

## PHYTOSOCIOLOGICAL DATABASE OF SLOVAK GRASSLAND VEGETATION

MONIKA JANIŠOVÁ, IVETA ŠKODOVÁ

*Institute of Botany, Slovak Academy of Sciences, Dúbravská cesta 14, 845 23  
Bratislava, Slovak Republic;  
e-mail: monika.janisova@savba.sk, iveta.skodova@savba.sk*

**ABSTRACT** – In Slovakia, the Central Phytosociological Database has been built since 1996 and it is located in the Institute of Botany, Slovak Academy of Sciences, Bratislava. Since 2005, we focused on the collection of phytosociological relevés from semi-natural grassland communities belonging to phytosociological classes *Molinio-Arrhenatheretea*, *Festuco-Brometea* and *Nardetea strictae*. All accessible published relevés were compiled and stored in the TURBOVEG program. Since 1990 an extensive field survey was carried out with the aim to record the actual stage of semi-natural grasslands in Slovakia after the period of profound land-use changes (collectivisation, abandonment, succession). As a result of this survey, 4988 of recent unpublished relevés were stored in our database. Altogether, the database of grassland vegetation contains 11 121 relevés, collected by 143 authors between 1924 and 2006. These relevés include 387 765 vascular plants individual records and 6 439 records of bryophyte and lichen species. The basic statistical information on this database is presented in the paper and the quality of the data is discussed. The possible application of such phytosociological dataset is outlined.

**KEY WORDS** – database, grassland communities, large-scale survey, phytosociology, Slovak Republic, vegetation sampling.

### INTRODUCTION

In 1996, the Slovak Republic has joined to the European effort of building national phytosociological databases in a standard format of TURBOVEG (Hennekens & Schaminée, 2001). Since then, the Central Phytosociological Database (<http://ibot.sav.sk/cdf/index.html>) has been built in the Institute of Botany, Slovak Academy of Sciences, Bratislava (Valachovič, 1996; Hegedúšová, 2007). During the last decade, a particular attention has been devoted to vegetation sampling of semi-natural grasslands caused by two main reasons: a) these communities overcame substantial changes during the last 50 years due to the profound land-use changes such as collec-

tivization, abandonment or succession, and b) grassland communities were sparsely studied in the past in a synthetic way and a comprehensive survey at the national level is still missing. Our contribution brings an overview of the grassland phytosociological data accumulated and processed during the last decade which are recently stored in the Slovak Central Phytosociological Database.

#### BASIC STATISTICS

The database of Slovak grassland vegetation contains 11 121 relevés (state to 1st January 2007), belonging to phytosociological classes *Molinio-Arrhenatheretea* Tx. 1937, *Festuco-Brometea* Br.-Bl. et Tx. ex Br-Bl. 1949 and *Nardetea strictae* Rivas Goday et Borja Carbonell 1961. The distribution of relevés in the territory of Slovakia is shown in Figure 1. The least sampled areas are the lowlands Podunajská nížina (the southwestern part of Slovakia) and Východoslovenská nížina (the southeastern part of Slovakia), where large areas are covered by intensively utilized agricultural landscape. The least representative material is gained from the northeastern part of Slovakia which attracted the least attention of phytosociologists in the past. On the contrary, several regions are over sampled e.g. botanically attractive areas such as Veľká Fatra Mts. and Biele Karpaty Mts., or focal points of regional research projects such as Liptovská kotlina, Starohorské vrchy Mts., Poľana Mts, Poloniny Mts., etc.

The oldest relevés come from 1924, nevertheless the grassland relevés from the first half of the 20th century are sparse in the database. The earliest published phytosociological relevés were recorded by J. Klika, A. Zlatník, P. Sillinger and K. Domin within strictly regional studies. Regionally focused studies of grasslands dominated during the whole 20th century with several exceptions made e.g. by Jurko (1969), Špániková (1978, 1984) or Kliment (1994) who made a syntheses within a larger geographical area. The systematic phytosociological sampling of grasslands started after 1990 and was performed mostly by H. Ružičková and her colleagues who studied the traditionally managed meadows over the whole Slovak territory. Several projects running since the nineties have supported the grassland research focusing on the proposition of appropriate management for the agricultural praxis and thus numerous regions were covered by an intensive phytosociological survey. Almost one half of the relevés in the database has been sampled since 1990 (they are mostly unpublished) and thus the database reflects well the actual stage and diversity of grassland vegetation (Figure 2).

Altogether, 230 published data sources, 39 theses and 17 publicly accessible manuscripts are covered by the database (Table 1). The relevés come from 143 authors (Table 2, only first authors were included into the calculation). Among them, H. Ružičková has a special position as her contribution exceeds one fifth of the whole database. The relevés include 387 765 vascular plants individual records and 6 439 records of bryophyte and lichen species. The frequency of individual species in the database reflects well their real frequency in the non-forest landscape types (Table 3). The altitudinal distribution of relevés is shown in Figure 3.

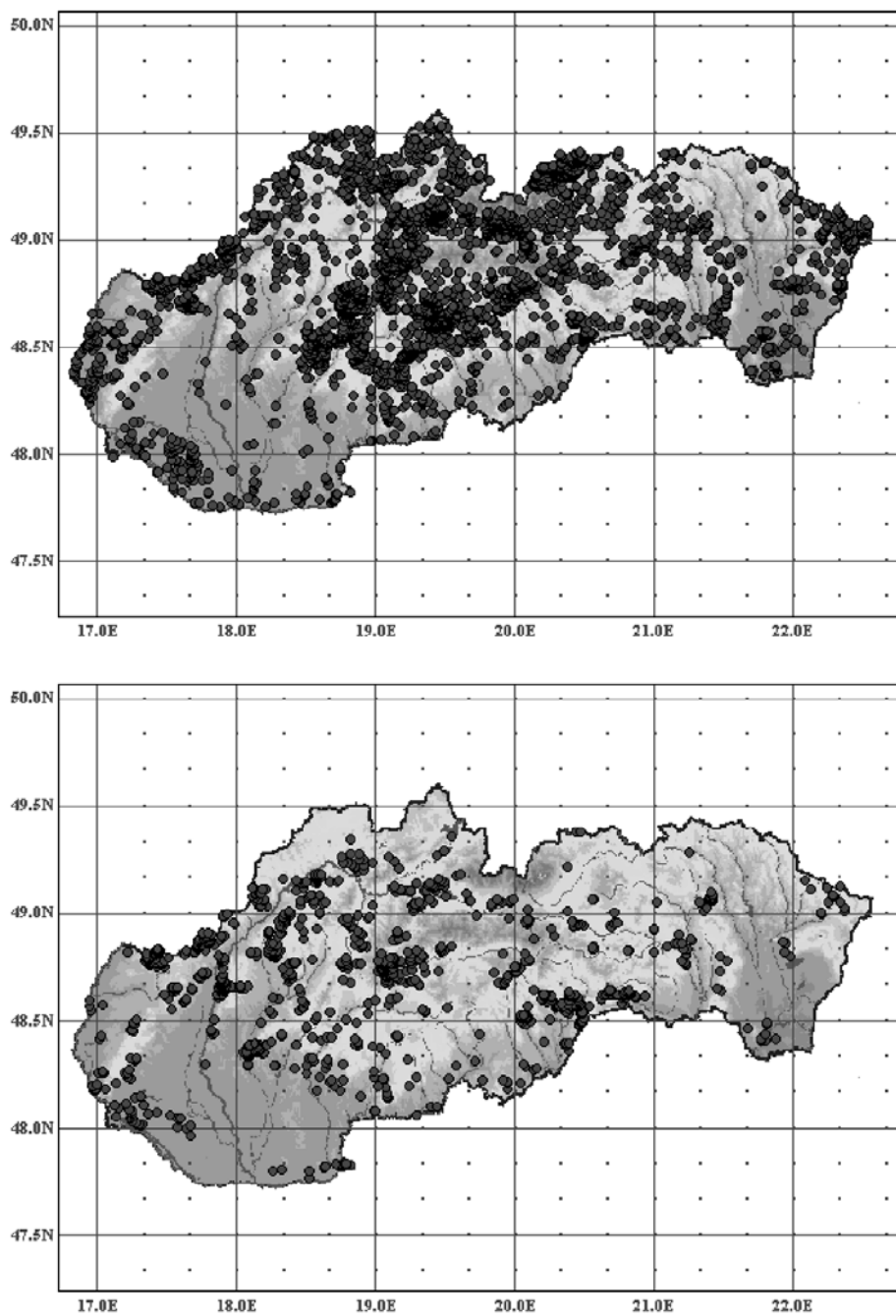


FIGURE 1 - Distribution of relevés ordered by original authors to phytosociological classes: a) Molinio-Arrhenatheretea, b) Festuco-Brometea (continues in the next page).

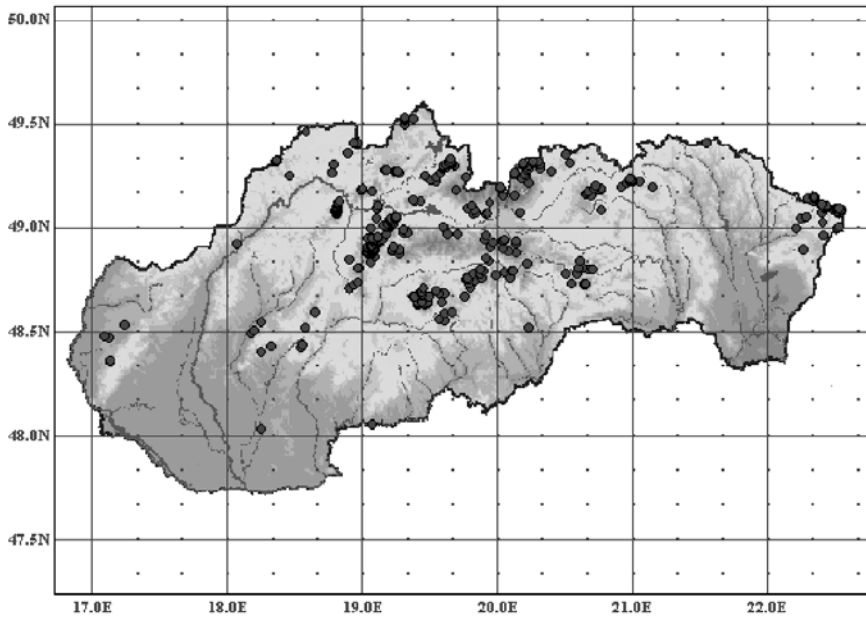


FIGURE 1 (continued from the previous page) - c) *Nardetea strictae*

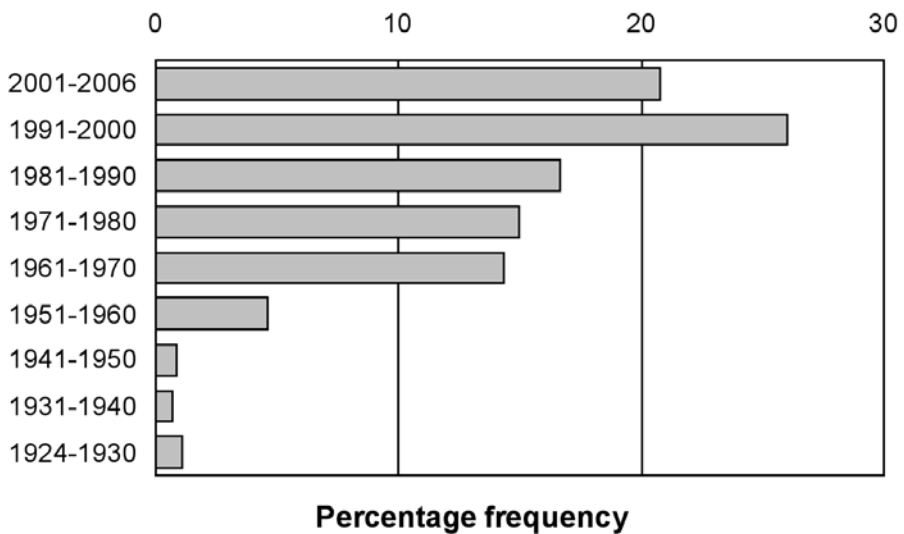


FIGURE 2 - Percentage frequency of relevés made in each decade since 1922 until end of 2006. Missing dates for relevés were substituted by publication dates.

TABLE 1 - Number of bibliographic references compiled in the database and number of relevés belonging to individual published sources.

Data source	Number of studies	Number of relevés
Published papers and monographs	230	3 965
Diplom theses and Ph.D. dissertations	39	1 526
Publicly accessible manuscripts	17	402
Unpublished relevés	-	5 219
Total	286	11 112

TABLE 2 - Twenty authors with the highest contribution to the database. Number of relevés is given for individual authors

Ružičková H.	2648	Háberová I.	211
Uhliarová E.	601	Maglocký Š.	209
Kliment J.	547	Jurko A.	205
Škodová I.	383	Linkešová K.	194
Ujházy K.	323	Hájková P.	192
Janišová M.	286	Miadok D.	182
Bosáčková E.	252	Klika J.	164
Balátová-Tuláčková E.	232	Dzubinová L.	155
Zlinská J.	223	Vozárová M.	141
Špániková A.	217	Krippelová T.	138

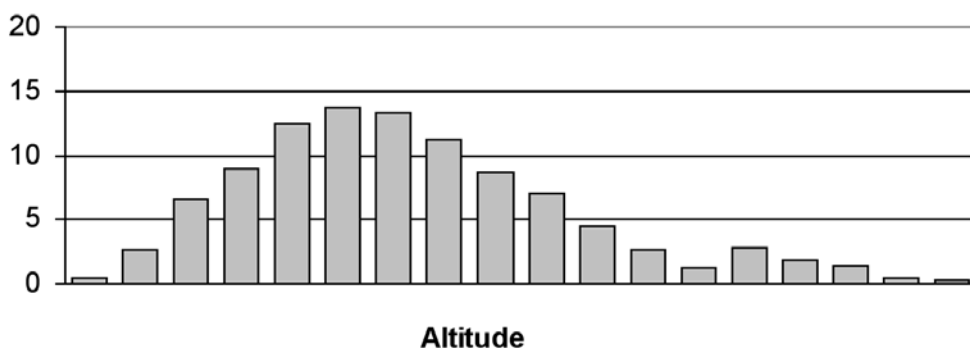


FIGURE 3 - Altitudinal distribution of grassland relevés. Percentage frequency of relevés is given for altitudinal intervals of 100 m.

TABLE 3 - Most frequent species or species aggregates (present in more than 25% of relevés) in the database and the number of relevés with their occurrence.

<i>Achillea millefolium</i>	6267	<i>Festuca pratensis</i>	3963
<i>Ranunculus acris</i>	5067	<i>Alchemilla spec div</i>	3999
<i>Plantago lanceolata</i>	4953	<i>Dactylis glomerata</i>	3890
<i>Lotus corniculatus</i>	4909	<i>Leontodon hispidus</i>	3871
<i>Trifolium pratense</i>	4778	<i>Cruciata glabra</i>	3759
<i>Anthoxanthum odoratum</i>	4741	<i>Taraxacum sect. Ruderalia</i>	3664
<i>Acetosa pratensis</i>	4721	<i>Luzula campestris</i>	3556
<i>Festuca rubra</i> agg.	4574	<i>Pimpinella saxifraga</i>	3413
<i>Leucanthemum vulgare</i> agg.	4477	<i>Campanula patula</i>	3078
<i>Poa pratensis</i> agg.	4383	<i>Potentilla erecta</i>	3068
<i>Briza media</i>	4218	<i>Plantago media</i>	3109
<i>Agrostis capillaris</i>	4130	<i>Cerastium holosteoides</i>	3143
<i>Trifolium repens</i>	4119	<i>Prunella vulgaris</i>	2870
<i>Veronica chamaedrys</i>	3986	<i>Vicia cracca</i>	2861

TABLE 4 - Percentage of missing values in the relevé header data.

Variable	% of missing values
Date of sampling	8.2 (910 relevés)
Plot size	14.6 (1628 relevés)
Altitude	26.4 (2934 relevés)
Herb layer % cover	33.1 (3685 relevés)
Moss layer % cover	63.3 (7035 relevés)
Identification of cryptograms	78.4 (8723 relevés)

TABLE 5 - Accuracy of relevé location in the database as a whole compared with more recent relevés (number of relevés and proportion in the data set is given in individual precision categories).

Accuracy of location	All data set		Rel. made after 1990		Rel. made after 2000	
	No rel.	%	No rel.	%	No rel.	%
Without coordinates	1 380	12.4	224	4.3	87	3.5
20 m-precision in site location (GPS)	1 662	14.9	1 155	22.6	582	23.5
20 to 100 m-precision in site location	337	3.0	292	5.7	274	11.0
over 100 m- precision in site location	7 742	69.7	3 438	67.4	1536	62.0
Total	11 121	100	5 109	100	2 479	100

## DATA QUALITY

The quality of our grassland database is strongly dependent on the quality of phytosociological relevés which were compiled from numerous sources (Table 1). Along with misidentification of some species in the field or typing errors the most serious limitation of the database is in insufficient attention paid to the cryptogam species. More than three quarters of relevés lack the bryophyte and lichen records (Table 4). This is especially true for relevés of mesophilous grasslands where the cryptogams usually do not play an important diagnostic role. Further limitation is caused by the missing header data attributes concerning the date, the relevé size, or insufficient description of relevé location (Table 4). Older relevés have been additionally located during the last two years. Due to the utilization of GPS (Global Positioning System) in the field the accuracy of relevé location is rising towards the recent time (Table 5).

## CONCLUSIONS AND PERSPECTIVES

According to our experience the building of a large phytosociological database is one of the best ways how to stimulate and broaden the existing phytosociological research. The database is an important source of historical information on the existing vegetation types and we suppose its value will rise in the future. But its main utilization we see in the synthetic evaluation of our knowledge on the grassland plant communities and the development of an adequate classification system. The process of the database completion and improvement by increasing the data quality or by establishment of links among other biological databases is a continuous effort and we stay still at the beginning of this process. Anyway, we hope our initiative will lead to better understanding of grassland vegetation at the national or even international level and to the development of the formalized identification system of grassland vegetation types applicable in the nature conservation and landscape planning.

## ACKNOWLEDGEMENTS

We thank all botanists which contributed to the Central Phytosociological Database or provided unpublished relevés. This contribution was supported by grants APVT-51-015804 and VEGA 2/5084/25.

## REFERENCES

- HEGEDŮŠOVÁ K., 2007 - *Centrálna databáza fytoecologických zápisov (CDF) na Slovensku. (Central database of phytosociological relevés in Slovakia)*. Bull. Slov. Bot. Spoločn. **29**: 124-129.
- HENNEKENS S.M. & SCHAMINÉE J.H.J., 2001 - *TURBOVEG, a comprehensive data base management system for vegetation data*. J. Veg. Sci. **12**: 589-591.
- JURKO A., 1969 - Die Weidegesellschaften des Strážover Berglandes in der Nordwestslowakei und die syntaxonomischen Probleme des Cynosurion-Verbandes in den Westkarpaten. Folia Geobot. Phytotax., Praha, **4**: 101-132

- KLIMENT J., 1994 - *Die Polygono-Trisetion Gesellschaften in der Slowakei*. Preslia, Praha, **66**: 133-149.
- ŠPÁNIKOVÁ A., 1978 - *Gesellschaften mit Molinia caerulea in der Slowakei*. Biológia (Bratislava), **33 (4)**: 291-305.
- ŠPÁNIKOVÁ A., 1984 - *Die Variabilität der Assoziation Arrhenatheretum elatioris Braun 1915 auf dem Gebiet der Slowakei*. Biológia (Bratislava), **39 (9)**: 887-897.
- VALACHOVIČ M., 1996 - *TURBOVEG - celoeurópsky databázový program pre fytoecnologické dáta. (TURBOVEG – a pan-European database program for phytosociological data)*. Bull. Slov. Bot. Spoločn. **18**: 189.