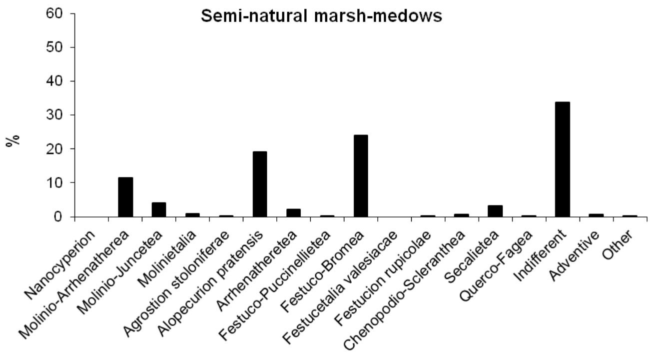


Figure 2. Proportions of the different coenological groups in semi-natural marsh-meadows and sown marsh-meadows.

The semi-natural marsh-meadows are dominated by marsh species (Alopecurion pratensis, Molinio-Arrhenatherea, Molinio-Juncetea) and dry grassland species (Festuco-Bromea), but indifferent species also play an important role in this vegetation type. Dominant species include: *Alopecurus pratensis, Carex preacox*, *Elymus repens, Galium verum, Poa pratensis* s. str. Frequent species are *Alopecurus pratensis, Carex praecox, Cirsium arvense, Convolvulus arvensis, Elymus repens, Galium verum, Geranium pusillum, Myosotis arvensis, Poa pratensis* s. str., *Veronica arvensis, Vicia angustifolia* and *Vicia hirsuta*. The proportion of marsh species is higher, but the proportion of dry grassland species is lower in the sown marsh-meadows than in the semi-natural marsh-meadows (Fig. 2). Dominant species of the sown marsh-meadows are *Alopecurus pratensis*, *Poa pratensis* and *Cirsium arvense*. Frequent species include: *Alopecurus pratensis, Bromus hordeaceus, Cirsium arvense, Geranium pusillum, Myosotis arvensis, Poa pratensis* s. str. There are 8 diagnostic species (*Carex praecox, Convolvulus arvensis, Elymus repens, Galium verum, Myosotis arvensis, Ranunculus polyanthemos, Valerianella locusta, Veronica arvensis*) of the semi-natural marsh-meadows and 5 diagnostic species (*Bromus hordaceus, Epilobium* sp.*, Galium aparine, Myosotis stricta, Potentilla supina*) of the sown marsh-meadows. Diversity profiles of the marsh-meadows are presented in Figure 3. Since profiles are not intersecting, we conclude that the semi-natural marsh-meadows are more diverse than the sown marsh-meadows.

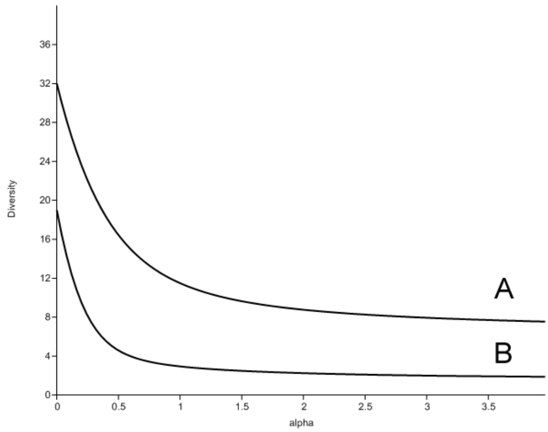


Figure 3. Diversity profiles of the semi-natural marsh-meadows (A) and sown marsh-meadows (B).

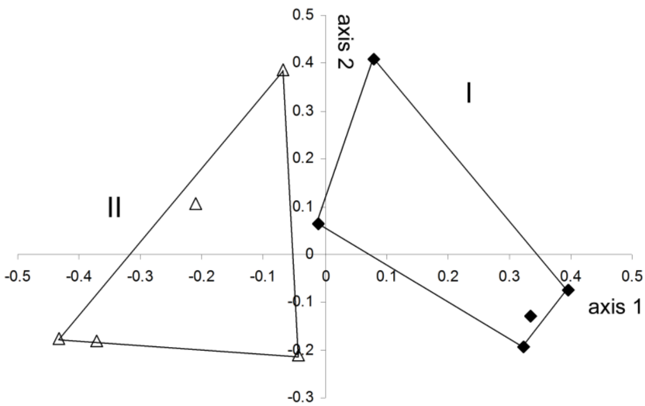


Figure 4. PCoA ordination diagram of the relevés of different forest types along the river Maros. I: riverine willow-poplar forests; II: planted oak-elm-ash forests.

The PCoA ordination scatter plot indicates a clear separation of the relevés of the different forest types (Fig. 4). Dominant species of the riverine willow-poplar forests are *Acer negundo, Galium aparine, Populus alba, Ulmus laevis*. Frequent species include: *Acer negundo*, *Fraxinus pennsylvanica, Galium aparine*, *Morus alba*, *Populus alba*, *Rubus caesius*, *Sambucus nigra*, *Ulmus laevis, Urtica dioica, Vitis riparia*.

Considering the cover data, the proportion of indifferent species is the highest in the riverine willow-poplar forests, while that of adventives is the highest in the planted oak-elm-ash forests (Fig. 5). Except *Quercus robur*, the planted oak-elm-ash forests are dominated by adventive species (*Acer negundo*, *Amorpha fruticosa*, *Fraxinus pennsylvanica*). Frequent species are *Acer negundo*, *Amorpha fruticosa*, *Quercus robur*, *Rubus caesius* and *Vitis riparia*. Only 2 diagnostic species can be distinguished between the forest types. *Sambucus nigra* is diagnostic for the riverine willow-poplar forests, while *Quercus robur* for the planted oak-elm-ash forests. According to the diversity profiles (Fig. 6), willow-poplar forests are more diverse than the planted oak-elm-ash forests.

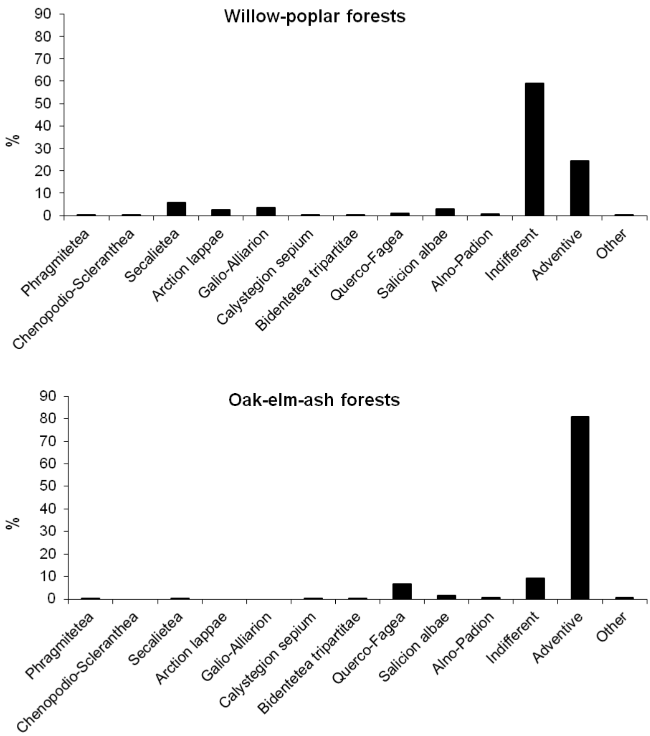


Figure 5. Proportions of the different coenological groups in riverine willow-poplar forests and planted oak-elm-ash forests.

Considering the results of other studies (cf. Borhidi 2003, Kevey and Tóth 2006, Kevey 2007, Bölöni *et al.* 2011) we can conclude that the major part of the riverine forests along the river Maros (from Szeged to Nagylak) are in poor conditions according to their species numbers, species compositions and vegetation texture. Nevertheless, some willow-poplar forest stands show an almost natural structure and also harbour a few riverine and oak forest species (e.g. *Circaea lutetiana*, *Cucubalus baccifer*, *Humulus lupulus*, *Lamium album*, *Viola reichenbachiana*). Marsh-meadows are in a better condition and therefore are more important from a nature conservation point of view. Habitat management should focus on the protection and improvement of those habitats which are natural elements in the landscape.

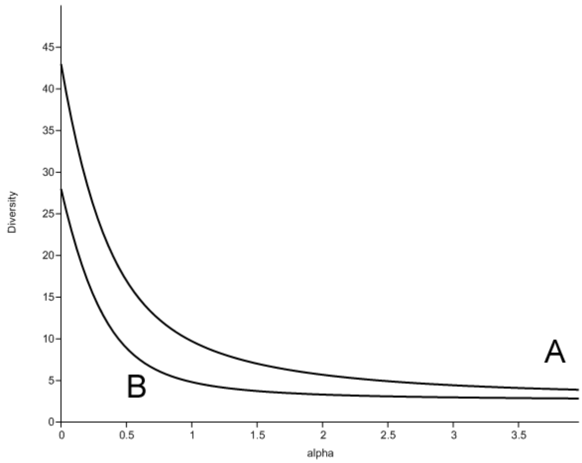


Figure 6. Diversity profiles of the riverine willow-poplar forests (A) and planted oak-elm-ash forests (B).

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Table 1. Analytical table of the semi-natural marsh-meadows (1-12: Magyarcsanád; 13-20: Makó) and sown marsh-meadows (21-25: Makó).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Nanocyperion																								
Potentilla supina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1
	Molinio-Arrhenatherea																								
Clematis integrifolia	-	-	-	1	-	-	-	-	-	-	10	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-
Daucus carota	-	-	-	-	-	-	-	0.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Poa pratensis s. str.	20	10	1	20	15	10	7	25	20	15	15	20	2	3	10	1	5	10	10	2	25	10	10	15	25
Rumex crispus	-	0.1	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	1	-	-	2	0.1	1	-	-
	Molinio-Juncetea																								
Carex distans	-	0.1	60	0.1	10	3	4	1	-	0.1	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Symphytum officinale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	1	-
	Molinietalia																								
Iris spuria	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thalictrum lucidum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
	Agrostion stoloniferae																								
Bromus hordeaceus	0.5	-	-	-	-	-	0.1	-	-	-	0.1	0.1	-	-	-	-	-	-	-	-	5	1	2	5	3
Rorippa × armoracioides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	3	1	-	-	-	-	-	-
	Alopecurion pratensis																								
Alopecurus pratensis	40	5	5	5	30	10	5	15	3	5	5	5	2	35	25	10	5	30	50	5	60	70	70	75	50
Bromus commutatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-
Galium rubioides	-	-	-	-	-	-	-	-	-	-	-	-	80	-	-	-	-	-	-	-	-	-	-	-	-
Valerianella locusta	1	0.1	0.5	2	5	2	4	-	1	1	0.5	1	-	-	-	1	-	-	-	-	-	-	-	-	-
	Arrhenatheretea																								
Arrhenatherum elatius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	-	-	-	-	-
Crepis biennis	-	-	-	-	-	-	-	-	0.5	-	2	0.5	-	2	-	-	-	1	-	-	-	-	-	-	-
Myosotis arvensis	2	5	0.5	2	1	7	5	0.1	2	1	0.1	0.1	0.1	0.1	0.1	1	1	2	0.1	0.5	0.1	0.1	0.1	0.1	-
Veronica arvensis	1	0.1	-	-	1	0.1	1	-	0.5	2	0.1	0.1	0.1	0.1	0.1	1	0.1	0.1	0.5	0.1	0.1	-	-	-	-
	Festuco-Puccinellietea																								
Podospermum canum	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
	Festuco-Bromea																								
Ajuga genevensis	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arenaria serpillyfolia	-	-	-	-	-	-	-	0.1	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex praecox	5	25	-	25	10	55	-	25	25	-	25	40	10	35	25	5	25	20	30	30	-	-	-	-	-
Cerastium brachypetalum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-
Cerastium	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

semidecandrum																									
Eryngium campestre	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Festuca rupicola	-	-	-	-	-	-	2	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Geranium pusillum	2	0.1	0.1	-	-	-	0.1	-	-	-	2	1	0.5	0.1	0.1	0.1	0.1	0.1	1	-	-	0.1	0.1	0.1	0.1
Myosotis stricta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1
Ranunculus	-	-	-	-	0.5	1	-	-	0.1	-	3	3	0.1	0.5	4	0.1	1	3	-	-	-	-	-	-	-
polyanthemos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Salvia nemorosa	-	-	-	-	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifolium campestre	-	-	-	-	-	-	-	0.1	1	-	-	0.1	5	3	-	-	10	-	-	8	-	-	-	-	-
Vicia angustifolia	1	5	-	1	3	0.5	0.5	1	4	5	4	1	-	1	-	1	5	1	1	0.1	0.1	0.1	-	-	0.1
	Festucetalia valesiacae																								
Geranium columbinum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
	Festucion rupicolae																								
Astragalus cicer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-
	Chenopodio-Scleranthea																								
Capsella bursa-pastoris	0.1	1	0.1	-	0.1	0.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
Lactuca serriola	-	0.5	-	-	-	-	-	0.1	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Lamium amplexicaule	0.1	1	0.1	0.1	3	1	3	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sonchus asper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-
	Secalietea																								
Adonis aestivalis	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lamium purpureum	-	-	0.5	-	-	0.1	0.5	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lathyrus tuberosus	-	-	1	-	-	-	-	-	-	-	-	-	2	2	1	1	-	-	5	5	-	0.1	-	-	-
Papaver dubium	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
subsp. albiflorum																									
Veronica polita	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vicia grandiflora	10	-	0.1	-	5	0.5	-	-	-	5	-	-	1	5	-	0.5	-	0.1	-	-	-	-	-	-	-
Vicia hirsuta	2	-	0.1	0.5	0.1	0.1	-	0.1	1	2	1	1	1	2	-	1	3	3	1	0.5	-	0.1	0.1	-	-
	Querco-Fagea																								
Ranunculus ficaria	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Indifferent																								
Allium vineale	-	0.1	-	-	-	-	-	-	-	-	-	0.1	-	0.5	-	1	-	0.1	-	0.1	-	-	-	-	-
Carduus nutans	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carex hirta	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cirsium arvense	-	0.1	15	5	2	2	-	2	2	-	3	6	0.5	15	2	0.1	10	3	7	0.5	15	20	20	15	20
Convolvulus arvensis	2	1	-	-	2	-	0.1	-	0.1	0.1	-	-	2	5	5	15	30	10	7	-	-	-	-	-	-
Cynodon dactylon	-	-	-	-	-	-	-	-	0.1	-	-	-	0.1	-	0.5	-	-	-	-	-	-	-	-	-	-
Elymus repens	-	40	2	15	0.1	0.1	15	0.1	1	-	10	30	1	1	-	5	25	30	10	4	-	-	-	-	-

Erophila verna	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Euphorbia virgata	0.5	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Galium aparine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1
Galium verum	30	25	15	15	15	20	6	20	35	70	-	-	-	-	25	50	0.5	1	-	50	-	-	-	-	-
Linaria vulgaris	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-
Ornithogalum umbellatum s.l.	1	0.1	-	1	1	0.1	-	-	2	1	-	-	-	-	-	0.1	-	-	-	0.1	-	-	-	-	-
Silene alba	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	3	0.5	-	-	-	-	-	-	-	-
Taraxacum officinale	0.1	0.1	-	-	-	-	-	-	-	-	2	0.1	-	-	-	0.1	-	-	-	0.1	-	-	-	-	-
Tragopogon dubium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	0.5	-	-	-	-	-
Verbena officinalis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	0.5	-	-	-	-	-	-	-	-
	Adventive																								
Amorpha fruticosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-
Asclepias syriaca	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
Robinia pseudoacacia	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xanthium italicum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-
	Other																								
Achillea sp.	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-
Artemisia sp.	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Centaurea sp.	0.1	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epilobium sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	0.1	0.1

Relevés were made by Z. Bátori, V. Cseh, L. Erdős and D. Turcuş

Table 2. Analytical table of the forest types (1-5: riverine willow-poplar forests; 6-10: planted oak-elm-ash forests).

		1	2	3	4	5	6	7	8	9	10
	Phragmitetea										
Typha angustifolia	C	-	-	-	0.1	-	-	-	0.1	-	-
	Chenopodio-Scleranthea										
Lactuca serriola	C	-	-	-	0.1	-	-	-	-	-	-
	Secalietea										
Aristolochia clematitis	C	-	-	-	-	-	-	-	0.1	0.1	-
Cirsium arvense	C	-	-	-	0.1	-	-	-	0.1	-	-
Lamium purpureum	C	20	2	5	-	-	-	-	-	-	-
	Arction lappae										
Anthriscus cerefolium	C	3	5	4	-	-	-	-	-	-	-
Arctium lappa	C	-	-	-	0.1	-	-	-	-	-	-
	Galio-Alliarion										
Chaerophyllum temulum	C	0.1	0.1	-	15	-	-	-	-	-	-
Parietaria erecta	C	-	1	-	-	-	-	-	-	-	-
	Calystegion sepium										
Lamium album	C	1	-	-	-	-	-	-	-	-	-
Solanum dulcamara	C	0.1	0.1	-	0.1	-	-	-	0.1	0.1	-
Stachys palustris	C	-	-	-	0.1	-	-	-	-	-	-
	Bidentetea tripartitae										
Lycopus europaeus	C	-	-	-	0.1	-	-	-	-	-	-
Lycopus exaltatus	C	-	-	-	0.1	-	-	-	0.1	-	-
Lysimachia nummularia	C	-	0.5	0.1	-	-	-	-	-	-	-
	Querco-Fagea										
Acer campestre	C	0.1	-	-	-	0.1	-	-	-	-	-
Clematis vitalba	C	0.5	0.1	-	-	-	-	-	-	-	-
Clinopodium vulgare	C	-	-	-	-	-	-	-	0.1	-	-
Cornus sanguinea	B	0.1	1	2	-	-	-	3	-	-	-
Cornus sanguinea	C	-	0.1	0.1	-	-	-	8	-	-	-
Fraxinus excelsior	B	-	-	-	-	-	-	-	-	2	-
Geum urbanum	C	-	0.1	-	-	-	-	-	-	-	-
Ranunculus ficaria	C	0.1	0.1	-	-	-	-	-	-	-	-
Scrophularia nodosa	C	-	-	-	-	-	-	0.1	-	-	-
	Salicion albae										
Cucubalus baccifer	C	0.1	0.5	-	-	-	-	-	-	-	-
Humulus lupulus	B	-	-	0.5	-	-	-	-	-	-	-
Humulus lupulus	C	1	-	1	-	-	-	-	-	-	-
Populus alba	A1	30	-	10	25	30	-	-	-	-	-
Populus alba	B	-	-	0.1	-	-	-	-	-	-	-
Populus alba	C	0.1	-	0.1	3	2	0.1	-	-	-	-
Rubus caesius	B	0.1	-	0.1	-	-	-	1	-	-	-
Rubus caesius	C	-	2	2	0.5	1	-	1	1	0.1	0.1
Salix alba	A1	-	35	-	-	20	-	-	-	-	-
	Alno-Padion										
Quercus robur	A1	-	-	-	-	-	60	45	40	50	65
Quercus robur	C	0.1	-	-	-	-	0.1	0.1	0.1	0.1	0.1
Ulmus laevis	A1	-	35	-	25	10	-	-	10	-	-
Ulmus laevis	A2	10	-	15	-	-	-	5	5	10	-
Ulmus laevis	B	0.1	-	1	-	-	-	-	-	-	-
Ulmus laevis	C	0.1	1	0.1	-	-	-	1	-	-	-
	Indifferent										
Sambucus nigra	B	3	20	15	0.5	-	-	-	-	-	-
Alliaria petiolata	C	1	-	-	-	-	-	-	-	-	-
Chelidonium majus	C	-	-	-	-	0.1	-	-	-	-	-

Galium aparine	C	30	60	60	20	-	-	-	2	15	-
Glechoma hederacea	C	-	-	-	4	-	-	-	0.5	-	-
Prunella vulgaris	C	-	-	-	-	-	-	-	0.1	-	-
Ranunculus repens	C	-	-	-	-	-	-	-	0.1	-	-
Sambucus nigra	C	0.5	-	-	-	-	-	-	-	-	-
Stellaria media s. str.	C	30	15	10	-	-	-	-	-	-	-
Taraxacum officinale	C	0.1	-	-	-	-	-	-	-	-	-
Urtica dioica	C	0.1	2	-	2	0.1	-	-	0.1	0.5	-
Veronica hederifolia agg.	C	3	1	1	-	-	-	-	-	-	-
	Adventive										
Acer negundo	A2	40	10	30	-	30	5	2	10	10	30
Acer negundo	B	2	20	15	-	3	-	-	1	-	2
Acer negundo	C	-	-	-	-	-	-	2	-	0.1	-
Amorpha fruticosa	B	-	-	-	2	-	-	-	10	40	15
Amorpha fruticosa	C	-	-	-	0.1	-	0.1	-	1	-	1
Celtis occidentalis	B	-	-	-	-	2	-	-	-	-	-
Celtis occidentalis	C	-	-	-	1	2	-	-	0.1	-	-
Fraxinus pennsylvanica	A1	5	-	-	-	-	-	25	-	-	-
Fraxinus pennsylvanica	A2	-	-	3	5	5	30	-	5	-	-
Fraxinus pennsylvanica	B	-	-	1	20	1	15	15	5	-	-
Fraxinus pennsylvanica	C	-	1	5	15	10	3	5	40	-	-
Gleditsia triacanthos	C	-	-	-	-	-	-	-	0.1	-	-
Morus alba	A2	-	2	-	5	3	-	-	-	-	-
Morus alba	B	-	-	-	2	-	-	0.1	1	-	-
Morus alba	C	-	-	0.1	0.1	-	-	-	-	-	-
Parthenocissus quinquefolia	C	0.5	0.5	-	-	-	-	-	-	-	-
Robinia pseudoacacia	A2	2	-	-	-	-	-	-	-	-	-
Robinia pseudoacacia	B	0.1	0.1	0.1	-	-	-	-	-	-	-
Vitis riparia	A1	-	-	-	5	-	-	-	-	-	-
Vitis riparia	B	-	3	1	0.5	1	-	-	1	-	-
Vitis riparia	C	0.5	-	5	0.1	1	0.1	-	1	1	0.5
	Other										
Cardamine sp.	C	-	-	-	-	-	-	-	0.1	-	-
Poa sp.	C	-	-	-	-	-	-	-	0.1	-	-
Populus × *euramericana*	A1	5	-	3	-	-	-	10	-	-	-
Prunus domestica agg.	A2	-	-	-	-	-	-	2	-	-	-
Prunus domestica agg.	C	-	-	-	-	-	-	1	-	-	-
Rumex sp.	C	-	0.1	0.1	-	-	-	-	-	-	-

Relevés were made by Z. Bátori, V. Cseh, L. Erdős and D. Turcuş.

CONSIDERATIONS ON PLANTS AND ECOSYSTEMS DIVERSITY AND CONSERVATION WITHIN FOUR LOCATIONS ALONG THE RIVER MUREŞ/MAROS

Gicu-Gabriel Arsene, Iulia-Natalia Dărăban, Violeta Turcuş, Ioan Don, Aurel Ardelean, Marian-Constantin Petrescu, Daciana Turcuş

Introduction

The valley of the River Mureș, and the river itself, represent a main ecological corridor in West-Romania. Especially in the plain areas of the Arad and Timiș counties, in a monotone agricultural landscape, riverine natural and semi-natural habitats are important not only for wildlife, but also as an element of human life quality and well-being. Setting the Lunca Mureșului Natural Park, downstream Arad city until the Romanian-Hungarian border, in 2003, constitutes a formal appreciation of these ecosystems value and a commitment assumed by Romanian authorities. Unfortunately, we have hitherto only descriptive studies concerning the flora and vegetation within this protected area (e.g. Ardelean 1995, 2006, Oprea 1976). There is an acute need of scientific ecological results in order to be used as decisional and pragmatic base in case-to-case nature management situations. Within the scope of the HURO project *Landscape-scale connections between the land use, habitat quality and ecosystem goods and services in the Mures/Maros valley (HURO/0901/205/2.2.2),* we sampled four locations along the river Mureş and draw up a picture of plant and habitat diversity. We focused also on present-day (semi)natural ecosystems status, in search of a reconnaissance of ecosystem services, anthropic pressure degree and threats.

Material and Methods

The study was carried out in 2012 in four locations, along the Mureș river, in the Arad County: Păuliș (near the city Lipova), Vladimirescu (about 10 km up-river from city of Arad), Felnac, and Igriș (see Fig. 1 at page 5); the last two ones are included in the Lunca Mureșului Natural Park. The altitude ranges from ca. 85-90 m a.s.l. (Igriș) to ca. 120-125 m a.s.l. (Păuliș). Each sampled area is a 3 × 3 km quadrat having a high diversity of ecosystems on both river margins

Flora was studied on transects; the floristic inventory includes also species from coenological relevés. Species identification was done according to Săvulescu (1952-1976) and Ciocârlan (2009). The considered nomenclature is from Flora Europaea Database (http://rbg-web2.rbge.org.uk/FE/fe.html). In the floristic conspectus, at each species, the location is mentioned, e.g. [P., V., F., I.] means the species was found at Păuliș (P.), Vladimirescu (V.), Felnac (F.) and Igriş (I.).

In the study of vegetation, we made relevés on 2 × 2 m (herbaceous vegetation), 10 × 10 m (scrubs) and 20 × 20 m (forests). Percentage cover of each species was estimated. Observations on threats, naturalness degree were made also.

In both cases (flora and vegetation), we did not pay attention to cultivated fields, but analyzed field edges.

The typology of habitats was established starting from phytosociological data (Ardelean 2006, Drăgulescu 1995, Sanda *et al.* 2008), and then using *Habitats of Romania* (Donță *et al.* 2005), EUR 27 *Interpretation Manual of EU Habitats* and the Romanian guide to habitats interpretation (Gafta & Mountford, 2008).

Results

Floristic conspectus

Abutilon theophrasti Medik. **[V., F., I.]**; *Acer campestre* L. **[V., F.]**; *Acer negundo* L. **[P., V., F., I.]**; *Acer tataricum* L. **[V., I.]**; *Achillea millefolium* L. **[P.]**; *Achillea setacea* Waldst. & Kit. **[P., V., F., I.]**; *Adonis vernalis* L. **[F.]**; *Agrimonia eupatoria* L. **[P., V., I.]**; *Agrostis capillaris* L. **[P., V., F.]**; *Agrostis stolonifera* L. **[P.,V., F., I.]**; *Ailanthus altissima* (Mill.) Swingle **[V., I.]**; *Ajuga genevensis* L. **[P.]**; *Alisma plantago-aquatica* (L.) **[P., V., F., I.]**; *Alliaria officinalis* **[P., V., F.]**; *Alliaria petiolata* (M.Bieb.) Cavara & Grande **[P., F.]**; *Allium scorodoprasum* L. **[V., F.]**; *Alopecurus pratensis* L. **[P., V., F., I.]**; *Althaea officinalis* L. **[P., V., I.]**; *Amaranthus crispus* (Lesp. et Thévenau.) N.Terracc. **[I.]**; *Amaranthus retroflexus* L. **[P., V., F., I.]**; *Ambrosia artemisiifolia* L. **[P., V., F., I.]**; *Amorpha fruticosa* L. **[P., V., F., I.]**; *Anagallis arvensis* L. **[I.]**; *Anemone ranunculoides* L. **[V.]**; *Anthemis arvensis* L. **[I.]**; *Anthoxanthum odoratum* L. **[P., V.]**; *Anthriscus sylvestris* (L.) Hoffm. **[P., V.]**; *Apera spica-venti* (L.) P.Beauv. **[P., I.]**; *Arctium lappa* L. **[P., V., F., I.]**; *Arctium tomentosum* Mill. **[P.]**; *Aristolochia clematitis* L. **[P., V., I.]**; *Arrhenatherum elatius* (L.) P.Beauv. ex J.Presl & C.Presl **[P., V., F., I.]**; *Artemisia absinthium* L. **[F.]**; *Artemisia annua* L. **[P., V.]**; *Artemisia vulgaris* L. **[P., V., I.]**; *Asclepias syriaca* L. **[P., V., I.]**; *Asparagus officinalis* L. **[V., F., I.]**; *Asperula arvensis* L. **[P.]**; *Aster tripolium* L. (incl. subsp. *pannonicus*) **[V., F.]**; *Astragalus cicer* L. **[F.]**; *Astragalus glycyphyllos* L. **[V., F.]**; *Atriplex patula* L. **[I.]**; *Avena fatua* L. **[I.]**; *Bidens tripartita* L. **[P., I.]**; *Brachypodium pinnatum* (L.) P.Beauv. **[F.]**; *Brachypodium sylvaticum* (Huds.) P.Beauv. **[P., V., F.]**; *Bromus arvensis* L. **[P., V., F., I.]**; *Bromus commutatus* Schrad. **[V., F.]**; *Bromus hordeaceus* L. **[P., V., F.]**; *Bromus inermis* Leyss. **[V., F., I.]**; *Bromus tectorum* L. **[P., V., F.]**; *Butomus umbellatus* L. **[P., I.]**; *Calamagrostis arundinacea* (L.) Roth **[P.]**; *Calamagrostis epigejos* (L.) Roth **[P., V., F., I.]**; *Calamintha sylvatica* Bromf. (subsp. *sylvatica*) **[V.]**; *Calystegia sepium* (L.) R.Br. **[P., V., I.]**; *Capsella* *bursa-pastoris (L.) Medik.* **[P., V., F., I.]**; *Cardaria draba* L. **[P., I.]**; *Carduus acanthoides* L. **[P., V., F., I.]**; *Carduus nutans* L. **[P., V.]**; *Caex brizoides* L. **[P., V., F.]**; *Carex distans* L. **[P., V., F., I.]**; *Carex divulsa* Stokes **[V.]**; *Carex hirta* L. **[P., V., F.]**; *Carex riparia* Curtis **[P., F., I.]**; *Carex sylvatica* Huds. **[V.]**; *Carex vulpina* L. **[F.]**; *Carlina vulgaris* L. **[P.]**; *Carpinus betulus* **[P., V.]**; *Carthamus lanatus* L. **[V., I.]**; *Celtis australis* L. **[V., I.]**; *Centaurea cyanus* L. **[I.]**; *Centaurea biebersteinii* DC. (subsp. *biebersteinii*) **[P., F., I.]**; *Centaurea pannonica* (Heuff.) Simonk. **[P., V., F., I.]**; *Centaurea solstitialis* L. **[F.]**; *Cerastium banaticum* (Rochel) Heuff. (subsp. *speciosum* (Boiss.) Jalas) **[P.]**; *Cerastium glomeratum* Thuill. **[I.]**; *Chaerophylum temulentum* L. **[V.]**; *Chelidonium majus* L. **[P., V., F.]**; *Chenopodium album* L. **[P., V., F., I.]**; *Chenopodium ficifolium* Sm. **[I.]**; *Chenopodium hybridum* L. **[F., I.]**; *Chondrilla juncea* L. **[P., V.]**; *Cichorium intybus* L. **[P., V., F., I.]**; *Circaea lutetiana* L. **[V.]**; *Cirsium arvense* (L.) Scop. **[P., V., F., I.]**; *Cirsium oleraceum* (L.) Scop. **[V., F.]**; *Cirsium rivulare* (Jacq.) All. **[V.]**; *Cirsium vulgare* (Savi) Ten. **[P., V., F.]**; *Clematis vitalba* L. **[P., V., F., I.]**; *Conium maculatum* L. **[V., F., I.]**; *Consolida regalis* Gray **[P., V., F., I.]**; *Convallaria majalis* L. **[V.]**; *Convolvulus arvensis* L. **[P., V., F., I.]**; *Conyza canadensis* (L.) Cronquist **[P., V., F., I.]**; *Cornus mas* L. **[V., I.]**; *Cornus sanguinea* L. **[P., V., F., I.]**; *Coronilla varia* L. **[F.]**; *Corydalis cava* (L.) Schweigg. & Körte **[V., F.]**; *Crataegus monogyna* Jacq. **[P., V., F., I.]**; *Cruciata laevipes* Opiz **[P.]**; *Cucubalus baccifer* L. **[P., F.]**; *Cuscuta europaea* L. **[I.]**; *Cynodon dactylon* (L.) Pers. **[P., V., F., I.]**; *Dactylis glomerata* L. (incl. subsp. *aschersoniana* (Graebn.) Thell.) **[P., V., F., I.]**; *Danthonia decumbens* (L.)DC. **[V.]**; *Datura stramonium* L. **[P., V., I.]**; *Daucus carota* L. (subsp. *carota*) **[P., V., I.]**; *Descurainia sophia* (L.) Webb ex Prantl **[V., I.]**; *Dianthus armeria* L. **[P., I.]**; *Dichanthium ischaemum* (L.) Roberty **[V., I.]**; *Digitaria sanguinalis* (L.) Scop. **[P., V., F., I.]**; *Dipsacus laciniatus* L. **[P., V., F., I.]**; *Echinochloa crus-galli* (L.) P.Beauv. **[P., V., F., I.]**; *Echinocystis lobata* (Michx.) Torr. & A.Gray **[P., V., F., I.]**; *Echinops ritro* L. (subsp. *ruthenicus* (M.Bieb.) Nyman) **[P., V.]**; *Echinops sphaerocephalus* **[F., I.]**; *Echium vulgare* L. **[P.]**; *Elaeagnus angustifolia* L. **[I.]**; *Eleocharis palustris* (L.) Roem. & Schult. **[P., V., F., I.]**; *Elymus repens* (L.) Gould **[P., V., F., I.]**; *Epipactis helleborine* (L.) Crantz **[V.]**; *Epilobium hirsutum* L. **[P., V.]**; *Epilobium palustre* L. **[P., V., F.]**; *Equisetum arvense* L. **[P., V., F., I.]**; *Erodium cicutarium* (L.) L'Hér. **[F., I.]**; *Eragrostis minor* Host **[P., V.]**; *Erigeron annuus* (L.) Pers. **[P., V., F., I.]**; *Erophilla verna* (L.) Chevall. **[P., V., F.]**; *Eryngium campestre* L. **[P., V., F., I.]**; *Eryngium planum* L. **[P., V.]**; *Euonymus europaeus* L. **[P., V., I.]**; *Eupatorium cannabinum* L. **[P.]**; *Euphorbia amygdaloides* L. **[P., V., F.]**; *Euphorbia cyparissias* L. **[P., V., F., I.]**; *Falcaria vulgaris* Bernh. **[P., V., F., I.]**; *Fallopia convolvulus* (L.) A$A.Löve **[P., V., F., I.]**; *Festuca arundinacea* Schreb. **[P.]**; *Festuca gigantea* (L.) Vill. **[P., I.]**; *Festuca ovina* L. **[F.]**; *Festuca pratensis* Huds. **[P., V., F.]**; *Festuca pseudovina* Hack. ex Wiesb. **[P., F.]**; *Festuca rupicola* Heuff. **[P., V., F.,**

I.]; *Festuca valesiaca* Schleich. ex Gaudin **[I.]**; *Filipendula vulgaris* Moench **[P., V., F.]**; *Fragaria vesca* L. **[I.]**; *Frangula alnus* L. **[V., F.]**; *Fraxinus americana* L. **[I.]**; *Fraxinus angustifolia* **[V., F., I.]**; *Fraxinus excelsior* L. **[P., V., F., I.]**; *Gagea lutea* (L.) Ker Gawl. **[V.]**; *Galega officinalis* L. **[V., F., I.]**; *Galeopsis speciosa* Mill. [**P., V.]**; *Galeopsis tetrahit* L. **[V.]**; *Galinsoga parviflora* Cav. **[P., F., I.]**; *Galium album* Mill. **[P., V.]**; *Galium aparine* L. **[P., V., F., I.]**; *Galium mollugo* L. **[P., V., I.]**; *Galium palustre* L. **[P.]**; *Galium rubioides* L. **[V.]**; *Galium schultesii* Vest **[P., V.]**; *Galium verum* L. **[P., V., F., I.]**; *Geranium robertianum* L. **[V., F.]**; *Geum urbanum* L. **[P., V., F., I.]**; *Glechoma hederacea* L. **[P., V., F., I.]**; *Gleditsia triacanthos* L. **[P., V., I.]**; *Glyceria maxima* (Hartm.) Holmb. **[V., F., I.]**; *Glycyrrhiza echinata* L. **[V., F., I.]**; *Glycyrrhiza glabra* L. **[P., F.]**; *Gratiola officinalis* L. **[P.]**; *Gypsophila muralis* L. **[F.]**; *Helianthus tuberosus* L. **[V., I.]**; *Heliotropium europaeum* L. **[I.]**; *Hibiscus trionum* L. **[P., V., I.]**; *Hippophae rhamnoides* L. **[cultivated, V.]**; *Holcus lanatus* L. **[P., V.]**; *Hordeum hystrix* Roth **[F.]**; *Hordeum murinum* L. **[V., F., I.]**; *Humulus lupulus* L. **[P., V., F., I.]**; *Hypericum perforatum* L. **[P., V., I.]**; *Inula britannica* L. **[P., V., I.]**; *Inula salicina* L. **[V., F.]**; *Iris pseudacorus* L. **[P., V., F., I.]**; *Juglans nigra* L. **[V.]**; *Juglans regia* L. **[P., V., F.]**; *Juncus conglomeratus* L. **[P., V.]**; *Juncus gerardi* Loisel. **[F.]**; *Juncus inflexus* L. **[P., V., I.]**; *Kickxia spuria* (L.) Dumort. **[F.]**; *Knautia arvensis* (L.) Coult. **[P., V.]**; *Koeleria macrantha* (Ledeb.) Schult. **[F.]**; *Lactuca saligna* L. **[P.]**; *Lactuca serriola* L. **[P., V., F., I.]**; *Lamium amplexicaule* L. **[I.]**; *Lamium purpureum* L. **[P., V., F., I.]**; *Lapsana communis* L. **[P., V., F.]**; *Lathyrus pratensis* L. **[V., F., I.]**; *Lathyrus sylvestris* L. **[P., V., F.]**; *Lathyrus tuberosus* L. **[P., F., I.]**; *Lavatera thuringiaca* L. **[P.]**; *Lemna minor* L. **[V., F., I.]**; *Lemna trisulca* L. **[P.]**; *Leontodon autumnalis* L. **[P., V.]**; *Leonurus cardiaca* L. **[V., I.]**; *Lepidium perfoliatum* L. **[V., I.]**; *Ligustrum vulgare* L. **[P., V., F., I.]**; *Linaria angustissima* (Loisel.) Borbás **[V., I.]**; *Linaria genistifolia* (L.) Mill. **[P., V.]**; *Linaria vulgaris* Mill. **[P., V., F., I.]**; *Logfia arvensis* (L.) Holub **[V.]**; *Lolium perenne* L. **[P., V., F., I.]**; *Lotus angustissimus* L. **[F.]**; *Lotus corniculatus* L. **[P., V., F., I.]**; *Lycium barbarum* L. **[P., I.]**; *Lycopus europaeus* L. **[P., V., F., I.]**; *Lycopus exaltatus* L.f. **[P., I.]**; *Lysimachia numularia* L. **[P., V., I.]**; *Lysimachia vulgaris* L. **[P., V., F., I.]**; *Lythrum hyssopifolia* L. **[V.]**; *Lythrum salicaria* L. **[P., V., I.]**; *Maclura pomifera* (Raf.) C.K.Schneid. **[P., V.]**; *Malva sylvestris* L. **[V., I.]**; *Malus sylvestris* L. **[V.]**; *Marrubium vulgare* L. **[P.]**; *Matricaria perforata* Mérat **[V., F., I.]**; *Medicago lupulina* L. **[P., V.]**; *Medicago minima* (L.) Bartal. **[V., I.]**; *Medicago sativa* L. **[P., V., F., I.]**; *Melilotus alba* Medik. **[P.]**; *Melilotus officinalis* (L.) Pall. **[F., I.]**; *Mentha aquatica* L. **[P., F.]**; *Mentha arvensis* L. **[P.]**; *Mentha longifolia* (L.) Huds. **[P., V., F., I.]**; *Mentha pulegium* L. **[V., F., I.]**; *Mercurialis perennis* L. **[V.]**; *Mycelis muralis* (L.) Dumort. **[P.]**; *Morus alba* L. **[P., V., I.]**; *Morus nigra* L. **[V., F., I.]**; *Myosotis scorpioides* L. **[P., V., I.]**; *Myriophyllum spicatum* L. **[P., I.]**; *Oenanthe aquatica* **[P., V., I.]**; *Oenothera biennis* L. **[P., I.]**; *Ononis arvensis* L. **[V., F., I.]**;

Onopordum acanthium L. **[P., V., I.]**; *Ornithogalum umbellatum* L. **[V., F.]**; *Oxalis acetosella* L. **[P., V.]**; *Papaver rhoeas* L. **[P., V., I.]**; *Parthenocissus inserta* **[P., V.]**; *Pastinaca sativa* L. **[P., V., F., I.]**; *Petrorhagia prolifera* (L.) P.W.Ball & Heywood **[P., V.]**; *Peucedanum oreoselinum* (L.) Moench **[P.]**; *Phalaris arundinacea* **[V., F.]**; *Phragmites australis* (Cav.) Trin. ex Steud. **[P., V., F., I.]**; *Picris hieracioides* L. **[P., V.]**; *Plantago lanceolata* L. **[P., V., F., I.]**; *Plantago major* L. **[P., V., F., I.]**; *Plantago media* L. **[P.]**; *Poa angustifolia* L. **[F., I.]**; *Poa annua* L. **[P., V., F., I.]**; *Poa pratensis* L. **[P., V., F., I.]**; *Polycnemum arvense* L. **[I.]**; *Polygonatum latifolium (*Jacq.) Desf. **[V.]**; *Polygonum amphibium* L. **[P., F., I.]**; *Polygonum aviculare* L. **[P., V., F., I.]**; *Polygonum lapathifolium* L. **[P., V., I.]**; *Polygonum persicaria* L. **[P., V., F., I.]**; *Populus alba* L. **[P., V., F., I.]**; *Populus nigra* L. **[P., V., F., I.]**; *Populus tremula* L. **[P., V.]**; *Populus x hybrida* M.Bieb. **[P., V., F., I.]**; *Portulaca oleracea* L. **[P., V., F., I.]**; *Potamogeton natans* L. **[P.]**; *Potentilla anserina* L. **[P., V., I.]**; *Potentilla reptans* L. **[P., V., F., I.]**; *Prunella vulgaris* L. **[P., V.]**; *Prunus cerasifera* Ehrh. **[P., V., F., I.]**; *Prunus spinosa* L. **[P., V., F., I.]**; *Pulmonaria officinalis* **[P., F.]**; *Pyrus pyraster* Burgsd. **[P., V., F., I.]**; *Quercus robur* L. **[P., V., F., I.]**; *Ranunculus acris* L. **[I.]**; *Ranunculus ficaria* L. **[P., V., F., I.]**; *Ranunculus repens* L. **[P., V., I.]**; *Ranunculus sardous* Crantz **[P., V., I.]**; *Ranunculus sceleratus* L. **[F., I.]**; *Rhamnus catharticus* L. **[I.]**; *Robinia pseudacacia* L. **[P., V., F., I.]**; *Rorippa austriaca* (Crantz) Besser **[I.]**; *Rorippa kerneri* Menyh. **[P., F.]**; *Rosa canina* L. **[P., V., F., I.]**; *Rosa gallica* L. **[P., F.]**; *Rubus caesius* L. **[P., V., F., I.]**; *Rubus fruticosus* L. **[P., V.]**; *Rudbeckia laciniata* L. **[P.]**; *Rumex acetosa* L. **[P., V., F., I.]**; *Rumex conglomeratus* Murray **[F.]**; *Rumex crispus* L. **[P., F., I.]**; *Rumex sanguineus* L. **[P., V.]**; *Sagittaria sagittifolia* L. **[P., V.]**; *Salix alba* L. **[P., V., F., I.]**; *Salix caprea* L. **[P., V., F., I.]**; *Salix cinerea* L. **[V., F., I.]**; *Salix fragilis* L. **[V., F., I.]**; *Salix triandra* L. **[F.]**; *Salsola kali* L. subsp. *ruthenica* (Iljin) Soó **[I.]**; *Salvia nemorosa* L. **[P., V., F., I.]**; *Sambucus ebulus* L. **[P., V., F., I.]**; *Sambucus nigra* L. **[P., V., F., I.]**; *Saponaria officinalis* L. **[V., I.]**; *Scabiosa ochroleuca* L. **[P., V., F., I.]**; *Scilla bifolia* L. **[V., F.]**; *Scirpus lacustris* L. (subsp. *lacustris*) **[V., F., I.]**; *Scrophularia nodosa* L. **[V.]**; *Senecio jacobaea* L. **[P., V., F.]**; *Senecio vernalis* Waldst. & Kit. **[I.]**; *Setaria pumila* (Poir.) Schult. **[P., I.]**; *Setaria verticillata* (L.) P.Beauv. **[V., I.]**; *Setaria viridis* (L.) P.Beauv. **[P., V., F., I.]**; *Silene latifolia* Poir. subsp. *alba* (Mill.) Greuter & Burdet **[P., V., I.]**; *Solanum dulcamara* L. **[P., V.]**; *Solanum nigrum* L. **[P., V., I.]**; *Solidago virgaurea* L. **[P.]**; *Sonchus arvensis* L. **[V., F., I.]**; *Sorghum halepense* (L.) Pers. **[P., V., F., I.]**; *Sparganium erectum* L. **[P., F., I.]**; *Stachys annua* (L.) L. **[V., I.]**; *Stachys palustris* L. **[P., F.]**; *Stachys sylvatica* L. **[P., V.]**; *Staphylea pinnata* L. **[V.]**; *Stellaria media* (L.) Will. **[P., V., F., I.]**; *Stellaria nemorum* L. **[P., V.]**; *Symphytum officinale* L. **[P., I.]**; *Tamus communis* L. **[V.]**; *Tanacetum vulgare* L. **[P., V., F., I.]**; *Taraxacum officinale* Weber **[P., V., F., I.]**; *Teucrium chamaedrys* L. **[V., F.]**; *Thalictrum minus* L. **[V., F.]**; *Thlaspi arvense* L. **[F., I.]**; *Thlaspi* *perfoliatum* L. [**V.]**; *Thymus glabrescens* Willd. **[I.]**; *Tilia cordata* Mill. **[V.]**; *Tilia platyphyllos* Scop. **[P., V.]**; *Torilis arvensis* (Huds.) Link **[V.]**; *Tragopogon pratensis* L. **[P., I.]**; *Tribulus terrestris* L. **[V.]**; *Trifolium arvense* L. **[P., F., I.]**; *Trifolium medium* L. **[P., V., F.]**; *Trifolium pratense* L. **[P., V.]**; *Trifolium repens* L. **[V., F., I.]**; *Typha angustufolia* L. **[F., I.]**; *Typha latifolia* L. **[P., V., F., I.]**; *Ulmus laevis* Pall. **[V., F.]**; *Ulmus minor* Mill. **[V., F., I.]**; *Urtica dioica* L. **[P., V., F., I.]**; *Verbascum phlomoides* L. **[P., V.]**; *Verbascum blataria* L. **[I.]**; *Verbena officinalis* L. **[P., V., F., I.]**; *Viburnum lantana* **[P., V.]**; *Vicia cracca* L. **[P., I.]**; *Vicia grandiflora* Scop. **[P., V., F., I.]**; *Viola arvensis* Murray **[P., V., F.]**; *Viola odorata* L. **[P., V., F., I.]**; *Viola reichenbachiana* Jord. ex Boreau **[P., V., F.]**; *Viola tricolor* L. **[F., I.]**; *Vitis vinifera* L. subsp. *sylvestris* (C.C.Gmel.) Hegi **[P., V., I.]**; *Vulpia myuros* (L.) C.C.Gmel. **[P., V.]**; *Vincetoxicum hirundinaria* Medik. **[V.]**; *Veronica chamaedris* L. **[V.]**; *Xanthium spinosum* L. **[P., V., F., I.]**; *Xanthium strumarium* L. (incl. subsp. *italicum* (Moretti) D.Löve) **[P., V., F., I.]**.

List of invasive species (sensu Anastasiu et al., 2008)

*Acer negundo, Ailanthus officinalis, Amaranthus retroflexus, Ambrosia artemisiifolia, Amorpha fruticosa, Asclepias syriaca, Conyza canadensis, Echinnocystis lobata, Erigeron annuus, Fraxinus pensylvanica, Galinsoga parviflora, Helianthus tuberosus, Morus alba, Parthenocissus inserta, Robinia pseudacacia, Rudbeckia laciniata, Sorghum halepense, Xanthium spinosum, Xanthium strumarium (*incl.subsp. *italicum).*

Main habitats summary description

91F0 Riparian mixed forests of *Quercus robur, Ulmus laevis,* and *Ulmus minor, Fraxinus excelsior* or *Fraxinus angustifolia,* along the great rivers (*Ulmenion minoris*) (= R4404 Ponto-danubian mixed forests with *Quercus robur, Fraxinus sp., Ulmus sp.,* with *Festuca gigantea*)

These forests occur in all four locations, as well as along the River Mureș and other rivers in forest-steppe (Ardelean, 2006, Pașcovschi & Doniță, 1967); they constitute the primary climax vegetation on non-flooded terrains. The canopy reaches the maximum height of 25-28 m and is composed by species as *Quercus robur, Fraxinus angustifolia, F. excelsior* (mainly, in variable proportions), *Ulmus laevis* and *U. minor*, accompanied by *Acer campestre, Acer negundo, Populus alba, Carpinus betulus, Tylia platyphyllos, Malus sylvestris. Juglans nigra* and *Ailanthus officinalis* are present at Vladimirescu, near planted parcels with *Juglans nigra*. In the underwood, we found *Cornus sanguinea, Prunus spinosa, Sambucus nigra, Ligustrum vulgare, Crataegus monogyna*. Here and there (islands, chiefly) the forest have a luxuriant physiognomy due to abundance of *Vitis vinifera sylvestris, Humulus lupulus* and *Parthenocissus inserta.* The herbaceous layer coverage is variable, with typical forest species (*Brachypodium sylvaticum, Carex sylvatica, Corydalis cava, Geranium robertianum, Geum* *urbanum, Lapsana communis, Polygonatum latifolium, Stachys sylvatica, Viola reichenbachiana* etc.), sometimes forming dense patches (*facies*).

In all locations, these forests are divided in rectangular parcels by back roads 2-4 m wide. It is an evidence of intensive wood exploitation (trees exceeding 70-80 years aged are very rare) and hunting. Back roads are also passage ways for ruderal and invasive plants.

Conservation value: medium.

92A0 *Salix alba* and *Populus alba* galleries (= R4407 Danubian forests of White Willow (*Salix alba*) with *Rubus caesius*)

The physiognomy of these communities ranges from dense alluvial forests with *Salix alba* and *Populus alba* (but also hybrid poplars) in variable proportions, to sparse tree patches. This type of forests (when *Salix alba* is the dominant species) occupy floodable areas. Sporadically, *Fraxinus angustifolia, Sambucus nigra, Acer negundo, Cornus sanguinea* and other woody species appear. The herbaceous layer is composed by species belonging roughly to two categories: nitrophilous (*Galium aparine, Rubus caesius, Urtica dioica* etc.) and hygrophilous (*Iris pseudacorus, Lythrum salicaria, Lycopus europaeus, Ranunculus sceleratus, Carex riparia* etc.)

Conservation value: high.

1530 * Pannonic salt steppes and salt marshes (= R1529 *Hordeum hystrix* ponto-pannonic meadows)

This alkali meadow type was identified at Felnac and Igriș, on small areas. The floristic diversity is low, only few characteristic species being present: *Hordeum hystrix, Bromus hordeaceus, Poa angustifolia, Chamomilla recutita, Verbena officinalis, Achillea setacea, Scorzonera cana, Trifolium fragiferum, Rorippa kerneri, Aster tripolium*. The origin of these meadows is probably secondary, as indicates Toth *et al.* (2009) for similar ecosystems in the Tisza valley.

Conservation value: medium

40A0 * Subcontinental peri-Pannonic scrub (= R3122 Ponto-Pannonic scrubs with *Prunus spinosa* and *Crataegus monogyna*; *Pruno spinosae – Crataegetum* Hueck 1931)

Prunus spinosa is a relatively frequent species in the four studied areas. It can be found on forests borders, in neglected canals, on meadows edges. Many of the patches we analyzed are poor in species presented in *EUR 27 Manual* as characteristic to this habitat. However, close to the typical floristic structure are the terraces from Felnac, where we found a small *Adonis vernalis* population. Other species are: *Rubus caesius, Urtica dioica, Brachypodium pinnatum, Rhamnus cathartica, Scabiosa ochroleuca, Carex hirta, Dacylis glomerata, Rosa canina, Pyrus pyraster, Agrimonia eupatoria*. A serious threat to these communities is the expansion of *Amorpha fruticosa* which literally replace *Prunus spinosa* in forest borders, especially in the proximity of the river.

Conservation value: medium.

3150 Natural eutrophic lakes with *Magnopotamition* or *Hydrocharition*-type vegetation (= R2202 Danubian communities with *Lemna minor*, *L. trisulca*, *Spirodela polyrhiza* and *Wolffia arrhiza*)

Free, shallow water pans, in canals and ponds, present a layer of duckweed. Other species identified are common with the habitats R5305 and 5309 (*Alisma plantago-aquatica, Butomus umbellatus, Typha latifolia, Sparganium erectum* etc.). Submerged species as *Potamogeton sp*. and *Ceratophyllum sp*. appear also associated with *Lemna minor*. There are difficulties in mapping such communities seeing their small areas.

Conservation value: medium.

R5305 Danubian communities with *Typha angustifolia* and *T. latifolia* (*Typhetum latifoliae* G. Lang 1973)

Typha species indicate a certain degree of eutrophication. We found these communities in canals with low water level (bellow 0,5 m) and on borders of former ballast pits (“cubice”, rom. pl.). Generally, *Typha latifolia* is more frequent than *Typha angustifolia*. Other species found: *Butomus umbellatus, Sparganium erectum, Alisma plantago-aquatica, Glyceria maxima, Lycopus europaeus.* Unoccupied water surface is almost in all cases covered with *Lemna minor* layer. Traditionally, bulrush was used as insulating material in barrels manufacturing and for netting various domestic objects.

Conservation value: low.

R5309 Danubian communities with *Phragmites australis* and *Schoenoplectus lacustris* (*Scirpo – Phragmitetum* W. Koch 1926)

Reed communities were identified on canals and ponds, sometimes in patches inside other hydrophyllic communities. The vegetal carpet is dominated by *Phragmites australis*, a small coverage being realized by: *Calystegia sepium, Lycopus europaeus, Salix cinerea, Lysimachia vulgaris, Mentha aquatica, Solanum dulcamara* etc. Reed was a traditional roofing material; the present-day importance of reed beds is that of nesting place for many bird species.

Conservation value: medium.

R5310 Dacian- Danubian communities with cu *Carex elata, C. rostrata, C. riparia* şi *C. acutiformis* (*Caricetum acutiformis* Engler 1933; *Caricetum ripariae* Knapp et Stoffer 1962)

Carex beds are dense vegetation found on canal banks and pond borders. They are dominated in the area by *Carex riparia*, accompanied by hygrophilous species as: *Lycopus europaeus, Carex acutiformis, Lysimachia vulgaris, Calystegia sepium, Galium palustre, Eleocharis palustris, Iris pseudacorus, Symphytum officinale* etc. These communities harbour many invertebrate species.

Conservation value: medium.

6440 Alluvial meadows of river valleys of the *Cnidion dubii* (= R3716 Danubian-Pontic meadows of *Poa pratensis, Festuca pratensis* and *Alopecurus pratensis*)

We included in this habitat plant associations primarily found on the dyke acclivities. Dykes can be considered a refuge for mown meadows species, which otherwise are rare in the area. The floristic diversity is high and our 4 m^2 samples belong to various associations: *Salvio – Festucetum rupicolae* Zolyomi 1939, *Agrostideto – Festucetum pratensis* Soó 1949, *Poetum pratensis* Răv., Căzac. et Turenschi 1956, *Arrhenatheretum elatioris* (Br.-Bl. 1919) Scherer 1925. Among the most frequent and abundant species are: *Festuca rupicola, Dactylis glomerata, Alopecurus pratensis, Festuca pratensis, Vicia sativa, Medicago sativa, Salvia nemorosa, Astragalus glycyphyllus.* Normally, these meadows are mown (as dyke maintenance measure) by the Hidrological Administration, at least once a year. They are also used as pastures, especially in early spring. Portions of dykes invaded by communities from *Sambucetum ebuli* (Kaiser 1926) Felföldy 1942 and *Glycyrrhizetum echinatae* (Timár 1947) Slavnic 1951 demonstrate that the dyke clearance is not a unitary treatment. At Păuliș site, we even noticed the expansion of scrubs on the dyke. Because these meadows are important for invertebrate fauna, as well for their specific diversity, we recommend the mowing once a year in early summer.

Conservation value: medium.

Other anthropic (ruderal) habitats identified in the areas are:

- R8702 Anthropic communities, with *Onopordum acanthium*, *Carduus nutans* and *Centaurea calcitrapa*;
- R 8703 Anthropic communities with *Elymus repens*, *Arctium lappa, Artemisia annua* and *Ballota nigra*;
- R8704 Antropic communities, with *Polygonum aviculare*, *Lolium perenne*, *Sclerochloa dura* and *Plantago major* (*Lolio – Plantaginetum majoris* (Linkola 1921) Berger 1950), especially on the top of dyke and along many roads.

Roads and crop borders present an intricate complex of other associations from *Chenopodietea*, *Artemisietea*, *Bidentetea tripartiti* and *Plantaginetea majoris*. On the gravel river banks or abandoned ballast pits proximities we found small surfaces from *Filagini – Vulpietum* Oberd. 1938.

Discussion

The floristic list is composed by more than 350 cormophyte species, for the total studied area (9 km^2 × 4 sites = 36 km^2). Before interpreting this specific diversity as high, we must notice that a large part of species are weeds in cultivated crop edges, canals and other ruderal habitats. No species from Habitats Directive (92/43/EEC) were found. On the dyke, in Igriș, we did not identify two steppe species (*Dasypyrum villosum* (L.) P. Candargy and *Aegilops cylindrica* Host) mentioned by Coste *et al.* (1998) at Cenad, few kilometers downstream.

In this list, 20 species are invasives. From far, the most problematic case is *Amorpha fruticosa*. Doniță *et al.* (2005) consider the *Amorpha*-dominant communities as a habitat type (*R4423 Amorpha fruticosa scrub*), and they approximate the area covered with (in Romania) at "… > 50 ha, in 200-400 m^2 patches". We found this kind of phytocoenoses on much more large areas, in all four locations. Romanian authors established a correspondent plant association (*Amorphaetum fruticosae* (Borza 1954) Coste 1975, *in* Sanda *et al.*, 2008) or sub-associations (*Salicetum triandrae* Malcuit 1929 subas. *amorphosum fruticosae* Borza 1954; *Salicetum albae – fragilis* Issler 1926 em. Soó 1957 subas. *amorphosum fruticosae* Morariu et Danciu 1970, *in* Pop, 1978, Drăgulescu, 1995). We found a total area of *Amorpha* scrubs about 2411 ha (1544 ha – Păuliș, 131 ha – Vladimirescu, 391 ha – Felnac, 345 ha - Igriș), wich represents less than 10 % of the total studied area. Our observations convey to a trivalent behaviour of this species in starting the colonization: on neglected meadows (Colour plate Figure 11.), on river nude banks (as pioneer), and on forest clearances. It seems that floods are a key factor in spreading seeds (fruits). There is not a strategy to eliminate this non-native plants, except some isolate measures taken by land-owners (land clearing, burning - Păuliș). Accordingly, the spreading of *Amorpha fruticosa* is a severe threat to biodiversity, especialy by competing *Prunus spinosa* and *Crategus monogyna* scrubs. The use of *Amorpha* fruits as medicine (Nistor *et al.*, 1987) is no more up-to-date.

The second invasive species as importance (in superficies) is *Ambrosia artemisiifolia*, found along roads, canals and in fallows. The presence of this species is a public health problem (due to its allergenic pollen) in all western part of Romania (Faur & Ianovici, 2001 and Hodișan & Morar, 2007 *in* Pele *et al.*, 2006).

Echinocystis lobata was found covering reed beds and scrub vegetation, in some cases copiously. This annual plant reduces the abundance of other native species by shading; its seeds are eaten by birds (Anastasiu & Negrean, 2007). As in case of *Amorpha fruticosa*, proliferation of this species has a high potential in altering the landscape. Drăgulescu (1995) includes this community type in the association *Salicetum albae – fragilis* Issler 1926 em. Soó 1957 as a new facies (*echinocystosum*).

Parthenocissus inserta is less worrisome, except its presence within the Islands of Igriș natural reserve, were it competes native lianas (*Clematis vitalba*). In such areas, rootage of *Parthenocissus* populations should be scheduled, as part of ecological reconstruction plans.

An invasive in progress seems to be *Ailanthus glandulosus*, since Ardelean (1995) did not mention this species in Vladimirescu, were we found numerous individuals.

Erigeron anuus is frequent in all locations, and it forms dominant populations in fallows, in first years following cultivation abandon. Giving the wide-spreading of this neophyte (Sîrbu *et al.*, 2006) and its populations decrease by natural sccession, a minimal control action recommended is mowing before seeds maturation.

Land-use categories

In all four study sites, we consider important for conservation purposes the ratio between (semi)natural ecosystems and the the natural ecosystems. We included in the first category: *Amorpha fruticosa* scrubs, meadows, forests, other type of scrubs, water surfaces, gravel, reed, and in the second one: fallow, arable, villages and farm buildings, orchards and vineyards, pit ballasts and golf course. The ratio of (semi)natural ecosystems/anthropic ecosystems ranges from 1:0.42 (Vladimirescu) to 1:1.91 (Felnac); values for Păuliș and Igriș are 1:1.69 and respectively 1:0.96. This indicator is however arguable since the positioning of quadrats are arbitrarily chosen, and do not take into account the connectivity (a parameter wich is calculated / estimated for larger areas).

Our maps (Colour plate Figures 7-10) illustrate different situations, with arable fields and meadows in-between dykes, chiefly at Felnac and Igriș (areas included in the Lunca Mureșului Natural Park); it is obvious therefore the Administration of the Park has to set specific management measures and work closely to locals.

Another tendency we notice is the land recuperation by some land-owners who build farms and huts near water (at Păuliș and Vladimirescu, especially).

We can interpret this as a returning to traditional farming systems, with temporary buildings near fields ("sălașe", rom. pl.), but also as a replacement of the sense of place by an exaggerated sense of property, since pastures are overgrazed and other symptoms of non-observance of nature management rules are obvious.

The cormophyte flora of studied locations comprises 370 species. The main invasive species is *Amorpha fruticosa*, and control actions should be urgently initiated.

As definitive (semi)natural ecosystems, the main ones are: the *Quercus robur – Fraxinus* forest, riverine willows plus poplars forests and meadows on dykes acclivities. Permanent wet meadows are invaded by scrubs or over-grazed. Fens occupy small areas in sampled areas. The naturalness of analyzed (semi)natural vegetation samples was the most frequently expressed by values of 3 and 4 on Németh & Seregélyes scale (Takács & Molnár, 2009).

Agriculture in the area is based mainly on some crops (maize, wheat, barley, sunflower). Orchards and meadows show a neglected aspect (Colour plate Figure 12) and reflect recent mutations in Romanian agriculture, as well as a shift from traditional uses (Colour plate Figure 13).

Among the ecosystem services provided by the habitats we identified, to be used as main direction in public information, and to keep local communities aware of, we may list as priorities (categories according to WRI, Millenium Ecosystem Assessment, 2005):

a) Provisioning services: food, fuel, wood, medicinal plants, ornamental plants;
b) Cultural services: recreational, ecoturism, education, sense of place;
c) Supporting services: habitat for game, water and nutrients recycling;
d) Regulating services: local climate regulation, pollination of crops, water clearance, protection against floods.

Conclusions

From the six strategic axes proposed by Austad (2000) for agriculture in preserving cultural landscape values, two are applicable to the cases we studied: protection of semi-natural vegetation types, and encouraging low-intensity farming, especially within the Lunca Mureșului Natural Park. Intensification of agriculture and landscape simplification, a probable trend since the landed property regime will be more stable, is generally correlated with a decrease in plant diversity (α- and β-diversity), as found by Flohre *et al.* (2011). More specific research is needed in re-connected local communities to their natural matrix, taking into account the ecosystem services, but also the community values (Raymond 2008).

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FURTHER DATA ON THE TRUE BUG FAUNA (INSECTA: HETEROPTERA) OF ALKALINE GRASSLANDS IN THE HUNGARIAN-ROMANIAN BORDER REGION

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Introduction

In the framework of HURO projects, several studies were carried out to reveal the effect of the land use practices, the landscape characteristics and the structure of vegetation on the invertebrate fauna in a transborder region between Hungary and Romania (e.g. Lörinczi *et al.* 2011, Lörinczi 2011, Szikora *et al.* 2012, Gallé *et al.* in this issue).

In the year of 2010 a faunistic survey was carried out in order to reveal the invertebrate fauna of alkaline grasslands in the region. Some faunistical results of various taxa including Heteroptera were already presented (e.g. Lőrinczi 2011, Lőrinczi *et al.* 2011). Even though various collecting methods were applied (i.e. pit-fall trapping, vacuum sampling, sweep netting), mostly the catching data of pit-fall traps were published in the work of Lőrinczi *et al.* (2011). Thus, the number of true bug species and specimens were rather low comparing to other arthropod groups e.g. spiders and ants. Several studies found that the most effective collecting method of true bugs is sweep netting (e.g. Remane 1958, Standen 2000, Coscaron *et al.* 2009). Although Standen (2000) stated that pitfall trap sampling was not necessary to estimate the species richness of true bugs in grasslands, in the case of ground-dwelling and cryptic species pitfall trapping is a suitable sampling method in the sense of both faunistical (e.g.Torma 2005) and ecological (e.g. Torma and Körmöczi 2009) aspects. In this point of view, the low number of true bug species published by Lőrinczi *et al.* (2011) was an acceptable result, but for a complete faunistical study, sweep netting is a necessary collecting method. Thus, the aim of the present work was to complete the list of the collected true bug species in alkaline meadows in the Hungarian-Romanian border region according to the sweep net sampling.

Materials and methods

In the previous issue of this monograph series (Körmöczi 2011), several studies were published in which the landscape history, the characteristics (i.e. land use type, vegetation and geomorphology) of Gyula-Vărşand region as well as the methodology of the project were discussed. Thus, in the Materials and methods section, only the sites sampled by sweep netting were listed again.

Gyula I.: (1) loess steppe and salt meadow; (2) salt meadow; (3) salt meadow and *Artemisia* salt steppe; (4) loess steppe; (5) Pannonic *Camphorosma* hollow and dense and tall *Puccinellia* sward with salt meadow; (6) salt meadow; (7) *Artemisia* salt steppe with dense and tall *Puccinellia* sward patches and Pannonic *Camphorosma* hollow; (8) loess steppe patches; (9) transition from *Artemisia* salt steppe to dense and tall *Puccinellia* sward; (10) salt meadow.

Vărşand (Gyulavarsány): (11) *Achillea* salt steppe with loess steppe patches; (12) uncharacteristic grassland; (13) *Artemisia* salt steppe with salt meadow patches and salt meadow with *Artemisia* salt steppe patches; (14) loess steppe;

Pilu (Nagypél): (15) uncharacteristic grassland (or degraded loess steppe); (16) degraded loess steppe; (17) *Achillea* salt steppe with *Artemisia* salt steppe patches; (18) *Artemisia* salt steppe and salt meadow with loess steppe patches; (19) *Artemisia* salt steppe with salt meadow patches and Pannonic *Camphorosma* hollow; (20) salt meadow with uncharacteristic grassland.

Gyula II.: (21) alkaline grassland (22); degraded loess steppe; (23) degraded loess steppe; (24) uncultivated old alfalfa field; (25) grassland strip near the alfalfa field; (26); grassy undergrowth vegetation in an orchard; (27) grassland strip between corn fields; (28) uncharacteristic, disturbed grassland (29) uncharacteristic, disturbed grassland;

Results and discussion

A total number of 3818 adult individuals of 110 true bug species representing 14 families were collected by sweep-netting (Table 1). The occurrence of 24 species of them was already published by Lőrinczi *et al.* (2011) according to the pitfall-trap and D-Vac samplings. Taking into account the total faunistical survey, 140 true bug species were recorded, altogether. Some records were worth to highlight. *Aoploscelis bivirgata* (A. Costa, 1853) is a Ponto-Mediterranean species. The south part of the Great Hungarian Plain is presumably the northern edge of its distribution area. It is relatively frequent in the Bánság (Romania and Serbia), however only one data is known from Hungary (Torma 2005). As the collecting site (Vărşand) is situated close to the Hungarian-Romanian border, *A. bivirgata* presumably lives also in the Hungarian part of the region, especially in the grasslands nearby Gyula. Further important result of the faunistic survey was the first record of *Ochetostethus balcanicus* (Wagner, 1940) in Hungary (Torma and Rédei in press). Although the specimens were collected near Magyarcsanád, the authors supposed the occurrence of species nearby Gyula, too. Present record of the species, in a salt meadow near to Gyula, verified their assumption.

The Hungarian true bug fauna is relatively well-known, especially that of the protected, natural areas (e.g. Bakonyi and Vásárhelyi 1981, 1987, 1993, Bakonyi *et al.* 2002, Földessy 1987, 1998, Földessy *et al.* 1999, Harmat 1986a, b, 1993, Kondorosy and Kis 1996, Kondorosy and Harmat 1997, Kondorosy and Földessy 1998, Kondorosy 2000, 2001, 2003, Vásárhelyi 1983, 1985, Vásárhelyi *et al.* 1990), but the south-eastern part of the Great Hungarian Plain is poorly studied in spite of the fact that the area of Körös-Maros National Park is situated in the region. Only a few work provided data about the true bug fauna of this region. Harmos *et al.* (2000) reported the occurrence of 105 true bug species, including some very rare ones and Torma (2005) published three new species for the Hungarian fauna. The results of the faunistical surveys in the region (e.g. the new species for the Hungarian fauna) highlighted that our knowledge about the true bug fauna of the south-eastern part of the Great Hungarian Plain is poor.

Table 1. List of the true bug species collected by sweep netting. No. - number of collected specimens; Site - marks of the collecting sites (For the marks of sites see Materials and methods section).

Taxa	No.	Site
Tingidae		
Agramma atricapillum (Spinola, 1837)	2	20, 26
Agramma confusum Puton, 1879	11	1, 9, 12, 15, 17
Catoplatus carthusianus (Goeze, 1778)	2	18
Dictyla humuli (Fabricius, 1794)	5	15, 21, 24, 25, 29
Lasiacantha c. capucina (Germar, 1836)	2	20, 24
Lasiacantha gracilis (Herrich-Schäffer, 1838)	6	1
Oncochila scapularis (Fieber, 1844)	1	18
Oncochila simplex (Herrich-Schäffer, 1830)	1	16
Tingis (s. str.) auriculata (Costa, 1843)	7	3, 5
Miridae		
Acetropis carinata (Herrich-Schäffer, 1842)	38	1, 3, 4, 5, 6, 7, 8, 9
Adelphocoris lineolatus (Goeze, 1778)	168	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 17, 18, 20, 21, 24, 28, 29
Amblytylus nasutus (Kirschbaum, 1856)	111	1, 2, 3, 4, 5, 6, 7, 8, 9,
Campylomma verbasci (Meyer-Dür, 1843)	1	12

Taxa	**No.**	**Site**
Charagochilus gyllenhali (Fallén, 1807)	1	1
Chlamydatus pulicarius (Fallén, 1807)	3	29
Chlamydatus pullus Reuter, 1870	6	12, 15, 29
Conostethus hungaricus E. Wagner, 1941	260	5, 7, 8, 9
Criocoris crassicornis (Hahn, 1834)	7	1
Criocoris sulcicornis (Kirschbaum, 1856)	106	1, 4, 7
Halticus apterus (Linnaus, 1761)	49	1, 3, 14, 15, 20, 25, 26, 29
Leptoterna dolabrata (Linnaeus, 1758)	1	6
Leptoterna ferrugata (Fallén, 1807)	1	9
Lygus gemellatus (Herrich-Schäffer, 1835)	12	3, 5, 12, 21
Lygus pratensis (Linnaeus, 1758)	12	3, 5, 14, 20, 21, 24, 26, 29
Lygus rugulipennis Poppius, 1911	17	3, 5, 12, 21, 24
Macrotylus paykulli (Fallén, 1807)	1	14
Megaloceroea reticornis (Geoffroy, 1785)	1	7
Megalocoleus molliculus (Fallén, 1829)	5	5, 15, 18
Notostira elongata (Geoffroy, 1785)	75	2, 3, 16, 21, 25, 26, 27, 28, 29
Orthocephalus saltator (Hahn, 1835)	6	15, 16, 20
Orthops basalis (Costa, 1852)	1	12
Orthops kalmii (Linnaeus, 1758)	6	25, 29
Orthotylus flavosparsus (F. Sahlberg, 1842)	17	1, 5, 21
Phytocoris insignis Reuter, 1876	1	8
Phytocoris varipes Boheman, 1852	2	6, 12
Plagiognathus bipunctatus Reuter, 1883	52	3, 5, 14
Plagiognathus chrysanthemi (Wolff, 1804)	1	20
Plagiognathus fulvipennis (Kirschbaum, 1856)	2	7, 20

Taxa	No.	Site
Plagiognatus sp.	6	5
Polymerus brevicornis (Reuter, 1878)	19	1, 3, 4, 14
Polymerus holosericeus (Hahn, 1831)	2	1
Polymerus unifasciatus (Fabricius, 1794)	18	1, 3, 4, 20
Polymerus vulneratus (Panzer, 1806)	130	1, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 16, 17, 18, 21, 24,
Solenoxiphus fuscovenosus (Fieber, 1864)	2	5, 6
Stenodema calcaratum (Fallén, 1807)	322	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 24, 25, 26, 27, 28, 29
Teratocoris sp.	1	8
Trigonotylus caelestialium (Kirkaldy, 1902)	210	3, 4, 5, 6, 7, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 25, 26, 28, 29
Trigonotylus pulchellus (Hahn, 1834)	1064	1, 3, 5, 6 ,7 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 25, 26, 28, 29
Anthocoridae		
Orius (Heterorius) horvathi (Reuter, 1884)	1	3
Orius (Heterorius) minutus (Linnaeus, 1758)	1	5
Orius (s. str.) niger Wolff, 1804	10	3, 12, 24, 28
Nabidae		
Nabis (s. str.) p. punctatus Costa, 1847	15	3, 5, 6, 21, 24, 25
Nabis (s. str.) p. pseudoferus Remane, 1949	124	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 24, 25, 26, 27, 28, 29
Nabis pseudoferus / punctatus ♀	81	1, 2, 3, 6, 7, 8, 10, 11, 12, 13, 15, 16, 17, 20, 21, 24, 25, 26, 27, 28, 29
Berytidae		
Berytinus sp.	1	17
Berytinus clavipes (Fabricius, 1775)	2	29
Berytinus minor	6	2, 18, 26, 29

Taxa	No.	Site
Berytinus montivagus (Meyer-Dür, 1841)	2	2
Neides tipularius (Linnaeus, 1758)	1	25
Piesmatidae		
Piesma capitatum (Wolff, 1804)	1	17
Piesma maculatum (Laporte, 1832)	2	5, 20
Piesma quadratum (Fieber, 1844)	1	19
Lygeaidae sensu lato		
Aoploscelis bivirgata (A. Costa, 1853)	1	12
Dimorphopterus doriae (Ferrari, 1874)	8	12, 14, 17, 28
Geocoris (s. str.) grylloides (Linnaeus, 1758)	3	3
Henestaris halophilus (Burmeister, 1835)	133	5, 6, 7, 9, 21
Ischnodemus sabuleti (Fallén, 1829)	6	2, 27
Kleidocerys resedae (Panzer, 1797)	1	4
Lygaeosoma anatolicum Seidenstücker, 1960	2	7
Metopoplax origani (Kolenati, 1845)	73	5, 7, 19, 20
Nysius ericae (Schilling, 1829)	1	5
Nysius senecionis (Schilling, 1829)	110	3, 5, 6, 7, 10, 15, 17, 18, 20, 21
Ortholomus punctipennis (Herrich-Schäffer, 1839)	3	3, 28
Oxycarenus pallens (Herrich-Schäffer, 1850)	4	3, 29
Peritrechus gracilicornis (Puton, 1877)	1	4
Peritrechus nubilus (Fallén, 1807)	2	5, 6
Platyplax salviae (Schilling, 1829)	4	20
Pterotmetus staphyliniformis (Schilling, 1829)	3	11, 25, 29
Xanthochilus quadratus (Fabricius, 1798)	5	6, 7, 9

Taxa	No.	Site
Pyrrhocoridae		
Pyrrhocoris marginatus (Kolenati, 1845)	2	8, 9
Alydidae		
Alydus calcaratus (Linnaeus, 1758)	1	26
Camptopus lateralis (Germar, 1817)	19	3, 6, 7, 8, 9, 20, 25
Rhopalidae		
Brachycarenus tigrinus (Schilling, 1817)	4	12
Chorosoma schillingii (Schummel, 1829)	10	3, 6, 7, 21
Corizus hyoscyami (Linnaeus, 1758)	8	2, 5, 14, 15, 20, 25
Liorhyssus hyalinus (Fabricius, 1794)	2	5, 12
Myrmus miriformis (Fallén, 1807)	24	1, 2, 3, 4, 10, 20, 25, 28, 29
Rhopalus parumpunctatus (Schilling, 1817)	78	1, 3, 5, 6, 7, 9, 12, 13, 15, 16, 18, 20, 21, 29
Stictopleurus abutilon (Rossi, 1790)	7	8, 12, 15, 18, 20
Stictopleurus punctatonervosus (Goeze, 1778)	10	5, 6, 7, 13, 21
Coreidae		
Ceraleptus gracilicornis (Herrich-Schäffer, 1835)	1	4
Coreus marginatus (Linnaeus, 1758)	1	5
Spathocera lobata (Herrich-Schäffer, 1840)	2	4, 9
Cydnidae		
Ochetostethus balcanicus (Wagner, 1940)	6	6, 15, 16
Scutellaridae		
Eurygaster maura (Linnaeus, 1758)	23	1, 2, 3, 5, 7, 8, 9, 24, 26, 28, 29
Pentatomidae		
Aelia acuminata (Linnaeus, 1758)	51	1, 2, 3, 4, 6, 7, 8, 9, 25, 29
Aelia rostrata Boheman, 1852	14	3, 5, 6, 9, 15, 16, 20

Taxa	No.	Site
Antheminia lunulata (Goeze, 1778)	12	5, 6, 7, 9, 20, 21, 28
Carpocoris fuscispinus (Boheman, 1850)	2	5, 8
Carpocoris purpureipennis (De Geer, 1773)	7	2, 14, 15, 20, 25, 29
Dolycoris baccarum (Linnaeus, 1758)	59	2, 3, 5, 6, 7, 8, 12, 13, 14, 15, 18, 20, 25, 29
Eurydema oleraceum (Linneaus, 1758)	9	5, 14, 16, 20, 21, 29
Eurydema ornatum (Linnaeus, 1758)	13	5, 20
Eusarcoris ventralis (Westwood, 1837)	2	7, 21
Graphosoma lineatum (Linnaeus, 1758)	1	1
Holcostethus vernalis (Wolff, 1804)	1	20
Piezodorus lituratus (Fabricius, 1794)	4	24, 26, 29
Podops inuncta (Fabricius, 1775)	1	7
Sciocoris cursitans (Fabricius, 1794)	1	2
Sciocoris distinctus Fieber, 1851	1	6
Vilpianus galii (Wolff, 1802)	60	1, 3, 4

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DATA ON THE ARTHROPOD (ARANEAE, FORMIVIDAE, HETEROPTERA) FAUNA OF FLOODPLAN FORESTS AT THE LOWER REACH OF THE RIVER MAROS/MURES

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Introduction

Disturbance is especially relevant in riverine landscapes in which flooding contributes to both spatial and temporal environmental heterogeneity (Naiman and Décamps 1997; Ward *et al* . 2002, Lambeets *et al.* 2008b), The flood regime affects the habitat structure, as it often determines the amont of the leaf litter (Uetz *et al.* 1979) and the diversity and architecture of the vegetation, which are correlated with the arthropod fauna of floodland areas (Gallé *et al.* 2011), resulting in a specialized invertebrate fauna and high species diversity. The arthropod assemblages with a high number of species in floodplains, they can indicate the effect of different habitat parameters on a very small scale (Bonn and Kleinwachter 1999).

In the 19^{th} century dikes were built along the river Maros to improve flood protection and support agriculture on the floodplain soils. Consequently, the floodplain area reduced with modified river dinamics and flooding regime. The arthropod fauna of Western European floodplains has been investigated by numerous authors (e.g. Greenwood *et al.* 1995, Bell *et al.* 1999, Lambeets *et al.* 2008a,b, 2009). However the arthropod fauna of the floodplain of river Maros and other rivers of the region is relatively poorly known (Gallé *et al.* 2005, Urák & Gallé 2005, Duma, 2006).

The aim of the present study was to reveal the composition of the ground dwelling arthropod of the floodplain of river Maros.

Material and Methods

Study area and sampling

The present study was carried out at the habitat complex of the riparian area of the lower Maros-valley near Pesica. In the floodplain forests, 30 plots were selected for sampling spider assemblages. To characterize the structure of the habitat, the percentage cover of the herbaceous vegetation, bare soil surface, leaf litter were assesed in three 1 × 1 meters quadrates at each sampling plot. The canopy closure was also assesed at each sampling plot. The location and habitat characteristisc are given in Table 1.

To sample the invertebrate fauna pitfall traps were applied (diameter 85 mm, filled with ethylene glycol as preservative, Koivula 2003, Schmidt *et al.* 2006). At each site five traps were placed. The traps were open for two 3-week long periods (02-21 June 2011 and 15 June- 06 July 2012). We expected an underestimation of the abundance of vegetation-dwelling and web-building species, as pitfall traps measure the activity-density of species at the ground level.

Results and Discussion

The faunistical data concerning the species-abundance data are given in Table 1 and 2.

During the two-years study a total number of 3562 spiders were collected belonging to 73 species and 19 families. The most abundant species was *Ozyptila praticola* (C.L. Koch, 1837), 895 specimens were collected. This species is of wide distribution area occuring mainly in floodplain forests. As *O. praticola* is a ground-dwelling crab spider it can be collected with high numbers with pitfall traps. This species occurred at all sampling sites. The lycosid *Pardosa lugubris* (Walckenaer, 1802) and *Phrurolithus festivus* (C.L. Koch, 1835), belonging to Corinnidae were also frequent.

In the two years a total of 38,464 ant individuals (38,323 workers, 123 queens, 18 males) were recorded, which represent 18 species of four subfamilies and nine genera (Table 1). The major part of species belonged to the Formicinae subfamily (9), followed by Myrmicinae (6). Among the genera found, *Lasius* presented the largest number of species (7).

Most of the collected species were recorded both from islands and riverbanks. Only five species, *Myrmica sabuleti*, *Temnothorax affinis*, *Tetramorium* cf. *caespitum*, *Lasius distinguendus* and *L. umbratus* were those that occurred only in islands, and one species, *L. flavus* was that that occurred only on riverbanks.

The most abundant ant species was clearly *Liometopum microcephalum*, representing more than 90% of all workers collected. Most of its individuals were, however, found only in a few locations and were obtained only from a small number of traps. This result was due to the particular foraging behaviour of this species. *L. microcephalum* is a dendrophilous, mainly oak-dwelling ant, which has very large colonies with several thousand individuals (Wiest 1967). Workers commonly form very long and busy trails that are used to connect their nest and foraging trees (Emery 1891). As a consequence of this, occasionally large number of workers falls into single traps that just cross their foraging trails.

Table 1. Location and habitat structure of the sampling sites. i: island, b: bank of the river

Site ID	Coordinates	Bare groud (%)	Leaf litter (%)	Veg. Coverage (%)	average height of herbaceous vegetation (cm)	Canopy colosure (%)	Location
1	N46 08.235 E21 08.789	2,7	21,7	70,0	56,7	71,7	i
2	N46 08.173 E21 07.714	21,7	6,7	68,3	23,3	70,0	i
3	N46 08.259 E21 08.836	18,3	20,0	61,7	53,3	75,0	b
4	N46 08.301 E21 07.713	5,0	70,0	30,0	15,0	66,7	b
5	N46 08.326 E21 06.902	5,0	48,3	48,3	50,0	36,7	b
6	N46 08.325 E21 06.790	0,0	88,3	11,7	30,0	87,7	i
7	N46 09.065 E21 05.024	1,7	11,7	83,3	56,7	45,0	i
8	N46 08.986 E21 04.870	58,3	25,0	16,7	18,3	78,3	b
9	N46 09.037 E21 03.955	1,7	55,0	43,3	53,3	75,0	i
10	N46 08.985 E21 03.908	1,7	84,3	15,7	43,3	85,0	b
11	N46 09.047 E21 03.873	0,0	68,3	31,7	43,3	88,3	i
12	N46 08.973 E21 03.794	0,0	83,3	16,7	40,0	93,3	b
13	N46 08.895 E21 03.107	25,0	41,7	33,3	38,3	75,0	i
14	N46 08.950 E21 02.984	13,3	78,3	8,3	23,3	95,0	i
15	N46 08.963 E21 02.874	0,0	86,7	13,3	20,0	85,0	b
16	N46 08.905 E21 02.423	3,3	23,3	73,3	56,7	35,0	i
17	N46 08.886 E21 02.350	6,7	43,3	50,0	43,3	58,3	i
20	N46 08.912 E21 01.986	0,0	46,7	53,3	63,3	76,7	i
21	N46 08.961 E21 01.235	6,7	61,7	31,7	60,0	75,0	i
22	N46 09.005 E21 01.105	1,7	55,0	31,7	60,0	75,0	b
23	N46 08.887 E21 02.333	6,7	43,3	50,0	43,3	58,3	i
24	N46 08.864 E21 02.382	10,0	41,7	48,3	33,3	91,7	b
25	N46 08.629 E20 59.081	0,0	56,7	43,3	60,0	75,0	i
26	N46 08.555 E20 59.044	10,0	63,3	26,7	53,3	78,3	b
27	N46 08.313 E20 59.137	3,3	81,7	15,0	43,3	88,3	i
28	N46 08.366 E20 59.112	0,0	75,0	25,0	36,7	71,7	b
29	N46 08.134 E20 59.563	3,3	73,3	23,3	50,0	85,0	i
30	N46 08.070 E20 59.838	1,7	76,7	21,7	28,3	91,7	b

Table 2. The list of the collected species in 2011 and 2012. Column captions are the site ID-s (cf. Table 1.)

2011

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Σ
Spiders																							
Dysderidae																							
Dysdera ninnii Canestrini, 1868	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Linyphiidae																							
Acartauchenius scurrilis (O.P.-Cambridge, 1872)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Araeoncus humilis (Blackwall, 1841)	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
Diplocephalus cristatus (Blackwall, 1833)	0	0	0	0	4	0	1	1	0	0	0	0	2	0	2	1	0	3	0	0	3	1	18
Diplocephalus picinus (Blackwall, 1841)	0	0	0	0	2	0	0	0	1	1	1	0	0	0	0	2	0	1	0	1	1	0	10
Diplostyla concolor (Wider, 1834)	8	1	0	0	0	0	2	2	2	2	0	1	5	2	0	4	0	2	2	0	2	2	37
Erigone dentipalpis (Wider, 1834)	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	7
Maso sundevalli (Westring, 1851)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	3
Meioneta rurestris (C.L. Koch, 1836)	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3
Neriene clathrata (Sundevall, 1830)	1	0	0	0	0	0	0	0	2	0	0	0	7	0	1	3	0	0	0	0	0	0	14
Tenuiphantes flavipes (Blackwall, 1854)	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Σ
Trichoncus hackmani Millidge, 1956	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Trichopterna cito (O.P.-Cambridge, 1872)	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Pelecopsis radicicola (L. Koch, 1872)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Walckenaeria atrotibialis (O.P.-Cambridge, 1878)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Walckenaeria mitrata (Menge, 1868)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Tetragnathidae																							
Pachygnatha degeeri Sundevall, 1830	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Pachygnatha listeri Sundevall, 1830	0	0	0	0	3	0	0	2	0	2	0	0	0	1	0	1	0	2	0	0	0	0	11
Theridiidae																							
Enoplognatha thoracica (Hahn, 1833)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Robertus lividus (Blackwall, 1836)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	4
Lycosidae																							
Arctosa lutetiana (Simon, 1876)	2	0	0	0	1	2	0	0	0	2	0	0	1	0	0	4	0	0	0	3	1	0	16
Pardosa agrestis (Westring, 1862)	7	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	11
Pardosa amentata (Clerck, 1757)	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	4
Pardosa lugubris (Walckenaer, 1802)	3	4	0	31	23	1	4	7	4	2	5	18	13	2	0	1	2	5	0	3	3	17	148
Pardosa prativaga (L. Koch, 1870)	0	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	4

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Σ
Pirata hygrophilus Thorell, 1872	0	1	1	0	6	0	7	10	1	3	0	1	1	9	0	2	10	6	5	3	1	4	71
Pirata latitans (Blackwall, 1841)	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	2
Trochosa ruricola (De Geer, 1778)	5	0	0	0	3	0	1	0	0	0	0	0	9	0	0	0	0	1	0	0	1	0	20
Trochosa terricola Thorell, 1856	2	1	0	9	4	2	4	2	0	1	3	2	2	0	0	0	0	0	1	9	3	5	50
Xerolycosa miniata (C.L. Koch, 1834)	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	3
Pisauridae																							
Pisaura mirabilis (Clerck, 1757)	3	0	0	1	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	7
Corinnidae																							
Phrurolithus festivus (C.L. Koch, 1835)	19	0	0	0	5	0	2	0	1	2	0	4	35	1	3	3	2	5	8	0	3	0	93
Phrurolithus minimus C.L. Koch, 1839	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Hahnidae																							
Hahnia nava (Blackwall, 1841)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Amaurobidae																							
Coelotes longispinus Kulczynski, 1897	0	0	0	2	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	5
Titanoecidae																							
Titanoeca schineri (L. Koch, 1872)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Liocranidae																							
Agroeca brunnea (Blackwall, 1833)	1	0	0	0	1	0	0	0	0	2	0	0	0	0	0	1	0	0	1	0	0	1	7

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Σ
Agraecina striata (Kulczynski, 1882)	3	0	0	1	1	1	0	2	1	7	3	13	7	19	2	1	2	4	2	7	0	7	83
Scotina celans (Blackwall, 1841)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Clubionidae																							
Clubiona lutescens Westring, 1851	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	7
Clubiona pallidula (Clerck, 1757)	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	2
Zodaridae																							
Zodarion germanicum (C.L. Koch, 1837)	0	0	0	0	0	0	0	0	7	0	0	5	0	0	0	9	0	0	0	0	0	0	21
Gnaphosidae																							
Drassodes lapidosus (Walckenaer, 1802)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Drassyllus villicus (Thorell, 1875)	0	0	0	0	1	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	5
Haplodrassus minor (O.P.-Cambridge, 1879)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Haplodrassus silvestris (Blackwall, 1833)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Micaria pulicaria (Sundevall, 1832)	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	3
Scotophaeus scutulatus (L. Koch, 1866)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Trachyzelotes pedestris (C.L. Koch, 1837)	3	3	0	0	6	0	0	3	0	0	1	10	2	1	0	1	0	0	0	0	1	1	32
Zelotes apricorum (L. Koch, 1876)	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3
Zoridae																							

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Σ
Zora spinimana (Sundevall, 1833)	1	0	0	0	1	1	0	0	0	1	0	0	1	1	0	0	1	1	1	0	1	0	10
Philodromidae																							
Philodromus cespitum (Walckenaer, 1802)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Thomisidae																							
Ozyptila praticola (C.L. Koch, 1837)	67	1	1	12	32	4	11	4	34	33	21	39	86	28	13	23	20	22	54	21	42	51	619
Xysticus kochi Thorell, 1872	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Xysticus luctator L. Koch, 1870	2	3	1	1	1	0	0	0	0	1	2	7	0	0	0	0	0	0	0	0	1	0	19
Ants																							
Workers																							
Subfamily Ponerinae																							
Ponera coarctata (Latreille, 1802)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	2
Subfamily Myrmicinae																							
Myrmecina graminicola (Latreille, 1802)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Myrmica rubra (Linnaeus, 1758)	15	14	47	0	11	8	10	3	55	13	0	43	1	0	0	5	3	9	14	58	2	11	322
Myrmica sabuleti Meinert, 1861	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Temnothorax crassispinus (Karavaiev, 1926)	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	4
Tetramorium cf. caespitum	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Σ
Subfamily Dolichoderinae																							
Dolichoderus quadripunctatus (Linnaeus, 1771)	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3
Liometopum microcephalum (Panzer, 1798)	0	0	0	62	0	0	0	3	29	273	76	3	0	0	0	0	0	0	1	5284	0	0	5731
Subfamily Formicinae																							
Camponotus fallax (Nylander, 1856)	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Lasius brunneus (Latreille, 1798)	0	0	0	5	0	0	0	1	0	1	3	0	0	0	0	0	0	0	0	0	0	0	10
Lasius flavus (Fabricius, 1782)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Lasius niger (Linnaeus, 1758)	34	3	0	0	51	1	3	6	3	67	1	6	96	20	20	292	13	21	45	6	35	7	730
Lasius platythorax Seifert, 1991	2	5	0	1	0	6	1	3	4	2	1	0	0	0	0	4	1	0	0	0	4	1	35
Queens																							
Subfamily Ponerinae																							
Ponera coarctata (Latreille, 1802)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	4
Subfamily Myrmicinae																							
Myrmica rubra (Linnaeus, 1758)	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	5
Tetramorium cf. caespitum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Subfamily Formicinae																							
Camponotus truncatus (Spinola, 1808)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Σ
Lasius distinguendus (Emery, 1916)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Lasius fuliginosus (Latreille, 1798)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lasius niger (Linnaeus, 1758)	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	9	0	0	0	0	7	0	18
Lasius platythorax Seifert, 1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	4
Heteroptera																							
Saldidae																							
Saldula c-album (Fieber, 1859)	0	0	0	0	0	0	0	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	6
Miridae																							
Mermitelocerus schmidti (Fieber, 1836)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
Lygus punctatus (Zetterstedt, 1839)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Agnocoris reclairei E. Wagner, 1949	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Halticus saltator (Geoffroy, 1785)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Pilophorus confusus (Kirschbaum, 1856)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Orthonotus rufifrons (Fallén, 1807)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Nabidae																							
Himacerus (s. str.) apterus (Fabricius, 1798)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Aradidae																							

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Σ
Aradus distinctus Fieber, 1861	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Lygaeidae sensu lato																							
Drymus (Sylvadrimus) brunneus (F. Sahlberg, 1848)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Scolopostethus puberulus Horváth, 1887	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Scolopostethus affinis (Schilling, 1829)	1	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	1	0	0	0	0	5
Scolopostethus thomsoni Reuter, 1874	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
Scolopostethus pilosus Reuter, 1874	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	4
Cydnidae																							
Legnotus limbosus (Geoffroy, 1785)	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	4
Pentatomidae																							
Rhaphigaster nebulosa (Poda, 1761)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

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	1	2	5	6	9	10	13	16	21	22	23	24	25	26	27	28	29	30	Σ
Spiders																			
Dysderidae																			
Dysdera hungarica Kulczynski, 1897	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Linyphiidae																			
Ceratinella brevis (Wider, 1834)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Diplocephalus cristatus (Blackwall, 1833)	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Diplocephalus picinus (Blackwall, 1841)	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	3
Diplostyla concolor (Wider, 1834)	5	1	2	0	0	0	1	3	2	2	0	0	0	0	0	2	1	1	20
Maso sundevalli (Westring, 1851)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Meioneta rurestris (C.L. Koch, 1836)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Neriene clathrata (Sundevall, 1830)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Tenuiphantes flavipes (Blackwall, 1854)	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	1	1	5
Pelecopsis radicicola (L. Koch, 1872)	1	3	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	9
Walckenaeria alticeps (Denis, 1952)	0	0	1	0	0	0	4	2	1	0	0	0	0	1	1	0	1	0	11
Walckenaeria cucullata (C.L. Koch, 1836)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
Tetragnathidae																			
Pachygnatha degeeri Sundevall, 1830	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1

	1	2	5	6	9	10	13	16	21	22	23	24	25	26	27	28	29	30	Σ
Pachygnatha listeri Sundevall, 1830	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
Theridiidae																			
Episinus angulatus (Blackwall, 1836)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Robertus lividus (Blackwall, 1836)	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lycosidae																			
Arctosa leopardus (Sundevall, 1833)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Arctosa lutetiana (Simon, 1876)	0	0	0	5	0	1	0	0	0	0	0	0	0	3	0	0	1	0	10
Pardosa agrestis (Westring, 1862)	0	1	0	0	1	1	0	0	1	0	1	0	2	0	0	1	0	0	8
Pardosa agricola (Thorell, 1856)	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
Pardosa amentata (Clerck, 1757)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pardosa lugubris (Walckenaer, 1802)	3	24	30	18	0	25	16	1	18	16	2	2	1	9	1	48	2	2	218
Pardosa prativaga (L. Koch, 1870)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pirata hygrophilus Thorell, 1872	1	0	7	1	0	1	2	0	0	2	0	4	0	0	0	0	0	0	18
Pirata latitans (Blackwall, 1841)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trochosa ruricola (De Geer, 1778)	0	2	5	0	0	1	56	0	1	0	0	0	1	0	0	2	1	0	69
Trochosa terricola Thorell, 1856	0	3	2	3	1	1	4	0	0	0	0	0	0	0	1	3	4	1	23
Xerolycosa miniata (C.L. Koch, 1834)	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3
Pisauridae																			
Pisaura mirabilis (Clerck, 1757)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1

	1	2	5	6	9	10	13	16	21	22	23	24	25	26	27	28	29	30	Σ
Agelenidae																			
Agelena labyrinthica (Clerck, 1757)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Corinnidae																			
Phrurolithus festivus (C.L. Koch, 1835)	2	6	11	0	2	1	46	3	57	0	9	0	29	1	7	25	0	0	199
Amaurobidae																			
Urocoras longispinus (Kulczyński, 1897)	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3
Liocranidae																			
Agroeca brunnea (Blackwall, 1833)	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Agroeca cuprea Menge, 1873	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Liocranoeca striata (Kulczyński, 1882)	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	3
Scotina celans (Blackwall, 1841)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Clubionidae																			
Clubiona lutescens Westring, 1851	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Clubiona pallidula (Clerck, 1757)	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	2
Zodaridae																			
Zodarion germanicum (C.L. Koch, 1837)	16	0	12	0	23	3	1	1	0	0	0	0	1	6	0	11	0	0	74
Gnaphosidae																			
Drassyllus pusillus (C.L. Koch, 1833)	0	3	1	0	0	0	2	0	3	0	0	0	0	1	0	1	1	0	12
Drassyllus villicus (Thorell, 1875)	0	0	1	0	0	0	1	0	0	0	0	0	1	2	0	1	2	0	8

	1	2	5	6	9	10	13	16	21	22	23	24	25	26	27	28	29	30	Σ
Haplodrassus minor (O.P.-Cambridge, 1879)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Micaria pulicaria (Sundevall, 1832)	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Trachyzelotes pedestris (C.L. Koch, 1837)	0	5	25	5	3	6	1	0	13	14	0	0	0	13	5	7	11	1	109
Zelotes apricorum (L. Koch, 1876)	0	4	2	2	1	2	0	0	0	1	1	0	9	2	0	6	4	0	34
Zelotes gracilis Canestrini, 1868	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
Zelotes longipes (L. Koch, 1866)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	2
Zoridae																			
Zora spinimana (Sundevall, 1833)	0	0	0	0	0	0	0	0	0	1	1	0	7	0	0	0	0	0	9
Thomisidae																			
Ozyptila praticola (C.L. Koch, 1837)	10	17	22	13	24	11	48	15	64	5	5	1	8	20	5	13	29	4	314
Xysticus luctator L. Koch, 1870	0	1	0	3	0	2	1	0	0	0	0	0	0	3	0	2	0	0	12
Salticidae																			
Euophrys frontalis (Walckenaer, 1802)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Euophrys obsoleta (Simon, 1868)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Myrmarachne formicaria (De Geer, 1778)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Neon reticulatus (Blackwall, 1853)	0	0	0	5	0	0	0	0	0	0	0	0	0	0	1	0	1	0	7

	1	2	5	6	9	10	13	16	21	22	23	24	25	26	27	28	29	30	Σ
Ants																			
Workers																			
Subfamily Ponerinae																			
Ponera coarctata (Latreille, 1802)	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	1	4
Subfamily Myrmicinae																			
Myrmecina graminicola (Latreille, 1802)	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2	0	5
Myrmica rubra (Linnaeus, 1758)	63	66	24	52	83	0	0	0	2	0	9	0	206	21	106	22	105	51	810
Myrmica sabuleti Meinert, 1861	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3
Temnothorax affinis (Mayr, 1855)	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	3
*Temnothorax crassispinus (*Karavaiev, 1926)	0	4	1	6	1	1	0	2	1	0	1	0	8	16	2	2	2	1	48
Tetramorium cf. caespitum	1	0	0	0	0	0	13	0	1	0	0	0	0	0	0	0	0	0	15
Subfamily Dolichoderinae																			
Dolichoderus quadripunctatus (Linnaeus, 1771)	0	2	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	6
Liometopum microcephalum (Panzer, 1798)	0	0	0	9612	6712	0	0	0	2	0	0	0	1	868	0	6010	6	5586	28797
Subfamily Formicinae																			
Camponotus truncatus (Spinola, 1808)	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	4
Lasius brunneus (Latreille, 1798)	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	20
Lasius niger (Linnaeus, 1758)	61	0	91	0	0	1	432	98	165	16	24	49	91	0	14	7	0	0	1049

	1	2	5	6	9	10	13	16	21	22	23	24	25	26	27	28	29	30	Σ
Lasius platythorax Seifert, 1991	39	24	27	20	26	7	35	231	0	0	0	0	2	81	59	158	0	7	716
Queens																			
Subfamily Myrmicinae																			
Myrmecina graminicola (Latreille, 1802)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Myrmica rubra (Linnaeus, 1758)	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
Subfamily Formicinae																			
Lasius brunneus (Latreille, 1798)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Lasius distinguendus (Emery, 1916)	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	3
Lasius fuliginosus (Latreille, 1798)	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
Lasius niger (Linnaeus, 1758)	2	0	2	0	2	0	10	1	1	0	0	1	1	0	0	0	1	0	21
Lasius platythorax Seifert, 1991	0	4	4	0	19	0	14	1	1	0	0	0	4	1	0	8	1	0	57
Lasius umbratus (Nylander, 1886)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Males																			
Subfamily Dolichoderinae																			
Dolichoderus quadripunctatus (Linnaeus, 1771)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Subfamily Formicinae																			
Lasius sp.	0	0	0	0	0	1	6	0	6	1	0	0	0	1	0	1	1	0	17

	1	2	5	6	9	10	13	16	21	22	23	24	25	26	27	28	29	30	Σ
Heteroptera																			
Ceratocombidae																			
Ceratocombus coleoptratus (Zetterstedt, 1819)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Tingidae																			
Derephysia foliacea (Fallén, 1807)	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
Miridae																			
Halticus luteicollis (Panzer, 1805)	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Salicarus roseri (Herrich-Schäffer, 1839)	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Orthonotus rufifrons (Fallén, 1807)	0	3	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	6
Nabidae																			
Himacerus (s. str.) apterus (Fabricius, 1798)	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Anthocoridae																			
Orius (Heterorius) minutus (Linnaeus, 1758)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Aradidae																			
Aradus distinctus Fieber, 1861	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Lygaeidae sensu lato																			
Drymus (Sylvadrymus) ryei Saunders, 1892	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

	1	2	5	6	9	10	13	16	21	22	23	24	25	26	27	28	29	30	Σ
Eremocoris podagricus (Fabricius, 1775)	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0	0	4
Scolopostethus pictus (Schilling, 1829)	0	0	0	0	0	0	2	1	0	0	0	0	0	0	4	1	0	0	8
Scolopostethus affinis (Schilling, 1829)	3	6	0	1	0	0	2	0	0	0	0	0	0	0	0	0	1	0	13
Rhyparochromus vulgaris (Schilling, 1829)	0	4	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	8
Raglius alboacuminatus (Goeze, 1778)	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
Coreidae																			
Coreus marginatus (Linnaeus, 1758)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cydnidae																			
Legnotus limbosus (Geoffroy, 1785)	4	2	0	1	3	1	0	0	0	0	0	0	0	0	2	7	0	0	20
Pentatomidae																			
Palomena prasina (Linnaeus, 1761)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

The most frequent species were *Lasius niger* and *Myrmica rubra*, occurring at most sampling sites. These species belong to the most common ant species in Central Europe. *Lasius* species are habitat generalists and known to have good dispersion abilities, they are the first ant colonizers of newly formed habitats (Vepsäläinen and Pisarski 1982). *M. rubra*, which is a moderately hygrophilous species, occurs in very diverse habitats, but it is particularly abundant in meadows with a high level of ground water (Czechowski *et al.* 2012). In the Upper-Maros/Mureş region *M. rubra* is a typical ant for wet habitats, including floodplain forests, wet meadows and peat bogs (Gallé *et al.* 2005). This species can also survive by forming floating aggregations of workers and queens on the water surface (Dietrich *et al.* 1998, Gallé *et al.* 2005). Because of their good transitions from monogyny to polygyny, *Myrmica* species also tend to monopolise islands if the habitats are suitable, and so they can occupy convenient nesting places in a short time (Vepsäläinen and Pisarski 1982).

110 specimens of 27 true bug species were collected during the two years sampling period and only 6 species were collected both years. It is well-known that the ground-dwelling true-bug fauna of the forests is scarce compared to the grasslands (Torma & Gallé 2010). I order to gain a more complete picture of the true-bug fauna of the floodplain forests different sampling mathods should be also applied (e.g. flight-interception traps, Gossner 2009).The dominant species were *Legnotus limbosus* (Geoffroy, 1785) and *Scolopostethus affinis* (Schilling, 1829). Out of the forest heteroteran species *L. limbosus* is a relatively heliophilous species with preference to scarce canopy cover (Holecová et al 2005). The preferred hostplants for *S. affinis* is *Urtica dioica* and *Fragaria* species; may also be a scavenger or fungivorous, this species occurs on the leaf litter of several forest types (Southwood & Leston 1959, Davis 1989).

There are only few ground-dwelling arthropod species that can tolerate the occasional disturbance caused by the river flood. Local species diversity can be also affected by anthropogenic disturbance, namely the perpetual presence of fishermen and weekend tourists both on the riverbanks and in the islands.

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PRELIMINARY REPORT ON SPIDER ASSEMBLAGE FORM THE PASTURES AND FIELDCROPS OF THE MURES RIVER FLOODPLAIN

Ioan Duma

Introduction.

Spiders (Araneae) are the most diverse group of predators in the world with 111 Families, 3879 Genera and 43244 described species (Platnick 2012). In spite of the rapid advance in spider taxonomy in the case of many species our knowledge is limited to their description. Very little is known about their biology, ecology, distribution.

The present study is aiming to identify spider assemblages present in different types of habitats found along the Mureș River floodplain and to asses if human activities, especially those from the agricultural fields are affecting the spider fauna composition at local level. It is known that spiders are effective predators contributing in the control of many insect species, so their importance to the ecosystem is high (Nyffeler and Benz 1987). However many studies show that they may be susceptible to different chemicals used in the agriculture (Huusela-Veistola1998) while spider associations are sensible to the changes made in their habitat (Lubin *et al.* 2011).

Material and Methods.

The flood plain of Mureș River is situated in western Romania close to the border with Hungary. The region has a temperate climate with an average yearly rainfall of about 700 mm and average yearly temperatures of 11.5 °C (Atlasul Climatologic al Republicii Socialiste România).

From the biogeographic point of view the study area fits into two regions: Pannonic (between Szeged and around Arad) and continental (the area that is close to Lipova town and Mureș River Gorge).

Along the most of its length, the habitats along the studied section of the Mureș River are deeply affected by agriculture practices of all kinds: from cattle rising, to field crops and invasive new plant species.

The spiders were collected with the most common method: pitfall traps. These were put in soil and filled with Ethylene glycol. The pitfalls were set in batteries of 5, placed five meters apart. They were covered with a plastic lid and verified once a month from April to August 2012. The material was then collected and stored in 70% alcohol.

The pitfall traps were set in the following types of habitat: 1) Not grazed pasture (semi natural pasture); 2) Grazed pasture; 3) Wheat field; 4) Marsh.

For identification of the specimens we used the online spider identification key provided so kindly by Wolfgang Nentwig, Theo Blick, Daniel Gloor, Ambros Hänggi & Christian Kropf.

Results

We have found 122 species belonging to 19 families (table 1). That is almost 12% of the total number of spider species recorded so far from Romania.

From the zoogeographical point of view the spider assemblages found within the study site fit well into the Panonian and Continental bioregions. The great majority of the species collected are Palearctic (83), these are followed by Holarctic species (16), European to Central Asia species (12) and European ones (10).

The natural pasture was so far the richest habitat with 69 species. The grazed pasture had 43 species, the marsh 39 species, and the most affected by the human activity was the arable land with only 12 species.

Table 1. The enumeration of spider species found at the floodplain of the Mureș river, their known distribution and habitats in which each species was found.

Taxon	*Distribution*	*Natural Pasture*	*Grazed Pasture*	*Wheat field*	*Marsh*
Atypidae					
1. Atypus muralis Bertkau, 1890	Central Europe to Central Asia	×			
Mimetidae					
1. Ero aphana (Walckenaer, 1802)	Palearctic	×	×		
2. Ero tuberculata (De Geer, 1778)	Palearctic	×			
Uloboridae					
** 1. Uloborus plumipes* Lucas, 1846	Old World	×			
2. Uloborus walckenaerius (Latreille, 1806)	Palearctic	×	×		
Theridiidae					
1. Anelosimus vittatus (C.L.Koch, 1836)	Palearctic	×			
2. Crustulina guttata (Wider, 1834)	Palearctic	×			
3. Cryptachaea riparia (Blackwall, 1834)	Palearctic				×

Taxon	*Distribution*	*Natural Pasture*	*Grazed Pasture*	*Wheat field*	*Marsh*
4. Dipoena melanogaster (C.L.Koch, 1837)	Europe-north Africa-Azerbaijan	×			×
5. Enoplognatha ovata (Clerck, 1757)	Holarctic	×	×		
6. Enoplognatha thoracica (Hahn, 1833)	Holarctic	×			
7. Episinus truncatus Latreille, 1809	Palearctic	×			
8. Heterotheridion nigrovariegatum (Simon, 1873)	Palearctic	×			
9. Neottiura bimaculata (Linnaeus, 1767)	Holarctic	×	×		×
10. Neottiura suaveolens (Simon, 1879)	Europe, Russia	×	×		
11. Simitidion simile (C.L.Koch, 1836)	Holarctic	×	×		
12. Theridion pictum (Walckenaer, 1802)	Holarctic	×			
13. Theridion pinastri L.Koch, 1872	Palearctic	×	×		
14. Theridion uhligi (Martin 1974)	Europe		×		
***Theridiosomadidae**					
** Theridiosoma gemmosum (L. Koch, 1877)*	Holarctic				×
Linyphiidae					
1. Acartauchenius scurrilis (O.P.-Cambridge, 1872)	Palearctic	×			
2. Agyneta subtilis (O.P.-Cambridge, 1863)	Palearctic	×	×	×	×
3. Bathyphantes approximatus (O.P.-Cambridge, 1871)	Palearctic	×			
4. Bathyphantes setiger O.P.-Cambridge, 1894	Palearctic	×			
5. Centromerus sylvaticus (Blackwall, 1841)	Holarctic	×			×
6. Ceratinella brevis (Wider, 1834)	Palearctic	×			×

Taxon	*Distribution*	*Natural Pasture*	*Grazed Pasture*	*Wheat field*	*Marsh*
7. Dicymbium nigrum (Blackwall, 1834)	Palearctic		×		
8. Diplostyla concolor (Wider, 1834)	Holarctic		×		
9. Erigone dentipalpis (Wider, 1834)	Holarctic	×	×	×	
10. Gnathonarium dentatum (Wider, 1834)	Palearctic	×			
11. Gongylidium rufipes (Linnaeus, 1758) Palearctic	Palearctic	×			
12. Labulla thoracica (Wider, 1834)	Europe, Russia		×		×
13. Linyphia hortensis Sundevall, 1830	Palearctic				×
14. Linyphia triangularis (Clerck, 1757)	Palearctic				×
15. Macrargus rufus (Wider, 1834)	Palearctic		×		
16. Mansuphantes arciger (Kulczynski, 1882)	Europe	×			
17. Mansuphantes mansuetus (Thorell, 1875)	Palearctic		×		
18. Maso sundevalli (Westring, 1851)	Holarctic		×		
19. Meioneta rurestris (C.L.Koch, 1836)	Palearctic	×	×		×
20. Micrargus apertus (O.P.-Cambridge, 1871)	Palearctic			×	
21. Nematogmus sanguinolentus (Walckenaer, 1842)	Palearctic		×		
22. Neriene clathrata (Sundevall, 1830)	Holarctic	×			
23. Neriene peltata (Wider, 1834)	Palearctic, Greenland	×			
24. Oedothorax agrestis (Blackwall, 1853)	Palearctic	×	×		
25. Oedothorax apicatus (Blackwall, 1850)	Palearctic		×	×	×
26. Pelecopsis elongata (Wider,	Europe, Russia		×		

Taxon	*Distribution*	*Natural Pasture*	*Grazed Pasture*	*Wheat field*	*Marsh*
1834)					
27. Pelecopsis radicicola (L.Koch, 1872)	Palearctic	×			
28. Porrhomma pallidum Jackson, 1913	Palearctic	×			
29. Pelecopsis parallela (Wider, 1834)	Palearctic	×			
30. Prinerigone vagans (Audouin, 1826)	Old World	×	×		
31. Tapinocyba affinis Lessert, 1907	Palearctic			×	
32. Tapinocyba biscissa (O.P.-Cambridge, 1872)	Palearctic			×	
33. Tenuiphantes alacris (Blackwall, 1853)	Palearctic	×			
34. Trichoncus affinis Kulczynski, 1894	Palearctic		×		
35. Walckenaeria acuminata Blackwall, 1833	Palearctic		×		
36. Walckenaeria alticeps (Denis, 1952)	Europe, Iran	×			
37. Walckenaeria capito (Westring, 1861)	Holarctic	×			
38. Walckenaeria monoceros (Wider, 1834)	Europe, Kyrgystan		×		
Tetragnathidae					
1. Tetragnatha montana Simon, 1874	Palearctic				×
2. Pachygnatha degeeri Sundevall, 1830	Holarctic				×
Araneidae					
1. Araneus angulatus Clerck, 1757	Palearctic			×	×
2. Araneus quadratus Clerck, 1757	Palearctic	×	×	×	
3. Araniella cucurbitina (Clerck, 1757)	Palearctic	×			×
4. Argiope bruennichi (Scopoli, 1772)	Palearctic	×	×		

Taxon	*Distribution*	*Natural Pasture*	*Grazed Pasture*	*Wheat field*	*Marsh*
5. Hypsosinga heri (Hahn, 1831)	Palearctic				×
6. Hypsosinga sanguinea (C.L.Koch, 1844)	Palearctic				×
Lycosidae					
1. Alopecosa trabalis (Clerck, 1757)	Europe, Central Asia		×		
2. Aulonia albimana (Walckenaer, 1805)	Palearctic	×			
3. Hogna radiata (Latreille, 1817)	Central Europe, Central Asia	×	×	×	
4. Pardosa agrestis (Westring, 1861)	Palearctic			×	
5. Pardosa alacris (C.L.Koch, 1833)	Europe, Russia	×			
6. Pardosa hortensis (Thorell, 1872)	Palearctic	×	×		
7. Pardosa lugubris (Walckenaer, 1802)	Palearctic	×			
8. Pirata knorri (Scopoli, 1763)	Palearctic				×
9. Pirata latitans (Blackwall, 1841)	Palearctic				×
10. Trochosa robusta (Simon, 1876)	Palearctic				×
Pisauridae					
1. Dolomedes fimbriatus (Clerck, 1757)	Palearctic				×
2. Pisaura mirabilis (Clerck, 1757)	Palearctic	×	×	×	
Oxyopidae					
1. Oxyopes heterophthalmus (Latreille, 1804)	Palearctic	×			
Zoridae					
1. Zora silvestris Kulczynski, 1897	Europe, Central Asia		×		
2. Zora spinimana (Sundevall, 1833)	Palearctic	×	×		
3. Zora sp.		×			
Agelenidae					

Taxon	*Distribution*	*Natural Pasture*	*Grazed Pasture*	*Wheat field*	*Marsh*
1. Malthonica campestris (C.L.Koch, 1834)	Europe, Azerbaijan	×	×		
2. Malthonica ferruginea (Panzer, 1804)	Europe, Azores	×			
3. Tegenaria agrestis (Walckenaer, 1802)	Europe, Central Asia, North America	×			
4. Tegenaria silvestris (L.Koch, 1872)	Europe, Russia	×			
Clubionidae					
1. Clubiona genevensis L.Koch, 1866	Palearctic	×	×		
2. Clubiona subsultans Thorell, 1875	Palearctic				×
Zodariidae					
1. Zodarion rubidum Simon, 1914	Europe				×
Gnaphosidae					
1. Micaria dives (Lucas, 1846)	Palearctic				×
2. Micaria formicaria (Sundevall, 1831)	Palearctic				×
3. Micaria fulgens (Walckenaer, 1802)	Palearctic				×
4. Zelotes latreillei (Simon, 1878)	Palearctic	×			
5. Zelotes sp. 1			×		
6. Zellotes sp. 2			×		
Philodromidae					
1. Philodromus aureolus (Clerck, 1757)	Palearctic				×
2. Philodromus cespitum (Walckenaer, 1802)	Holarctic				×
3. Philodromus poecilus (Thorell, 1872)	Palearctic	×			
4. Thanatus pictus L. Koch, 1881	Palearctic	×			
5. Tibellus maritimus (Menge, 1875)	Palearctic	×	×	×	×
Thomisidae					
1. Misumena vatia (Clerck, 1757)	Holarctic	×	×		
2. Ozyptila praticola (C.L.Koch,	Holarctic	×			×

Taxon	*Distribution*	*Natural Pasture*	*Grazed Pasture*	*Wheat field*	*Marsh*
1837)					
3. *Ozyptila scabricula* (Westring, 1851)	Palearctic	×			×
4. *Synema globosum* (Fabricius, 1775)	Palearctic				
5. *Tmarus piger* (Walckenaer, 1802)	Palearctic	×			×
6. *Xysticus audax* (Schrank, 1803)	Palearctic		×		
7. *Xysticus ferrugineus* Menge, 1876	Palearctic		×		
8. *Xysticus lanio* C.L.Koch, 1835	Palearctic	×			
9. *Xysticus ulmi* (Hahn, 1831)	Palearctic	×	×		
Salticidae					
1. *Ballus chalybeius* (Walckenaer, 1802)	Europe, North Africa, Central Asia				×
2. *Carrhotus xanthogramma* (Latreille, 1819)	Palearctic				×
3. *Evarcha falcata* (Clerck, 1757)	Palearctic	×			
4. *Heliophanus auratus* C.L.Koch, 1835	Palearctic		×		
5. *Heliophanus cupreus* (Walckenaer, 1802)	Palearctic	×	×		
6. *Leptorchestes berolinensis* (C.L.Koch, 1846)	Europe, Turkmenistan		×		
7. *Marpissa nivoyi* (Lucas, 1846)	Palearctic				×
8. *Myrmarachne formicaria* (De Geer, 1778)	Palearctic				×
9. *Pellenes nigrociliatus* (Simon, 1875)	Palearctic	×	×		
10. *Sitticus distinguendus* (Simon, 1868)	Palearctic				×
11. *Sitticus zimmermanni* (Simon, 1877)	Europe, Central Asia				×
12. *Sitticus saxicola* (C.L.Koch, 1846)	Palearctic				×
13. *Synageles hilarulus* (C.L.Koch, 1846)	Palearctic	×			

Discussion

The present study has revealed that human disturbances in habitats are seriously affecting the spider community and species richness. In present study it was found that the most affected type of habitat was the wheat field which had the most severe vegetation cover change. In contrast the semi natural pasture was found to be the richest with 69 spider species.

Although the study region was located in two very well studied bioregions: Pannonian and Continental, the faunistical list revealed some novelties at least for Romania. Among the novelties that the present study brings are one new family of spiders for Romania: Theridiosomatidae, with a very rare species: *Theridiosoma gemosum* and another, this time invasive species which seems to be spreading towards east: *Uloborus plumipes* Lucas, 1846.

Conclusions

The present study shows that human activities are disrupting the spider assemblages and richness and so are interfering with one of the most important group of invertebrate predators that serve as pest control (Maloney *et al.* 2003). By reducing the number of spider species and richness the agriculture is deprived of one of the most important factors that control the herbivorous insect populations and so makes it more dependent on chemical alternatives.

The present study reveals that Romanian spider fauna has a new Spider Family: Theridiosomatidae with a new species: *Theridiosoma gemosum*. Also the Family Uloboridae with only two species (Weiss and Urak 2000) gets a third one: *Uloborus plumipes* a species that seems to spread eastwards. With this new record Romania is the eastern limit of the species in Europe.

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CONTRIBUTION TO THE KNOWLEDGE OF THE ORTHOPTERAN FAUNA (CAELIFERA ET ENSIFERA, DERMAPTERA, MANTODEA AND BLATTARIA) OF THE MURES VALLEY

Richard Hoffmann

Introduction

First records of Orthopteran fauna from Arad County respectively Arad City, were made in 1893 by SIMONKAI. In this publication 12 species are mentioned, which are: *Acrida ungarica, Calliptamus italicus, Forficula auricularia, Gomphocerippus rufus, Gryllotalpa gryllotalpa, Gryllus campestris, Locusta migratoria*, *Mantis religiosa, Oecanthus pellucens*, *Oedipoda caerulescens, Tettigonia viridissima* and *Tetrix subulata*. Last gradations on *Locusta migratoria* were reported in 1879 in eastern Hungary (Nagy, 1994). It is not known whether this impact would have any influence in the studied area. Other publications on wildlife Orthoptera appeared recently are Lőrinczi *et al.* (2011), Nagy & Szövényi (1998), Worschech (1998) and others. This study also aims to examine the Orthoptera species in terms of their ecology. Some of the species are bioindicators and therfore reflect the influence of human activity on environment.

Material and Methods

Study area

The studied area is located in the western part of Romania (Arad County), and extends along the Mures River from Lipova to Igris, at elevations ranging from 96 to 115 meters a.s.l. (see Fig.1 at page 5).

Sampling methods

For field studies the following equipments were used: entomological net (30cm diameter), a GPS/PDA (ASUS A636), a camera Pentax W90, collection containers with ethanol (50ml) and identification manuals. At the laboratory stage were used: a microscope, a binocular loupe, tweezers and identification manuals. The Orthoptera species inventory was achieved by combining multiple methods. The most applied method was individual capture with entomological net (30cm diameter). Other methods that have been applied in the studied area are: selectively capturing samples by hand, by listening to the males' stridulations, tree canopy shaking method and raising stones and logs. Remains to be noted that under these inventory methods can not be obtained quantitative data, just qualitative. The Orthoptera species inventory of the study area occurred during the years 2011 and 2012 (Table 2) using the above methods.

Determination

The determination of Orthoptera species was performed using the following Identification Manuals: Kis (1960), Kis (1961), Kis (1976), Kis (1978a), Harz (1975), Bellmann (2006), Baur *et al.* (2006) and Kocárek *et al.* (2005).

Results and Discussion

During the study, 60 Orthoptera species were identified within 4 sites (26 Ensifera, 30 Caelifera, 2 Blattaria, 1 Dermaptera and 1 Mantodea) in the studied area (Table 1). Two of them are listed in Annex II and IV of the Habitat Directive. It is *Isophya stysi* Cejchan, 1957 and *Odontopodisma rubripes* Ramme, 1931 species who were not reported from the studied area until now. The presence of these species requires designation of special areas of conservation. At the same time there was present one endemic species too called *Odontopodisma acuminata* Kis, 1962.

Table 1. List of species inventoried during the study (Ensifera et Caelifera, Blattaria, Dermaptera, Mantodea); Nomenclature after: [Heller *et al.* (1998)].

Scientific name	Abbreviations
Ensifera	
Phaneroptera falcata (PODA, 1761)	Ph.fal
Phaneroptera nana FIEBER, 1853	Ph.nan
Leptophyes albovittata (KOLLAR, 1833)	L.alb
Leptophyes discoidalis (FRIVALDSKY, 1867)	L.dis
Isophya stysi CEJCHAN, 1957	I.sty
Poecilimon schmidtii (FIEBER, 1853)	P.sch
Polysarcus denticauda (CHARPENTIER, 1825)	P.den
Meconema thalassinum (DE GEER, 1773)	M.tha
Conocephalus fuscus (FABRICIUS, 1781)	C.fus
Ruspolia nitidula (SCOPOLI, 1786)	R.nit
Tettigonia viridissima LINNAEUS, 1758	T.vir
Decticus verrucivorus (LINNAEUS, 1758)	D.ver
Platycleis (Platycleis) affinis FIEBER, 1853	P.aff
Platycleis (Tessellana) veyseli KOCAK, 1984	P.vey
Metrioptera (Metrioptera) bicolor (PHILIPPI, 1830)	M.bic
Metrioptera (Metrioptera) roeselii (HAGENBACH, 1822)	M.roe
Pholidoptera fallax (FISCHER, 1853)	P.fal
Pholidoptera griseoaptera (DE GEER, 1773)	P.gri
Gryllotalpa gryllotalpa (LINNAEUS, 1758)	G.gry
Myrmecophilus acervorum (PANZER, [1799])	M.ace
Oecanthus pellucens (SCOPOLI, 1763)	O.pel

Pteronemobius heydenii (FISCHER, 1853)	P.hey
Gryllus campestris LINNAEUS, 1758	G.cam
Melanogryllus desertus (PALLAS, 1771)	M.des
Eumodicogryllus bordigalensis (LATREILLE, 1804)	E.bor
Modicogryllus frontalis (FIEBER, 1844)	M.fro
Caelifera	
Xya pfaendleri (HARZ, 1970)	X.pfa
Tetrix subulata (LINNAEUS, 1758)	T.sub
Tetrix tenuicornis SAHLBERG, 1893	T.ten
Calliptamus italicus (LINNAEUS, 1758)	C.ita
Pseudopodisma nagyi GALVAGNI ET FONTANA, 1996	P.nag
Odontopodisma acuminata KIS, 1962	O.acu
Odontopodisma rubripes RAMME, 1931	O.rub
Odontopodisma sp.	O.spec.
Pezotettix giornae (ROSSI, 1794)	P.gio
Acrida ungarica (HERBST, 1786)	A.ung
Mecostethus parapleurus (HAGENBACH, 1822)	M.par
Aiolopus thalassinus (FABRICIUS, 1781)	A.tha
Oedipoda caerulescens (LINNAEUS, 1758)	O.cae
Oedaleus decorus (GERMAR, 1826)	O.dec
Chrysocraon dispar (GERMAR, [1834])	C.dis
Euthystira brachyptera (OCSKAY, 1826)	E.bra
Doiciostaurus brevicollis (EVERSMANN, 1848)	D.bre
Doiciostaurus maroccanus (THUNBERG, 1815)	D.mar
Stenobothrus crassipes (CHARPENTIER, 1825)	S.cra
Stenobothrus stigmaticus (RAMBUR, 1838)	S.sti
Omocestus haemorrhoidalis (CHARPENTIER, 1825)	O.hae
Omocestus rufipes (ZETTERSTEDT, 1821)	O.ruf
Gomphocerippus rufus (LINNAEUS, 1758)	G.ruf
Chorhippus oschei HELVERSEN, 1986	C.osc
Chorthippus biguttulus (LINNAEUS, 1758)	C.big
Chorthippus brunneus (THUNBERG, 1815)	C.bru
Chorthippus dorsatus (ZETTERSTEDT, 1821)	C.dor
Chorthippus mollis (CHARPENTIER, 1825)	C.mol
Chorthippus parallelus (ZETTERSTEDT, 1821)	C.par
Euchorthippus declivus (BRISOUT de Barneville, 1849)	E.dec
Dermaptera	
Forficula auricularia LINNAEUS, 1758	F.aur
Mantodea	
Mantis religiosa (LINNAEUS, 1758)	M.rel
Blattaria	
Ectobius erythronotus nigricans RAMME, 1923	E.ery
Phyllodromica megerlei (FIEBER, 1853)	P.meg

During the study period 4 sites were driven by chance once or twice that were inventoried for Orthoptera species with the following results: surface near Lipova at 01.11.2011 5 species found (Annex I), site near Felnac also at 01.11.2011, 8 species, near Igris (12.06.2012), 10 species, near Lipova (05.08.2012), 18 species (Colour plate Figure 14), near Frumuseni (06.08.2012) were 16 species, near Felnac (14.08.2012) 31 species, at Igris-island (18.08.2012) 6 species, near Igris (18.08.2012) 9 species, at the site near Frumuseni (21.08.2012) were found 16 species (Colour plate Figure 15) and last but not least in the other plots along the Mures Valley 15 species were found.

After analysing the data, we determined that the site which had the most favorable conditions for Orthopteran fauna was at Felnac (Colour plate Figure 16), which had the greatest diversity of species. On the Island near Igris (Colour plate Figure 17) an endemic species of national interest, *Odontopodisma acuminata* KIS, 1962, was found in August too (Colour plate Figure 19). The same species was found at Ceala Forest near Arad, along the road that crosses the forest between Airport and the III-th Ireland. Near Frumuseni several species were identified, among which one is rare in the Mures Valley, it is *Oedaleus decorus* (Germar, 1826), a specific species for sandy areas (Colour plate Figure 18). Another species *Xya pfaendleri* (HARZ, 1970) was found in 2 of 4 studied sites: Frumuseni and Igris.

In the study, some of the ecological aspects of orthoptera were examined, like humidity of the site, the way of life of the species, the associated substrate type and hemerobiotic degree of species.

Tables 3, 4 and 5 show the preferences of each species in terms of ecological characteristics. By analyzing these ecological characteristics of Ensifera the most species were xerophilous (7 species) followed by xero-mesophilous species (5). Concerning to the landscape structure most frequent of Ensifera was that pratinicol (14 species) followed by that deseti/pratinicol (6) and others. The substrate type of the species that are the most lived on was graminicol (7 species) followed by others. The species with an average tolerance of human disturbance were the most common with 15, followed by the sensitive species (8) and some others that show a high tolerance (3) (Table 2).

Among the Caelifera species, many of them were xerophilous (14), followed by mesophilous (6), hygrophyllous (4), xero-mesophilous (3), from mesophilous to hygrophyllous (2) and a single representative from hygrophyllous to xerophilous. The Caelifera's most common landscape structure was pratinicol (15), followed by deserti/pratinicol (8) and others. In terms of substrate type the most common species of Caelifera were graminicols (12), fewer terricols (4) and terri/graminicols (1). After analysing the hemerobiotic degree, most of the species had an average tolerance of human impact (14), some were less sensitive (13) and just a few had a high tolerance (3) (Table 3).

Table 2. Ecological characteristics of Ensifera species [Pisica & Iorgu (2006); Ingrisch & Köhler (1998)].

Taxon	Ecological characteristics			
Ensifera	Humidity	Landscape structure	Substrate type	Hem.
Ph.fal	xero-mesophilous	deserti/pratinicol	arbusticol	ome
Ph.nan	xero-mesophilous	deserti/pratinicol	arbusti/arboricol	ome
L.alb	meso-xerophilous	deserti/pratinicol	gramini/arbusticol	ome
L.dis	meso-xerophilous	deserti/pratinicol	graminicol	ome
I.sty	meso-xerophilous	pratinicol	gramini/arbusticol	om
P.sch	xerophilous	pratinicol	arbusticol	om
P.den	hygro-mesophilous	pratinicol	geocol-graminicol	ome
M.tha	mesophilous	silvicol	arboricol	ome
C.fus	hygro-mesophilous	ripi/pratinicol	graminicol	ome
R.nit	hygrophyllous-meso-xerophilous	pratinicol	gramini/arbusticol	om
T.vir	mesophil	prati/silvicol	arbusti/arboricol	ome
D.ver	xero-mesophilous	pratinicol	graminicol	ome
P.aff	hygrophyllous	pratinicol	graminicol	om
P.vey	xerophilous	pratinicol	graminicol	om
M.bic	xerophilous	pratinicol	graminicol	om
M.roe	hygrophyllous	pratinicol	graminicol	om
P.fal	meso-xerophilous	prati/silvicol	arbusticol	ome
P.gri	mesophilous	prati/silvicol	gramini/arbusticol	ome
G.gry	meso-hygrophyllous	ripi/pratinicol	geobiont-terricol	omep
M.ace	xero-mesophilous	pratinicol	terricol	om
O.pel	xerophilous	deserti/pratinicol	graminicol-arboricol	omep
P.hey	hygrophyllous	pratinicol	terricol	ome
G.cam	xero-mesophilous	deserti/pratinicol	terricol	ome
M.des	xerophilous	pratinicol	geobiont-terricol	omep
E.bor	xerophilous	pratinicol	geobiont-terricol	ome
M.fro	xerophilous	pratinicol	geobiont-terricol	ome

Abbreviations: Hem. – hemerobiotic degree, omep – oligo-meso-eu-polyhemerob, ome – oligo-meso-euhemerob, om – oligo-mesohemerob.

Table 3. Ecological characteristics of Caelifera species [Pisica & Iorgu (2006); Ingrisch & Köhler (1998)].

Taxon	Ecological characteristics			
Caelifera	Humidity	Landscape structure	Substrate type	Hem.
X.pfa	hygrophyllous	ripicol	geophil-geobiont	om
T.sub	hygrophyllous	pratinicol	terricol	ome
T.ten	xerophilous	pratinicol	terricol	ome
C.ita	xerophilous	deserti/pratinicol	terricol	om
P.nag	mesophilous	prati/silvicol	gramini/arbusticol	om
O.acu	mesophilous	prati/silvicol	arbusticol	ome
O.rub	mesophilous	prati/silvicol	arbusticol	om
Odontopodisma sp.	mesophilous	prati/silvicol	arbusticol	om
P.gio	xerophilous	deserti/pratinicol	gramini/arbusticol	ome
A.ung	xerophilous	deserti/pratinicol	graminicol	om
M.par	mesophilous-hygrophyllous	pratinicol	phitophil	om
A.tha	hygrophyllous	pratinicol	geophil-phitophil	ome
O.cae	xerophilous	deserticol	terricol	ome
O.dec	xerophilous	pratinicol	geophil	ome
C.dis	hygrophyllous	pratinicol	graminicol	om
E.bra	hygrophyllous - xerophilous	pratinicol	graminicol	om
D.bre	xerophilous	pratinicol	geophil-phitophil	ome
D.mar	xerophilous	pratinicol	geophil-phitophil	ome
S.cra	xerophilous	pratinicol	graminicol	ome
S.sti	xerophilous	pratinicol	terricol-graminicol	ome
O.hae	xerophilous	deserti/pratinicol	graminicol	om
O.ruf	xero-mesophilous	deserti/pratinicol	graminicol	ome
G.ruf	xero-mesophilous	prati/silvicol	gramini/arbusticol	om
C.osc	mesophilous-hygrophyllous	pratinicol	graminicol	ome
C.big	xero-mesophilous	deserti/pratinicol	graminicol	omep
C.bru	xerophilous	deserti/pratinicol	terri/graminicol	omep
C.dor	mesophilous	pratinicol	graminicol	om
C.mol	xerophilous	deserti/pratinicol	graminicol	om
C.par	mesophilous	pratinicol	graminicol	omep
E.dec	xerophilous	pratinicol	graminicol	ome

Abbreviations: Hem. – hemerobiotic degree, omep – oligo-meso-eu-polyhemerob, ome – oligo-meso-euhemerob, om – oligo-mesohemerob.

Table 4. Ecological characteristics of Dermaptera, Mantodea and Blattaria species [Pisica & Iorgu (2006); Ingrisch & Köhler (1998)].

Taxon	Ecological characteristics			
Dermaptera	Humidity	Landscape structure	Substrate type	Hem.
F.aur	mesophilous	campi/prati/silvi/deserticol	terri/gramini-arboricol	omep
Mantodea				
M.rel	xerophilous	deserti/pratinicol	gramini/arbusticol	ome
Blattaria				
E.ery	meso-xerophilous	silvi/pratinicol	terricol-arbusticol	omep
P.meg	meso-xerophilous	prati/silvicol	terri/graminicol	om

Abbreviations: Hem. – hemerobiotic degree, omep – oligo-meso-eu-polyhemerob, ome – oligo-meso-euhemerob, om – oligo-mesohemerob.

In the study area 22 xerophilous species were identified, followed by mesophilous (10), xero-mesophilous (8), hygrophyllous (7), meso-xerophilous (6), hygro-mesophilous (2), from mesophilous to hygrophyllous (2), meso-hygrophyllous (1), from hygrophyllous to mesophilous (1) and one from hygrophyllous to meso-xerophilous (Fig.1).

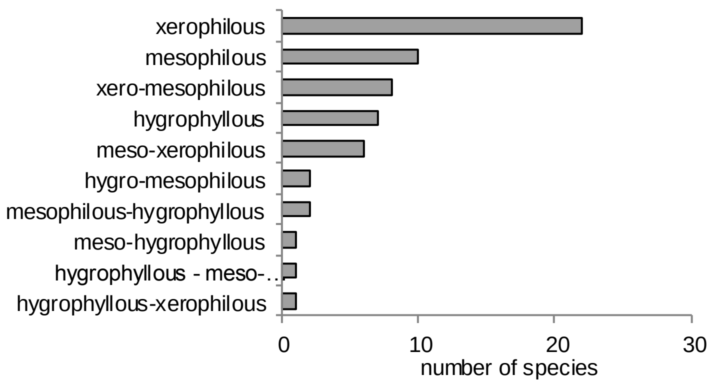

Figure 1. Preferences of species inventoried against moisture.

On the basis of landscape structure it could be observed that most species were pratinicols (29), deserti/pratinicols (15) followed by that prati/silvicols (9), ripi/pratinicols (2), silvi/pratinicols (1), ripicols (1), silvicols (1), deserticols (1) and campi/prati/silvi/deserticols (1) (Fig. 2).

On the type of substrate preference most of the species were graminicols (19) (Fig.3), followed by gramini/arbusticols (7), terricols (7), arbusticols (4), geophils-phitophils (3), arbusti/arboricols (2), geobiont-terricols (2), geophils (2), arboricols (1), graminicols-arboricols (1), terri/gramini-arboricols (1), terricols-arbusticols (1), geophils-geobionts (1), geocols-graminicols (1), terricols-graminicols (1), respectively terri/ graminicols (1).

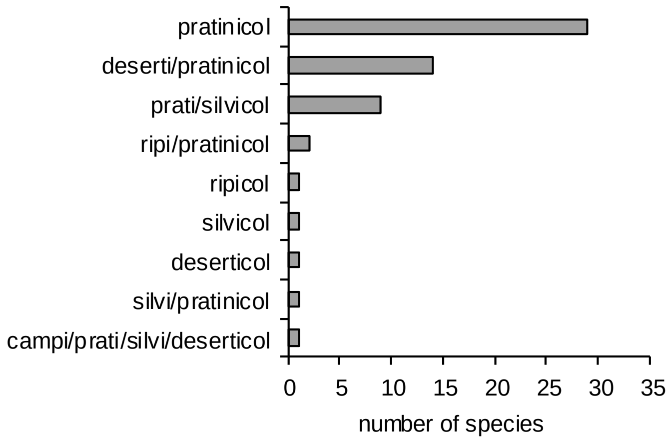

Figure 2. Preferred landscape structure of Ortoptera species of Mures Valley.

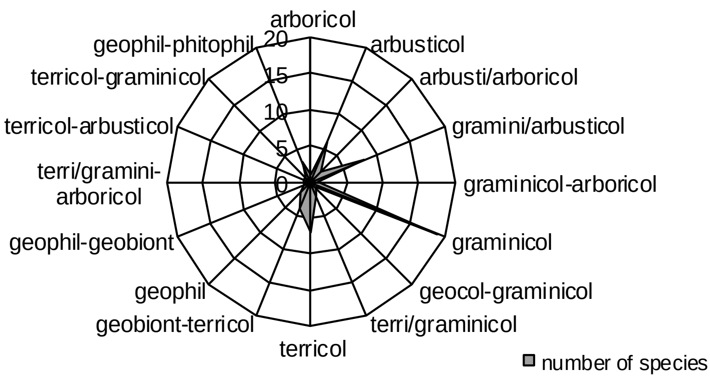

Figure 3. Diagram with prefered substrate type of Orthoptera species from Mures Valley.

Regarding the toplerance of anthropogenic influence (hemerobiotic degree) it was found that 22 species show a low tolerance, 30 species had only an average tolerance and 8 of them tolerate a very high anthropogenic influence (Fig.4).

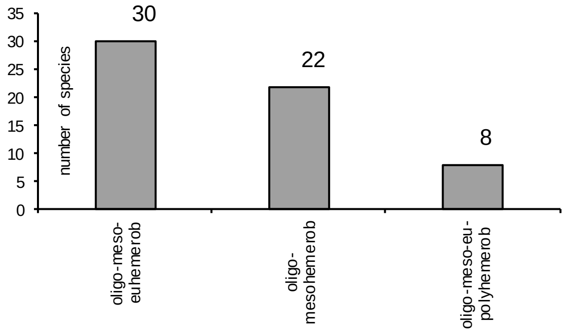

Figure 4. Diagram with hemerobiotic degree of Orthoptera species found on studied area.

Legislation

Among the species of Community interest two species were found (*Isophia stysi* Cejchan, 1957 and *Odontopodisma rubripes* Ramme, 1931), who are listed in Annex II and IV of the Habitat Directive and Annex 3 of OUG 57/2007. Neither species were reported until now at the NATURA 2000 site ROSCI0108. Conservation of these species requires the designation of special protection areas. Among the species of national interest just one strictly protected species (*Odontopodism acuminata* KIS, 1962) was found which is listed in Annex 4B of OUG 57/2007. Furthermore the species *Odontopodisma rubripes* Ramme, 1931 is listed in The IUCN Red List of Threatened Species too, as vulnerable. Because they are sensitive species with declining populations, it was necessary to implement protective measures throughout Europe by Habitat Directive: Annexe II and IV and nationally by OUG 57/2007 and OMMDD 1964/2007.

Conclusions and Recommandation

During the study several problems were mate that can cause the disappearance of sensitive species and their populations like *Isophya stysi* Cejhan, 1957, *Odontopodisma rubripes* RAMME, 1931, *Odontopodisma acuminata* KIS, 1962 and others. Problems like overgrazing, invasion by alian plants like *Amorpha fruticosa* L. along the River and other plant species, all over heap of rubbish, especially near the villages and last but not least the river pollution by garbage and other pollutants conducted from the households into the Mures. Another problem that seems to be majore impact especialy in the autumn is caused by a road inside the Ceala Forest, where especially the endemic species *Odontopodis-ma acuminata* Kis, 1962 is rund over by cars (Colour plate Figure 21). All the mentioned problems can cause massiv habitat degradations, fragmentation and loss through out to ireversible impact. To solve these problems we need a management plan that will be strictly controlled while implementing protective measures, to stop the population decline of sensitive species, habitat deterioration and fragmentation.

One of the major problems was notified in several plots of the studied area is the state sequence field. For most species, extensiv grazing seems to have a very important role, because only in this way can be kept the areas open without scrubs and also other precious habitats. Also, follow preferences sensitive species that do not tolerate the troubles of domestic animals (overgrazing). In this respect remains to mention that the goal is to keep fully current of Orthoptera fauna. For *Isophya stysi* Cejhan, 1957 and *Odontopodisma rubripes* RAMME, 1931 be defined sites of Community interest by which to protect all populations. For endemic species like *Odontopodisma acuminata* Kis, 1962, measures are necessary be taken to preserve their habitats and also existing populations. In fact it would be important that all species and habitats of Community interest (listed in Annexes II and IV of the Habitat Directive), which are present in the studied area, would be reported later to the EU Commission.

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Annex I Table 1: Species found in the Mures Valley. 1: Lipova 01.11.11; 2: Lipova 05.08.12; 3:Felnac 01.11.11; 4: Felnac 14.08.12; 5: Igris 12.06.12; 6: Igris-island 18.08.12; 7: Igris 18.08.12; 8: Frumuseni 06.08.12; 9: Frumuseni 21.08.12; 10: other plots from Mures Valley

Species	1	2	3	4	5	6	7	8	9	10
Ph.fal										
Ph.nan				×		×				
L.alb					×					
L.dis							×			
I.sty										×
P.sch				×						
P.den										×
M.tha										×
C.fus		×		×			×			
R.nit		×							×	
T.vir	×	×		×	×	×		×		
D.ver										×
P.aff				×					×	
P.vey				×						
M.bic				×	×					
M.roe		×			×					
P.fal				×						
P.gri		×		×		×				
G.gry										×
M.ace										×
O.pel	×	×		×		×	×	×		
P.hey		×		×	×			×	×	
G.cam		×	×	×	×				×	

Species	1	2	3	4	5	6	7	8	9	10
M.des		×		×	×				×	
E.bor		×		×						
M.fro										×
X.pfa					×		×	×	×	
T.sub							×		×	
T.ten										×
C.ita		×		×				×	×	
P.nag										×
O.acu						×				
O.rub										×
O.spec.										×
P.gio	×			×		×	×	×	×	
A.ung		×		×				×	×	
M.par		×								
A.tha				×					×	
O.cae				×				×	×	
O.dec									×	
C.dis				×						
E.bra				×						
D.bre								×		
D.mar								×		
S.cra				×						
S.sti			×							
O.hae			×	×						
O.ruf			×	×				×		
G.ruf										×
C.osc				×						
C.big		×	×	×			×	×		
C.bru		×		×			×		×	
C.dor	×	×	×	×	×			×		
C.mol			×					×		
C.par	×	×		×	×			×	×	
E.dec		×		×			×	×	×	
F.aur			×							
M.rel				×						
E.ery										×
P.meg										×

LAND USE AND ECOSYSTEM SERVICES IN THE HUNGARIAN SECTION OF MAROS VALLEY

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Introduction

Investigation of the social perception of the natural environment is a substantial step in understanding the underlying mechanisms shaping the landscape.

The main objective of our study was to explore how local stakeholders perceive their natural environment by the River Maros and to assess what is important and valuable for them in it. We conducted this evaluation in the conceptual framework of ecosystem services (ESs). We used the definition of the Millennium Ecosystem Assessment, according to which ESs “are the benefits human populations derive, directly or indirectly, from natural and human-modified ecosystems” (MEA 2006).

Based on the results of our previous studies on ESs assessment (see Málovics et al 2011, Gébert et al 2011), we investigated the following questions: 1) What kind of ESs are perceived by local people? 2) Are there any differences between the ESs perceptions of the various stakeholder groups? 3) How local institutions (including norms, rules and regulations) interact with land-use types in the Maros-valley?

Material and Methods

Sampling methods

Environmental valuation methods addressing the role of ESs in society are extensively debated (Hanley-Spash 1993, Marjainé Szerényi 2000, 2005, Kelemen *et al.* 2010, Hein et bal. 2006, Kelemen 2011, Limburg *et al.* 2002, Munda 2003, Spash-Hanley 1995, Nagy-Kiss 2011, Vatn 2009).[1] In this recent socioeconomic study we used qualitative methods. Our methodological choices are explained in depth in our earlier papers (see Gébert *et al.* 2011, Málovics *et al.* 2011.) Below we only detail elements of the current methodology which are different to the previously applied methodology. We conducted 60 in-depth semi-

[1] Further reading about the critique of nature’s the monetary valuation can be found in CONCERTED ACTION: Environmental Valuation in Europe (EVE) project: http://www.clivespash.org/eve/publ.html#SJI

structured interviews with local farmers, members of NGO-s, teachers, hydrology and conservation specialists, foresters and officeholders between February and May, 2012. 33 interviews were taken at the Northern (Maroslele) site, 27 at the Southern (Ferencszállás-Klárafalva) site. University researchers and undergraduate students of the University of Szeged with either social or natural science background took part in the research. Approximately 40 students were trained to participate in the research.

We asked respondents to describe the three topics indicated below both in connection with the floodplain of the Maros and the general surroundings of the settlements (Maroslele, Klárafalva, Ferencszállás): *i*) Present land use patterns and previous changes in the local environment and land use. *ii*) Institutions influencing land use. *iii*) Desirable land use.

Written notes of the interviews were taken instead of sound recording. According to our previous experiences, interviewees were able to talk in a more open way when sound recorders had been switched off. Therefore when quoting an interview we refer to our notes and not recordings. Each interview is indicated by an individual code (E1-33 for the Northern side and D1-27 for the Southern side).

After the interviews, a smaller group (incl. researchers and students) analyzed the notes in pairs through categorization, meaning condensation and interpretation (see Kvale 1996). Results presented below are the outcomes of intensive deliberative process within the research group.

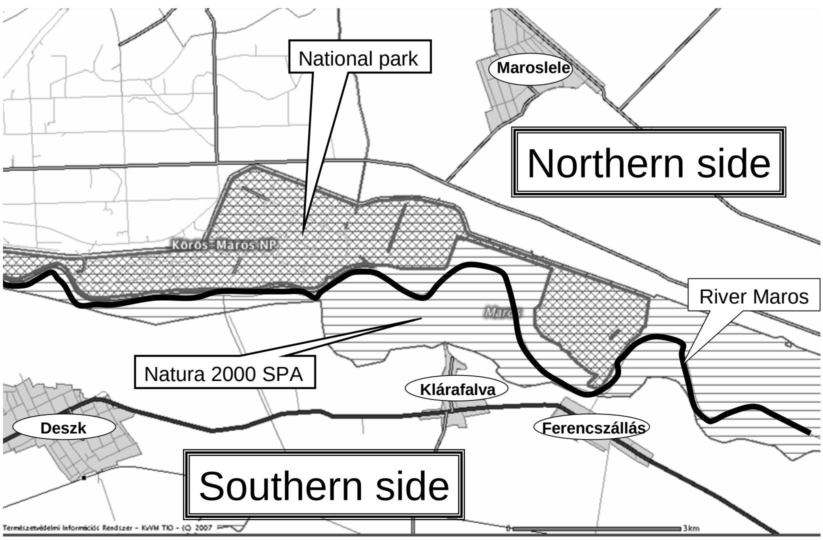

Fig. 1. The study area belongs to the territory of three villages: Maroslele (Northern side), Klárafalva and Ferencszállás (Southern side). Nature Conservation Information System (http://geo.kvvm.hu/tir_en/)

Study area

We conducted our study in the two sides along the Hungarian section of the river Maros: 1) Northern part (right side) of the river: area of Maroslele, 2) Southern part (left side) of the river: area of Klárafalva and Ferencszállás. The floodplain in this area is quite wide covered mainly by forests. The two sides are different in terms of conservation status. The Northern part belongs to the Körös-Maros National Park, while the Southern part is Natura 2000 SPA (Fig. 1).

Landscape history

The Maros Valley has been inhabited since prehistoric times. The landscape was shaped by the river. Various habitats were presented in the floodplains: lakes, backwaters, marshes, gallery forests, reeds and meadows. The rich wildlife provided excellent opportunities for fishing, hunting and herbs-collecting, while the higher and therefore dry fields could be used for agriculture (Blazovich 1993, Gaskó 1999, Marjanucz 2000, Tóth 2000, Sümegi *et al.* 2011).

During the Conquest of the Carpathian Basin (the end of the 9th century) the floodplain along the river was covered by soft and hardwood forests with marshy forests in the higher terrain as suggested by historical overviews of the entire Great Plain (Danszki 1963, Lajtos 2012). According to historical maps, in the Middle Ages several villages were located along the river. Until the 18th century during the larger floods of the Maros the land was covered by 2-3 meters of water, so at this time people travelled by boat between Makó and Szeged (Bálint 1926). By the end of the Turkish Occupation (1541-1686) the Maros Valley had become deserted. This was followed by a period of slow resettlement (Blazovich 1993, Tóth 2000). By the time of the early 18th century the re-settled population lived on animal husbandry, fishing and hunting, and also on salt and wood transportation from Transylvania (Blazovich 1993). Arable farming, viticulture, orchards and vegetable gardens were also common but less important. The energy of the river was harnessed by water-mills, its sand was mined and it supplied drinking-water (Tóth 2000).

A river canalization attempt began in 1754, but in a short time, the Maros returned into its original bed (Paulovics 2002). Then in the middle of the 19th century the river was canalized and the flood protection dikes were built (Blazovich 1993). During the 19th century arable and grassland management was intensifying, the terrain was levelled (Gaskó 1999, Sümegi *et al.* 2011). In the drier areas forests were typically cleared and converted to grasslands and arable fields. Willows in the lower areas were spared to produce twigs and fagots for the dikes (Lajtos 2012). At the end of the 19th century the proportion of arable land increased at the expense of meadows and pastures. This process was promoted by the flood control (Szabó 2002).

One plan for reforestation was prepared in 1875 by Fendt Antal (the ‘forest master’ of Szeged). He suggested planting Canadian poplar in the floodplain, but it is not known how many plantations were implemented (Gaskó 1999). After 1945 forests became state-owned and state-managed. Large-scale reforestation started in the area in the 1950’s. During the 1970s’ incentives were introduced to enhance the production of ‘paper-poplars’ (large plantations of non-native Populus hybrids, which grow faster than native Populus species) in the floodplain (Lajtos 2012). Oak trees were also planted in the middle of the 20th century according to one respondent; we couldn’t find the exact data of it in the literature. After the transition in 1989, even more Populus hybrid forests were planted in the former arable lands, therefore Poplar plantations significantly increased in the overall area (Lajtos 2012).

The formation of the Körös-Maros National Park (1997) and the new conservation legislation led to the efforts to replace the non-native Populus hybrid plantations with native poplar and ash species. However this proved to be a difficult task, due to the damage caused by game and some invasive wood species (e.g. *Acer negundo, Amorpha fruticosa*, *Fraxinus pennsylvanica*) (Lajtos 2012). Nowadays the floodplain is characterized by forestry and hunting and the area of cultivated land is diminishing (E4). Recent changes in the land use are detailed in the next chapter.

Land use

The important land use types mentioned by the informants were the following: forestry, animal husbandry, agriculture on plough land, gardening, hunting, fishing, tourism and recreation, environmental education. Due to the diversity of our respondents we can give a rather detailed picture from the local perspective about land use of the studied area.[2]

Forestry

On the N side, in the area between the dikes and the riverbed, the main land use type is forestry. Most of the forests are state-owned and managed by a large forestry corporation: DALERD Zrt. (E9, E33, D19). The area also belongs to the Körös-Maros National Park, because of an old oak forest and seminatural poplar and willow forests with considerable conservation value. A Hungarian Forest Reserve Programme study site is also located here (E5). The formerly more intensive management had to be changed because of nature conservation legislation after 1998 (E5, E20). Not only nature conservation, but also forest management regulations cause difficulties for the foresters, not to mention invasive tree species (E33, E31). Economical constrains are not well received by

[2] Codes indicate the interview codes.

the stakeholders (E8, D16). There are also some private forests in the area, which are used by following an adaptive management approach according to its owner (E31). Collection of firewood is restricted because of the biological importance of dead wood in the forest – clearly resented by locals (E6, E9, E14). On the S side of the river the forests were established mainly after the great flood in 1970 (D8, D12). These are mainly hybrid poplar plantations, and the short cultivation period is typical (D8, D22). Private owners are present here; they employ staff to manage the forests. (D12). Controlled collection of firewood is possible (D12). Some people think that the forests are being well managed (D14), but others complain of mismanagement (D16).

Animal husbandry

There were herds of horses, sheep and pigs in the seventies in the N side of the river. Pastures were present on both side of the dike (E1, E4, E9). Today the fodder is too expensive, and there is no market for the products (E15, E30, E10). The pastures were converted to forest or plough land. On the S side of the river there were pastures in the sixties (D3, D20, D13) with cows, horses and sheep. The animals were bathed and watered in the Maros (D3, D13). Today only very few people have any livestock remained, mainly around the house (D2, D20).

Arable fields

The soil is very suitable for agriculture; irrigation is possible from the river at Maroslele village (E13, E12, E18, D3). Small scale garlic production is very popular here (E17, E23, E21, E24). In this production system crop rotation is necessary, so produce maize or wheat are grown between two garlic production years (E25). There are very few arable land inside the dike in both side of the river. It is used mainly by the hunters for game fodder production (E6, E7, E13). On the southern side of the river there are some large private farms outside the dike, they cultivate the land intensively, producing mainly maize, wheat and rape (D4, D6).

Gardening

There were orchards and small private gardens in the floodplain in both side of the river formerly, most of them have been abandoned by now (E14, E15, E25, D2, D17). Some people produce vegetables in their garden but much less than earlier (D3, D11).

Hunting

Being very active, the hunting association in Maroslele has quite a lot of members, with even visitors from abroad to hunt (E6, E17, E30). Hunters have conflicts frequently with other land users (especially with foresters) (E6, E9, E30). There is a hunting association also in the Southern side of the river, hunting, however, is not significant here. The chair of the hunters association and the forestry district is the same person thus resolving of conflicts is easier (D12).

Fishing

Sport fishing is very popular even now (E19), though earlier it was more so. Fish abundance has decreased in the last decades. There is another type of fishing in the river, using fishnet and fish pot. Fishing authority controls both – actually competing – types of fishing (E20, E29). Most of the anglers have a license, but poaching is recorded occasionally, too (E1). In the Southern part of the river, near Ferencszállás a tiny picnic and angling place ("Angler beach") is a popular community space for local people (D14, E22).

Tourism and recreation

Most of the locals do not go often for walking and picnic to the river and forest (E4, E18, E22, E25, E27, D22). Almost every interviewee mentioned the "Big Tree of Hungarians", a several hundred years old poplar tree, as a popular destination of excursions before its collapse in 2002 (E3, E12, E19). Formerly tourism and recreation was much more intense (E27). Beside the popular 'Angler beach' mentioned above (D2, D8, D14), we also met people who has never visited the river (D20).

Environmental education

The local school in Maroslele organizes regular excursions to the river and the floodplain forests (E19, E17, E27). Conservation and ornithological camps were organized here as well from the 80s' (E1), while no such activity was mentioned in the Southern part of the river.

Mining

The floodplain and watercourse of Maros is suitable for sand mining. In the northern part of the river, near to Maroslele, large quantity of sand were mined in the last few years for the M43 highway building (E2, E6, E30). Three large sand-mine pits remained to be used as fishing-lake after the flooding, according to the land-owner's plans. Illegal sand mining was also mentioned (E1). There were also intensive sand mining in the Southern side 15 years ago, but it has stopped (D4, D11). Oil mining is present in the area of Maroslele, but the oil company tends not to disturb the agriculture, forestry or nature conservation (E28, E31).

Inventory of ecosystem services

We present the perceived ESs according to the main categories used in the MEA 2006, i.e. "Provisioning services", "Regulating services", "Cultural services" and "Supporting services" with quotations from the interviews (*in italics*).

Provisioning services

On the Northern side, the most valuable ecosystem services mentioned by the people are "Provisioning services" especially: "Food" and "Fodder". We experienced a significant difference between the perception of past and present. Most of the interviewees had nice memories from the past, when agriculture was more frequent in the floodland and also a more valuable activity than nowadays. Animal husbandry is also a disappearing "Provisioning service" in the area.

"Until the 80's, there was turf and grass on the floodplain, many of the farmers grew there corn and potato, which were sown late, and could stand the flood" (E1).

"There is onion production on my field. In the old times, we used to farm on the fields after work and grown corn and sugar beet" (E18).

"The area is suitable for garlic. The spring-garlic loves here" (E21).

"Folks were independent from the shops in the old times, because they could grow themselves their own food. We could use better the agricultural capability of the area" (E24).

"Locals are not dealing with animal husbandry anymore" (E17).

People also value timber and some of them mentioned other type of raw materials like sand and thermal water.

"Timber is an important product of forestry. It is worse if people stoke with it at home than fuel power plants with them" (E33).

"There are wrap-material, pallet and boxes, timber made from the poplar grown in the area. It is mostly exported, because there are only a few domestic manufactories for this (E33).

"The locals come to collect dry wood to the floodland, but they already need a license from the forestry for this activity. There is a demand for this very much" (E31).

"There are also oil-pumps in the area" (E31)."MOL is in this area for decades because of oil and gas" (E28).

"There is sand-mining in the floodland" (E29).

"They found thermal-water in this area. We could use this to heat our homes and greenhouses" (E2).

In the Southern side provisioning services appeared also frequently in the 26 interviews especially "Food", "Timber or other raw materials", "Energy source, fuel" and "Fodder". The supposed healing power of the river mud of Maros was also mentioned by one participant. An interviewee told us about a formerly cultivated potato variety, known as the 'rose potato', which has already disappeared from the region.

"There used to be some vegetable gardens in the floodplain. It was great, we didn't have to buy everything, people could produce for themselves. I would take back the good old days" (D17).

"There used to be approximately 100 cattle and 300 pigs in the village those days. Now there are just three houses with livestock remained. This part of the landscape deteriorated after the transition, after the closure of collective farms. Brainy people escape from here" (D20).

"Agriculture should be revived, that would solve the problem of unemployment, too. Different co-ops, laboratories, perhaps factories should be established, which could revive this region in terms of many areas. The main cause of neglect here is that nobody has any interest in production, there isn't much money and finding a technology, which doesn't pollute the environment, is hard. There are much more opportunities in this area than we thought" (D9).

"Fishermen from Szeged get all the fish left in the river. They extended their fishing area and they use electricity for fishing. There is no chance (for local people) to catch anything" (D20).

"Sand mining was highly productive approximately 15 years ago. Much more sand could be yielded from the river Maros but there is no demand so those huge machines won't be used needlessly by this fuel price of 450 HUF" (D4).

Forestry and the collected dead wood as "Energy source and fuel" seem to be often emphasized in the interviews.

"Tree plantations are good, because they are tidier and at least we have fuel wood. The area is mainly worthy for afforestation" (D14).

"It isn't good that we mustn't collect the dead wood, everything is wild but it would help many people if they were allowed to take home the firewood. It is because in case it was permitted, people would get not only the logs but also would cut the living trees" (D22).

"In the woods the soil is good, there could be arable lands in areas where forests are cut down. But the trees are always re-planted and it takes too much time for the trees to grow up" (D6).

"This situation's going to be worse. Previously the woods were in the center of the foresters' heart. Nowadays they just get a chainsaw and that's all. It's only the money that counts for the entrepreneurs. Subsidies for re-planting are being stolen" (D16).

"Here are just Populus hybrids, nothing wild and swampy, no bushy parts or grasslands. One part of local people is managing the woods the other part is stealing the wood… Forest is a really good investment nowadays! Wood can be sold abroad for making orange boxes out of them. Nowadays the area doesn't provide the same amount of wood as previously especially because we cut it down too early. It's good that the area isn't protected so we can work in the forests in summertime, too!" (D12).

Regulating services

"Water regulation", "Flood protection" and "Conservation of nature and biodiversity" are the perceived regulating ES on the Northern part of the riverbank. Some of the interviewees - especially foresters - mentioned species reproduction. They intentionally left ancient oaks and dead trees for insects to proliferate.

"The irrigating possibilities are not totally used as should be" (E30).

"Irrigating from the Maros is cheap and economical" (E13).

Quotations for "Regulating species reproduction" and "Conservation of nature and biodiversity":

"The avifauna is the same as 30 years ago. It is rich and free from human interference" (E1).

"There is a lot of songbird, raven, black kite, black stork and black woodpecker. There are heron-sites, insects and snails (E16).

"The capability of the area to support games is lower than in the old times because of agriculture" (E6).

" There was 3.5 acre (of an old oak wood), but we cut down in 1992 and left 0.2 acre for insects" (E9).

"The nature is beautiful only if there are living creatures in it" (E30).

"The forest-reservation in the area remained without interference. These are not installed forests, they work as gene-bank" (E9).

"When they grazed the cattle, it was better if there was more species on the meadow. The grass is more fine, and also the milk" (E28).

Most of interviewees from the Southern part mentioned the "Regulating species reproduction", the "Water regulation", the "Flood protection" and the "Conservation of nature and biodiversity". In addition to these ESs, smaller emphasis were given to the "Climate regulation", the "Air quality regulation", the "Pollination" and the "Break down of pollutants" ES. Only a few people referred to the role of the trees in the floodplain in terms of flood protection while many mentioned the dam. Some interviewees recognized that soils are more productive in areas affected by the floodings.

"Woods and plants provide the clean air. The river has a positive effect on the microclimate of the surrounding areas, air humidity is higher" (D15).

"Wood take up waves so the water doesn't wash out the bank" (D14).

"Unfortunately fish aren't abundant nowadays. The trees and the animals are the real values on the bank" (D21).

The pollution of the river was mentioned by many, affecting the possible use and resort of specific ES.

"Previously people could almost drink the water of the river" (D14).

"The evidence of cyanide pollution in the river Tisza has been still apparent in the river Maros. The water of the river Maros looks like the red beet juice because of the tanneries in Romania" (D20).

"I don't like this huge amount of rubbish, previously the river was much cleaner and nicer. I would be happy, if something was done against rubbish" (D11).

The respondents also talked about institutional changes in the area connected with the use of environment.

"The natural shelters for wild animals had been diminishing during the time of the collaborative farms, because the drains had to be maintained due to the regular checks of the water authority" (D7).

"The land is not land anymore but a livelihood for the local people. They are exploiting the environment and everything becomes sterilized" (D25).

Cultural services

Cultural services are another very much appreciated ESs, especially cultural and historical heritage. Many of the interviewees spoke about the so-called "Big Tree of Hungarians", which was a huge poplar on the Northern side floodlands. The surrounding are was a place for social events, like picnics and memorials, until it dried out.

"I am really sorry that the Big Tree of Hungarians has dried out. In the old times, we used to go there often, but unfortunately the road to that place is hardly viable nowadays" (E3).

"I have a lot of nice memories from my childhood about the afternoons spent around the Big Tree of Hungarians" (E19).

"When the Big Tree was fallen, everybody from the locals brought a piece to home as a memory" (E9).

"The hunt of woodcock was banished some years ago, but it had a tradition in Hungary" (E6).

"In the old times the bank of Maros was a community space. We used to go to swim" (E4).

"On the first of May, there was a tradition to gather on the pasture and there was hussar-demonstration and we were cooking in cauldron" (E27).

The "Day of Birds and Trees" was also frequently mentioned when the citizens of Maroslele - especially fowlers - organize a trip to the forests near Maros. The educational value of the forests was indicated related to the school trips.

"*There were fowler camps and ecocamps in the area, people come here from the whole country. We made a place for tents and asked permission from the National Park" (E1).*

"Fowlers are coming to the area" (E20).

"It is important that the children should get to know the nature, the forests. There are playful competitions for kids during forests-trips and teachers also organize garbage collection" (E25).

"Recreation and ecotourism" is often emphasized in the interviews. The place is especially valued because of recreation fishing and other small family trips.

"I go walking to the rampart with pleasure. I am very sorry that the roads are not in the same state as in my childhood" (E22).

"The most important motivation to go to the bank of Maros is recreation fishing" (E22).

"The Hunting Association organizes trips, also for foreigners" (E17).

"There could be a thermal-bath, like in Zalakaros from the thermal-water found by MOL" (E21).

"People use the forest to sport and trips" (E30).

"The mine lakes, remained from the sand-mining are good for bathe" (E13).

"I would like to build a small fishing-haunt, to have a good time there with friends (E11).

"In the old times, people went to the riverbank more often; there was a built beach with pub. Nowadays, nobody wants to go there, because they are afraid from the strong backwash" (E4).

"Aesthetic values" and the value of "Sense of place" were indicated in some of the interviews, often connected with cultural heritage.

"There is nothing else here, than beautiful landscape" (E33).

"If I can, I go to delight in the landscape" (E15).

"I have warm memories from my childhood, when we went to the riverbank with my little pals and listen to the bird-singing" (E18).

"I like this place, I can not imagine living elsewhere" (E10).

Similarly, for the Southern area, the river and its surroundings are the most important landscape elements for the respondents. Among the Cultural services most interviewees mentioned "Recreation and ecotourism", "Aesthetic values" and "Sense of place". "Cultural, historical and spiritual heritage values", and "Scientific and educational services" appeared with smaller emphasis. Buildings, which became part of the landscape e.g. a church in the floodplain, a small house in an island and an archaeological site as an important element were also mentioned.

"*The bank of the river here, in my opinion there isn't any better place than this" (D21).*

"Previously people used to swim in the Maros and life weltered there. I would gladly bring back the good old days when we'd gone carelessly onto the pier and were allowed to use nature free" (D17).

"It's only horse riding that comes to my mind as a touristic value, nothing else. This place is not for tourists. I am sorry that this place isn't utilized better, if it was treated well lots of thing could be brought out" (D11).

"This situation won't change because nobody does anything against it, there isn't money for it… to make a living, that's the most important for people, they can't deal with the environment" (D17).

"Living here is better than in a village, which isn't by the river" (D4).

"We were born here, we are going to die here" (D8).

"If the river Maros wasn't here I wouldn't live here" (D13).

"The three most important things are: water, calmness and peace. There isn't more beautiful than when everything is calm and I can fish by myself" (D2).

Supporting services

Supporting services was the least mentioned type of the four main categories. Interviewees spoke about "Soil formation" and "Nutrient cycling".

"The area is a good field for fodder, the good soil structure depends on the Maros" (E30).

"There was cattle-breeding, therefore the task of maturing was solved. But it is not so nowadays" (E21).

"With crop rotation the field can renew itself" (E25).

"The forests renew themselves naturally along the river" (E31).

In some interviews from Klárafalva and Ferencszállás, "Soil formation" appeared and the inappropriate management of the soil was highlighted. "Nutrient cycling" was mentioned by one person who knows that dry, dead trees are important for this. "There is really high-quality soil here. If there is a half brick put into the soil, it will be a whole next day" (D3).

"The aim was to cultivate the land in the most efficient way. With our soil we don't do what we should, and don't do when we should, but only when we have time for it" (D26).

Comparison of the Northern and the Southern side of the river:

"Food", "Timber or other raw materials" were the most frequently mentioned categories from "Provisioning services" on the both sides of the river Maros. Less participants mentioned "Energy source, fuel" and "Fodder", "Genetic resources" appeared on both sides. "Biochemicals, natural medicines and pharmaceuticals" appeared in interviews only on the Southern bank of the river, viz. the healing power of the river mud. There were not big differences about "Regulating services" on either sides of the river Maros. "Water regulation", "Flood protection", "Conservation of nature and biodiversity", "Erosion regulation", "Regulating species reproduction" and "Air quality regulation" were mentioned in Maroslele. Beside these categories – except "Erosion regulation"- appeared "Climate regulation", "Break down of pollutants" and "Pollination" in Klárafalva and Ferencszállás.

The most frequently mentioned cultural services were the "Recreation and ecotourism" like horse riding and the "Cultural, historical and spiritual heritage values", as the "Big Tree of Hungarians" on the Northern side. Fewer participants mentioned the other categories. "Scientific and educational services" - like fowling and school-trips seems to have more significance in the northern bank of the river. According to the interviews "Recreation and ecotourism" and

“Aesthetic values” are the most important for interviewees in Klárafalva and Ferencszállás. “Sense of place” was more frequently mentioned on the Southern side than on the Northern

“Soil formation” and “Nutrient cycling” appeared from “Supporting services” on both sides of the river Maros.

Discussion

The Millennium Ecosystem Assessment (MEA 2006) – as the cornerstone of the sustainability science – was a massive and thorough effort by the scientific and the policy community to explore the impact of the ecosystems and their services on human well-being. As Carpenter *et al.* (2009) states, besides the strengths the MEA exposed “gaps in the underlying science” related to ES and human-wellbeing. “We lack basic information on the dynamics of social–ecological systems and the relationships of ecosystem services to human well-being.” (Carpenter at al 2009.). According to a recent paper by Martín-Lopez *et al.* (2012), ecosystem assessments have been developed by mainly based on biophysical and economic indicators, however, only a few studies focused on the socio-cultural dimensions of ES.

Regarding our results, ES perception in the area was mainly linked to provisioning and cultural services. In other similar studies the most frequently perceived ES were not provisioning, but rather regulating services (Martin-López *et al.* 2012, Agbenyega *et al.*, 2009 and Castro *et al.*, 2011). The history of ES and the negative/positive trends related to these services were recognized. “Provisioning services” are strongly linked to livelihood, husbandry, and reflected the dramatic changes in the last decades. During the socialist period people had a closer connection with the landscape, since much more people got their livelihood from working in the agriculture and forestry in the collective farms. A storyline rising again and again is – it was much better when the landscape was “really used” meaning: when the forests in the floodplain were kept tidier, the drains in the fields were always clean; it was also easy to find people to cut the hay from the bank. In this narrative, “use” meant a more intensive presence of the people in the field. From the end of the nineties nature conservation activity became more influential with a new and strong presence in the area, causing the further “removal” of local people from the landscape. However, it was not able to encourage the other type of ES use, such as is tourism, education or recreation.

“Cultural services” perception was closely related to the people’s attachment toward this area: enthusiastic interviewees talked about the beauty of the landscape, their intense feelings towards the environment, but also a negative trend were mentioned several times about using the cultural services this ecosystem provides. It is important to emphasize the methodological barriers of our study. Our sampling was not representative, therefore we cannot make general statements about the importance of ES for local people. However, there seems to be definable trends in the interviews and conspicuous differences between the two riverside. Our impression is that in the southern villages closer to the riverbank (Klárafalva, Ferencszállás), the relevance of ES connected directly to the river was much higher, the closer location of the Southern villages to the river increases the probability of local visitings to the riverbank.

During our research, we also had to face with some methodological and conceptual dilemmas. One of the questions was how to evaluate the man-made objects in the landscape? For instance: is a perceived service – like flood protection - connected with an artificial building - like a dam - one of the ES? In this study we choose to handle these objects as part of the ecosystem, because it is hard to separate the services provided by a man-made and a natural object.

Another dilemma was how to handle the mentioned ESs from the past? Can they be recognized as an ES, in case they are not present anymore? We decided to incorporate past ESs in our inventory, as from the differences between past and present situation, we can identify important storylines about changes of the landscape and ES.

Our research revealed some trade-offs (e.g. provisioning and regulating or cultural ES), conflicts (e.g. between forestry – national park, forestry-hunters, fishermen groups), the effect of local institutions on land-use types, and differences between the ES perception of the stakeholder groups. Detailed discussion of these findings will be presented in a further paper.

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AN INSTITUTIONAL ANALYSIS OF LAND USE IN THE MAROSLELE AREA IN HUNGARY

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Introduction - the framework of institutional analysis

Land use patterns influence the effectiveness of conservation to a high extent. Therefore, exploration and understanding of socioeconomic factors affecting land use is vital when planning and carrying out conservation activities. The aim of our study is to explore and understand those institutonal factors which affect land use in the surroundings of Maroslele, Hungary.

In order to accomplish our task, we use institutional analysis as a conceptual and methodological framework (Ostrom 1990). Institutional analysis of natural resource use can be manifold. For instance, it can help to identify design principles for sustainable natural resource (common pool resource – CPR) use, or the threats regarding it (Ostrom 1999). It can contribute to the identification of those institutional factors which influence land use in the examined area, as perceived by local people. We define institutions as rules based on (Vatn 2006, pp. 2.): "*Institutions are the conventions, norms and legal rules of a society. They provide expectations, stability and meaning essential to human existence and coordination. Institutions regularize life, support values and protect and produce interests.*"

Our qualitative study is of exploratory nature – i.e. we do not want to generalize regarding the relationship between institutions and land use, but rather understand its complexity. We use Ostrom's (2007, 2009, Poteete at al. 2010) „General Framework for Analyzing Sustainability of Social-Ecological Systems" framework for our analysis (Figure 1.) This framework identifies four subsystems (resource units, resource systems, governance system and users) which are in interaction with the CPR situations and its outcomes.

Each subsystem can be characterized with so called second-tier variables (Table 1) which themselves can be further detailed by the definition of third- and fourth-tier variables.

In the following sections those variables which significantly influence land use in the area of Maroslele as perceived by land users are being identified. Although the framework applied here is often used to analyze variables affecting (un)sustainable CPR use, no such analysis has been carried out in this study. The reasons for that: (1) on the one hand this focus was not included among our research goals, and thus (2) we do not have data on the sustainability of land use in the area. Based on Ostrom (1990), we can say that a CPR system is used sustainably if a group of principals can organize and govern themselves to obtain continuous benefits from the given CPR. Based on this definition, sustainable land use can be defined as a situation where a group of principals are able to organize and govern themselves to obtain continuous benefits from the land at stake.

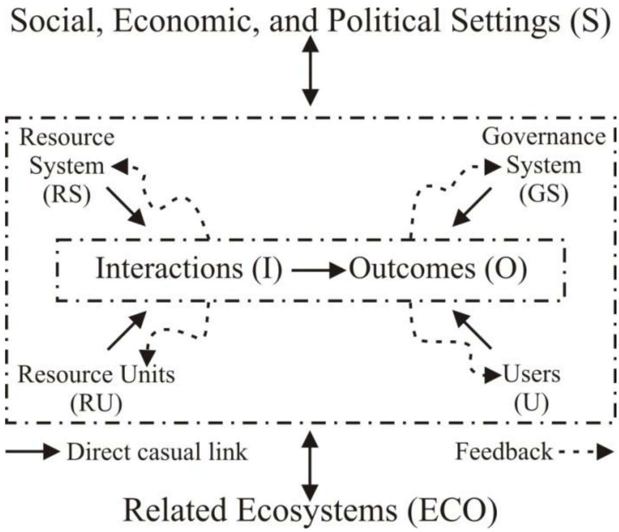

Figure 1. The core subsystems in a framework for analyzing social-ecological systems. Source: Ostrom (2007)

Unfortunately, our research results do not allow us to make a judgement on the sustainability of the land use in the area. This is due to two reasons. First, it is generally quite difficult – if not impossible – to judge the unsustainability/sustainability of given situations/resource use tendencies, processes (Vollenbroek 2002, Costanza 1991). Second, even if we wanted to make a judgment on the sustainability of land use in the area, we have contradictory information. On the one hand, the local stakeholders interviewed did not emphasize much "negative" or "unsustainable" changes/processes regarding local land use and local environmental changes.[3] On the other hand, preliminary results of a recent research[4] show the potentially unsustainable use of the Maros river.

[3] We directly asked questions about the changes in the surrounding natural environment in our interviews.
[4] This research is the so called FUTUMAR project: http://www.geo.u-szeged.hu/futumar

Table 1:. Second-tier variables in the „General Framework for Analyzing Sustainability of Social-Ecological Systems

Social, Economic, and Political Settings (S)	
S1 – Economic development. S2 – Demographic trends. S3 - Political stability.	
S4 – Government settlement policies. S5 – Market incentives. S6 – Media organization.	
Resource System (RS)	**Governance System (GS)**
RS1 – Sector (e.g., water, forests, pasture, fish)	GS1 – Government organizations
RS2 – Clarity of system boundaries	GS2 – Non-government organizations
RS3 – Size of resource system	GS3 – Network structure
RS4 – Human-constructed facilities	GS4 – Property-rights systems
RS5 – Productivity of system	GS5 – Operational rules
RS6 – Equilibrium properties	GS6 – Collective-choice rules
RS7 – Predictability of system dynamics	GS7 – Constitutional rules
RS8 – Storage characteristics	GS8 – Monitoring & sanctioning processes
RS9 – Location	
Resource Units (RU)	**Users (U)**
RU1 – Resource unit mobility	U1 – Number of users
RU2 – Growth or replacement rate	U2 – Socioeconomic attributes of users
RU3 – Interaction among resource units	U3 – History of use
RU4 – Economic value	U4 – Location
RU5 – Size	U5 – Leadership/entrepreneuship
RU6 – Distinctive markings	U6 – Norms/social capital
RU7 – Spatial & temporal distribution	U7 – Knowledge of SES/mental models
	U8 – Dependance on resource
	U9 – Technology used
Interactions (I) →	**Outcomes (O)**
I1 – Harvesting levels of diverse users	O1 – Social performance measures (e.g., efficiency, equity, accountability)
I2 – Information sharing among users	
I3 – Deliberation processes	O2 – Ecological performance measures (e.g., overharvested, resilience, diversity)
I4 – Conflicts among users	
I5 – Investment activities	O3 – Externalities to other SESs
I6 – Lobbying activities	
Related Ecosystems (ECO)	
ECO1 – Climate patterns. ECO2 – Pollution patterns. ECO3 – Flows into and out of focal SES.	

Source: Ostrom (2007)

Based on the aforementioned research focus, our paper is structured as follows. In the second part we explore those factors which influence land use in the examined area. We do this by following the logic of Ostrom's (model). After this exploration we discuss these results and draw some conclusions which also concern nature conservation.

We do not introduce our research methodology and the examined are (the surroundings of Maroslele) in this study since this information is included in the previous chapter (Mihók *et al*. in this book).

Institutions and land use in the Maroslele area

There are many institutional factors affecting land use in the Maroslele area. Here we present our analysis on the effects of these institutional factors on local land use as perceived by local people. We use the framework for analyzing social-ecological systems (Ostrom 2007) for our analysis.

Economic development (S1) and market incentives (S5)

We investigate the effects of economic development and market incentives together – although these two are two separate factors in Ostrom's original model (Ostrom 2007). The reason for such a choice is twofold. First, since none of the two expressions are defined in the original model, the exact difference between them is unclear. Second, according to our interviews, present market incentives are strongly connected to the more general economic trends people experienced in the area in the last several years, or even decades.

S1 and S5 affect land use in different ways. Their most trivial effect is their direct impact on agricultural land use, by influencing the importance of animal husbandry and crop production. Lately, market forces do not allow locals to be able to do animal husbandry profitably, thus this form of agricultural production is basically disappearing from the area (E6, E11, E23, E30, E15, E27).

"In the 70's there used to be herds of cattle in Lele, grazing on the grasslands. There also used to be horses, 30-40 horse-drawn carriages, sheep and pigs. After the transition, the number of the animals gradually decreased, there are very few of them in these days. I could count the number of the cows in the village on one hand. The horses are only kept for leisure, but even so only a few animals remain." (E30)

Besides the general trends in S1 and S5, according to some this process is also affected by other factors, e.g. by the change of regime in Hungary in 1989, since at that moment Hungary lost its former Eastern markets (E30). According to others (E8) this change is also the result of (and reason for) the changing way of local life (changing norms – U6) and (the lack of) economic opportunities (agriculture provides) for young people (potential newcomers in agriculture) in the area. These latter factors influence local involvement in agriculture in general.[5]

"The settlement is getting even more-and-more "city-like" nowadays. Few people keep animals. While formerly some pigs and poultry were kept by every house, these days only a few poultry can be seen and only at some houses." (E13)

[5] There is disagreement on the economic opportunities of newcommers, since according to other local people: *„young people should not be afraid of agriculture, it can provide good money, an earn of living." (E13)*

Besides influencing the weight of animal husbandry and crop production, S1 and S5 have an effect on crop production itself. This effect seems to be at least twofold. First, raising input prices make many people quit crop production because of reduced profitability (E2, E25, E26, E30).[6] S1 and S5 seem to unfold their effects together with other institutional factors. One of these is changes in technology used (U9). According to several interviewees, it is not anymore rentable to carry on with farming if someone is not able to invest in mechanization, which also influences (not only) the average land property size upwards (E8), resulting in land property concentration, and the loss of certain local employment opportunities. This also reduces the employment potential of the floodplain (E24).

"Farming is not profitable, more and more people rent their fields out, including many old people who cannot work on the land anymore." (E2)

"Fuel weighs on the farmers as a rather heavy burden." (E30)

"Agriculture is declining; it is not worth dealing with it." (E2)

"Everyone got a restitution ticket and could bid for the fields. The yards with their associated parcels were privatized and sold for good money. Private production started again, but they are not able to produce goods cheap enough to be able to sell them. There are one or two farmers, who ventured into mechanization and purchased large fields. Previously many people were employed in the area. Diggers and loggers were needed, but now everything is mechanized." (E24)

Second, the composition of grown agricultural plants is also changing since certain plants – such as endogenous local fruit species (E24) – are not worth producing anymore (E14, E26). S1 and S5, together with constitutional rules (GS7) – this latter being connected to nature protection in certain parts of the Maros floodplain – also influence perceptions on forest management. According to one of the interviews.

"Selection cutting is a huge dead end of the conservation. Only clear cutting can make a profit!" (E33)

"The fields must be managed, jobs are needed, but the goal of conservation is also important." (E33)

This former quotation shows that economic goals in the present economic system with high incentives on profit and efficiency may clash with nature protection goals. As an example in our case, S1 and S5 of high efficiency and

[6] This effect might not be independent from the effect of changing lifestyles and changing socioeconomic attributes of users, since agriculture is not as popular among young people than it used to be several decades ago. In an ageing population this results in not being able to carry on hard agricultural work. We discuss these trends later in more details.

profit motive influence the preferred tree species and employment opportunities. These effects emerge also because of the changes in technology used (U9) and changed norms (U6) of the owners – in our case a government organization (GS1) –, i.e. the fact that state forestry is pretty much interested (and forced) in making profits from its operations.

"In 1991 and 1992 the old oak wood was cut down, except for 0.2 hectares, and the clear cut areas were reforested. Only the soft wood can renew itself, but its market value is not high, so they brought in some so-called non-native species, e.g. the hybrid Poplar, and the Gray and White Poplar or the American Ash. Oak trees are not planted recently due to economic reasons." (E9)

"In 1968 the forestry produced 450 m^3 timber per year and employed 220-250 people. Now they produce several thousand m^3, but employ less people. The amount of profit to be produced is decided in Budapest." (E9)

"My father and I sawed the trees, then we had lunch and baked sausages. The trees were pulled away by horses. In the evening we went to look after the livestock, there was enough time, there was no need to rush. Nowadays they get sick if they don't cut 50-60 m^3 per day!" (E31)

In a capitalist society profitability is the bottom line, the fulfillment of other societal goals only come after this.

"Thing must be done in a sustainable way for both nature and the company. The contractors are only interested in money, not what the forest really needs." (E31)

Local economic circumstances (development) also seem to have an effect on land use besides the general patterns of market and economic tendencies. This effect seem to be at least twofold: (1) low real income motivates people to engage in small scale farming to gain supplementary income and (2) subsistence crime may discourages certain activities.

"Game and fish are a great opportunity. A fishing lake was almost set up in the pits from which the sand was excavated for the highway, but in the end it did not work out, because no one grows fish for others to steal them." (E14)

"I myself also grow garlic to supplement my salary." (E12)

Property-rights system (GS4) and sector (RS1)

GS4 and RS1 seem to unfold their most significant effects hand-in-hand – at least in the Maros floodplain. Before the 1970's, agricultural activity was common in the floodplain area. Significant change in land use began in the seventies, after a huge flood (E4, E9, E25, E27).

“Until 1970 there were mainly orchards and small gardens, which were almost able to supply the surrounding villages with all the fruit they needed. These orchards were real jewels, they were really kept tidy. Grapes, apples, almost every kind of fruit could be found here. Many owners were concentrated in a small area. There was a large flood in the early 70's, which destroyed the gardens in the floodplain. Their destruction marked the beginning of the afforestation, because floods cause the smallest damage in forests.” (E9)

“The water level of the Maros used to be higher, but after the great flood in 1970 the dike was heightened by 2 meters. In the old times there was agriculture in the floodplain, root crops were grown, dominated by corn; sunflower could only be found in a much lesser extent. In these days the floodplain is cultivated at people’s own risk, but the risk is high and these fields cannot be insured.” (E27)

Within the Maros floodplain, the dominant economic sector currently is forestry with one larger state actor (DALERD) and smaller local private owners. This kind of change is – as the former quotations show – also connected to the relatively low predictability of system dynamics (RS7), which makes agriculture within the floodplain risky. Thus RS7 with one irregular environmental state (“huge flood”) resulted in a change in human constructed facilities (RS4 – the heightening of a dike), economic sector (RS1) being present in the area and ownership (GS4)

However, land use changes did not stop at that point but went on. Many interviewees complained about the lack of accessibility to the forest areas within the Maros floodplain (E3, E6, E17), because present owners do not care about forest roads, resting places, local monuments (basically other elements of human-constructed facilities – RS4). This is the reason why several forms of earlier local uses (e.g. bathing, recreational fishing) is basically lacking (E4, E19, E22, E24), and these changes in RS1 and GS4 also contribute to the reduction in the level of resource use (harvesting levels – I1).

“Fishing and cooking was a common all day family program of the time.” (E22)

“The old trekking places and groves disappeared completely and became weedy.” (E24)

“The so-called “Tiszaháti” or “Vetyeháti” Tree or the Big Tree of the Hungarians was located in the area. This tree was a white poplar. It was about 110 years old when it fell in 2002. It functioned as a place for excursions. According to my wife 16 people were not enough to reach around it. When it fell, the locals took a piece of it as a relic. The area did not become an important excursions destination because the local town bureaus could not decide whose authority it belongs to.” (E9)

“While the Big Tree of the Hungarians was alive, many people went out there, but nowadays there are only a few visitors from Szeged.” (E11)

This process is also influenced by the changing socioeconomic attributes (U2) and norms/way of life (U6) of users (see later). Also, according to one opinion this process is somewhat self-reinforcing.

"The gifts of the Maros are appreciated, but unfortunately the utilization decreased significantly compared to the distant past, therefore this area is slowly becoming forgotten and increasingly neglected." (E15)

Property rights influence local land use also in other ways. It is interesting that according to some (E4) state cooperatives operating before the change of regime in Hungary were in a sense better „keepers" of the area because the state cooperative system allowed land use to be planned and carried out unanimously and had different (e.g. voluntary) economic incentives – e.g. it was able to establish barter-like use agreements with locals.

"Many pastures were on the dike, we didn't have to pay for it, just had to keep it clean. The slope of the dike was parceled out, everybody got e.g. 100 meters, 50 for the pigs, 50 for the cows." (E10)

"The locals mainly go to the Maros for fishing and collecting wood. But lately wood collection can only be done with the permission of the forestry. There is a great demand for wood." (E31)

Our interviewees disagreed whether there is a difference between private forest owners and the large state owner regarding the way of forestry. According to some (E2) state forestry is more "responsible", while others (E20) see no difference.

Besides forestry, there are three important players in the area which influence local land use. The first one is MOL, an oil company having impacts on land use outside the floodplain.

"Thermal water was found by the MOL, but they had no need for it, so it was covered back. It could have been exploited as a spa like the one in Zalakaros, or used for heating greenhouses. We could have made big money with paprika and tomato." (E21)

"Near the oil wells, the roads are well maintained by the MOL- staff ." (E11)

The second one is the national park, which influences land use within the floodplain most of all through Hungarian legislation – see later. And the third one is the Fishing Cooperative, having an impact on the use of the Maros itself (E29).

Human constructed facilities (RS4)

We already mentioned how the lack of certain human constructed facilities in the floodplain result – together with other factors – in a reduced use of the floodplain area. Besides, there are at least three recently built human constructed facilities which influence land use.

First and foremost, the heightening of the dike changed land use opportunities – as already analyzed earlier.

"Before the construction of the embankments around 1970, the flood reached the Rózsa street. Our current place was a port for boats then. My father-in-law protested against this place at site selection saying it was too low!" (E4)

"In the past the water level of the Maros determined the type of the cultivated plants in the area. After the dam was built, the flood became less important for the crop production, so forest management has become the primary economic activity." (E27)

Second, a motorway was built recently close to the examined area, which influenced land use and life opportunities (E13) in different ways. First, it had a direct impact, e.g. by having a new artificial facility in the landscape and by the induced sand mining. This latter changed the landscape within the floodplain. According to some these changes are quite negative (E1), while others see an opportunity to improve the use of the floodplain by enhancing recreational angling opportunities in the sandpits which came into existence because of sand mining. The motorway also has an indirect impact which might influence land use later on by influencing the local way of life by "bringing the city closer."

"Large pastures have diminished as land was needed for the motorway." (E27)

"Most of the villagers gave up on farming, they work in the bigger cities (Makó, Szeged) , many of them are employed by the porcelain and the rubber factory. Travelling to the cities has become much more easier since the motorway was built." (E26)

Local production facilities as part of RS4 might also change market incentives (S5). In our case, together with relatively cheap labor input – through the opportunities provided by a legally enabled (GS7) public employment program – they seem to partly change (redirect) agricultural production (E13, E26, E30).

"The municipalities employ public workers in agriculture, they will produce pumpkin for the pumpkin seed factory in Maroslele." (E30)

The change in the state of formerly more intensively used human constructed facilities – not being independent from property rights (GS4) – also affects harvesting levels/use levels (I1). For example, deterioration of formerly intensively used facilities, e.g. the so called "Návay Castle" results in a less intense use and the loss of certain forms of use. Also, human constructed facilities in other geographical areas might influence the state of the local socio-ecosystem.

"The river has become cleaner in the recent years. Formerly, a sugar factory in Romania and a paper factory in Szolnok let the effluent into the river. But now the factories are closed or they implemented water treatment facilities." (E16)

Productivity of the system (RS5)

The productivity of the resource system is influencing land use patterns heavily. The productivity of the area obviously influences local land use by influencing agricultural opportunities in and outside the floodplain. As long as it does not worth to do agriculture in the floodplain area – partly because the change in human constructed facilities (RS4), and also because the lack of predictability of the resource, i.e. River Maros (RS7) –, the surroundings of Maroslele are considered to be important for agricultural production.

"It's not worth cultivating the land in the floodplain, huge risk… crop rotation is just not possible to make, as only maize can tolerate floods. Sometimes corn is replaced with sunflower for a year, but usually it is produced in monocultures. Wheat can be grown occasionally but it's very risky.." (E6)

Predictability of System dynamics (RS7)

As aforementioned, RS7 influences agricultural opportunities within the floodplain (E7, E14).

"Sometimes the river Maros has an inundation each year, sometimes once in every 10 years, so farming in the floodplain is quite difficult. The soil quality in the area is very good, that's a pity it's not worth cultivating the land." (E14)

Besides, the relatively low predictability of the river also discourages fishing and angling.

"Nowadays we can't live on fishing only, because the river (water level) is "whimsical", when the water level is high there are many fish, when low we can't catch anything. If the infrastructure was better developed, I think, one possibility for using the area would be encouraging tourism. A tourist centre for fishermen could be built, though who will pay for this…I don't know. In a place like the Lake Tisza with a steady water-level it's much easier to develop such things for the delight of the whole family. Here at the Maros, with continuously changing water levels, it's much more difficult. " (E29)

Location (RS9)

The geographical distance (thus: location RS9 and the location of users U4) together with other factors, e.g. with the local way of life (see later) influence the intensity of the use of the floodplain. According to several interviewees (e.g. E10, E17) the relatively distant location of the floodplain from the settlement (Maroslele) influence its level of use negatively. The same is true for the floodplains' distance of the nearby city, Szeged. This latter – although it was not mentioned in the interviews – might also be connected to the available transport infrastructure, i.e. physical distance is further enhanced by the lack of physical infrastructure providing quick access to the area for the inhabitants of the larger city.

"Although it's only 6 km, it's much too far away for visitors from Szeged." (E11)

"I don't use the floodplain really,, it's too far (4 km), but sometimes it would be good to catch fish or to collect mushrooms." (E20)

Operational rules (GS5)

The operational rules, being put in practice by the water authority, influence the land use by the dike.

"The management encourages the dike-reeves to keep sheep on the dam, because: the sheep are grazing the side of the dike; compress the ground; and manure the land. But you have to take care of them, they can easily "disappear" as happened at Gabor K. (a dike-reeve)." (E26)

The lack of sanctions for certain polluting activities also influences the state of the socio-economic system and land use (E29)

Constitutional rules (GS7)

There are several forms of constitutional rules affecting local land use. Within the floodplain, one of the most important is the Hungarian forestry law (37/2009), which sets up the frame for forest management, providing a stricter regulation than before according to certain opinions (E33) –. According to one opinion (E31), after the change of regime in Hungary many forests were cut down because of the fuzzy regulation of the "transition" period.

Hungarian and EU-level natural protection, e.g. the designation of Natura 2000 sites also affects opportunities for land use (E2, E11, E27, E31, E33).

"I have forests in the floodplain, but I need to ask for permission to cut some trees. The rule is: if you cut down a number of trees, you must plant the same amount." (E2)

"I'd like to collect the punk wood for heating, but I can't do this, because protected insects live in the punk wood. The forest reserve is beautiful for those who want to see the dead wood…Leave the wood for the insects instead of people in need, well, this is weird…" (E11)

The EU influences land use also by regulations other than Natura 2000. E.g. the EU financially supports forest settling within the examined area (E33). This means that there it creates market incentives (S5) to change land use from arable farming and orchards to forestry.

“As the EU supports the forestation in the area, forests of 10, 20… acres are planted in the floodplain and outside of it… Many farmers prefer to plant forests now inside and outside the dam” (E27)

The budget allocating activities of the national government is another factor influencing land use according to some by cutting back on local development opportunities.

“The city of Makó takes all of the financial resources.” (E1)

Local regulations might also influence land use. According to one local rule:

“ Local retired older farmers can give their lands to the Local Municipality as a result of a new regulation of the last few years, in return they receive a life annuity.” (E21)

The creation of this rule might not be independent of the change in the socioeconomic attributes of users (U2) – see later.

Monitoring and sanctioning processes (GS8)

We already mentioned rule enforcement in connection with operational rules. Besides, according to one opinion, rule enforcement also influences forestry by setting different levels of controlling activities for private and state managers (E33).

Economic value (RU4) and dependence on resource (U8)

The economic value (RU4) of the Maros floodplain seems to be significantly lower nowadays than it used to be, due to the decrease of local resource-needs.

“*In the 80s’ young locals used to go to the floodplain forests to collect fuel wood: to cut the branches off from the trees pulled down by the foresters.*” (E18)

This aforementioned change in the local resource use is probably not independent from several other changes: (1) change in (heating) technology (technology used – U9); change in property-rights regimes (GS4) and economic development (S1) and market incentives (S5) which are different (more private-property and profit oriented) nowadays compared to socialist times; (3) change in norms (U6), being nowadays a lot more private-property centered, and (4) constitutional rules (GS7) regarding nature protection affecting intervention opportunities within protected forests (E8)

"*In the past, local people from Maroslele were allowed to collect the dead wood, twigs for fuel wood. Now they are banned from doing this, because the dike-reeves collect the wood. These current rules restrict the freedom of the local people*." (E8)

The economic value of resource units within agriculture directly influences local farmers' choices regarding agricultural production– together with local traditions (history of use – U3) and local agricultural conditions. In the Maroslele area the most popular agricultural product is garlic, thanks to the aforementioned factors (E17, E21)

The river itself also has an economic value for the local agricultural production, since it secures easy and cheap irrigation (E6, E17, E13) and contributes to the good quality of the local soils, arable land. However, we didn't reveal the particular use of the river by the farmers.

Socioeconomic attributes of users (U2)

The change in the socioeconomic attributes of users also influences land use. This phenomenon is basically connected to the ageing of the population in the settlement (E2, E18).

"*Most of the people who live here are members of the older generations, young people have been moving into cities*." (E18)

According to many locals ((E18, E22, E1, E24) this tendency is connected to both market circumstances/economic development (S1).

"*after the splitting up of the former socialist cooperatives, living at the settlement became more difficult for people in economic sense. It is difficult to find a work here and earn a living.*" (E18).

The change in socioeconomic attributes may also be connected to a change in the social norms of users (U6) according to which urban lifestyles might be more attractive to young people than traditional lifestyles (E24). This, according to some, affects both agricultural land use (see earlier) and also land use within the floodplain.

"The floodplain used to be really beautiful, but it is totally abandoned now. Young people don't care about it anymore, those who managed the land have disappeared by now." (E7)

History of use (U3)

The history of local use (U3) influences the memories locals having about the landscape and thus local attitudes, norms and perceived importance of the natural resource. Many interviewees mentioned nice memories connected to the floodplain area (E3, E18), and a deep attachment to the area as their homeland (E3).

History of local agriculture might also influences agricultural production in two ways. First, by having certain agricultural traditions connected to certain agricultural cultures (garlic, in our case) and by enhancing knowledge transmission between generations.

"The situation of local onion producers is similar to that of the apple producers' in Szabolcs." (E17)

"*what I know I learned from my parents and not in school*" (E6)

Location (U4)

Several interviewees mentioned that large amount of litter is piling up by the banks of the Maros. On the one hand perception of this phenomenon is the consequence of certain users' norms (U6) since some of them complain that local and non-local sport fishermen are the ones who leave their litter there (E15, E11). On the other hand the location of the analyzed resource (U4) might also influence this situation, since according to other users litter is being brought by the river itself from Romania (E11).

Leadership/entrepreneurship (U5)

We found several examples of local leadership potentially affecting resource use. Several interviewees mentioned the local major as an example of positive local leadership. However, its influence on land use was not detailed at all.

"Recently, a considerable development has been initiated, mainly by the mayor." (E22)

"The life of the village is getting better since we have a new mayor." (E2)

We also found that "environmental leadership" might play a role in the launch of environmental protection legislation and forestry management (E16, E20, E31).

"I am a committed ornithologist and conservationist since I was a child. I initiated the preservation of several sites here around, and I myself played an important role in the naming of the Körös-Maros National Park." (E16)

"The plantation of the forests began in the 50's. A clever forester was the leader of the work, so a lot of oak forest was planted. (E20)

On the other hand, changes in the life circumstances of local actors being enthusiastic in certain issues (e.g. nature protection) may also influence land use according to some. This may also be connected to the fact that these interests are (perceived as) partial interest within the community having represented by only a small minority of local community members. Thus, the drop out of only a few interested people might "ruin the case".

"Most of the formerly very active people founded families, so the issue (of ornithology) is declining".

Norms/social capital (U6)

Changing lifestyles (norms) (U6) of local people, especially younger generations, influenced by the wider technological environment and wider societal culture also influences attitudes towards local natural resources and land use (E2, E6, E8, E14) –resulting in a reduced land use in the floodplain and a reduced local involvement in agriculture.

"I love nature. Nature means nothing for the youth nowadays. Even if it means something for them , it cannot be compared to what it means for the elders." (E8)

"The landscape is changing because people are changing too. Nowadays people are running, formerly they used to have time for everything." (E14)

The effect of social capital on land use is also interesting. First, local judgment on its level is contradictory. Some interviewees were talking about experiencing high levels of social capital (E3), while according to others, the level of social capital is quite low (E1, E6, E8, E21).

The perceived lack of social capital, together with the missing local leadership (U5) is perceived as one reason for local farmers not being able to effectively stand for their interests against larger market actors (E6, E13). Paradoxically, the presence of different kind of larger economic actors might influence local agricultural opportunities positively.

A significant change, partly connected to changes in local norms is the reduction of the amount of people living in farm-steads (Tanya) and farm-steads themselves (E10, E11, E31). This change might also be affected by economic factors like the former anti farm-stead policy of the socialist regime, the lack of formerly existing education opportunities and certain other uses/owners of the area.

Changes in social norms affects land use also in quite specific forms. It influences quite specific land use types, e.g. birding habits, the cleanness and tidiness of the settlement environment.

"Modern ornithologists do not appreciate old values. The leaders of the ornithological camps spend most of their time in the pubs." (E1)

„The village is tiny and clean, the villagers contribute to it because they appreciate the surroundings and take care of it." (E22)

However, generally we found a diversity in local norms regarding the importance of environmental protection. While some of the local users state to be quite environmentally conscious when using the local environment – *„They are trying to minimize the use of chemicals. They try to use the minimum of what is necessary for profitable agriculture. (E13)* – others seem to be more motivated by economic factors. According to environmentalists (E16, E20), foresters are pretty much economically motivated – even to an extent where they neglect/skip environmental regulations. However, certain foresters (E31) see themselves the opposite way – giving the best possible environmental performance among present market circumstances. Some people neglect norms when fishing illegally (E29) – this latter might also be the result of poor local economic opportunities.

"They seed the oak in rows, but the wild-boar is a smart animal, it goes along the row and pick up the seeds… They know how to cut too much tree, so the rest of the oak trees get more light, and they become bushy, or the grape-stalk run up the tree, so the foresters can cut down the forest because of bad health. They know how to do it, if they really want (to cut more trees)." (E20)

"I never cut down more than the annual growth! I wish to leave the forest to my descendants… I work according to the management plan. The oak tree is ready for cutting down when it is 60 years old, although in the forestry law there is 110 years. The whole circle is necessary: plantation, rejuvenation, attenuation, cutting. The mass of the wood (in cubic meters) is rather growing on my territory. (E31)

Although according to some (e.g. E22) preserving traditions is quite an important "norm" for the villagers, it does not seem to be connected to the floodplain area.

The local way of life also influences the use of the floodplain. Since *"all who live here spend their whole day in the open"* (E17), local people might not have that much need for recreation in nature as people living in larger cities. According to some, the reduced use of the Maros is – besides other factors – also caused by a change in norms, since people became more risk averse than they used to be..

"*Nowadays not too many people go down to bath in the river, because they fear from the river, from the strong drifting, and from the whirlpools.*" (E4)

"*I did not let my youngest son to go to the bank of the Maros, because the landscape has been changed, and especially because of the fast flow of the river.*" (E26)

"*Perhaps because of the fear from the ticks people are not going so often to the forest.*" (E30)

According to Ostrom (1990), one of the prerequisites of sustainable resource use is discounting. Some interviewee state to have low discounts rate.

"*I do not need better business than a good one*." (E27)

Local education was also mentioned as a factor influencing local norms and land use .

"I had to take practical classes in school already as a child. We learned about hoeing and prepared bird-feeding box in the forest." (E8)
"Young people are not able to mow by hand-scythe." (E15)

Knowledge of SES/mental models (U7)/Deliberation among users (I3)

The mental models of local users and their communication also influence land use. According to one interviewee (E33) there is regular communication between the state forestry and the natural park in the area, and communication is "easy" because of the similar background..

„We consult annually with the staff of the National Park. They are foresters too, we can come to an agreement." (E33)

However, on other levels, the lack of deliberation means serious problems for certain local actors.

„The problem with the National Park is that they do not give enough information, so people do not know what is allowed and what is not in the protected area". (E1)

Lack of communication may also result in conflict with local users, especially that conservationists have different mental models and knowledge of SES compared to other users. As long as conservationists prefer untouched natural environment, locals have different preferences, e.g. they prefer certain elements of the former landscape and emphasize the economic aspects of land use.

"The everyday people only realize that nature conservation limits certain activities." (E1)
"The National Park plants native species now, for example 'grungy poplar', which is good for nothing. Earlier, foresters planted nice tall poplar forests, but nowadays they breed such trees which are good for nothing." (E11)
"Native species are suitable to use mixed with other species. The forest is good when it is mixed. If the native poplar becomes firm, the alien species can not overgrow it." (E31)

"If I invest into something, I would expect that I get something out of it. If I populate young fish, I expect some results, and not the cormorants to eat all fish." (E29)

„Everybody sees it in a different way. Nowadays nature conservationists are the ones who dominate. They are not governed by money. But the furniture industry needs wood, it is necessary to fulfill its needs also. Nature conservation is important, the birds, and the capricorn beetles are important as well, but the production is necessary too." (E31)

Creating categories based on occupations (e.g. conservationists, foresters, farmers etc.) does not mean that these groups are uniform regarding their mental models and knowledge. There seem to be significant differences in opinions between conservationists either.

"With so many rules it is not nature which is the master… We should not force nature to adapt to our rules, but we should adapt to rules of nature... We did better to leave the forest to grow up, and encroach only rarely. Nor the foresters neither the NP can imagine this, because former experience is diminished". (E20)

It is also interesting to observe how local people gain knowledge about the local land and land use. Knowledge transmission from parents, "masters" and family seem to be of significant importance in this respect (E26, E31).

"Gyula Kiss drove the afforestation of the Maros floodplain in the 1950'. He was my master, but only for one year. I got a considerable part of my knowledge from my practical experience." (E31)

Lack of trust in industrial agriculture also significantly affects land use.

"The animal husbandry is not profitable, but at least I know what I eat."

Dependence on Resource (U8)

Different stakeholders use the floodplain and the surroundings of the settlement in different ways and to a different extent, thus they have a different kind and extent of dependence on local natural resources.

Significant forms of use and dependence are:

(1)The river and the floodplain: irrigation, wood harvesting (forestry), biodiversity protection (national park), hunting, fishing and sport-fishing. These activities are connected to different stakeholders: as long as wood harvesting, biodiversity protection and fishing are not connected to local users, irrigation, hunting and fishing are to a lesser or higher extent connected to local community members.

(2)Settlement surroundings: agriculture is the most important form of use, with garlic as the most important local agricultural product.

Formerly significant, but decreasing forms of use are (1) recreation – in the case of the floodplain; (2) gathering wood for heating – in the floodplain; and (3) animal breeding.

Although the land around the settlement seems to be very important in terms of the economic well-being of the local community, there is some divergence of its importance – probably because the aforementioned reduction of certain types of land use, but probably also because of more developed agricultural opportunities.

"The economy has changed, people are not that much dependent on nature as they used to be." (E15)

Besides "hard" economic dependence, "softer" dependence was also mentioned connected to the ecosystem service "sense of place" (E15, E22).

"We like to live here, because of our attitude towards nature. We love silence and stillness. Only those like to live near to the Maros, who could perceive the beauty of rural life." (E15)

Technology used (U9)

According to several interviewees, modern agricultural technology is essential for profitable agricultural production – indicating a difference a to earlier times.

"Who has a land, but does not have any machines, can not make profits. It is pure suicide. (E14)

This shift in certain land use types might also be connected to transmission failures (E27, E28), and also to the alteration of local norms – the increased "demand" for an "easy" way of life.

Discussion

The effects of institutional factors in land use

Institutional factors have diverse and complex effects on land use in the examined area. These can be divided into two main categories: direct and indirect effects.

By indirect effects we mean that certain institutional factors influence other institutional factors while these latter influence land use directly. This means that certain institutional factors unfold their effects indirectly through their effects on other institutional factors. An example for such effects is the heightening of the dike in the 1970s. This change in institutional factor "human constructed facilities

(RS4)" resulted changes in other institutional factors – e.g. in resource predictability (RS7) and the productivity of the system (RS5) outside the floodplain (the area surrounded by the river and the dike). These processes induced changes in sector (RS1) and influenced property rights (GS4), which factors in turn – probably together with other factors, e.g. market norms/incentives – induced alterations in land use in many different forms. The simplified example for the aforementioned complex indirect influences (interdependency) chain is shown in Figure 2.

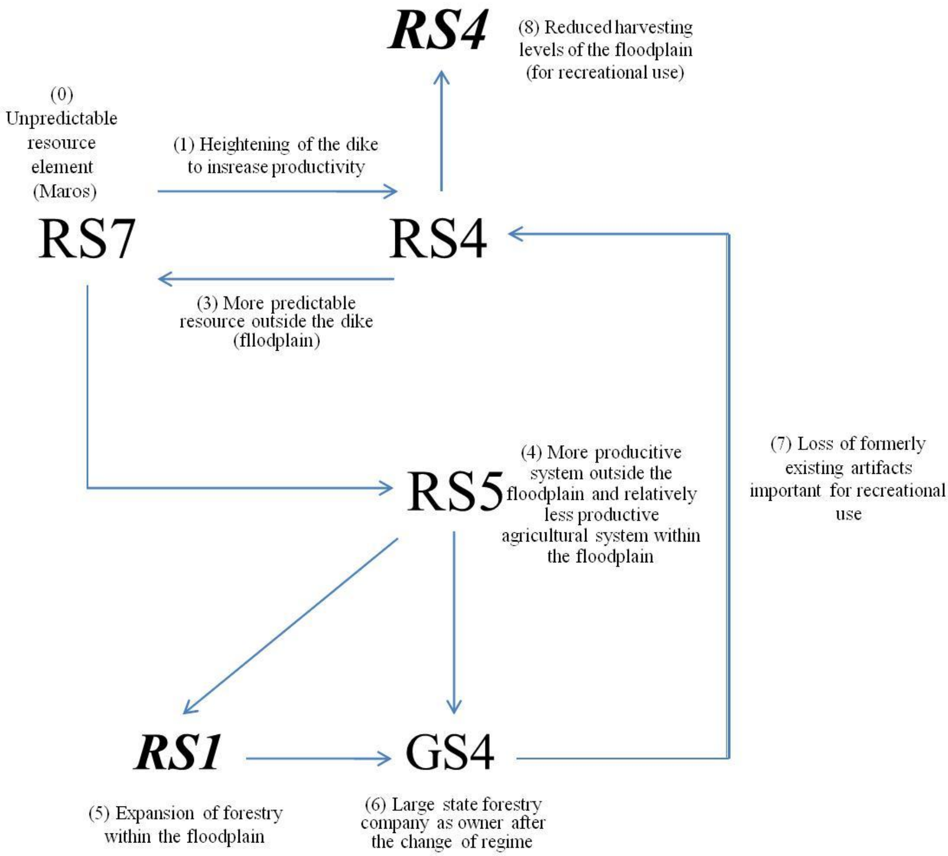

Figure 2. A simplified example of indirect influence of institutional factors on land use
Factors marked with bolod italic mean direct land use change. *Source*: own illustration

Institutional factors can affect land use directly. For example, altered market circumstances influence agricultural land use patterns directly by changing the profitability of certain activities. These direct relationships are shown in Figure 3.

Figure 2 and Figure 3 show us that even if we examine second-tier institutional variables (which are themselves quite aggregated categories), there is a complex and diverse relationship between institutions and land use.

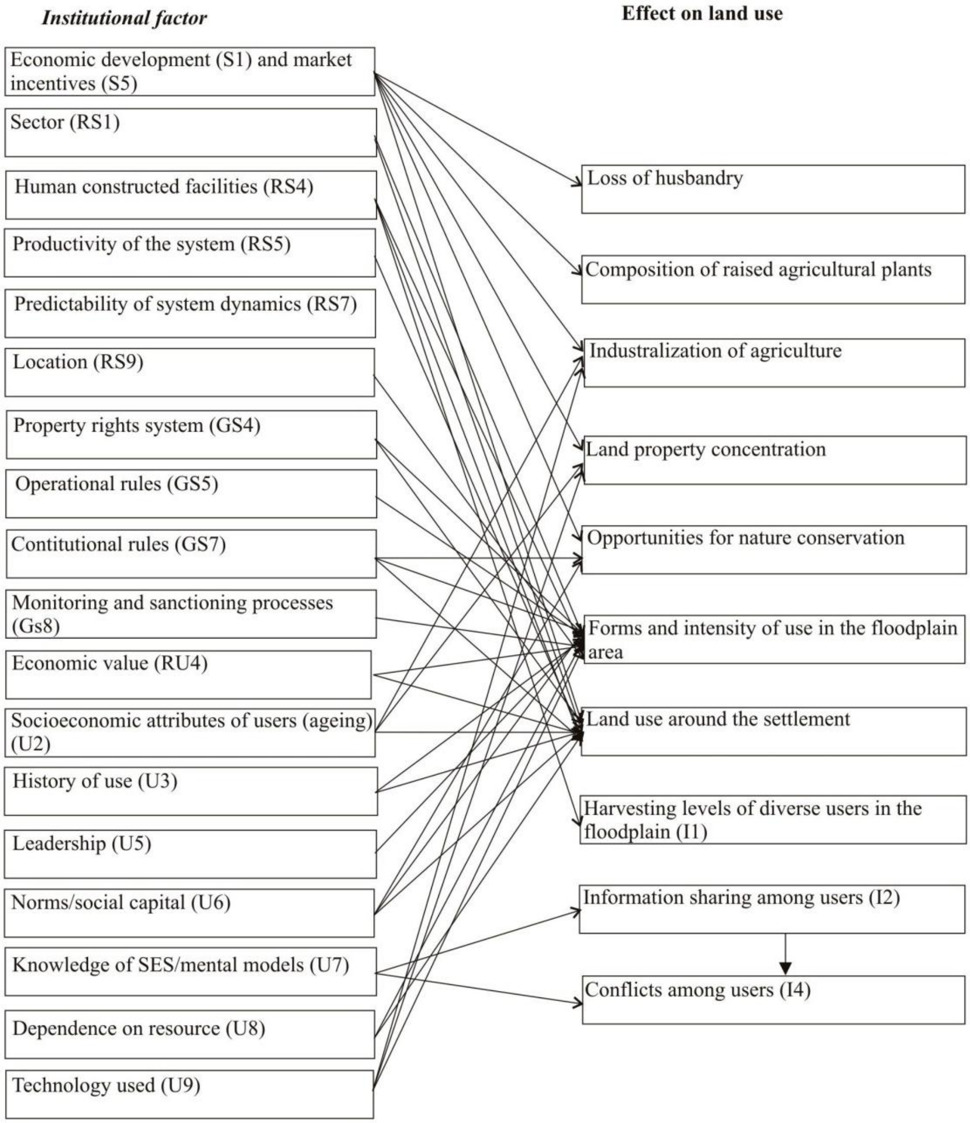

Figure 3. Direct effects of institutional factors on land use. *Source*: own illustration

Furthermore, second-tier variables cover many potential third- and fourth-tier variables with different effects on land use. “Norms/social capital (U6)” as a second-tier variable might cover many kinds of social norms (third-tier variables) affecting land use in many different ways. Such third-tier variables could be (1) local way of life; (2) broader societal lifestyles; (3) trust; (4) the level of environmental consciousness; (5) the nature of economic norms; (6) discounting, etc.[7]

We think that this highlights two facts. First, qualitative analysis is essential when someone wants to understand land use and CPR situations in general. This does not mean that quantitative analysis does not provide relevant information, but we are convinced that at the planning and implementation phases of land use policies qualitative analysis provides information which makes the understanding of the local context possible in such a rich way which cannot be reached by pure quantitative analysis. Second, there are very many factors directly influencing land use and thus the conservation opportunities and the effectiveness of conservation. Thus, it seems to be important to examine these factors in details before planning and implementing conservation policies.

What do we know? Facts, interpretations and conservation

Our research was aimed to reveal the role of institutions in influencing land use in the Maroslele area. However, it is clear that a qualitative methodology reveals both facts (knowledge) and interpretations (opinions, feelings etc.). By making this differentiation, we accept a "modified constructivist" view on social reality (Tacconi 1998, Pataki et al. 2011) This means that „There exists a physical reality subject to differing interpretations by human beings. Thus, there exist multiple socially constructed realities." (Tacconi 1998, pp. 99)[8]

Furthermore, sometimes it is difficult to differentiate between facts and interpretations. Even if opinions on "facts" are unanimous within a community, it is clear that it might be because of a common interpretation of certain parts of the facts within the local community. (E.g. in the case of the reduced level of local use of the floodplain area, a common interpretation exists regarding the reasons for it – which are most of all connected to the lack of human constructed facilities. However, one can never be sure whether other factors are – also – behind such processes, which are not realized by the interviews themselves, e.g. their changed attitude towards the resource.)

On the other hand, university researchers might perceive to have a fine knowledge on the ecological reality regarding the natural resource at stake. But this is a quite partial knowledge if for instance, local knowledge on land use and the knowledge on local social realities are absent from it. (A scientific

[7] Here we only mention variables which turned up in present research. The special literuter e.g. on the meausrement ofsocial capital (see e.g. Stiglitz et al. 2010) provides the reader with many more informnation and potential variables.

[8] For further theoretical dilemmas on this topic and this aspect of qualitative research see e.g. Kvale (1996), Mitev-Ariel (2012), Babbie (2006), Tacconi (1998).

conservationist/researcher might have fine knowledge on the "valuable" species within one area, while she might lack other important knowledge, e.g. local conservation traditions, local social/political preferences etc. It is clear that this latter type of knowledge, partly being a "locally constructed reality" is also part of that social-physical reality which influence e.g. effective conservation opportunities.)

In our view the issues raised above have an important consequence regarding conservation. We are convinced that effective conservation should take into consideration both (1) existing social and physical realities and (2) also those multiple socially constructed realities which (local) stakeholders experienced regarding the existing social and physical realities.[9] Since the actions of stakeholders – as our research implies – is not based on pure, objective scientific, physical realities, but rather on their own socially constructed realities. Therefore beside the examination of the physical realities effective conservation demands the exploration and understanding of socially constructed ones.

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[9] A good example for a planning method enabling such type of conservation activities is avaliable in Kelemen et al. (2010).

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COLOUR PLATES

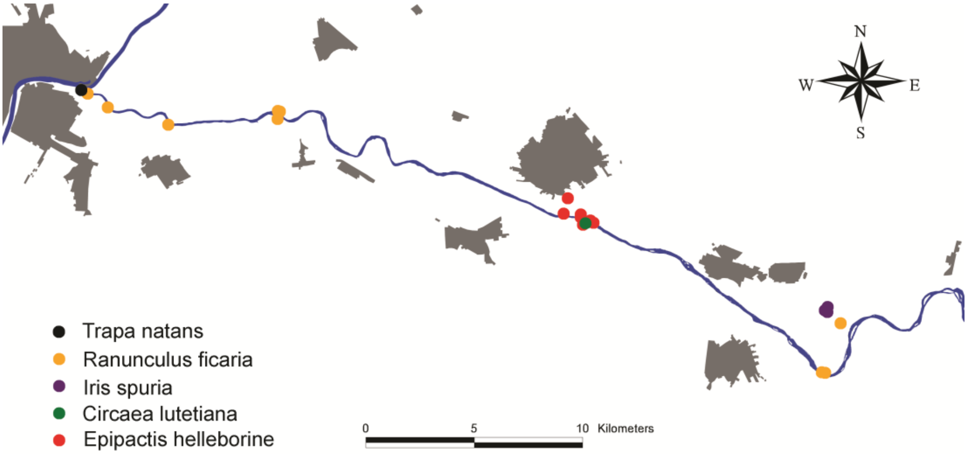


Figure 1. Occurrences of some rare or protected plants along the river Maros.

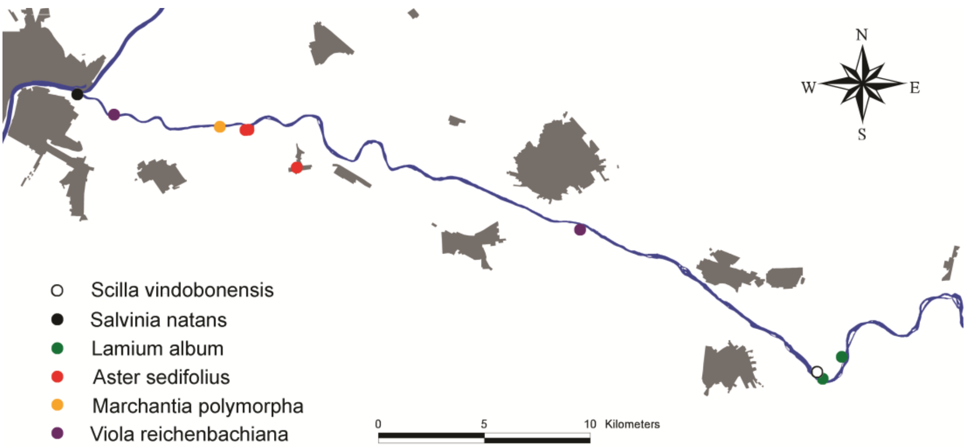


Figure 2. Occurrences of some rare or protected plants along the river Maros.

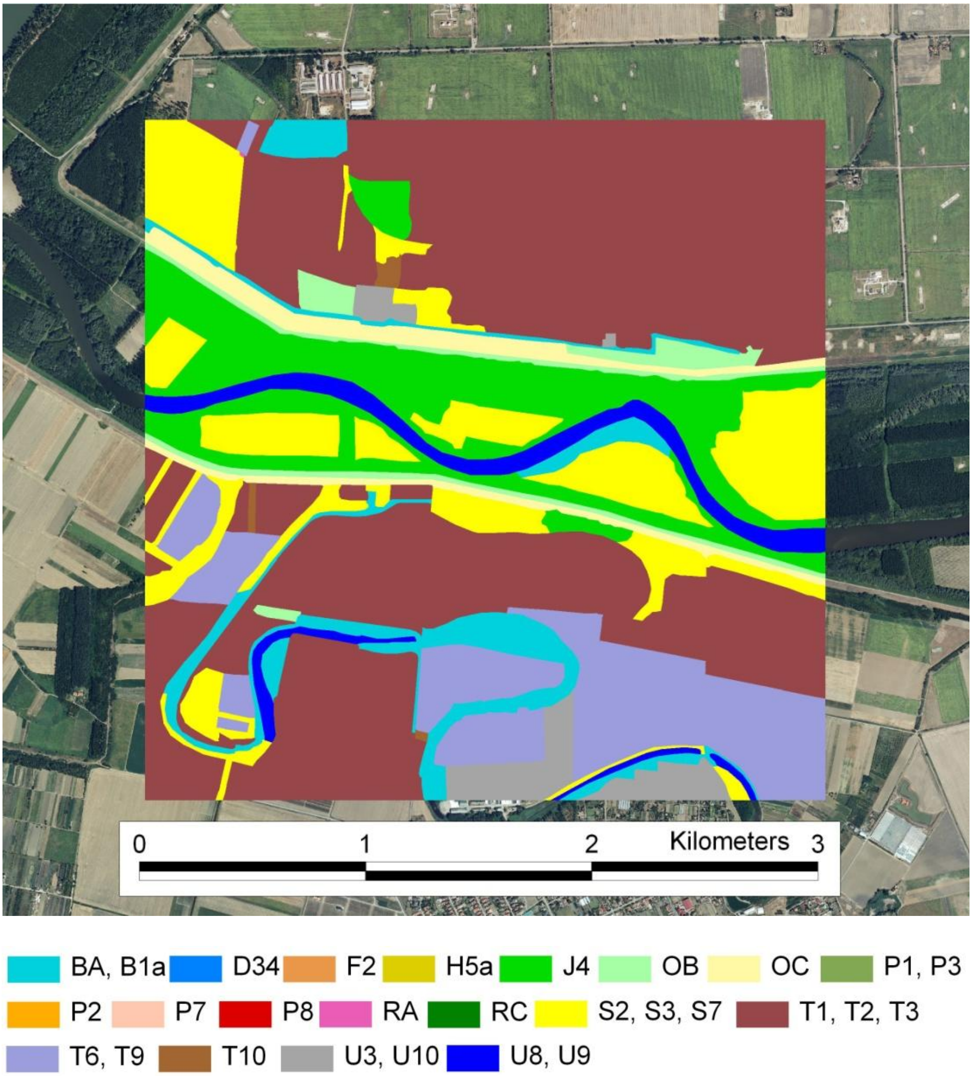


Figure 3. Habitat map of the Szeged site

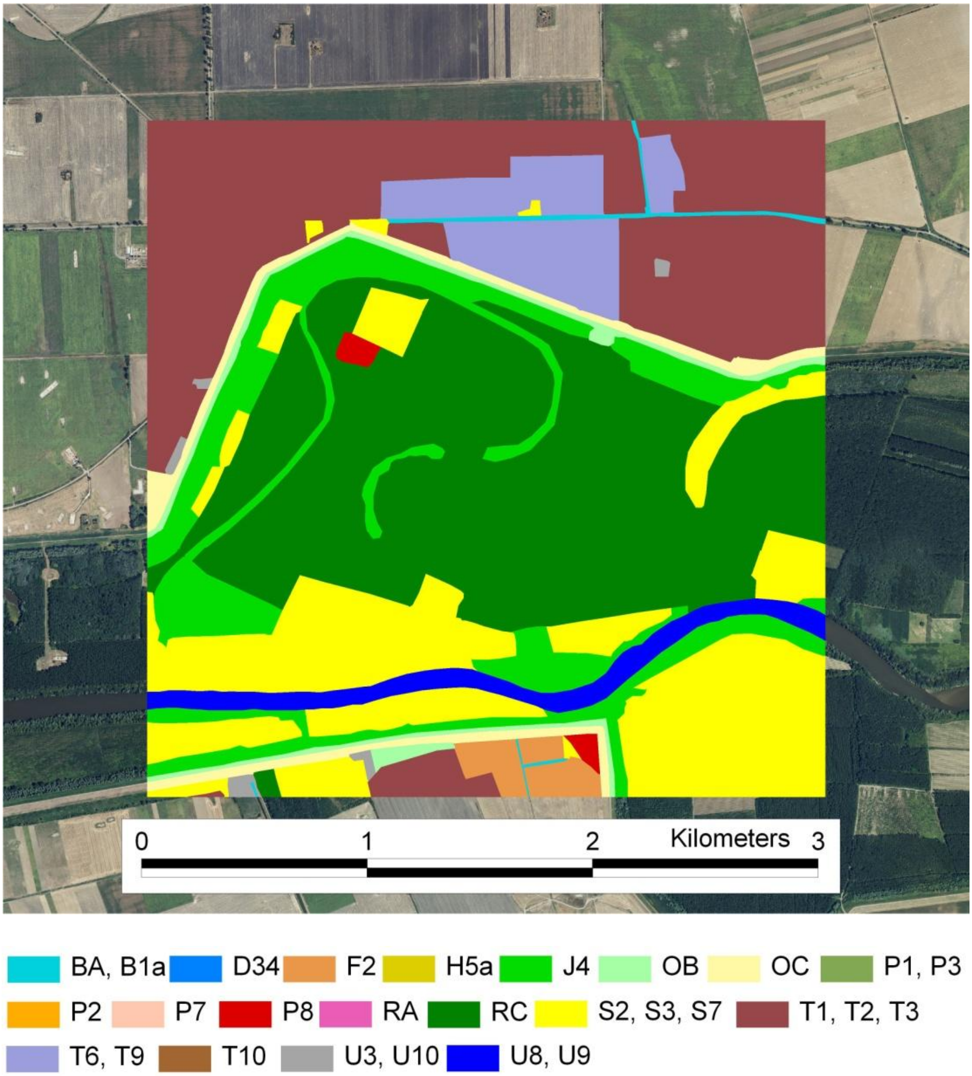


Figure 4. Habitat map of the Maroslele site

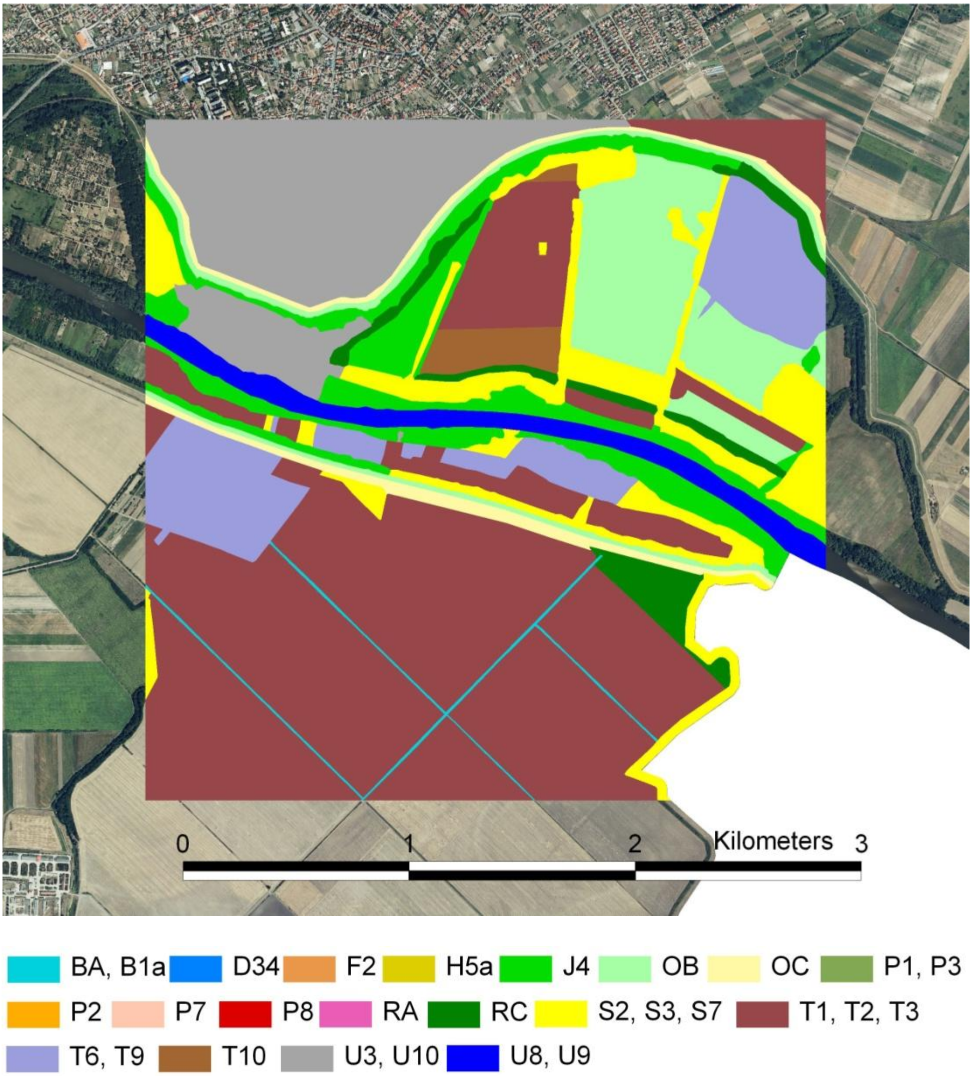


Figure 5. Habitat map of the Makó site

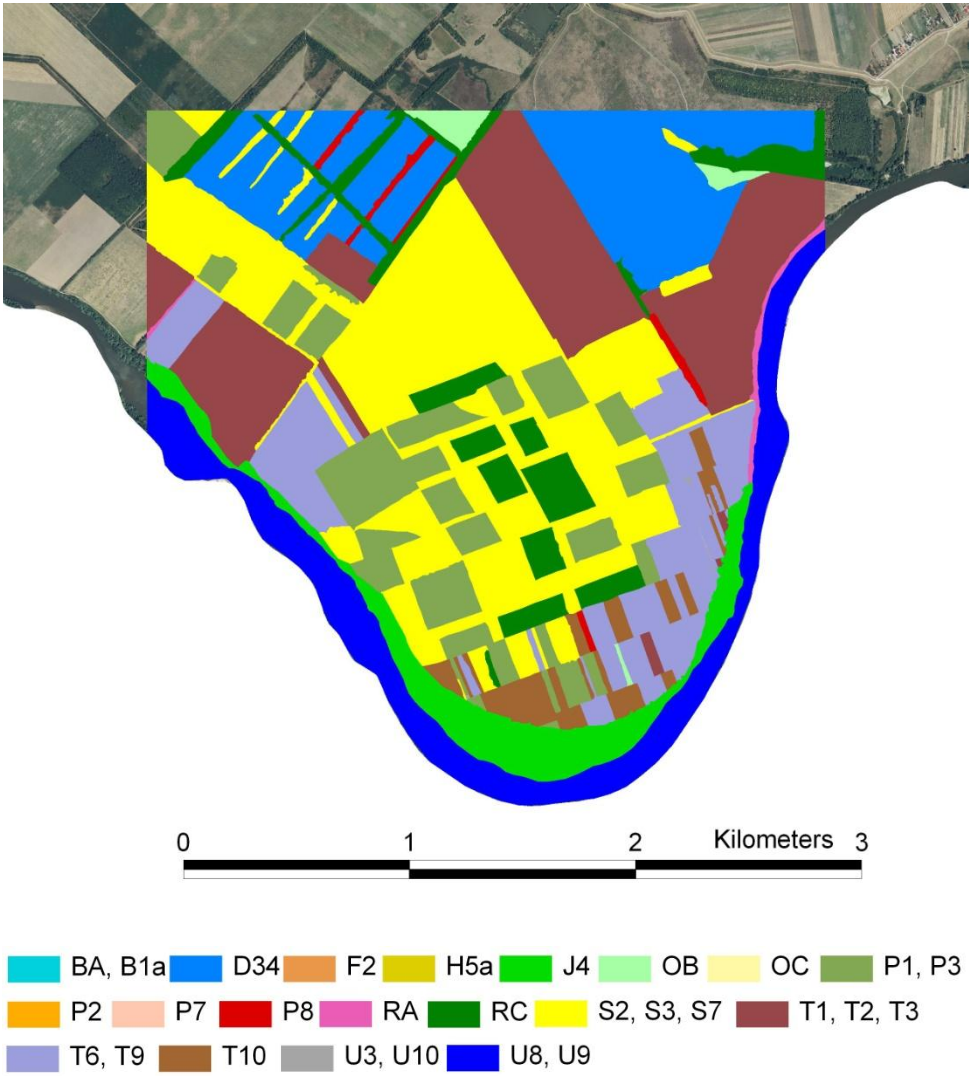
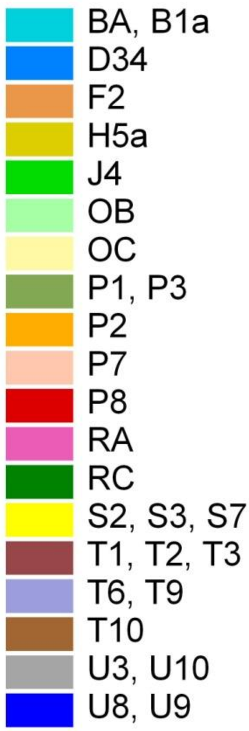


Figure 6. Habitat map of the Magyarcsanád site

Legend for the Figures 3-6 in Colour plates. Explanation of Á-NÉR habitat codes.



BA,B1a	Eu- and mesotrophic reed and Typha beds
D34	Mesotrophic meadows
F2	Salt meadows
H5a	Closed steppes on loess, clay, toff
J4	Riverine willow-poplar woodlands
OB	Uncharacteristic meadow and tall herb communities
OC	Uncharacteristic dry/semi-dry grasslands and tall herb communities
P1	tand of native trees
P2	Mesic shrub wegetation
P3	New afforestation
P7	Extensive orchard with ancient cultivars
P8	Clear cuts
RA	Scattered native trees or narrow tree lines
RC	Uncharacteristic hardwood woodlands and plantations
S2	American poplar plantations
S3	Other non-native deciduous plantations
S7	Tree lines mostly with non-native species
T1	Annual intensive arable fields
T2	Perennial intensive arable fields
T3	Vegetable and flower plantations, greenhouses
T6	Mosaic of small agricultural parcels
T9	Gardens
T10	New abandonments on arable lands, vineyards and orchards
U3	Villages
U8	Rivers and streams
U9	Lakes and ponds
U10	Farms

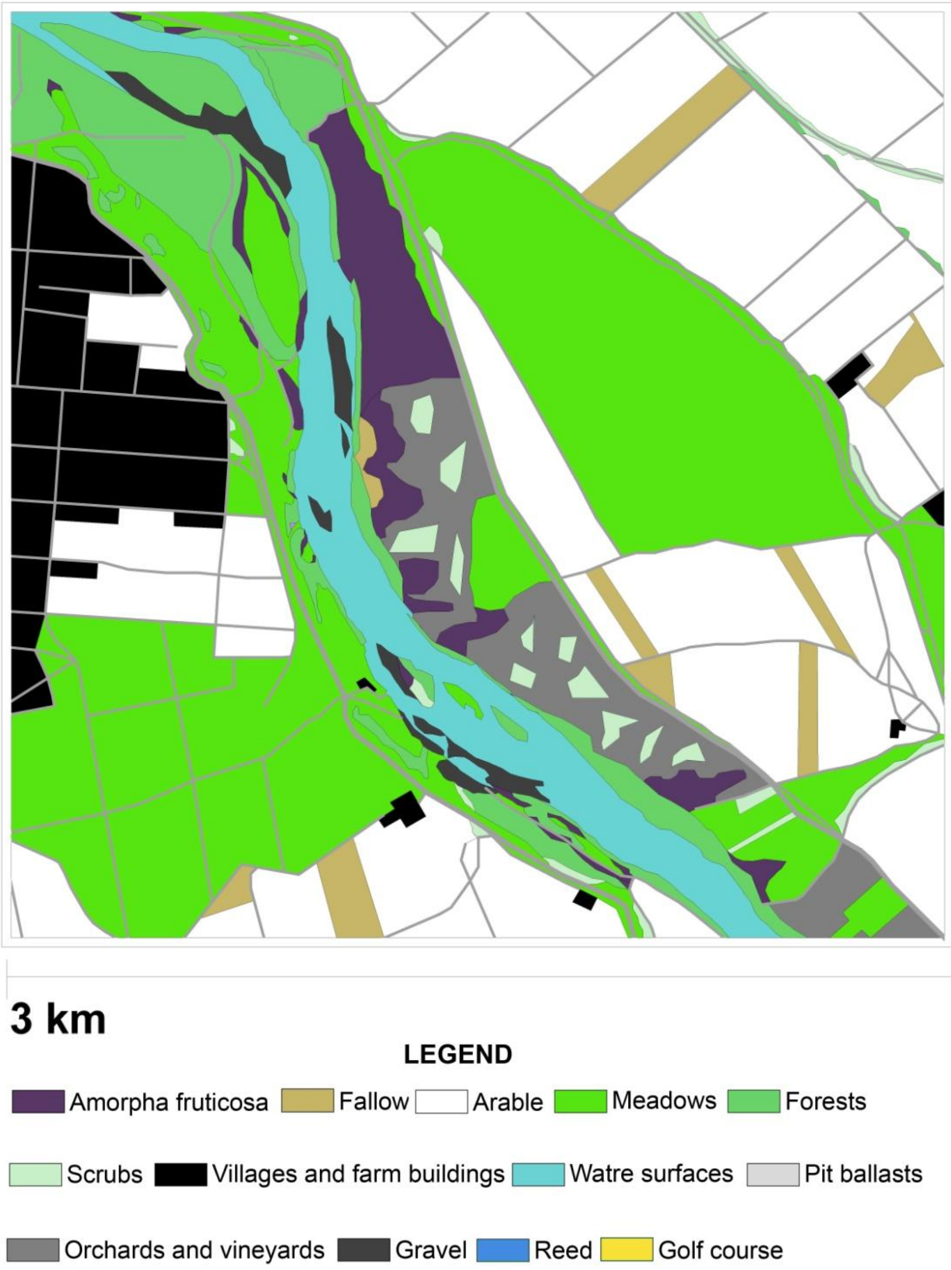


Figure 7. Land-use categories – Igriș.

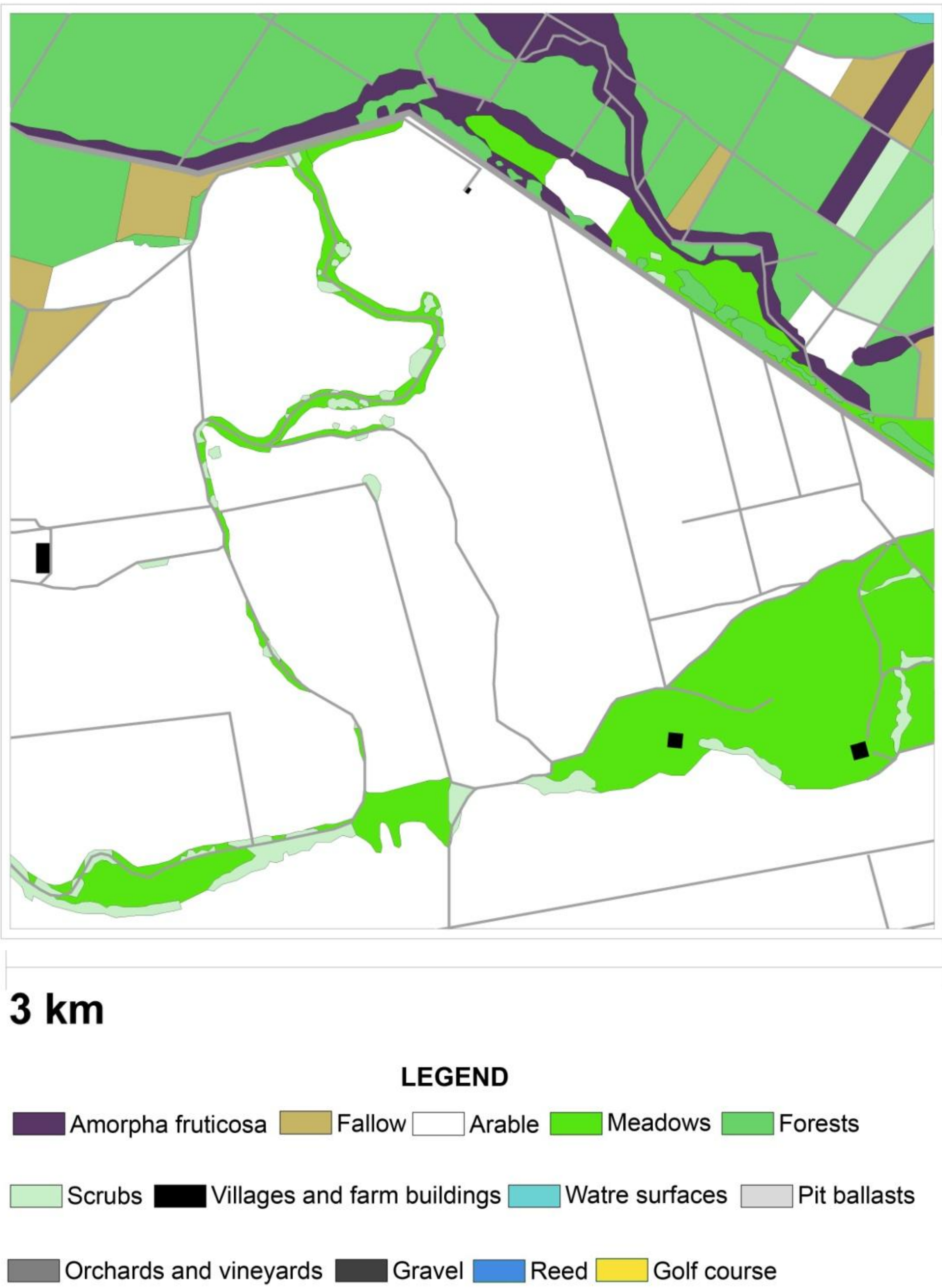


Figure 8. Land-use categories – Felnac.

Figure 9. Land-use categories - Vladimirescu.

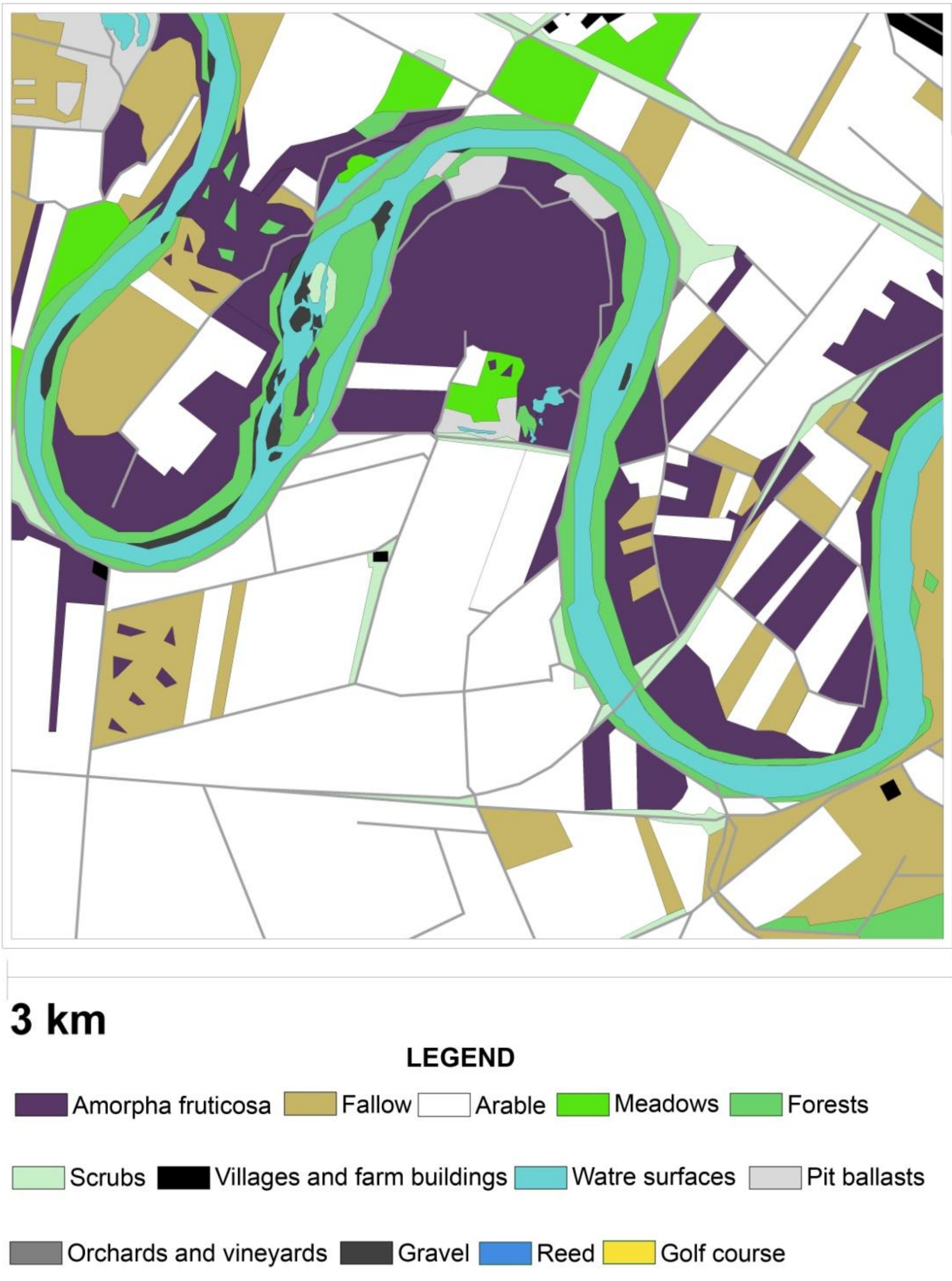


Figure 10. Land-use categories – Păuliș.

Figure 11. Pasture invaded by *Amorpha fruticosa* (at Păuliș).

Figure 12. Abandoned plum orchard (Păuliș)

Figure 13. Coppiced willows – remnants of traditional practices (at Igriș)

Figure 14. Lipova (Hoffmann, 2012).

Figure 15. Frumuseni (Hoffmann, 2012).

Figure 16. Felnac (Hoffmann, 2012).

Figure 17. Igris-island (Hoffmann, 2012).

Figure 18. *Oedaleus decorus* (Germar, 1826) ♀ (Hoffmann, 2012).

Figure 19. *Odontopodism acuminata* Kis, 1962 ♂ (Hoffmann, 2012).

Figure 20. Road in the Ceala Forest near Arad used by *Odontopodisma acuminata* taking sunbath during fall (see Figure 13) (Hoffmann, 2012).

Figure 21. *Odontopodisma acuminata* Kis, 1962 ♀ rund over by car (Hoffmann, 2012).