Natura Somogyiensis	12	17-29	Kaposvár, 2008

Vegetation of Külső-Somogy in Hungary II Regional diversity and pattern of non-woody habitats at landscape scale

[1]Salamon-Albert Éva & [2]Horváth Ferenc

[1]University of Pécs, Biological Institute, Department of Systematic and Ecological Botany
H-7624 Pécs, Ifjúság útja 6., e-mail: albert@gamma.ttk.pte.hu
[2]Institute of Ecology and Botany of the Hungarian Academy of Sciences
H-2163 Vácrátót, Alkotmány utca 4., e-mail: feri@botanika.hu

Salamon-Albert É. & Horváth F.: *Vegetation of Külső-Somogy in Hungary II Regional diversity and pattern of non-woody habitats at landscape scale.*

Abstract: In this study occurrence, proportion and landscape pattern of grasslands and wastelands are analysed in Külső-Somogy based on MÉTA method at landscape scale. The relative importance of these habitat types represent more than the half of the total number of non-woody habitats listed for Hungary. Wastelands (62%) and disturbed grasslands (54%) have relatively the greatest area in this region, where uncharacteristic dry or semi-dry grasslands and tall herb communities dominate. Semi-natural dry and semi-dry grassland habitat types are in subordinated position in the southern and eastern parts of the region, especially with habitats of E-group, H-group or uncharacteristic herb communities (OC). As semi-natural non-woody wet grasslands types habitats of B-group are the relatively most frequent with eu- and mesotrophic reed and Typha beds, non-tussock beds of large sedges and mosaics of marsh communities of channels, ditches and artificial lakes. In landscape elements which are poor in grasslands uncharacteristic wet or dry grass habitats (O-group) are significant. The north-western parts of Külső-Somogy near Lake Balaton are strongly endangered by the reduction or lack of semi-natural grasslands. Regional land and grassland management ought to promote functioning of grassland regeneration processes.

Keywords: GIS database, MÉTA method, habitat patches, grasslands, landscape ecology

Introduction

Külső-Somogy is a characteristic hilly landscape with semi-natural woodlands and grasses in the middle of Transdanubia belonging to Kaposense and Somogyicum phytogeographical regions. This landscape is the least revealed and documented area in Transdanubia according to Hungarian flora and vegetation. Published botanical data of species and (semi-)natural vegetation stands are sporadic in the last decades (e.g. Horvát 1943, Kevey 1988, 1989, 1993, 1995, 2001). Reference points for the southern and western zones of Külső-Somogy region are basic or correspondent vegetation descriptions and analyses of the sorrounding areas (e.g. Zselic, Belső-Somogy e.g. Borhidi 1984, Juhász 2006). Results of complex botanical mapping and research started in the last decade (Bartha et al 2002). It would be presented as the reference verifying and finding new occurrences of vegetation types on one hand or as corresponding

analyses of existing semi-natural vegetation types as habitats on the other hand (SALAMON-ALBERT and HORVÁTH 2008). In our work, as the second study of a landscape series, we present and evaluate characteristic non-woody habitat types, groups and connected wastelands, their patches with areal data and spatial patterns in Külső-Somogy region. Analyses at landscape scale are implemented with MÉTA method and mapping (GIS database for Hungarian Habitats, Magyarországi Élőhelyek Térképi Adatbázisa, HORVÁTH et al 2008) based on a landscape ecology oriented protocol fitted to the whole territory of Hungary (BÖLÖNI et al 2003, 2007, MOLNÁR et al 2007).

Material and method

Region of Külső-Somogy (Fig. 1) is located south from Lake Balaton, bordered by Kapos River, Sió Channel and Pogány Valley in the territory of Somogy and Tolna counties. Its total extension is 3000 km^2, mean altitude is 186 m a.s.l., 200-300 m a.s.l. especially on the ridges of the hills. The bedrock is limestone covered by loess on the surfaces of the crests trended to north-south direction. In the western part of the area (West Külső-Somogy) the ridges of the hills are exposed to erosion and derasion. The eastern part of the region (East Külső-Somogy) is dissected with valleys parallel to Lake Balaton and the south part of it (South Külső-Somogy) is a horizontal loess plateau with moderate slope to Kapos River. Running through the main north-south valleys, Jaba Stream and Koppány Stream flow from west to east. According to the data of regional meteorological stations (Szabadhídvég, Kaposvár) the mean temperature is -2,5 °C in January, +20,5 °C in July, the sum of precipitation is 650 mm per year. There are some cities and

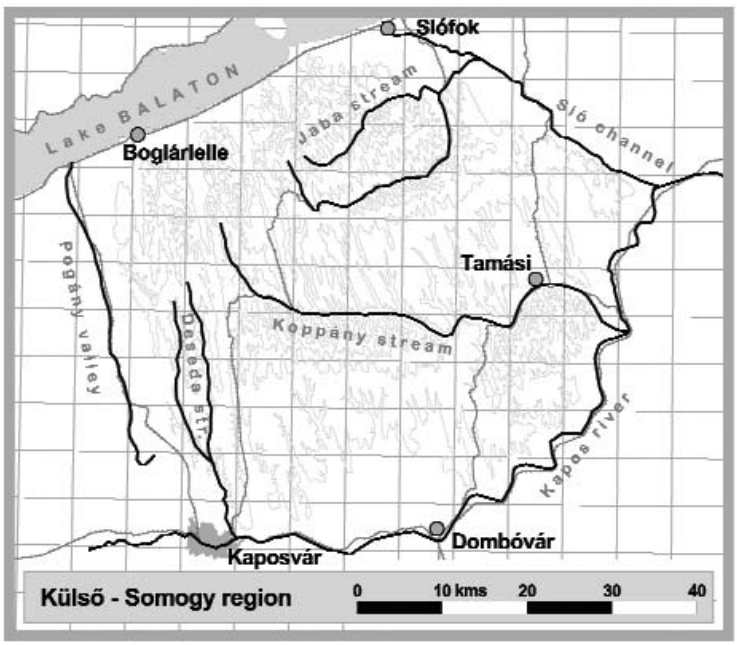

Fig. 1: Territory, settlements, geographical and hydrological elements of Külső-Somogy

many small villages, so Külső-Somogy is not a frequent region from an economical point of view (MAROSI and SOMOGYI 1990). On the basis of drought-sensitivity index several vegetation types existing in the south-eastern part of the region could be endangered in climatically dry periods (NÉMETH et al 2004).

Grasslands of Külső-Somogy are diverse from their phenological and original point of view. In the sandy depressions and valleys of the rivers many of wet grasses could exist with their typical or transitional stands caused by decissation or human disturbance. Semi-natural grasslands, as the most valuable objects for conservation, represent variability of non-woody vegetation in the region. One of them is the Látrány Nature Conservation Area which is totally explored in botanical and zoological respect (ÁBRAHÁM 2003, LÁJER 2003). In some 225 ha marshes, flushes, transition mires, raised bogs, eu- and mesotrophic meadows and tall herb communities are dominating with stands of *Phragmitetum communis* Soó 1927 em. Schmale 1939, *Typhetum latifoliae* Lang 1973, *Typhetum angustifoliae* (Soó 1927) Pignatti 1953, *Cladietum marisci* Zobr. 1935, *Bolboschoenetum maritimi* Eggler 1933, *Caricetum elatae* Koch 1926, *Caricetum acutiformis* Eggler 1933, *Caricetum ripariae* Soó 1928, *Carici gracilis-Phalaridetum* /Kovács et Máthé 1967/ Soó 1971 corr. Borhidi 1996, *Juncetum subnodulosi* Koch 1926, *Junco obtusiflorae-Schoenetum nigricantis* Allorge 1921, *Eleocharidi uniglumi-Eriophoretum angustifolii* Lájer 1998, *Cirsietum rivularis* Nowinski 1928, *Succiso-Molinietum hungaricae* /Komlódi 1958/ Soó 1969, *Agrostio-Deschampsietum caespitosae* /Soó 1928/ Újvárosi 1947. In some semi-natural stands closed steppes on loess or sand (e.g. *Astragalo austriacae-Festucetum sulcatae* Soó 1957) occur. The other nature conservation area connected to Natura 2000 network of Hungary is the Koppány meadows. Among patches of woodlands eu- and mesotrophic reed, *Glyceria* and *Typha* beds, tussock and non-tussock beds of large sedges, mesotrophic meadows and uncharacteristic meadows with tall herb communities occur (BAUER and MÁRKUS 2007). Near Lake Balaton at the Northern margin of Külső-Somogy mire vegetation complex of Nagyberek is preserved (LÁJER 2007). Some additional communities are *Berulo erectae-Menthetum aquaticae* Kovács ex Borhidi 2001, *Calamagrostetum canescentis* Simon 1960, *Galio palustris-Caricetum ripariae* Bal-Tul. et al 1993, *Oenantho aquaticae-Rorippetum amphibiae* Lohmeyer 1950, *Astero pannonici-Schoenetum nigricantis* Lájer 2006.

On the ridges covered by loess closed, dry grasslands occur as *Salvio nemorosae-Festucetum rupicolae* Zólyomi ex Soó 1964. Semi-natural stands of them are sustainable managed by traditional grazing as pastures. Lack of this management uncharacteristic grasslands e.g. *Cynodonti-Poetum angustifoliae* Rapaics ex Soó 1957 or shrublands are arising (HORVÁT 1943, BORHIDI 2006). Dry grass communities in Külső-Somogy are sporadic and rich of protected vascular plant species. Along the Jaba valley (SZABÓ et al 2006) besides of eu- and mesotrophic reed beds, sedge communities and wet Molinia or mesotrophic meadows some stands of xeromesophylous steppe grasslands are occuring especially *Salvio-Festucetum rupicolae* with the largest extension. Protected plant species are *Adonis vernalis, Cirsium boujartii, C. furiens, Hippocrepis emerus, Inula helenium, Orchis ustulata, O. militaris, O. purpurea, Scabiosa canescens, Sonchus palustris, Spiranthes spiralis, Stipa pennata, Taraxacum serotinum*. Ploughed fields dealed with land use dynamics have become secondary grasses with several dominant species as *Bothriochloa ischaemum, Bromus erectus, Brachypodium pinnatum* and *Festuca rupicola* types. Identification of these types for MÉTA categories can be done by their current dynamic status and naturalness. Determination of the ancient vegetation type is difficult because of habitat changes in time and disturbance in space, but wet or dry characteristics can be estimate by their floristic composition.

Submediterranean dry and mesophilous grasslands (*Brometalia erecti* Br-Bl. 1936) have some patches in the Eastern part of the region connected to the surfaces covered by sedimented sand or loess. Their compositional and structural features mainly depend on grazing regime resulted in spreading some dominant grass species (*Bromus erectus, Brachypodium pinnatum, Briza media, Festuca rupicola*) (SZABÓ et al 2006).

Diversity of various arable weed communities would be mentioned among non-woody vegetation types, but they don't afford to MÉTA method and protocol.

Data collection

Field data collection was executed between 2003-2006 as a grid-based, satellite-image supported (SPOT4), multi-attributed, large-scale mapping method so called MÉTA (Molnár et al 2007). It is based on Á-NÉR2003 mapping and habitat guide (MOLNÁR 2003, BÖLÖNI et al 2003). The goals of the research were: 1) to collect data of all natural and semi-natural habitat types in Hungary 2) to create maps of semi-natural vegetation patches and 3) to evaluate landscapes with vegetation types and their attributes as well, 4) to evaluate territorial extension and spatial distribution of the wastelands that could be the basis of grassland regeneration. The database is constructed on a hexagon grid system of 35 hectars covering the whole area of the country as the primary mapping units (HORVÁTH et al 2008). Approximately 100 hexagons are associated into a quadrat at landscape scale as a secondary mapping unit. In hexagons main existing habitat types, their roughly estimated areas and several vegetation attributes are listed (e.g. naturalness, neighbourhood, land use). This multi-attributed database is suitable to determine natural-based habitat quality, to estimate the relations of the wastelands in the Hungarian landscape and to compose the prognosis of future changes for vegetation and landscape. For more details see MOLNÁR et al (2007).

Data analysis

In our work we present landscape characteristics and habitat types of non-woody habitats in Külső-Somogy region. On the basis of MÉTA method a non-statistical quantitative analysis and evaluation was carried out on one hand, spatial thematic maps were constructed for displaying the actual semi-natural grasslands and wastelands and their spatial patterns at broad (landscape) scale on the other. Occurrence and relative areal proportion (ha) of non-woody habitat types and habitat groups were calculated and compared with each other. Habitat diversity was defined as the number of habitats or the occurrence of their landscape patches. Most important non-woody habitat types, habitat groups and associated habitat groups were displayed on GIS thematic maps with appropriate additional layers (e.g. settlements, hydrological and geographical elements) using ESRI ArcView 3.3 software from valid hexagons of 95 quadrats. Habitat types in hexagons of 6 quadrats were estimated by the aerial photo owing to missing data.

Basic non-woody habitat types and their abbreviations: A1 - Standing water communities with Trapa, Lemna, Salvinia and Ceratophyllum, A23 - Euhydrophyte communities with Nymphaea, Nuphar, Utricularia and Stratiotes, A3a - Slowly running water communities with Potamogeton and Nymphoides, B1a - Eu- and mesotrophic reed and Typha beds, B1b - Oligotrophic reed and Typha beds of fens, floating fens, B2 - Glyceria, Sparganium and Schoenoplectus beds, B3 - Water-fringing helophyte beds with Butomus, Eleocharis and Alisma, B4 - Tussock sedge communities, B5 - Non-tussock beds of large sedges, B6 - Salt marshes, BA - Mosaic/Zonation of marsh communities of channels, ditches and artificial lakes, C1 - Soft and hard water flushes, D2 - Molinia meadows, D34 - Mesotrophic meadows, D5 - Water-fringing and fen tall herb communities, D6 - Tall herb communities of floodplans and marshes, E1 -

Arrhenatherum hay meadows, E2 - Festuca rubra hay meadows and related communities, H4 - Bromus erectus-Brachypodium pinnatum xero-mesophilous grasslands, dry tall herb communities and forest steppe meadows, H5a - Closed steppes on loess, clay, tufa, H5b - Closed sand steppes, I2 - Semi-desert vegetation on loess cliffs, OA - Uncharacteristic wetlands, OB - Uncharacteristic meadows and tall herb communities, OC - Uncharacteristic dry/semi-dry grasslands and tall herb communities in accordance with MÉTA guide (Bölöni et al 2007). Habitat groups and their abbreviations are: A-group (Euhydrophyte habitats): A1 + A23 + A3a, B-group (Marshes): B1a + B1b + B2 + B3 + B4 + B5 + B6 + BA, C-group (Flushes, transition mires and raised bogs): C1, D-group (Rich fens, eu- and mesotrophic meadows and tall herb communities): D2 + D34 + D5 + D6, E-group (Colline and montane hay meadows, acid grasslands and heaths): E1 + E2, H-group (Dry and semi-dry closed grasslands): H4 + H5a + H5b, I-group (Non-ruderal pioneer habitats): I2, O-group (Other non-woody habitats): OA + OB + OC. Finally we introduced a new habitat variable as 'associated habitat group' forming 'wet grasslands' with A+B+C+D+OA+OB, 'dry and semi-dry grasslands' with E+H+I+OC habitats, 'semi-natural grasslands' with A+B+C+D+E+H+I habitats, 'disturbed grasslands' with O habitats and the wastelands.

Taxonomical nomenclature is by SIMON (2000), syntaxonomical nomenclature is by BORHIDI (2003), habitat nomenclature is by BÖLÖNI et al (2007).

Results

Habitat types and diversity

Altogether 48 habitat types are identified in Külső-Somogy region, they represent more than half of the total number of habitats listed for Hungary (56%). Among them 25 types are attached to the stands of grasslands, so the relative importance of non-woody habitat types is quite high (52.1%). Summarized area of non-woody habitat types compared to the geographical area of the region is 3.4%. Participation of grasslands in sum of vegetation cover is 23.2%, including semi-natural and disturbed grass habitats as well. Total territorial ratio of the wastelands is 2.1% (6100 ha) to the whole territory of the region, 14.4% to the total vegetation cover and 62.1% to the extension of grasslands.

The total area of non-woody semi-natural habitats is 9800 hectares, including wastelands (6100 ha) that are more than the half part of the sum (62.1%). The greater part of non-woody vegetation stands represents disturbed grass habitat types attached to O habitat group (54%) and wet habitat types (55%). Other non-woody (O) habitat group is divided into three habitat types: OA and OB represent wet grasses and tall herb communities connected to them, OC habitat types contains dry and semi-dry grasslands. Between them dry and semi-dry grassland habitat type (OC) dominates (33%). Local environmental influences has a great importance for determining occurrence of grass habitats controlled by the surplus or lack of water. This associated habitat group forming with A, B, C, D and I habitat groups is in subordinate position (33.6%). Non-woody semi natural habitats controlled by climatic conditions (E+H habitat groups) have the smallest proportion among associated habitat groups (12.2%). Territorial extension and proportion of wastelands are fairly high (62.1%), containing secondary non-woody habitats taking grassland regeneration process (Table 1).

Analysing non-woody habitat types and groups compared to the total vegetation area (Fig. 2) uncharacteristic grasslands and tall herb communities representing other non-woody habitats have the greatest areal proportion (O habitat group: 5318 ha=12.6%). In

Table 1: Area (ha) and relative proportion (%) of non-woody habitat types in Külső-Somogy.

Associated habitat type	Habitat group(s) or type(s)	Area (ha)	Proportion (%)
Sum of grasslands	A+B+C+D+E+H+I+O	9800	100
Semi-natural grasslands	A+B+C+D+E+H+I	4500	45,8
Disturbed grasslands	O	5300	54
Wet grasslands	A+B+C+D+OA+OB	5350	54,5
Dry and semi-dry grasslands	E+H+I+OC	4470	45,5
Wastelands*	- - -	6100	62,1

*without habitat specification

this habitat group uncharacteristic dry/semi-dry grasslands with tall herb communities (OC: 3262 ha=7.7%) and uncharacteristic meadows with tall herb communities (OB: 1903 ha=4.5%) occur with the largest percentage. Ratio of uncharacteristic wetland stands are scattered in the land (OA: 153 ha=0.4%). Marshes have the second greater proportion (B habitat group: 2475 ha=5.8%), containing several habitat types with native fens, beds, tusssock and non-tussock communities as well. Among them eu- and mesotrophic reed and Typha beds have the greatest ratio (B1a: 1747 ha=4.1%), non-tussock beds of large sedges have the second largest relative proportion (B5: 431 ha=1.0%). Scattered oligotrophic reed and Typha beds of fens and floating fens (B1b: 0.35 ha), (Glyceria, Sparganium and Schoenoplectus beds (B2: 1.8 ha), water-fringing helophyte beds with Butomus, Eleocharis and Alisma (B3: 0.4 ha), tussock sedge communities (B4: 0.35 ha) and salt marshes (B6: 2.5 ha) have insignificant contribution to B habitat group. A special vegation complex as mosaic or zonation of marsh communities of channels, ditches and artificial lakes are frequent with its third largest proportion in the group (BA: 291 ha=0.7%). The third important habitat group is rich fens, eu- and mesotroph-

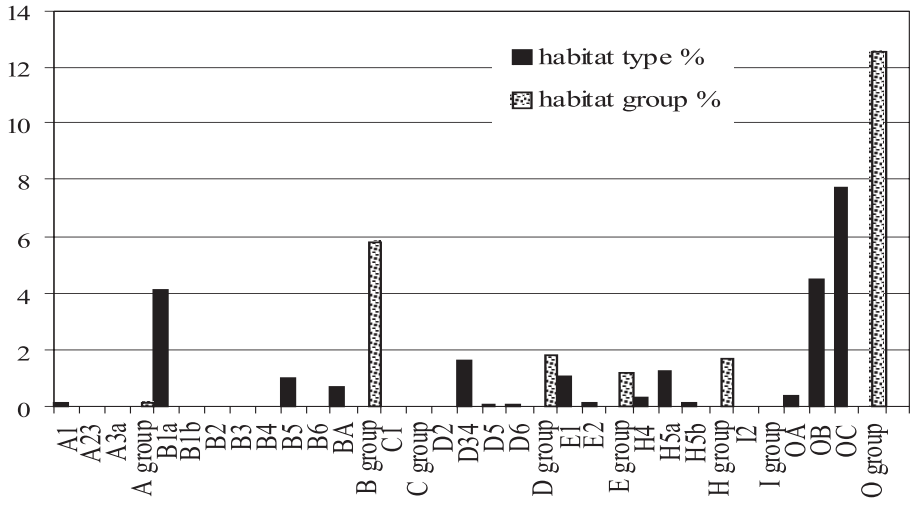

Fig. 2: Territorial proportion of non-woody habitat types and habitat groups in sum of vegetation cover in Külső-Somogy region

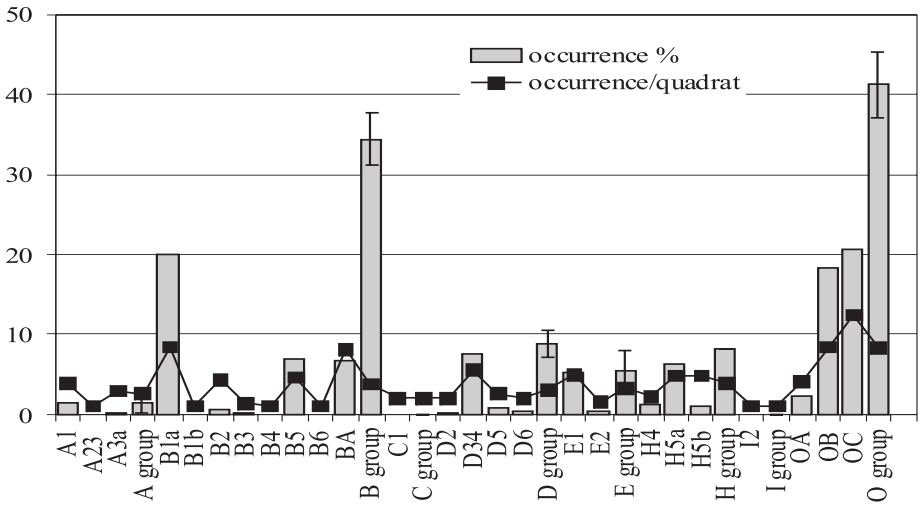

Fig. 3: Patches distribution of non-woody habitat types and habitat groups in Külső-Somogy. Occurrence: percentage of cases in 95 quadrats, occurrence/quadrat: mean number of patches per valid quadrats with standard deviation in habitat groups

ic meadows and tall herb communities (D group: 748 ha=1.8%). In this habitat group mesotrophic meadows are the most prominent habitat type occuring with the largest relative percentage (D34: 697 ha=1.6%). Molinia meadows (D2: 4.6 ha), water-fringing and fen tall herb communities (D5: 22 ha) and tall herb communities of floodplans and marshes (D6: 23.8 ha) are sporadic and have a small areal contribution. The fourth habitat group is the 'dry and semi-dry closed grasslands' (H group: 716 ha=1.7%) containing several types of grasses adapted to climatic conditions. The largest habitat type in this group is 'closed steppes on loess, clay or tufa' (H5a: 515 ha=1.2%) existing in the place of woodland cuttings or old wastelands. 'Bromus erectus-Brachypodium pinnatum xero-mesophilous grasslands, dry tall herb communities, forest steppe meadows' (H4: 127 ha) and 'closed sand steppes' (H5b: 73.9 ha) are more insignificant in this habitat group. Habitats controlled by permanent water table are in the group of 'euhydrophyte habitats' (A group: 73.9 ha=0,2%) with the most important habitat type 'standing water communities with Trapa, Lemna, Salvinia and Ceratophyllum' (A1: 69 ha=0.16%). 'Colline and montane hay meadows, acid grasslands and heaths' existing in the place of woodland cuttings form a characteristic group with small areal proportion (E group: 488 ha=1.2%) dominated by 'Arrhenatherum hay meadows' (E1: 452 ha=1.1%). Habitat types of 'soft and hard water flushes' (C1: 0.06 ha) and 'semi-desert vegetation on loess cliffs' (I2: 0.06 ha) are attaching to habitat list as community fragments with small extensions.

Roughly estimated area of habitat types or groups and occurrences of them could give information about vegetation patch statistics for 95 quadrats and average occurence per quadrat (Fig. 3). In the database 2295 occurrences were recorded for 25 grassland habitat types existing at least with one case in every valid quadrat. In the first series we could analyse the occurrence percentage for the non-woody habitats and groups. The most distinct and related vegetation patches are revealed in case of O habitat group (1233 cases, 41.2%) especially. The number of occurrences and their proportion decreases in order to OC (622 cases, 20.1%), OB (545 cases, 18.2%) and OA (66 cases, 2.2%). The second

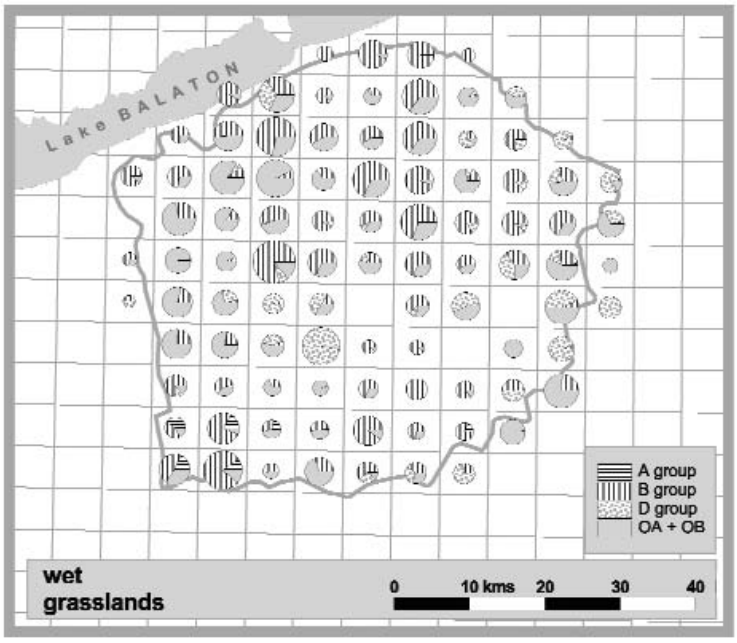

Fig. 4: Territorial extension (circle diameter) and proportion (circle segment) of main associated habitat groups of wet grasslands in Külső-Somogy

large ocurrence and percentage of habitat patches have marshes (1030 cases, 34.4%) with eu- and mesotrophic reed and Typha beds which have the greatest occurrence number and proportion (B1a, 598 cases, 20%). Case statistics of D, E and H habitat groups are similar to each other in respects for relative occurrence and average case per quadrat (D group: 265 cases=8.9%, E group: 165 case=5.5%, H group: 250 cases=8.4%). Occurrence and number of average case of euhydrophyte habitats are low (A group: 48 cases=1.6%), by characteristics of flushes, transition mires and raised bogs and non-ruderal pioneer habitats (C and I groups: 2-2 cases) are sporadic or not remarkable in the region. In the second series average number of patches per quadrat for valid stands could be compared among habitat types and groups. Among habitat groups O have the largest occurrence number per quadrat (O group: 41.2%, 8.3 case per quadrat), I habitat type have the lowest ones (I2: 2 case per quadrat). In the order of habitat frequencies (case per valid quadrats) the most frequent habitat types are OC (12.5), B1a and OB (8.4), BA (8.1), D34 (5.45), E1 (5.1), H5a and H4 (4.8).

Spatial patterns at landscape scale

In order to display occurrence and spatial distribution of habitat types and habitat groups, thematic maps were constructed. These maps emphasize spatial variation of one or a small number of series of target attributes. In the first step quality and territorial extension of habitat types and groups were calculated on a previously standardized consensus scale (<2 ha, 2-15 ha, 15-200 ha, 200-500 ha, >500 ha). Data calculation was based on valid hexagons only, spatial habitat maps were displayed at quadrat level referred to a GIS database. According to the map of significant associated habitat groups were constructed which could visualize the variability of non-woody habitat types and groups classed among: 1) wet grasslands, 2) dry and semi-dry grasslands, 3) wastelands.

In the first map the three main associated habitat groups and uncharacteristic herb communities of wet grasslands are displayed as the most important non-woody habitats (Fig. 4). Regional distribution of wet grasslands is nearly continuous with some exception. Euhydrophyte habitats (A-group), marshes (B-group) or other non-woody wet habitats (OA and OB of O-group) are dominating nearly in case of the whole territory of Külső-Somogy. Habitat participation of 'rich fens, eu- and mesotrophic meadows and tall herb communities' (D-group) is locally significant only in the middle and the Eastern part of the region. Presence of 'uncharacteristic non-woody habitat types' (OA and OB) is constant, their territorial proportion is relatively high in case of large, medium and small areal grassland extensions as well in the Northern and Western parts. In the Southern and Eastern parts of the region semi-natural grassland types - habitats of A-, B- and D-groups - are dominant.

By further detailed analysis of wet grasslands the marshes (B1a + B1b + B2 + B3 + B4 + B5 + B6 + BA habitat types) have the largest proportion in this associated habitat group (Fig. 5). Great extension and ration of eu- and mesotrophic reed and Typha beds' (B1a) is generally characteristic in grassland-rich land elements in the Northern and Western parts as well. Opposite to previous 'mosaic of marsh communities of channels, ditches and artificial lakes' (BA) is significant in the quadrats along the Kapos River in the South. Habitat of 'non-tussock beds of large sedges' (B5) is manifested by heterogenous patches in any part of the region. Other further habitat types connected to B-group (B1b, B2, B3, B4, B6) have no significant contribution to spatial pattern of the marshes.

As for special and relatively rare grassland habitat types and groups of 'dry and semi-dry grasslands' Külső-Somogy region is not too diverse according to them (Fig. 6). Pattern of these non-woody habitat types concentrates to the West-northern and South-

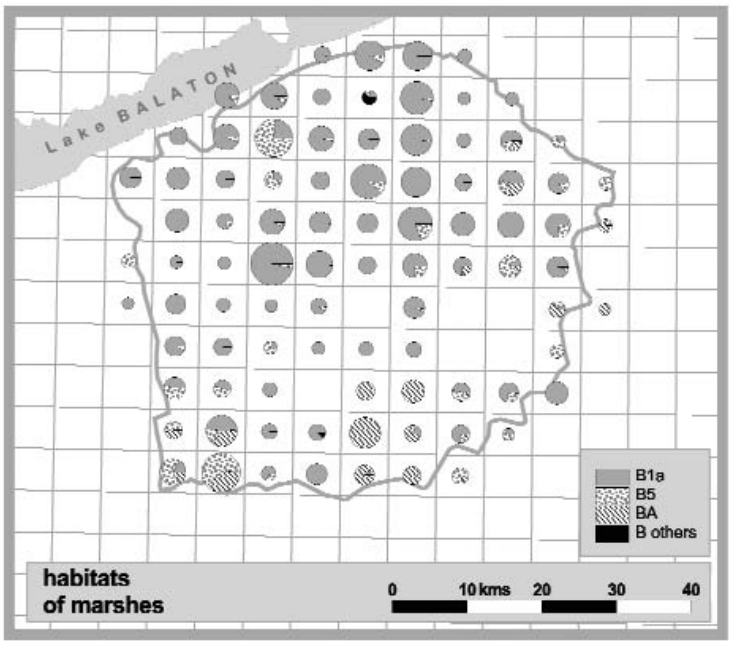

Fig. 5: Territorial extension (circle diameter) and proportion (circle segment) of significant habitats of marshes from B-group in Külső-Somogy.

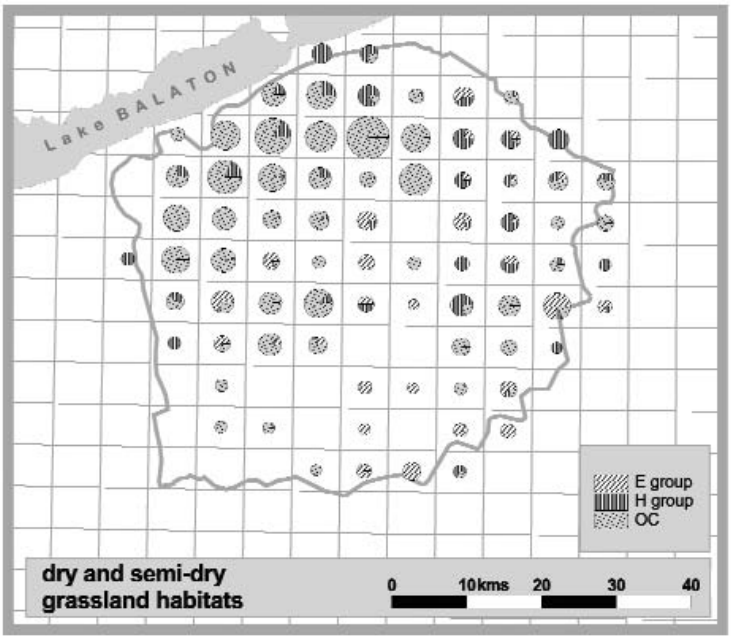

Fig. 6: Territorial extension (circle diameter) and proportion (circle segment) of dry and semi-dry grassland habitats in Külső-Somogy

eastern parts of the region. The major component of them is 'uncharacteristic dry or semi-dry grasslands and tall herb communities' (OC). Quadrats which have medium or large cover of these types of grasslands are less diverse in habitats, quadrats which include small summarized territories of this habitat type are more diverse with 2-3 habitat types per quadrat.

In the spatial map of 'xero-mesophilous closed grasslands' existing under climatic influence are clearly distinguished by three main habitat types (H4, H5a, H5b) (Fig. 7). Landscape pattern of 'Bromus erectus-Brachypodium pinnatum xero-mesophilous grasslands' (H4) and 'closed steppes on loess, clay, tufa' (H5a) are distinct and spatially composite. Occurrence of 'closed sand steppes' (H5b) could be observed only in a small territory of the region in the valid quadrats exclusively. Habitats of 'xero-mesophilous grasslands' (H-group) are completely absent in the South part of Külső-Somogy region.

Discussion

In our study we have discussed the areal proportion, distribution and regional spatial patterns of non-woody habitat types at landscape scale in Külső-Somogy. Analysing regional extension data, more than half of the territory of woodlands is covered by disturbed non-woody vegetation, mainly by the wet habitat types. Semi-natural dry and semi-dry grasslands have the second major areal proportion in the region, they are in subordinated position principally in the central-south and eastern parts. Several types of wet grasslands (e.g. A-group, B-group, D-group, O-group) generally occure in the

region with the exception of the south-eastern parts. By studying spatial attributes it is established that quadrats with larger summarized territory of grasslands have a larger proportion of uncharacteristic non-woody habitat types opposite to semi-natural ones. Habitat diversity is a little bit bigger in the case of wet grasses than dry and semi-dry grassland habitat types and groups at landscape scale.

The actual hydrological status could primarily and essentially determine the occurrence of non-woody habitat types or the distribution of patches. Outside parts along the Kapos River are relatively poor in any kind of grasslands, especially in xero-mesophylous closed semi-natural ones. Settlements and land use practices of Külső-Somogy seem to be the hampering or endangering factors for grassland existence, regeneration or spreading. After all, we could presume that spatial patterns of non-woody habitat types are strongly influenced by natural and human impact as well.

Acknowledgements

Data for the analyses were delivered from MÉTA workgroup, Institute of Ecology and Botany of the Hungarian Academy of Sciences (Vácrátót, Hungary). The project was financed by the grant of OM-NKFP/2002: "Magyarország természetes növényzeti örökségének felmérése és összehasonlító értékelése". Further participating botanists are Bódis J., Botta-Dukát Z., Csiky J., Dávid J., Friedrich Á., Horváth A., Szalóky I., Juhász M., Kádár G., Király G., Mányoki G., Ortmann-Ajkai A., Pándi I., Pfeiffer N., Szabó A., Varga A. and Zsidákovits J. contributed to field data collection.

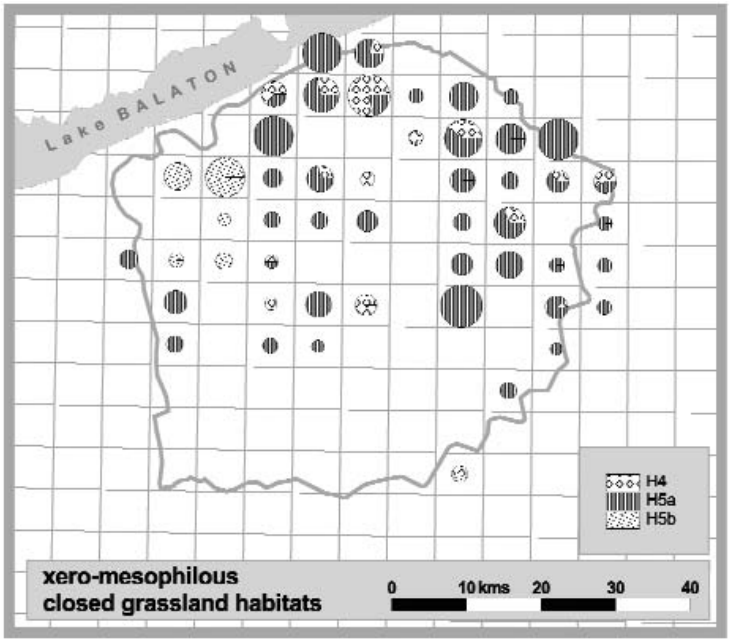

Fig. 7: Territorial extension (circle diameter) and proportion (circle segment) of xero-mesophilous closed grassland habitat types in Külső-Somogy

References

ÁBRAHÁM, L. 2003: A Látrányi Puszta Természetvédelmi Terület általános környezeti jellemzése és kutatása. - Natura Somogyiensis 5: 7-12.

BARTHA D., KIRÁLY G. and MOLNÁR ZS. 2002: Magyarország természetes növényzeti örökségének felmérése és összehasonlító értékelése. - In: SALAMON-ALBERT É. (ed.): Magyar botanikai kutatások az ezredfordulón. PTE Növénytani Tanszék, Pécs, pp. 309-342.

BAUER N., MÁRKUS A. 2007. A Törökkoppányi erdők és a Koppány-menti rétek Natura 2000 területeinek botanikai értékei. - Somogyi Múzeumok Közleményei 18: 1-16.

BORHIDI A. 2003: Magyarország növénytársulásai. - Akadémiai Kiadó, Budapest, p. 610.

BORHIDI A. 2006: Dél-Dunántúl, Külső-Somogy. - In: FEKETE G. and VARGA Z. (eds): Magyarország tájainak növényzete és állatvilága. - Magyarország az ezredfordulón, stratégiai tanulmányok a Magyar Tudományos Akadémián, MTA Társadalomkutató Központ, Budapest, pp. 386-387. ISBN 963-229-735-0

BÖLÖNI J., KUN A. and MOLNÁR ZS. 2003: Élőhelyismereti útmutató 1.0. "Magyarország növényzeti örökségének felmérése és összehasonlító értékelése" Adatminőség-ellenőrzési Munkacsoport. MTA ÖBKI Vácrátót, pp. 1-213.

BÖLÖNI, J., MOLNÁR ZS., ILLYÉS E. and KUN A. 2007: A new habitat classification and manual for standardized habitat mapping. - Annali di Botanica (nuova serie) 7: 55-76.

HORVÁT A. O. 1943: Külsősomogy és környékének növényzete. - Borbásia 6: 1-70.

HORVÁTH F., MOLNÁR ZS., BÖLÖNI J., PATAKI ZS., POLGÁR L., RÉVÉSZ A., KRASSER D. and ILLYÉS E. 2008: Fact sheet of the MÉTA Database 1.2. - Acta Botanica Hungarica 50. Suppl. (in press)

JUHÁSZ M. 2006: A Barcsi Borókás vegetációja és természetes erdőtársulásainak fitocönológiai elemzése. - PhD értekezés, Pécs, pp. 96.

KEVEY B. 1988: Adatok Magyarország flórájának és vegetációjának ismeretéhez IV. - Botanikai Közlemények 74-75: 93-100.

KEVEY B. 1989: Adatok Magyarország flórájának és vegetációjának ismeretéhez V. - Botanikai Közlemények 76: 83-96.

KEVEY B. 1993: Adatok Magyarország flórájának és vegetációjának ismeretéhez VI. - Botanikai Közlemények 80: 53-60.

KEVEY B. 1995: Adatok Magyarország flórájának és vegetációjának ismeretéhez VII. - Botanikai Közlemények 82: 45-53.

KEVEY B. 2001: 1989: Adatok Magyarország flórájának és vegetációjának ismeretéhez VIII. - Botanikai Közlemények 88: 95-105.

LÁJER K. 2003. A Látrányi puszta Természetvédelmi Terület növényzetéről. On the vegetation of the Látrányi Puszta Nature Conservation Area. - Natura Somogyiensis 5.: 13-28.

LÁJER K. 2007. A Nagyberek flórájának és lápi-mocsári vegetációjának alapvonásai. The characteristic features of the flora and mire vegetation of "Nagyberek". - Natura Somogyiensis 10: 73-93.

MAROSI S. and SOMOGYI S. (eds) 1990: Magyarország kistájainak katasztere II. - MTA Földrajztudományi Kutató Intézet, Budapest, 479-513.

MOLNÁR ZS. (ed.) (2003): MÉTA módszertani és adatlapkitöltési útmutató (Guide on the methods of MÉTA and on the completion of the MÉTA datasheets). - MTA ÖBKI, Vácrátót.

MOLNÁR ZS., BARTHA S., SEREGÉLYES T., ILLYÉS E., BOTTA-DUKÁT Z., TÍMÁR G., HORVÁTH F., RÉVÉSZ A., KUN A., BÖLÖNI J., BÍRÓ M., BODONCZI L., DEÁK J. Á., FOGARASI P., HORVÁTH A., ISÉPY I., KARAS L., KECSKÉS F., MOLNÁR CS., ORTMANN-NÉ AJKAI A. and RÉV SZ. 2007: A grid-based, satellite-image suppported, multi-attributed vegetation mapping method (MÉTA). - Folia Geobotanica 42: 225-247.

NÉMETH Á., BELLA SZ. and SZALAI S. 2004: Aszályérzékenység vizsgálata térinformatikai eszközökkel. - http://www.otk.hu/cd03/1szek/Nemet-Bella-Szalai.htm

SALAMON-ALBERT É. and HORVÁTH F. 2008: Vegetation of Külső-Somogy in Hungary I. Regional diversity and pattern of woody habitats at landscape scale. - Natura Somogyiensis 12: 5-15.

SIMON T. 2000: A magyarországi edényes flóra határozója, harasztok virágos növények. - Tankönyvkiadó, Budapest, pp. 1-846.

SZABÓ I., KERCSMÁR V., SZŐNYI É. H. and NYÉKI E. L. 2006: Florisztikai és vegetáció tanulmány a Jaba völgyében (Külső-Somogy). Floristische und Vegetation Studien im Jaba-Thal (Ungarn, Somogy Komität). - Somogyi Múzeumok Közleményei, B Természettudomány 17: 69-82.

Külső-Somogy vegetációja II.
Fátlan élőhelyek diverzitása és tájmintázata

SALAMON-ALBERT ÉVA és HORVÁTH FERENC

A tanulmány Külső-Somogy fátlan élőhelytípusait és az ezekhez kapcsolódó parlagokat, azok területi előfordulását és tájmintázatát értékeli az országos MÉTA adatbázis alapján. A régióban a fátlan élőhelytípusok országos listájának több mint fele fordul elő. A tájban uralkodnak a különféle típusú zavart gyepek (O élőhely csoportok), legnagyobb relatív részesedéssel a száraz-félszáraz jellegtelen típusok szerepelnek. A természetközeli száraz gyepek a régió déli és keleti részein alárendelt pozícióban vannak az E és H élőhely csoportok illetve a jellegtelen száraz gyepek (OC) dominanciájával. A természetközeli nedves gyepek foltjai a B élőhely csoporthoz tartoznak, mint a vízparti növényzet nádasokkal és zsombékosokkal, a nem zsombékképző magassásosok és a csatornákat, tavakat kísérő nedves élőhelymozaikok. A gyepekben abszolút értékemben is szegény tájelemekben uralkodnak a jellegtelen száraz vagy nedves gyeptípusok. Külső-Somogy Balatonhoz közeli, észak-nyugati része különösen veszélyeztetett a természetközeli gyeptípusok alacsony aránya vagy hiánya miatt. Éppen ezért regionálisan támogatni kell azokat a helyzeteket, amelyek elősegíthetik a gyepek regenerációját.