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From Külső-Somogy to Mecsek Hills: Vegetation of three hilly landscape regions of SW Hungary

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Ortmann-né Ajkai, A. & Horváth, F.: *From Külső-Somogy to Mecsek Hills: Vegetation of three hilly landscape regions of SW Hungary.*

Abstract: Landscape-level GIS analysis of actual vegetation of Baranyai-hegyhát, Völgység and Tolnai-hegyhát was performed on the base of Landscape Ecological Vegetation Database and Map of Hungary (MÉTA). Natural and semi-natural vegetation covers 34% in Baranyai-hegyhát, closest to Mecsek hills, and about 10% in the other regions. 45 habitat types occur, 53% of all Hungarian ones. Patterns of mesophilous and dry and semi-dry grasslands and forests, according to climatic data, shows a distinct SW-NE gradient from mesophilous beech and hornbeam-oak forests to turkey oak-pedunculate oak and closed steppe oak forests and from colline hay meadows to xero-mesophilous grasslands and closed steppes. Our results support Hungary's new vegetation-based landscape regions.

Keywords: landscape-level vegetation patterns, actual natural and semi-natural vegetation, continentality gradient, grid-based analysis, habitat database (MÉTA)

Introduction

Tolna-Baranya hills (Tolnai-hegyhát, Völgység and Baranyai-hegyhát regions) are situated south of Külső-Somogy, north of Mecsek Hills. The three regions are adjacent to each other in a southwest-northeast sequence. Völgység, in the middle, is transitionary between the two other ones. Regarding its geomorphology and land-use (stronger anthropogenic effect) it resembles to Tolnai-hegyhát, but regarding e.g. its climate it stands closer to Baranyai-hegyhát. This is why it is interesting to present analyse these three regions in the same paper. As a consequence of their similar character and their gradual transition, their classification is uncertain: according to vegetation-based landscape regions of Hungary (Molnár et al. 2008) Völgység and Baranyai-hegyhát are grouped together with Mecsek hills, only Tolnai-hegyhát preserved its autonomy.

Research results are sparse from each of the three regions. Some sporadic floristic results, mostly by-products of study of neighbouring regions (Mecsek, Mezőföld) are published in Kevey (1989, 1993, 1995, 2001, 2004), Kevey & Horváth (2000), Tóth (1998, 2000, 2002), Király (1998). MÉTA Survey, a country-wide research project collecting habitat data according to a strict protocol for building Landscape Ecological

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Fig. 1: Overview map of study area (MAROSI, SOMOGYI 1990)

Vegetation Database and Map of Hungary (MÉTA) brought many new data on the vegetation of these regions (MOLNÁR et al. 2007). MÉTA Survey was performed on about half of the total area of these regions by the first author. This paper presents detailed vegetation description based on MÉTA database. A short description was published by TÓTH and CSIKY in KIRÁLY (2008a,b,c).

Research area

The three adjacent regions, situated in Tolna and Baranya countries, south of Külső-Somogy, are transitionary towards Mecsek Hills and Duna valley (Fig. 1.). This hilly landscape is bordered by easily recognizeable structure lines: Völgységi- and Mucsi-Hidasi creeks in the south, Sásdi-árok in the west, Kapos river in west-northwest, Duna valley in the east. Its average height is 180-300 m a.s.l. Area of Baranyai-hegyhát is 200 km^2, of Völgység is 450 km^2 and of Tolnai-hegyhát is 600 km^2 (MAROSI and SOMOGYI 1990).

Climate of Völgység and Baranyai-hegyhát is moderately warm and moderately wet; of north part of Tolnai-hegyhát is moderately warm, moderately dry. More climate factors show a distinct SW-NE gradient of increasing continentality in Baranyai-hegyhát – Völgység-Tolnai-hegyhát sequence (Fig. 2).

Most widespread soil type of Baranyai-hegyhát is brown forest soils with clay illuviation (88%), of Völgység are brown forest soils with clay illuviation (47%) and chernozjem brown forest soils (29%), of Tolnai-hegyhát are chernozjem soils (53%) but also Raman brown forest soils cover a significant area (21%) (MAROSI and SOMOGYI 1990).

According to phytogeographical classification, all three regions belong to Sopianicum included in Praeillyricum; their vegetation is similar to that of Mecsek hills, but less rich, especially in mediterranean elements (KEVEY and HORVÁTH 1986).

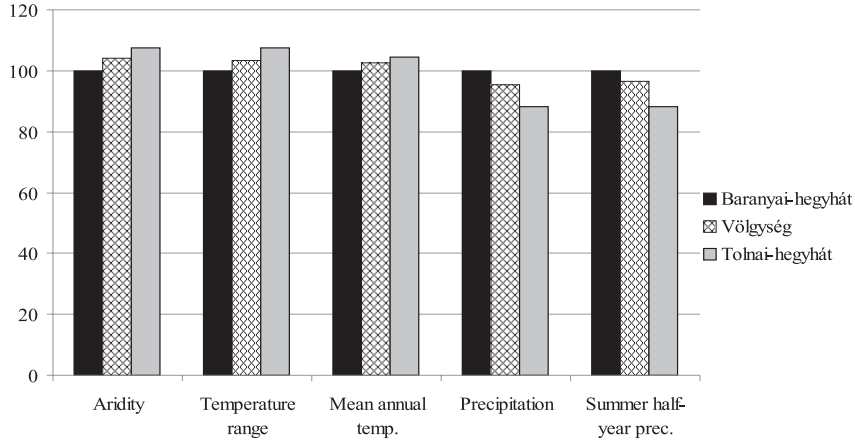

Fig. 2: Climatic gradients in the three regions studied (100%: Baranyai-hegyhát)

According to the potential natural vegetation map of Hungary (ZÓLYOMI 1989), Baranyai-hegyhát is situated marginally between zones of illyrian hornbeam-oak forests and turkey oak – sessile oak forests, Völgység is in the zone of turkey oak – sessile oak forests, and Tolnai-hegyhát is in zones of turkey oak – sessile oak forests and closed and mixed steppe oak forests. Original vegetation types – besides of these zonal communities – are: azonal alder woodlands, lowland oak-hornbeam woodlands (very rare), and small stands of euhydrophyte vegetation and marshes along watercourses, acidic oak-hornbeam and beech forests on steep, hillsides with soils turning slightly acidic, some small rock and ravine woodlands (only in Baranyai-hegyhát, closest to Mecsek hills), and extrazonal beech forests. All three regions are intensively cultivated today, natural and semi-natural vegetation covers in Baranyai-hegyhát about 34%, in other two ones about 10%. Actual vegetation consists of remnants of former forests, secondary xero-mesophilous grasslands in place of former forests, pastures with trees (only in Baranyai-hegyhát), in valley bottoms mesotrophic and *Arrhenatherum* hay meadows, in place of former lowland alder groves secondary willow stands, and narrow, fragmented euhydrophyte and marsh belts of fishponds' edges.

Data collection and analysis

Field data collection was executed between 2003-2006 as a grid-based, satellite-image supported (SPOT4), multi-attributed, large-scale mapping method called MÉTA (MOLNÁR et al. 2007). It was directed and coordinated by compulsory use of Á-NÉR 2003 mapping and habitat guides (MOLNÁR 2003, BÖLÖNI et al. 2003). The goals were: 1) collecting data of all natural and semi-natural habitat types in Hungary 2) creating maps of natural and semi-natural vegetation patches and 3) evaluating landscapes with vegetation types and their attributes as well. The database is constructed on a hexagon grid system of 35 hectars covering the whole area of Hungary as mapping units. Approximately 100 hexagons are grouped into a quadrant at landscape scale. In hexa-

gons habitat types, roughly estimated areas and vegetation attributes are listed (e.g. naturalness, neighbourhood, land use). This database is suitable to determine natural-based habitat quality and to compose the prognosis of future changes for vegetation and landscape (SALAMON-ALBERT and HORVÁTH 2008a,b). Our study area consists of 31 whole MÉTA quadrants and of 23 quadrant-parts.

Analyses and maps are based on vegetation type and area data of MÉTA database. Occurrences and area data of each habitat type were summarized for quadrants, and some types were contracted (see detailed analyses). Data query was performed with MS SQL, GIS analysis were executed and maps prepared with ArcGIS 3.1 (HORVÁTH and POLGÁR 2008).

Habitat groups occurring in the study area are as follows, bold ones are representing habitats covering larger areas. Habitat nomenclature and codes are by BÖLÖNI et al. (2003, 2007).

A. Euhydrophyte habitats:
A1 - Standing water communities with Trapa, Lemna, Salvinia and Ceratophyllum,

B. Marshes:
B1a - Eu- and mesotrophic reed and Typha beds,
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
D. Rich fens, eu- and mesotrophic meadows and tall herb communities:
D34 - Mesotrophic meadows,
D5 - Water-fringing and fen tall herb communities,
D6 - Tall herb communities of floodplans and marshes

E. Colline and montane hay meadows, acid grasslands and heaths:
E1 - Arrhenatherum hay meadows,
E2 - Festuca rubra hay meadows and related communities,

H. Dry and semi-dry closed grasslands:
H3a - Slope steppes on stony ground,
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

I. Non-ruderal pioneer habitats:
I2 - Semi-desert vegetation on loess cliffs,
O. Other non-woody habitats:
OA - Uncharacterisic wetlands,
OB - Uncharacteristic meadows and tall herb communities,
OC - Uncharacteristic dry/semi-dry grasslands and tall herb communities,

Bush vegetation and woodland margins:
J1a - Salix cinerea mires,
P2a - Mesic shrub vegetation,
P2b - Dry shrub vegetation with Crataegus, Prunus spinosa and Juniperus,
M6 - Continental deciduous steppe thickets,
M8 - Thermophilous woodland fringes

Riverine and swamp woodlands:
J2 - Alder and ash swamp woodlands,
J5 - Riverine ash-alder woodlands,
J6 - Riverine oak-elm-ash woodlands

K. Mesic deciduous woodlands:
K1a - Lowland oak-hornbeam woodlands
K2 - Oak-hornbeam woodlands,
K5 - Beech woodlands,
K7b - Acid oak-hornbeam woodlands

L. Dry deciduous woodlands:
L1 - Closed termophilous oak woodlands,
L2a - Turkey oak - sessile oak woodlands,
L2a - Turkey oak - se4ssile oak woodlands,
L2x - Closed and mixed steppe oak woodlands on foothills,
L5 - Closed lowland steppe oak woodlands,

LY Rock woodlands:
LY1 - Ravine woodlands (mesic rock woodlands rich in Acer pseudoplatanus),
LY2 - Mixed forests of scree, rocky slopes, rich in Tilia spp.,
LY3 - Limestone beech woodlands,
LY4 - Mixed relic oak woodlands on rocks

Other woody habitats:
RA - Scattered native trees or narrow tree lines,
RB - Uncharacteristic (often pioneer) softwood woodlands and plantation,
RC - Uncharacteristic hardwood woodlands and plantation,
RD - Uncharacteristic woodlands and plantation mixed with non-native tree species,
P45 - Wooded pastures and sweet chestnut woodlands,
P7 - Extensive orchards with ancient cultivars (often invaded by shrubs and trees)

Results

Overwiew of natural and semi-natural habitats

Natural and semi-natural habitats (all MÉTA types except RD – Uncharacteristic woodlands and plantations mixed with non-native tree species) are preserved best in Baranyai-hegyhát (34% of total area), in Völgység and Tolnai-hegyhát far less (11.7% and 12%, accordingly). Much of natural and semi-natural vegetation in Baranyai-hegyhát and (74%, 58%) or almost half of it (Tolnai-hegyhát: 46%) is made up of forests, located in three blocks: in the whole area of Baranyai-hegyhát (adjoining to forests of Mecsek hills), and two isolated remnants of woodlands on hills SE from Kapos valley: one of them is on the border between Völgység and Tolnai-hegyhát, the other one is on the northern part of Tolnai-hegyhát. On deforested areas near-natural vegetation consists of small patches of grasslands and wetland habitats mostly along streams, and uncharacteristic tree stands (Fig. 3.)

45 habitat types occur in study area, 53% of all Hungarian vegetation types. Most of types can be found in Tolnai-hegyhát (38 types, 45%), some less in Baranyai-hegyhát and Völgység (34 types, 40%, 32 types, 38%). Woody habitat types are most diverse in Baranyai-hegyhát (12 types, 48% of woody types), which has less continental climate and lies closest to forest-covered Mecsek hills. Regarding only mesophilous forest (K group), their representation is 80%, only acidophilous beech forests are missing. Grassland habitat types are most diverse in Tolnai-hegyhát, close to the forest-steppe zone (25 types, 45% of all grassland types). Woody habitat types are also more numerous (10/40%) here than in Völgység, laying closer to woodland-rich Baranyai-hegyhát, because of dry forest types (L group). Grassland habitats are far less diverse in Baranyai-hegyhát and Völgység (18 types, 32%) (Fig. 4).

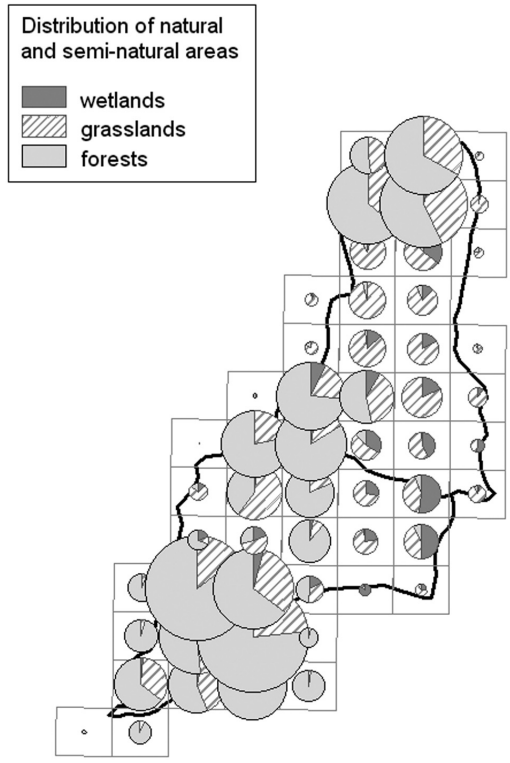

Fig. 3: Distribution of natural and semi-natural areas

Regarding cover data too, most of natural and semi-natural areas are mesophilous forest (K group, 8000 ha), more precisely oak-hornbeam forests (K2). More than half of these forests are in Baranyai-hegyhát. Area of well-lighted dry oak forest is about 3000 ha, most of them are turkey oak – sessile oak forests (2300 ha) and closed mixed steppe oak woodlands on foothills (L2x, 700 ha); 70% of them are in Tolnai-hegyhát. Next habitat types with significant area are uncharacteristic grasslands (OB, OC – 2000 ha) and bushes (P2a, P2b – 2300 ha) showing that degradation of grassy habitats by overgrowing with scrubs, due to abandonment of grazing, is similar to countrywide negative trends. Other habitat types with with an area worth mentioning are dry and semi-dry closed grasslands (1600 ha) and reedbeds and sedge habitats (near 1000 ha) (Fig. 5.)

Detailed description of habitats

Wetland habitats

Wetland habitats (A, B groups) cover less than 1% of total area, 5% of natural and semi-natural vegetation. Euhydrophyte habitats (A group) are especially poor, represented only by A1 type (standing water communities), due to the fact that natural lakes are missing here, and intensive fishponds and canals are not appropiate for them. Marshes (B group) are more widespread (625 ha) and diverse (6 of 7 MÉTA types), but most of them are narrow, fragmented reed or *Typha* stands at the edges of canals and

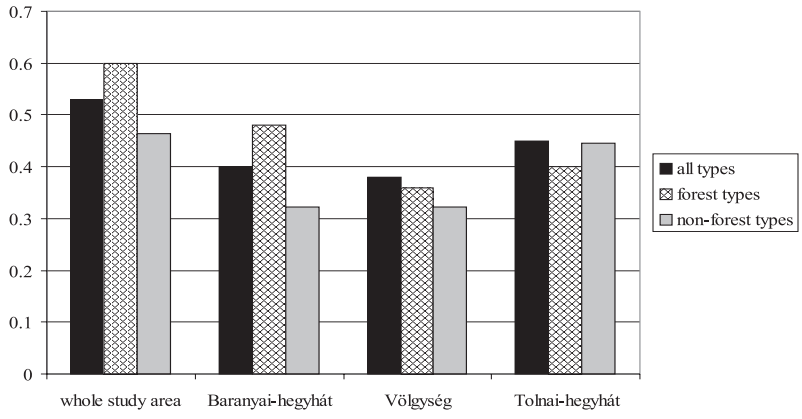

Fig. 4: Habitat types occurring in the regions (% of all MÉTA types)

fishponds. Non-tussock large sedge beds (B5) are most widespread natural and semi-natural habitats of valley bottoms, covering 245 hectares, mostly in Völgység (170 ha). (Fig. 3.)

Grassland habitats

Grassland habitats are basically divided into two groups: dry and semi-dry grasslands of hillsides (H group) and wet and mesotrophic ones (D, E). Distribution of these two groups fits to the SW-NE climatic gradient. Wet and mesotrophic meadows are more widespread in the hornbeam-oak vegetational zone, and their relative cover is also higher in deforested areas, due to hay meadows of valley bottoms, where tillage is constrained by frequent water coverage in springs – often they represent last remnants of near-natural vegetation here. Pastures with trees (P45), found only in Baranyai-hegyhát, in abandoned state, are shown separately due to their outstanding landscape and historical values (Fig. 6).

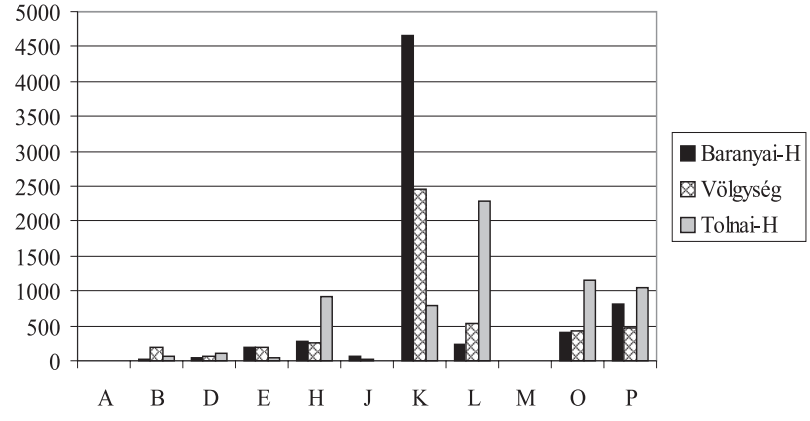

Fig. 5: Area of habitat groups in the three regions (ha)

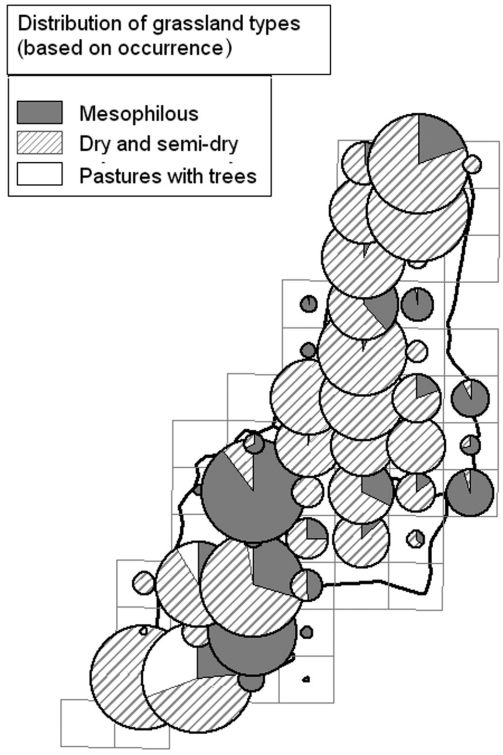

Fig. 6: Distribution of grasslands

Grassland habitats mentioned above covers 2300 ha, about half so much as uncharacteristic and bushy grasslands together. Natural and semi-natural grassland cover 11% of natural and semi-natural habitats, 1.9% of total area, most in Tolnai-hegyhát: 15% vs 2.4%. Area of grasslands increases with increasing continentality.

Most of natural and semi-natural grassland are dry or semi-dry ones (Group H, 1500 ha), occurring in all (whole) quadrants, on hillsides too steep for profitable cultivation, often secondarily on places of former vineyards. Two widespread types: closed steppes on loess and clay (H5a) and *Bromus erectus – Brachypodium pinnatum* xero-mesophilous grasslands, dry tall herb communities and forest steppe meadows (H4) are present in all three regions, Closed sand steppes (H5b) occur only in Tolnai-hegyhát.

Areal distribution of two widespread dry grassland types also corresponds well with the SW-NE climatic gradient: area of *Bromus erectus – Brachypodium pinnatum* xero-mesophilous grasslands, dry tall herb communities and forest steppe meadows (H4), replacing former forests after cutting decreases, area of closed steppes on loess and clay (H5a) increases with increasing continentality. H4 type (also herbaceous layer of wooden pastures) characterises Baranyai-hegyhát, with more forests and more atlantic climate; grasslands of Tolnai-hegyhát belongs almost completely to H5a; the latter one dominates also in the middle-situated Völgység, but not exclusively.

Mesotrophic and hay meadows cover far less area and their distribution is more rhapsodic. From group D mesotrophic meadows (D34) and tall herb communities (D5, D6)

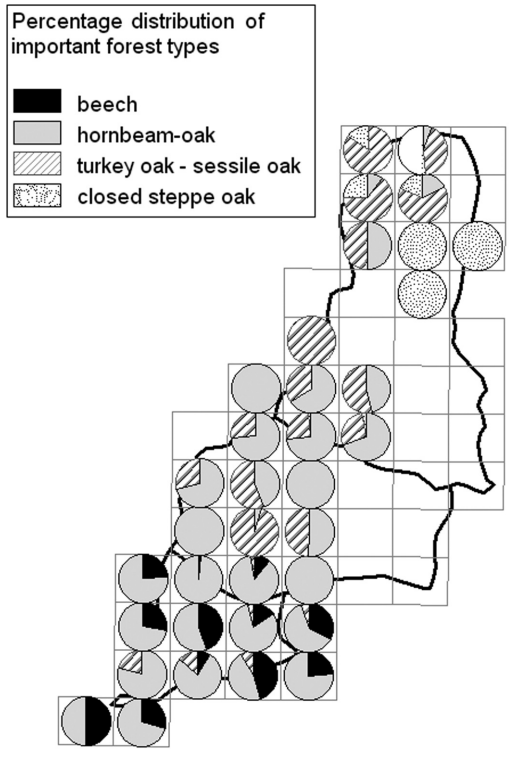

Fig. 7: Distribution of mesophilous and dry forests

are present. Total area of them is about 200 ha, they are situated mostly in valley bottoms, latter ones besides watercourses. None of group D grasslands types show any SW-NE gradient, perhaps due to their azonal, waterside character.

Hay meadows are represented by *Arrhenatherum* hay meadows (E1) in all regions, and *Festuca rubra* and related hay meadows (E2) with small area only in Baranyai-hegyhát. Their total area is 420 ha, 2.2% of natural and semi-natural vegetation.

Grasslands in this area are secondary, formed and maintained by century-long grazing and mowing. Their subsistence in natural and semi-natural state requires this traditional land use. In the past two decades significant decrease of extensive farming resulted in degradation or disappearence of natural and semi-natural grasslands, which indicated here by the fact that uncharacteristic grasslands (O group: mostly extremely weedy grasslands, in lesser extent artifical grasslands and regenerating old-fields) and bushes (P2, mostly overgrowing abandoned pastures, in lesser extent abandoned cultivated areas) covers twice as much as natural and semi-natural ones (2000+2300 ha vs 2300 ha).

Forest habitats

Much of natural and semi-natural vegetation in Baranyai-hegyhát and Völgység (74%, 58%) or almost half of it in Tolnai-hegyhát (46%) is made up of forests.

Natural and semi-natural forests (forest types without plantations) cover about 11000

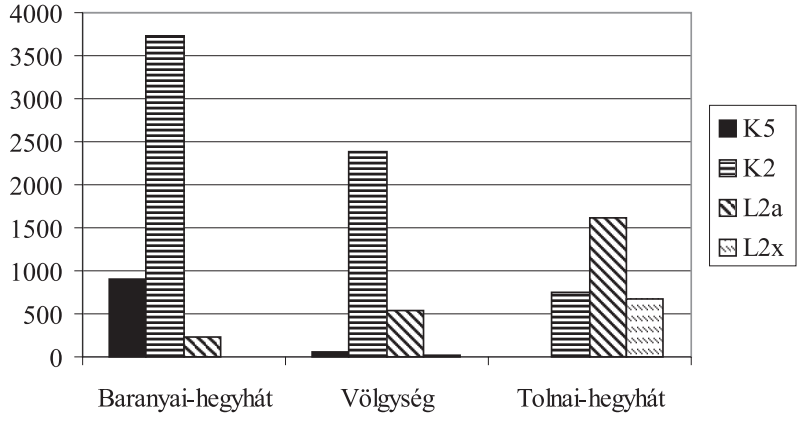

Fig. 8: Area of most important forest types

ha in the study area, almost half of them in Baranyai-hegyhát (5000 ha), neighbouring well-forested Mecsek hills. Percentage of forests of total region area of the region is 22.5% in Baranyai-hegyhát, far less, 7.5% (3000 ha) and 6% (3100 ha) in Völgység and Tolnai-hegyhát, accordingly. Native tree plantations (RB, RC) covers less than 1% of total region area everywhere, but in many deforested parts in Völgység and Tolnai-hegyhát only these are the only woody ("forest-like" in landscape view) communities.

Natural and semi-natural woody habitats are diverse in habitat level, 15 of 25 MÉTA types occur here (60%). Percentage areas of forest habitats demonstrate that our study area intersects three vegetational zones. Most of forests are hornbeam-oak forests (K2, 62% of total forest area), turkey oak – sessile oak forests (L2a, 21%) and closed and mixed steppe oak woodlands (L2x, 6%). Extrazonal beech forests cover 9%. Other forest types occurs only accidentally (2%).

Areal distribution of forests shows (Fig. 3.) that Baranyai-hegyhát is well forested (22.5%), but forests are basically missing from the other two regions except for two larger forest blocks: isolated remnants of woodlands on hills SE from Kapos valley. On of them is on the border between Völgység and Tolnai-hegyhát, laying between settlements Döbrököz, Dúzs, Mucsi and Mekényes (predominantly mesophilous forests (group K), similar to that of Mecsek hills); other one is on the northern part of Tolnai-hegyhát, with more dry forest (group L), between settlements Belecska, Simontornya, Kisszékely, Nagyszékely and Miszla.

Wet and mesophilous woody habitats of valley bottoms are: alder and ash swamp woodlands (J2), riverine ash-alder woodlands (J5), riverine oak-ash-elm woodlands (J6), lowland oak-hornbeam woodlands (K1a), scattered native trees (mostly williows) and narrow tree lines (RA). They are present everywhere but with small area: total of 250 ha, 1.3% of natural and semi-natural habitats. Their significance is that in many deforested areas only they represent natural and semi-natural woody habitats. Alder groves (J5), original vegetation besides streams, quickly disappear as we leave forested Baranyai-hegyhát in NE direction; in the two deforested regions they are replaced by groups and borderlines (RA) of willows (mostly *Salix alba*).

Mesophilous forests (group K) are present in every region, but their area and diversity decreases with increasing continentality towards NE. In Baranyai-hegyhát four of five mesophilous forest habitats are present: lowland oak-hornbeam woodlands (K1a),

dominant oak-hornbeam woodlands (K2, 3700 ha), beech woodlands (K5) and acid oak-hornbeam woodlands (K7b); only acid beech woodlands (K7a) are missing. Dominant mesic woodlands in Völgység are also hornbeam-oak forests (2400 ha), and we can find some beech forests (K5, 60 ha) on northern slopes of the above-mentioned large forest block. Of mesic woodlands only hornbeam-oak forests occur in Tolnai-hegyhát with a total area of 750 ha, but it is far less then coverage of dry woodlands (3000 ha).

Complementarily to mesic woodlands, area of dry woodlands increases with increasing continentality. According to climatic gradients, area percentages of dry woodlands (especially that of turkey oak – sessile oak woodlands (L2a) and of closed and mixed steppe oak woodlands (L2x)) increasing from SW to NE (Fig. 7). Closed and mixed steppe oak woodlands even become dominant in some quadrants of Tolnai-hegyhát. Völgység and Tolnai-hegyhát are separated most distinctly by this attribute. Explosive area increase of closed and mixed steppe oak woodlands (L2x) is especially remarkable. (Fig. 8).

Our analyses support Zólyomi's "map of natural vegetation" so far that Tolnai-hegyhát belongs to vegetational zones of turkey oak – sessile oak woodlands and closed and mixed steppe oak woodlands, but does not support that Baranyai-hegyhát lays in zones of turkey oak – sessile oak woodlands and illyrian hornbeam-oak forests, and Völgység wholly in turkey oak – sessile oak zone. According to our data, Baranyai-dombság lays clearly in hornbeam-oak zone, and Völgység in hornbeam-oak and turkey – sessile oak zones, so the border between hornbeam-oak and closed and mixed steppe oak woodlands zones seems to be situated more to the east compared to Zólyomi's map.

Our results support Hungary's new vegetation-based landscape regions (Molnár et al. 2008) as long as Baranyai-hegyhát belongs to Mecsek, and Völgység – showing a transitory character beetween the two others in most of our analyses – can be grouped here too because of absence of closed and mixed steppe oak woodlands. Its being a separate region is neither supported by our results.

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