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## VEGETATION-BASED LANDSCAPE REGIONS OF HUNGARY

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The first version of the map of the Hungarian vegetation-based landscape regions were prepared at the scale of 1 : 200,000 (1 km or higher resolution). The primary goal of the map was to provide an exact background for the presentation and evaluation of the data of the MÉTA database. Secondly, we intended to give an up-to-date and detailed vegetation-based division of Hungary with a comprehensive nomenclature of the regions. Regions were primar-

ily defined on the basis of their present zonal vegetation, or their dominant extrazonal or edaphic vegetation. Where this was not possible, abiotic factors that influence the potential vegetation, the flora were taken into consideration, thus, political and economical factors were ignored. All region borders were defined by local expert botanists, mainly based on their field knowledge. The map differs in many features from the currently used, country-wide, flora- or geography-based divisions in many features. We consider our map to be temporary (i.e. a work map), and we plan to refine and improve it after 5 years of testing.

Key words: botanical map, classifying by vegetation, Hungary, natural vegetation, phytogeography

## INTRODUCTION

The division of Hungary into landscape regions have already been prepared by many authors from different point of views (e.g. pedological, public service, ethnographical, silvicultural, see Pécsi 1989) and at different scales. Although, botanical divisions are also available, these are either confined to local areas (e.g. certain mountains) or based mainly on floristic data. For botanical studies, the most frequently used division is the inventory of the physical geographical microregions of Hungary (Keresztesi *et al.* 1989, Marosi and Somogyi 1990), because of its relatively high resolution and country-wide completeness. The silvicultural division of Hungary combines geographical (site-conditions), vegetational (forest-types) and forest management (borders of forestry districts) factors (Babos 1954), but more recently, a solely geography-based division was also prepared (Halász 2006). Regarding its methodology and results, this map is similar to the one presented in this paper. Zoogeographical maps were also drawn based mainly on geographical and botanical features beside the zoological ones (e.g. Soós 1934, Kolosváry 1936, Varga 1964, Mándy 1989).

Botanical division of Hungary into phytogeographical landscape units dates back to the end of the 19th century. The work of Borbás (1905), Simonkai (published by Tuzson 1910) and Tuzson (1911) should be mentioned. The first comprehensive map was prepared by Jávorka (1925) and Rapaics (1927), and this was modified and unified by Zólyomi (1951) and Soó (1941, 1960, 1961, 1964). Until now, most authors use the work of Soó (1964), or its later versions (e.g. Pócs 1981, Molnár 1999). Floristics always played a major role in Hungarian phytogeography, perhaps because of the influence of Rezső Soó and the special botanical characteristics of the Carpatho-Pannonian Region, thus the phytogeographical landscape divisions were all based on floristic data, and they divided the country into flora regions and flora subregions. On the other hand, many fine scale vegetation maps were merged by Zólyomi (1967, 1989)

into a map of the natural vegetation of Hungary. Since it was not amongst its goals, the map did not delimit vegetation regions, as did neither other large scale synthetic works (e.g. Niklfeld 1973, Isachenko and Lavrenko 1974, Michalko *et al.* 1987, Ivan *et al.* 1993, Bohn *et al.* 2000–2003). Flora- and vegetation-based delimitations could be combined by regarding vegetation zones as landscape regions (e.g. the beech zone or the *Quercus cerris* zone could form one region in the Északi-középhegység (Fekete 1998, Vojtkó *ex verb.*), but such a map has never been prepared. Few years ago, a work team of botanists led by Sándor Farkas attempted to refine the microregion borders of Marosi and Somogyi (1990) for the proper localisation and analysis of floristic data (Farkas 2001–2005). This map (the preparation has not finished yet) drove the attention of many botanists to the need of a new phytogeographical division, so it can be considered as the most important antecedent of the map presented here.

## METHODS

The resolution of the map was set partly arbitrary, since we planned to produce a map with approx. 100 regions. This is a scale between the physical geographical micro- and mesoregions (Marosi and Somogyi 1990). The borders were drawn with at least 1 km accuracy (scale *ca* 1 : 200,000). All regions were delimited based on its vegetation, we looked for repetitive vegetation complexes (zonal vegetation, or the dominant extrazonal and edaphic vegetation). Where no natural vegetation survived or recent fragments differ significantly from the natural vegetation (e.g. only water-fringing vegetation remained in a once wooded landscape), the potential vegetation was considered. Floristic composition and abiotic factors (e.g. geology, climate) were taken only secondarily into consideration. We did not consider economical (e.g. roads, canals) and political factors (e.g. state and county borders of Hungary) factors. This resulted in some small regions that cross the country border, and only small parts lie in Hungary (e.g. “Vendvidék” vegetation-based landscape region, “Maros-ártér” vegetation-based landscape region, “Érmellék” vegetation-based landscape region). The division of the whole Pannonicum into vegetation-based landscape regions remained a future task. Regions made up of two or more parts were only formed if it was absolutely necessary (e.g. the basalt inselbergs (“Szent György-hegy” and “Szigliget”) of “Balaton-felvidék” or the “Tihanyi-félsziget”).

All borders were defined by local expert botanists, mainly based on their field knowledge. Other background information was rarely used, so our map is not a database derived one. For the exact localisation of the borders, the following maps were used: topographical maps, altitudinal maps, satellite im-

ages, pedological maps (Agrotopo, Várallyay 1985, Szabó *et al.* 2005), and additionally, in certain cases, historical maps, climatic data and habitat data from the MÉTA database were also used. Some recently published maps and studies (Vojtkó 2001, Bodonczai 2005, Király *et al.* 2007, Deák 2008, Schmidt *et al.* 2008) were also used.

Since the map is a co-operational work of many botanists, certainly, it comes with heterogeneity. Albeit we tried to apply a uniform algorithm (at least at the physical geographical macroregion level), this could not be fully reached. We accept that there are only few sharp borders in nature so the region borders on the map – in most cases – in fact are transitional zones with variable width.

The borders of regions were often based on elevation above sea level (e.g. border between “Dráva-sík” and “Mecsek” mountains, or between “Magas-Máttra” and “Déli-Máttra”, or between “Hegyalja” and “Harangod és Hernádmagaspart”), or on a significant altitudinal lift (e.g. border between “Baranyai-dombság” and “Duna-völgy”; border between “Harangod és Hernádmagaspart” and “Sajó és Hernád völgye”). On the lowlands geomorphology of the floodplains were consequently used for delimiting the great river valleys (e.g. along the Tisza and Duna). Geological differences in the mountains (e.g. “Északi-Cserhát” and “Központi-Cserhát”, “Visegrádi-hegység” and “Pilis, Budai-hegység”) and soil pattern on the lowlands (e.g. “Észak-Nyírség” and “Dél-Nyírség”, “Felső-Bácska” and “Homokhátság”, “Mosoni-sík” and “Hanság”) also played an important role.

Many difficulties were faced during the delimitation of the regions. Firstly, the division of certain areas can be made in different ways, due partly to the different views of the local experts, partly to the characterless, secondary actual vegetation, and partly also to the wide continuous transitions. This is the case in the regions “Őrség” and “Vasi-, Zalai-hegyhát és Kemeneshát”. These regions could have been merged, but their size and the East–West gradient through them argued for separating them into two regions. The border of these regions, however, could have been drawn elsewhere, more to the East. In many cases the vegetation between two distinctive regions became as much degraded and characterless as we could attach this transitional land to either region. This is specifically true for lower hilly regions between mountains, where the above-mentioned phenomenon is strengthened by natural factors (e.g. rarity of extreme habitats, stronger influence of macroclimate). The attachment of small sized transitions to a certain region was the decision of the local experts (see e.g. the borders of “Karancs és Medves”). We endeavoured to avoid the use of river valleys as borders, since rivers rather connect landscapes than separate. So, their valleys were either separated as a distinct unit (e.g. “Rába-völgy”, “Tisza-völgy”, “Sajó- és Hernád-völgy”), or they were at-

tached to the neighbouring region (e.g. the “Zala-völgy” to the “Zalai-dombság” region; the “Sió-völgy” to the “Nyugat-Mezőföld”; the valleys of Zagyva and Tarna to the “Tápió-Sajó hordalékkúp síkság”). The delimitation was in many cases hampered by the complete lack of natural vegetation. The region borders in these cases were drawn with some inaccuracy and difficulty (e.g. “Maros-Körös köze” and the eastern part of the “Berettyó-Körös-vidék”). In many cases, we faced the problem of delimitation of areas where the region was characteristically different from its neighbours, but the size of the region was below the aimed scale. These areas were either treated as separate units (like the “Fertőmelléki-dombsor”, or “Velencei-hegység”), or they were by necessity attached to a neighbouring region (e.g. the “Vindornya” mire was attached to the “Balaton-vidék” region). In one case, again by necessity, several small sized, but quite different regions were grouped together to form a heterogeneous region, the “Észak-Mezőföld”.

The nomenclature of the vegetation-based landscape regions, whenever it was possible, followed the traditional nomenclature (e.g. “Ipoly-völgy” vegetation-based landscape region, “Vendvidék” vegetation-based landscape region, “Hanság” vegetation-based landscape region) or was derived from the traditional name (e.g. “Göcsej és Hetés” vegetation-based landscape region, “Észak-Nyírség”, “Sárvíz- és Sió-völgy”). However, in certain cases the region borders did not fit to any traditional regions, so we had to create new names (e.g. “Szegedi-sík” vegetation-based landscape region, “Maros-ártér” vegetation-based landscape region) with careful respect to the regulations of the Hungarian geographical literature (Kádár 1941). All disconnected parts of a multi-segmented region were separately named and coded (e.g. the three parts of “Alpokaljai hegyek” are “Soproni-hegység”, “Kőszegi-hegység” and “Vas-hegy”). There are three cases where only a very small part of a region lies in the territory of Hungary. We suggest evaluating these small regions as part of a neighbouring, similar region during future analysis.

## RESULTS AND DISCUSSION

The map of the Hungarian vegetation-based landscape regions is shown in Figure 1, the nomenclature of the vegetation-based landscape regions in Table 1.

The map differs from the currently used, country-wide, but flora-based botanical divisions (Soó 1964, Molnár 1999) in many features. Compared to the flora regions our map considers the “Lake Balaton”, and the “Marcal-medence”. The whole “Észak-Mezőség” is not classified under the Bakonyicum flora region (“Dunántúli-középhegység”). The “Kisalföld” flora subregion (Arra-

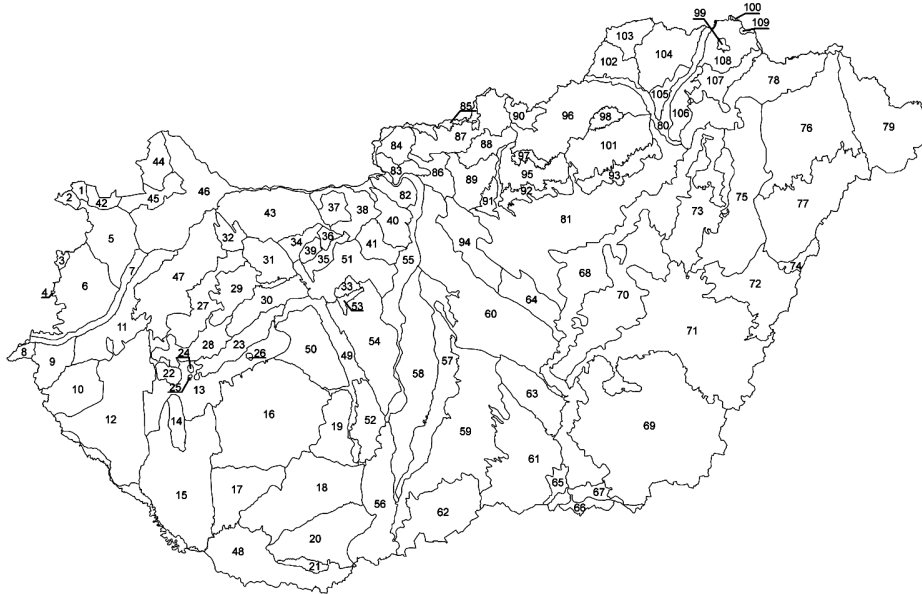


Fig. 1. The map of Hungarian vegetation-based landscape regions

Table 1

Names and authors of vegetation-based landscape regions

Geographical macroregions	Vegetation-based landscape regions	Subregions	ID	Authors	
Nyugat-Dunántúl	Fertőmelléki-dombsor		1	KG	
	Alpokaljai hegyek	Soproni-hegység	2	KG	
		Kőszegi-hegység	3	KG	
		Vas-hegy	4	KG	
		Répcse- and Ikva-sík	5	KG	
		Gyöngyös- and Pinka-sík	6	KG, BL, MeA	
		Rába-völgy	7	KG, BL, MeA	
		Vendvidék	8	BL	
		Órség	9	BL, MeA	
		Göcsej and Hetés	10	ÓM, BI	
		Vasi- and Zalai-hegyhát, Kemeneshát	11	MeA, BL, ÓM, KG	
	Dél-Dunántúl	Zalai-dombság		12	ÓM, JM
		Balaton-vidék		13	BN, JM, HA, ÓM
		Marcali-hát		14	JM
		Belső-Somogy		15	JM
		Külső-Somogy		16	JM, HA
		Zselic		17	Jm, CsJ

Table 1 (continued)

Geographical macroregions	Vegetation-based landscape regions	Subregions	ID	Authors	
Dél-Dunántúl	Mecsek, Völgység,		18	CsJ, JM, PD	
	Szekszárdi-dombság		19	CsJ, HA, JM	
Dunántúli-közép-hegység	Tolnai-dombság		20	CsJ, PD	
	Baranyai-dombság		21	CsJ	
	Villányi-hegység		22	BJ, BN, ÓM	
	Keszthelyi-hegység				
	Balaton-felvidék	Balaton-felvidék			
		(central part)	23	BN	
		Szent György-hegy	24	BN	
		Szigliget	25	BN	
		Tihany	26	BN	
		Nyugati-Bakonyalja	27	BN, MeA	
		Déli-Bakony	28	BN	
		Belső-Bakony	29	BN, BJ	
		Keleti-Bakony	30	BN, BJ	
		Központi-Bakonyalja	31	BN, BJ	
		Pannonhalmi-dombság	32	SchD, BN	
		Velencei-hegység	33	BJ, BN	
	Kisalföld	Bársonyos		34	BZ
Dél-Vértes			35	BZ, BN	
Vértes and Gerecse		Északi-Vértes			
		(eastern part)	36	BZ	
		Központi-Gerecse	37	BZ	
		Keleti-Gerecse	38	BZ	
		Északi-Vértes (western part)	39	BZ	
		Pilis, Budai-hegység	40	BJ	
		Zsámbéki-medence és környéke	41	KSzJ, BZ	
		Fertő-medence	42	KG	
		Győr-Tatai-teraszvidék and Igmánd-Kisbéri-sík	43	KG, SchD, BN	
		Mosoni-sík	44	KG	
		Hanság	45	KG	
		Kisalföldi Duna-völgy	46	KG, BZ, NJ	
		Marcal-medence	47	MeA, ÓM	
Alföld		Dráva-sík		48	CsJ, JM, ÓM, PD
		Sárvíz- and Sió-völgy		49	HA
	Nyugat-Mezőföld		50	HA, BZ, JM	
	Észak-Mezőföld		51	HA, BZ, KSzJ	
	Dél-Mezőföld		52	HA	
	Velencei-tó		53	HA, KSzJ	
	Kelet-Mezőföld		54	HA, KSzJ	
	Közép-Duna-völgy		55	BM, HA, KSzJ, NJ	
	Alsó-Duna-völgy		56	BM, CsJ, HA	
	Órjeg		57	MáA, BM	
Duna-sík		58	BM, MáA		
Homokhátság		59	BM, DJÁ, MáA, CsAI		

Table 1 (continued)

Geographical macroregions	Vegetation-based landscape regions	Subregions	ID	Authors	
Alföld	Öreg-Homok		60	BM, MáA, DJÁ, SzV	
	Dorozsma–Majsai-hát		61	DJÁ, BM, CsAI, MáA	
	Felső-Bácska		62	BM, CsAI	
	Duna–Tisza közti löszös homokok	Kiskunsági löszös hát	63	BM, DJÁ, MáA	
		Gerje-Perje-sík	64	BM, VT	
		Szegedi-sík	65	DJÁ, CsAI	
	Észak-Bánság*		66	CsAI, DJÁ	
	Maros-ártér**		67	DJÁ, CsAI	
	Tisza-völgy		68	BM, DJÁ, MoA, MZs, TT, CsAI	
	Maros–Körös köze		69	MZs, TT, CsAI, DJÁ	
	Nagykunság		70	MZs, MoA, DJÁ	
	Berettyó–Körös-vidék		71	MoA, DJÁ, TT, MZs	
	Bihari-sík		72	MoA	
	Hortobágy		73	MoA, MZs	
	Érmellék		74	MoA	
	Hajdúság		75	MoA	
	Észak-Nyírség		76	MoA	
	Dél-Nyírség		77	MoA	
	Taktaköz and Alsó-Bodroghöz		78	MZs, MoA, MCs	
	Bereg–Szatmári-sík		79	MoA	
	Sajó and Hernád völgye		80	MCs, SzF	
	Tápió–Sajó hordalékkúp-síkság		81	MCs, MZs, HK, SG, SzV, VT	
	Északi-középhegység	Visegrádi-hegység		82	BJ
		Dél-Börzsöny and Naszály		83	NJ
		Észak-Börzsöny		84	NJ
		Ipoly-völgy		85	HK, NJ
		Kosdi- and Csővári-dombság		86	HK, NJ
Észak-Cserhát			87	HK, CsJ, NJ	
Központi-Cserhát			88	HK	
Dél-Cserhát			89	HK, SzV	
Karancs and Medves			90	CsJ, HK	
Hegyalják		Cserhátalja	91	HK, MCs	
		Mátraalja	92	MCs	
		Bükkalja	93	MCs	
Gödöllői-dombság			94	SzV, VT, BM	
Déli-Mátra			95	SG, MCs, MG	
Heves–Borsodi-dombság, Északi-Mátra, Északi-Bükk			96	CsJ, HK, MCs, MG, SG	
Hegytetők		Magas-Mátra	97	SG, MG	
	Bükk-fennsík	98	MCs		



Table 1 (continued)

Geographical macroregions	Vegetation-based landscape regionsSubregions	ID
Északi-középhegység	Magas-“Zemplén”	99 MCs, SzF
	Milic	100 MCs. SzF
	Déli-Bükk	101 MCs
	Putnoki-dombság	102 SzF, VV
	Gömör-Tornai-karszt	103 SzF, VV
	Cserehát	104 SzF, VV, MCs
	Harangod and Dél-Cserehát	Dél-Cserehát 105 MCs
		Harangod and 106
		Hernád-magaspart MCs
	Hegyalja	107 MCs
	Abaúji hegyek 108 MCs	
	Zempléni-szigethegység*** 109 MCs	

\* = 66 “Észak-Bánság” in analyses can be merged to 69 “Maros-Körös köze”

\*\* = 67 “Maros-ártér” in analyses can be merged to 68 “Tisza-völgy”

\*\*\* = 109 “Zempléni-szigethegység” in analyses can be merged to 107 “Hegyalja”

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bonicum) is divided into 5 vegetation-based landscape regions. Similarly, the traditional division unites the “Zalai-dombság”, Tapolca and Kál Basins with “Bakonyalja” region (Saladiense), these are separate vegetation-based landscape regions. The traditional approach almost regularly cuts the “Északi-középhegység” into parts along its West–East axis, in contrast, our map tries to connect this pattern to altitudinal vegetation zones and edaphic vegetation features.

Grouping the vegetation-based landscape regions into six groups (according to the physical geographical macroregions, Marosi and Somogyi 1990), the fit is almost perfect. In fact, our map is a more precise version of the geographical regions. Differences are almost negligible (e.g. the river valleys protruding into the “Északi-középhegység” from the “Alföld” [namely “Zagyva” and “Sajó and Hernád” vegetation-based landscape regions], and the “Dráva-sík” vegetation-based landscape region intruding into “Dél-Dunántúl”). The new map treats some transitional regions, which are traditionally divided in geographical literature as separate unit, like the “Észak-Mezőföld”, which links the “Alföld” to the “Dunántúli-középhegység” (the geographical division might intend to avoid the separation of “Velencei-hegység” as an is-

land). Similarly, we classified separately some regions that lie in the foreground of the “Északi-középhegység”, namely the vegetation-based landscape regions “Cserhátalja”, “Mátraalja”, “Bükkalja”, “Harangod and Dél-Cserhát”. When compared to the geographical mesoregions, the differences are more conspicuous, since the theoretical background of the divisions is quite different (see e.g. the “Bükk” and “Mátra” mountain regions).

The present map is not considered to be a final version. Both future field studies and the analysis of the MÉTA database will possibly introduce changes, refinements. The collaborators of this map intend to make a revised version of the map after five years of testing.

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