# HUNGARIAN PHYTOSOCIOLOGICAL DATABASE (COENODATREF): SAMPLING METHODOLOGY, NOMENCLATURE AND ITS ACTUAL STAGE

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Abstract – The article contains the methodological guide of the national phytocoenological database, called CoenoDat Reference Database, which was prepared to build up the first Hungarian reference databank of the natural and semi-natural vegetation types in 2003. Nomenclature of plants follows Dobolyi (2002). Syntaxonomical nomenclature follows Borhidi & Sánta (1999) and Borhidi (2003). For databasing the authors used TurboVeg for Windows. Up to now, CoenoDatRef contains some 9,000 relevés of app. 400 natural and/or semi-natural associations. The number of entered relevés of different vegetation classes is included.

Key words – CoenoDatRef, methodology, Hungary, syntaxonomy, vegetation databank

## Introduction

Recent developments of vegetation-plot databases (Brisse *et al*. 1995, Font & Ninot 1995, Mucina *et al*. 2000, Ewald 2001, Hennekens & Schaminée 2001, Chytrý & Rafajová 2003) provide an opportunity for the unification of vegetation classification at coarse-scale (e.g. Botta-Dukát *et al*. 2005, Dengler et al. 2006, Illyés et al. in press.). Although the phytosociology has a long tradition in Hungary (cf. Soó 1961-1980, Borhidi & Sánta 1999), Mucina *et al*. (1993) revealed a clear Hungarian backlog of this area, and until 2002 there was no comprehensive database of the Hungarian vegetation. A project of the survey of Hungarian vegetation (Molnár *et al*. in press.) made it possible to start building such database. We recognized that it is not sufficient to collect published relevés only, because it would result a strongly unbalanced database (i.e. some areas and syntaxa over-, while other are under-represented in the literature, c.f. Knollová *et al*. 2005). Therefore, we planned to collect huge number of new relevés, and to digitize the most important published (archive) relevés.

The preliminary work with the accomplishment of the CoenoDat Reference Database has revealed that for the feasibility of requirements made on the data base a methodological guide is needed. The data base involves new and published relevés, moreover special bibliography for each association. The new relevés have to satisfy all requirements, while published relevés have to meet only the most important ones. To avoid the over- or under-representation of any association, we decided the number of relevés needed according to the distribution, species richness and internal variation of the association. Collection of relevés from each association is organized by a so-called association-coordinator.

In this paper we overview the methodology of this project, and show the present state of the database.

## Methodology

### *Selection of new relevés*

Required number of relevés for each natural/semi-natural association was established according to its range, frequency, local species richness and internal heterogeneity. Before survey, the knowledge about the range, species composition, structural and physiognomic variety of the investigated association should be revealed by the association coordinators.

By the selection of stands for sampling two special conditions should be considered: the range and variety of the association.

At least one relevé is needed from each great region where the community occurs (Fig. 1). We take the following 6 such regions into account (Marosi & Somogyi, 1990):

1. Great Hungarian Plain,
2. Small Hungarian Plain
3. West Hungary (Praenoricum)

4. South Transdanubia (Praeillyricum)

5. Transdanubian medium range (Bakonyicum)

6. North Hungarian medium range (Matricum)

If it is allowed by the prescribed relevé number, the distribution of relevés by regions is weighted according to the community's importance in regions, while its extent of variety is also considered.

The extent of variety includes any differences (including those related to degradation) in the structure, physiognomy, species composition, or abundance/dominance conditions, if the relevé unambiguously classified into the given syntaxon.

Within a stand of the studied community, the plot has to be selected carefully by the Braun-Blanquet method, considering the floristic-ecological homogeneity. For the thorough investigation of floristic homogeneity a recommended method, including the exact determination of minimum area, is accessible (Lájer, 2002; 2004).

The shape of sample plot could go by the situation of the stand. In a favourable case (great, homogenous, isotropic stand) the selection of circle or square shape is expedient (the latter is proposed), but if necessary it can be departed from this, e.g. in an inevitably mosaic-like habitat the sample plot can be build from several separate areas.

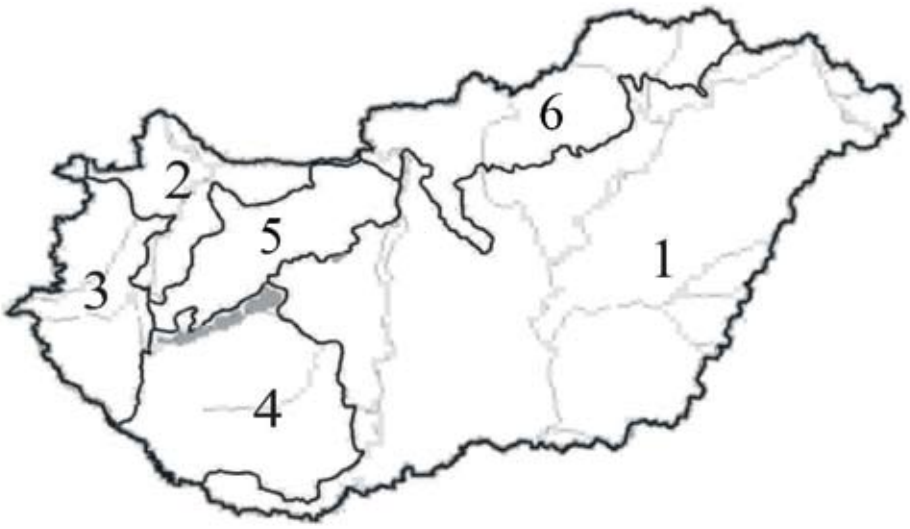


FIGURE 1 – The six great regions of Hungary

The locality of relevé should be marked on a topographic map (1:25000 Gauss-Krüger). The map should be attached to the data sheet.

*Sampling date*

The date of field work should be chosen so that the occurring species could be identified undoubtedly. If some of the species can not be identified at a moment (e.g. temporal aspects standing out in sharp contrast alternate), repeated sampling (and, of course, a correct, reliable marking of the sample plot) is needed. The optimal number and date of field work depend on the community. The following overview gives an approximate orientation:

Open dry grasslands: March (-April), as well as May-June (July), incidentally September.

Species rich deciduous forests: April-May, as well as June-July.

Wet meadows and hayfields: May, and incidentally June-July.

Marshes, bogs, fens and other wetlands: June-July, and accidentally August-September.

Mud vegetation: August-September

Others: June-July.

If by repeated sampling in a year different abundance-dominance values are observed, the greatest should be given. This means that possibly the most complete development of each population is taken into account.

*Plot size*

The size of sample plots should be at least as large as the minimum area, but usually greater. It could vary depending on the community type, the following overview for square or rectangle shaped sample plots gives a first orientation:

Reed-grass vegetation, oligotrophic hollow communities: 1 $m^2$

Spring grasses, mud vegetation, cleft vegetation: 4-9 $m^2$

Oligo- and mesotrophic mire vegetation, salt marshes, species-poor pioneer grasses: 9-16 $m^2$

Dry grassland: 4-25 $m^2$

Wet meadows and hayfields, reed-beds, tall sedge communities, tall herb vegetation: 25-49 (-100) $m^2$

Shrubby and cutting vegetation: 25-100 $m^2$

Forests: 400 $m^2$.

Within an alliance the plot size should be the same, as far as possible. For this purpose, the association-coordinators should come to agreement with each other.

*Supplementary data*

The supplementary data to record by the survey are the followings according to the recommendations of MUCINA et al. (2000) modified by the authors (surveying data sheet):

| | |
|---|---|
| Serial number of relevé | (obligatory) |
| Syntaxonomical arrangement (name of association) | (obligatory) |
| mmÁ-NÉR (the modified general system of national habitat classification) code | (obligatory) |
| Name of the author | (obligatory) |
| Date (year-month-day) | (obligatory) |
| (If the relevé was made by repeated sampling, their dates should be listed.) | |
| Sample plot size ($m^2$) | (obligatory) |
| Sample plot shape (rectangular, band, circle, irregular, consisting of several partial areas [recommendation: new surveys should be made on rectangular plots] | (obligatory) |
| Scale of abundance-dominance estimation (1: classic Braun-Blanquet, 2: refined Braun-Blanquet, 3: Londo, 4: percentile) | (obligatory) |
| Stand size ($m^2$ or ha) | (recommended) |

Here the size of the connected stand should be given, in which the survey was made. A stand is considered as connected if it is not made up of disjunctive patches, separated by other community. In other words, a connected stand can be traversed without entering any stand of other community. With full knowledge of local communities and their differential species, the patch boundaries can be determined, principally with any precision (Lájer, 2000). If the sample plot is extended to several disconnected patches of a mosaic-like habitat, their total area is relevant.

| | |
|---|---|
| County | (recommended) |
| Municipal area | (obligatory) |
| Locality (local geographical name, from map readable) | (obligatory) |
| Altitude above sea level (with 50 m precision) | (obligatory) |
| Exposition (N, NE, E, SE, S, SW, W, NW) | (obligatory) |
| Inclination (interval also may be given. Resolution: plain, between 1-5° by 1°, above 5° by 5°) | (obligatory) |
| Distance from the coastline (for aquatic communities, m) | (recommended) |

| | |
|---|---|
| Water depth (for aquatic communities, dm) | (recommended) |
| Greenwich coordinates (degree-minute-second) | (recommended) |
| UTM network (resolution 10 km x 10 km or better) | (recommended) |
| Network of Central European floristic mapping | (recommended) |
| Total cover (%) | (obligatory) |
| E3 (canopy layer) cover | (obligatory) |
| E3δ (emergent layer: outstanding trees) cover | (recommended) |
| E3γ (upper canopy layer) cover | (recommended) |
| E3β (medium canopy layer) cover | (recommended) |
| E3α (lower canopy layer) cover | (recommended) |

(The above breaking up should be used according to the observed vertical structure of the stand. The emergent level is the canopy level of the outstanding trees above the contiguous canopy level. If only 2 sublevels can be distinguished within the contagious canopy level, these are considered as upper and medium canopy levels. If only one level has developed, this is considered as upper canopy level. In the head of an absent level 0 should be written.).

| | |
|---|---|
| E2 (shrub layer) cover (%) | (obligatory) |
| E2β (upper shrub layer) cover | (recommended) |
| E2α (lower shrub layer) cover | (recommended) |
| E1 (herb layer) cover | (obligatory) |
| E1γ (upper herb layer) cover | (recommended) |
| E1β (medium herb layer) cover | (recommended) |
| E1α (lower herb layer) cover | (recommended) |
| E1e (emergent layer for aquatic vegetation) cover | (obligatory) |
| E1n (floating layer for aquatic vegetation) | (obligatory) |
| E1s (submerged layer for aquatic vegetation) | (obligatory) |
| E0 (cryptogam layer, only on soil or rock) cover | (obligatory) |
| E0m (moss layer, only on soil or rock) cover | (recommended) |

| | |
|---|---|
| E0l (lichen layer, only on soil or rock) cover | (recommended) |
| E0al (alga layer, only macroscopically observable, in water or on soil) cover | (recommended) |
| Litter-cover | (recommended) |
| Rock cover | (recommended) |
| Open water area | (recommended) |
| Bare soil area | (recommended) |

| | |
|---|---|
| E3 (canopy layer) height (m) | (obligatory) |
| E3δ (emergent layer: outstanding trees) height | (obligatory) |
| E3γ (upper canopy layer) height | (obligatory) |
| E3β (medium canopy layer) height | (obligatory) |
| E3α (lower canopy layer) height | (obligatory) |

(The above breaking up should be used according to the observed vertical structure of the stand. The emergent layer is the canopy layer of the outstanding trees above the contiguous canopy layer. If only 2 sub-layers can be distinguished within the contagious canopy layer, these are considered as upper and medium canopy layers. If only one level has developed, this is considered as upper canopy layer. In the head of an absent level 0 should be written.).

| | |
|---|---|
| E2 (shrub layer) height (m) | (obligatory) |
| E2β (upper shrub layer) height | (recommended) |
| E2α (lower shrub layer) height | (recommended) |

| | |
|---|---|
| E1 (herb layer) height (cm) | (obligatory) |
| E1γ (upper herb layer) height | (recommended) |
| E1β (medium herb layer) height | (recommended) |
| E1α (lower herb layer) height | (recommended) |
| E1ε (emergent layer for aquatic vegetation) height | (recommended) |
| E1ν (floating layer for aquatic vegetation) height | (recommended) |
| E1σ (submerged layer for aquatic vegetation) height | (recommended) |

| | |
|---|---|
| E0 (cryptogam layer) height (cm) | (obligatory) |

| | |
|---|---|
| E0m (moss layer) height | (recommended) |
| E0l (lichen layer) height | (recommended) |
| E0al (alga layer) height | (recommended) |
| Habitat attributes (to what extent typical, naturalness, threatening factors /if any/, and so on.) | (obligatory) |
| Geomorphologic forms | (obligatory) |
| Base rock/substratum | (obligatory) |
| Physical soil type (sand, sandy adobe, adobe, clayey adobe, clay) | (recommended) |
| Genetic soil type | (recommended) |
| Further observations for soil can be given in the remarks. | |
| Microclimate (observations) | (recommended) |
| Within-year changes of water level | (recommended) |
| Management (e.g. protected, grazed, mowed, coppice, seedling-forest, etc.): | (recommended) |
| Vegetation complex (adjacent units) | (recommended) |
| Vegetation dynamics (secondary in place of abandoned arable land, vineyard, orchard, degraded, overgrown with weeds, expanding species, patchy occurrence, age and stage structure of forests, etc.) | (recommended) |
| Remarks (taxonomy, sampling, etc.) | (recommended) |

*Sampling cryptogam species*

The surveying should be extended to all vascular plant species occurring in the sample plot. In particular cases the surveying of moss species also cannot be neglected, especially when these play a determinant role in the life of community. In frame of the present project the survey of moss level (on soil or basic rock) is obligatory in the following plant communities: *Montio-Cardaminetea* Br.-Bl. & Tx. 1943, *Caricion lasiocarpae* Van den Berghen ap. Lebrun & al. 1949, *Caricion fuscae* Koch 1926 em. Klika 1934, *Eriophoro vaginati-Sphagnetum recurvi* Hueck 1925, *Genisto pilosae-Festucetum ovinae* Simon 1970, *Festuco ovinae-Nardetum* Dostál 1933, *Luzulo albidae-Callunetum* (I. Horv. 1931) Soó 1971, *Asplenietea trichomanis* (Br.-Bl. in Meyer & Br.-Bl. 1934) Oberd. 1977, *Arabidopsidion thalianae* Passarge 1964, *Corynephorion canescentis* Klika 1931, *Achilleo ochroleucae-Corynephoretum* (Hargitai 1940) Borhidi 1996, *Galio veri-Holoschoenetum vulgaris* (Hargitai 1940) Borhidi 1996, *Bassio laniflorae-Brometum tectorum* (Soó 1938)

Borhidi 1996, *Minuartio-Festucetum pseudodalmaticae* (Mikyska 1933) Klika 1938, *Festuco pallenti-Brometum pannonici* Zólyomi 1958, *Alnetalia glutinosae* Tx. 1937, *Alnenion glutinosae-incanae* Oberd. 1953, *Tilio platyphyllae-Acerion pseudoplatani* Klika 1955, *Seslerio hungaricae-Fagetum* Zólyomi 1967, *Tilio-Sorbetum* Zólyomi & Jakucs (1957) 1967, *Luzulo-Fagion* Lohm. & Tx. in Tx. 1954, *Genisto germanicae-Quercion* Neuhäusl & Neuhäuslová-Novotná 1967, *Castaneo-Quercion* Soó 1962 em. 1971, *Erico-Pinion* Br.-Bl. in Br.-Bl. et al. 1939, *Bazzanio-Abietetum* Ellenberg & Klötzli 1972, *Pino-Quercion* Medwecka-Kornas & al. 1959. In other cases the survey of moss level is recommended. If surveyed, the identification of moss species should be complete.

The survey of lichens is recommended if suitable expertise is available. In case of partial investigation the species can be enumerated in the Remarks.

*Cover estimation*

For the estimation of abundance-dominance values principally acceptable any scale, which can be transformed to a numeric scale by an accepted method (and so suitable for quantitative data processing), moreover has a resolution of at least the 7 degree Braun-Blanquet scale. It is not expedient to choose a resolution more fine than the measurement error of estimation method. In frame of this project the use of following scales is possible: the classic Braun-Blanquet scale (r, +, 1, 2, 3, 4, 5), the refined Braun-Blanquet scale preferred in Central-Europe (r, +, 1, 2m, 2a, 2b, 3, 4, 5), Londo scale. It is also possible to give the percentile cover value.

If individuals of a taxon are rooted out of the plot, but contribute to the cover, this circumstance can be marked by putting the abundance-dominance estimation value in square brackets, e.g. *Quercus robur* [2].

If a taxon is represented in the sample plot only by such rudimentary individuals (e.g. seedlings), the development of which to mature plant is strongly doubtful, or even can be excluded on the basis of experience (e.g. Cs *Carpinus betulus* r, in an intact stand of *Caricetum elatae*), it should be marked by a letter 'Cs' (of the Hungarian alphabet).

At least one documentary photograph (about the stand) should be attached to the relevé. This may be a slide or (if possible) a picture by digital camera.

*Selection of archive relevés*

For the selection of archive relevés the following minimal requirements are to be met:

At least one relevé on which the first knowledge about the Hungarian occurrence of the considered community type is based (if published from Hungary, the nomenclatural type, i.e. one of the followings: holotype, lectotype, neotype) should be included. Moreover, each relevé should contain

- the most important survey-methodological information;
- the total species composition including all taxonomical groups prescribed for

complete relevés (see above), with abundance-dominance estimates for each species

- the required minimum structural/physiognomic information (see complete relevés).

In respect of supplementary data

| | |
|---|---|
| Syntaxonomical arrangement (name of association) | (obligatory) |
| Author(s) | (obligatory) |
| Date (year-month-day) | (obligatory) |
| Sample plot size ($m^2$) | (obligatory) |
| Sample plot shape (rectangular, band, circle, irregular, consisting of several partial areas | (obligatory) |
| Scale of abundance-dominance estimation (1: classic Braun-Blanquet, 2: refined Braun-Blanquet, 3: Londo, 4: percentile) | (obligatory) |
| Municipal area (for control) | (obligatory) |

All other data available based on the original documentation should be given (see list of obligatory/recommended data for new relevés).

By deciding on whether an archive relevé will get to the database, it should be taken into account that the plot size possibly should not differ from that of the new relevés (belonging to the same plant community).

As regards abundance-dominance estimation scale the same principles should be applied as by the complete relevés.

In the remarks the information concerning the actual state of the stand should be described according to the following categories:

- Almost unchanged
- It exists also at present, but has changed (the change should be detailed in the remarks), but in the proximity there is a stand similar to the original one.
- It exists also at present, but has changed (the change should be detailed in the remarks, and in the proximity there is no stand similar to the original one.
- Destroyed, but in the proximity there is a stand similar to the original one.
- Destroyed and in the proximity there is no stand similar to the original one.

Here also a short explanation for the selection of relevé should be given (e.g. ‘This is the holotype of association’ or ‘A typical stand of Transdanubia’).

As far as possible, the place of the plot should be marked on a topographic map (1:25000 Gauss-Krüger). If it can be only inaccurately localized, a patch should be drawn in, which certainly encloses the place of the plot. Within this, the most probable place of the plot should be marked by a cross. The map supplied with the marking should be attached to the data sheet.

### *Nomenclature*

Nomenclature of species follows a special adaptation of the list of Horváth *et al*. (1995) by Dobolyi (2002). In some genera which taxonomy are not clear enough

Table 1 - Actual stage (number of relevés) of CoenoDatRef (date: 25.03.2007)

| Class | Planned | **Actual** |
|---|---|---|
| *Lemnetea* | 125 | 325 |
| *Utricularietea intermedio-minoris* | 10 | 0 |
| *Charetea fragilis* | 10 | 18 |
| *Potametea* | 140 | 321 |
| *Litorelletea uniflorae* | 5 | 5 |
| *Isoëto-Nanojuncetea* | 95 | 340 |
| *Phragmitetea australis* | 720 | 1458 |
| *Montio-Cardaminetea* | 40 | 60 |
| *Scheuchzerio-Caricetea fuscae* | 340 | 153 |
| *Oxycocco-Sphagnetea* | 10 | 8 |
| *Puccinellio-Salicornietea* | 647 | 725 |
| *Molinio-Arrhenatheretea* | 1035 | 720 |
| *Calluno-Ulicetea* | 115 | 62 |
| *Asplenietea trichomanis* | 35 | 35 |
| *Sedo-Scleranthetea* | 50 | 50 |
| *Koelerio-Corynephoretea* | 30 | 32 |
| *Festucetea vaginatae* | 220 | 344 |
| *Festuco-Brometea* | 945 | 1141 |
| *Trifolio-Geranietea sanguinei* | 80 | 5 |
| *Rhamno-Prunetea* | 300 | 397 |
| *Salicetea purpureae* | 90 | 132 |
| *Alnetea glutinosae* | 150 | 187 |
| *Querco-Fagetea* | 1240 | 1450 |
| *Quercetea pubescentis-petraeae* | 930 | 850 |
| *Erico-Pinetea* | 20 | 9 |
| *Pulsatillo-Pinetea* | 10 | 0 |
| *Vaccinio-Piceetea* | 35 | 29 |

(e.g. *Rubus* spp.) or the taxa are not easy to distinguish on field (e.g. *Quercus* spp.) we subsumed the species under the superior "*sensu lato"* taxa (e.g. *Agrostis canina* agg.). According to this agreement in principle we marked all the species occur in Hungary with three type of acronyms (**aa**: *sensu stricto* identification is obligate; **a**: identification of taxa on this level is sufficient; **b**: identification of species on this level is not necessary). Classification was managed in this way to produce a practical taxon list for field workers. These taxa can be easily identified using Simon (2000).

Nomenclature of syntaxa follows Borhidi & Sánta (1999) and Borhidi (2003).

### *Actual stage of database*

CoenoDatRef is not completed. According to the vegetation types of Hungary (Borhidi & Sánta 1999, Borhidi 2003), there are 27 natural and semi-natural association classes in the system. Comparing the planned and actual number of relevés in each classes of the Hungarian vegetation (Tab. 1), it appears that some vegetation types are not represented completely in the database. Some of them (e.g. *Utricularietea intermedio-minoris*, *Pulsatillo-Pinetea*) have already been sampled on field, but the relevés are not digitalized yet, others are poorly studied (e.g. *Trifolio-Geranietea sanguinei*). Some associations are extinct from Hungary (e.g. *Sphagno tenelli-Rhynchosporetum albae*), while others are new for the country (e.g. *Glycerietum nemoralis-plicatae*) and/or for the world (e.g. *Astero pannonici-Schoenetum nigricantis* Lájer 2006). The most important task for the near future is supplying the lacking relevés and checking the entered dataset.

## Acknowledgement

This research was supported by NKFP 2002/0050-3B (CoenoDatRef) Project.

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