7th European Dry Grassland Meeting

Succession, management and restoration of dry grasslands

27-31 May 2010
Smolenice Congress Centre, Slovak Republic

Abstracts & Excursion Guides

Edited by Monika Janišová, Monika Budzáková and Mária Petrášová

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Excursion Guides
by Karel Fajmon, Viera Feráková, Katarína Hegedüšová, Monika Janišová, Sylva Mertanová, Katarína Rajcová, Dušan Senko and Iveta Škodová

Memories to Pavel Deván and his bibliography
by Jozef Májsky, Tomáš Derka, Peter Jánsky and Andrej Štangler

Translation of contribution by J. Májsky and T. Derka: Katarína Rajcová

Graphical design: Riki Watzka

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Figure on the cover page: Dynamics of dry grassland vegetation in the Tematínske vrchy Mts. is ruled mainly by the succession of woody species. Dramatic changes in the cover of woody species are obvious in the photos of the western ridge of Kňaží vrch taken in 1993, 2005 and after removal of woody species in 2010. Photos: M. Janišová.

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19.00 Dinner

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Abstracts

The South-East European Dry Grassland Group (SEEDGG) and its supranational vegetation database: project, overview of available data and first analyses

Iva Apostolova[1]*, Claudia Bita-Nicolae*[2]*, Jürgen Dengler*[3]*, Monika Janišová*[4]*, Anna Kuzemko*[5]*, Inge Paulini*[6]*, Hristo Pedashenko*[8] *& Alexey Sorokin*[7]

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In February 2010, the South-East European Dry Grassland Group (SEEDGG) was founded in Hamburg as a regional subgroup of the European Dry Grassland Group (EDGG). Geographically, SEEDGG covers the area of S Poland, Slowakia, Hungary, Serbia, Macedonia, Bulgaria, Romania, Moldova, Ukraine, Russia (S sector of European part), Kazakhstan (European part), Georgia, Azerbaijan, and Armenia. The basic aims of SEEDGG are:

- to establish a comprehensive database of steppe vegetation and related grasslands in SE Europe
- to use this database for analyses of diversity patterns, large-scale consistent classifications, and for conservation planning
- to collect high-quality data on grassland diversity in little known regions of SE Europe in joint EDGG Research Expeditions
- to connect the researchers from the different countries in this region of Europe.

SEEDGG presently (as of 21 March 2010) has 128 members and is governed by a Steering Committee (chair: Iva Apostolova) together with national representatives. The joint database will be handled under TURBOVEG. Presently, we are

collating uniform species lists and header data structures across the 14 involved countries. Further, we are compiling an overview about existing relevé data (1-100 m^3 plot size) of dry grasslands from the study region. At the conference, we will provide a first meta-analysis of this compilation.
Further, we announce the 2nd EDGG Research Expedition, which will lead to Central Podilia, a little studied region of Ukraine with highly diverse grasslands. From 10-25 July 2010, we will sample high-quality baseline data for biodiversity analyses, large-scale classification, and conservation planning. The 18-person expedition is led by Anna Kuzemko (Ukraine) and Jürgen Dengler (Germany), and interested colleagues can apply for participation.

Vegetation types of the initial successional stages of grasslands in the Horné Požitavie region, Mid-Western Slovakia

***Andrej Bača*[1]**

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Eight vegetation types (eleven including the sub-types) of the moist and semi-dry permanent grasslands abandoned for 2-33 years or extensively grazed were identified in a submountain area of 40 km^2. Woody plants cover did not reach over 15 % on the localities. Their actual vegetation was recorded on the plots of 49 m^2 and assigned to 3 age categories of abandonment. The vegetation types were distinguished using the indirect gradient analysis DCA that allows to find links between the types of abandoned vegetation and towards the managed grasslands. Ecological factors were analysed as well to facilitate the classification and to identify the driving forces of abandonment. The main criteria for defining a vegetation type were the presence of a characteristic dominant species, moisture and pH level. Frequency of species that accompany the characteristic dominants was calculated from the detailed plots of 1 m^2. Presence of woody plants and its trends were analysed as well. The aggregate taxons *Rosa canina* and *Crataegus monogyna* represented the most abundant woody plants in this type of abandoned grasslands in the altitude of 450-700 m. Species diversity of grasslands did not vary significantly among the overall age categories, but slightly increased in semi-dry grasslands and slightly decreased in moist grasslands. Species diversity was negatively affected by expansion of dominant species.

The 45-year changes in calcareous xerothermic vegetation in the Lower Odra river valley (NW Poland)

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3 *Museum and Institute of Zoology, Polish Academy of Sciences, Wilcza 64, 00-679 Warsaw, Poland*

We compared characteristics of calcareous xerothermic vegetation in Odra river valley (NW Poland) in two periods: 1960 and 2005-08. We used 37 plots (25 m^2 each) located on a 60 km^2 area in the Odra valley on which vascular plants were identified and their abundance was assessed in 1960 and again in 2005-08. In both study periods the field work methods were the same. The increase of plant species number from 89 in 1960 to 155 in 2005-08 was recorded. However the increase was related predominantly with occurrence of several generalists from non-xerothermic associations. Rarefied diversity of all plant species as well as estimated species richness, corrected for unseen species in the samples, increased significantly during the study period. However, in the case of subset of xerothermic specialists the changes were less distinct and insignificant. In contrary, abundance and species richness of non-xerothermic species, including alien and invasive species, or those typical of other communities (meadows, forests) increased significantly during 45 years. Mean coverage per plot of 19 species (13 xerothermic specialists and 6 non-xerothermic) significantly declined, whereas for other 12 species (5 xerothermic specialists and 6 non-xerothermic) significantly increased. On the basis of rate of decline of mean coverage of xerothermic specialists and assuming linear trend we estimated that 23 plants will extinct until 2050. Active protection of the calcareous xerothermic grassland is urgently needed to stop the degeneration process.

Diversity of calcareous xeric grasslands in Poland

Katarzyna Barańska[1,2] *& Michał Żmihorski*[3]

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We investigated variability of plant species composition of calcareous xeric grasslands in three regions in Poland: Odra Valley, Vistula Valley and Uplands. We included data from 67 plots (25 m^2 each, abundance of each species assessed in each

plot) in which 273 plant species were found. The study was carried out on patches of calcareous xerothermic grassland belonging to the *Festuco- Stipion* alliance (class *Festuco-Brometea*) and termophilous, calcareous psammophilous grassland communities from the *Koelerion glaucae* alliance (class *Koelerio-Corynephoretea*). We made an attempt to assess similarity of plant composition of xeric grasslands in the three regions. For this purpose we used DCA implemented in CANOCO software and improved Sorensen similarity index implemented in EstimateS software.

We recorded that grasslands from the Odra Valley and the Vistula Valley were more similar in respect to species composition relative to remaining regions-pairs. What is important, similarity of the grasslands from the Uplands and grasslands from the Odra Valley was significantly higher than the similarity of the grasslands from the Uplands and grasslands from the Vistula Valley. This pattern was confirmed by DCA analysis as well as by the average values of Sorensen similarity index computed for all possible plots-pairs placed in the three regions. This result is unexpected since spatial distance between Uplands and Vistula Valley (340km) is lower as compare to the distance between Uplands and Odra Valley (480km). As a consequence, spatial distance between the regions did not correlate with similarities in plant species composition of calcareous xeric grasslands in the regions. These results may indicate that historical distribution and dispersal of xeric species are responsible for the obtained pattern of similarity of calcareous xeric grasslands in Poland.

Information statistical methods for detecting degradation and regeneration in species rich grasslands

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Successful adaptive management needs powerful methods that are capable of detecting short-term, fine-scale changes in vegetation structure. We propose a new protocol for monitoring fine-scale structural complexity and community assembly rules at multiple spatial scales. The protocol was tested on grasslands representing a gradient of secondary succession and a gradient of degradation due to overgrazing. Study sites are situated in the Transylvanian Lowland in the northern-central part of Romania. The degraded sites occur near the village Valea Florilor on cattle pastures. The grazing gradient consisted of 6 sites at varying distances from a livestock watering point and included a remote reference site dominated by *Brachypodium pinnatum* and *Festuca rupicola* where livestock impacts were minimal. The grazing intensity gradient was verified with changing species

composition using ordination methods. Grassland regeneration was studied on abandoned agricultural fields abandoned 1, 4, 6, 14 years ago near the village Suatu. In each stand, the presences of plant species were recorded along 52 m circular belt transect of 1040 units of 5 cm × 5 cm contiguous microquadrats. We applied information statistics for detecting the diversity of species combinations and for measuring multispecies spatial dependence. Information statistics were calculated across a range of scales from 5 cm × 5 cm to 5 cm × 25 m by merging two, then three, then four, ...etc. consecutive microquadrats by subsequent computerised samplings from the baseline transect data sets.

Diversity of species combinations decreased while the grain of the related patterns increased along the gradient of increasing grazing intensity. The opposite trend was found along the successional gradient. Multispecies spatial dependence showed no consistent trends.

The diversity of species combinations proved to be a very sensitive indicator of community degradation or regeneration and therefore we recommend to use it in the monitoring of grassland management. The disadvantage of this method is the large sample size required for unbiased estimates. However, the characteristic maximum scales of information statistics are more robust. Consequently, the direct monitoring of these characteristic scales are proposed in extensive field works.

The primary pastures in the Bucegi Mountains

***Claudia Biță-Nicolae*[1]**

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The primary pastures in the Bucegi Mountains lie on vast areas, on slightly inclined slopes through the alpine lower belt.

Those phytocoenoses vegetate on poorly developed oligotroph and strong acid lithosoils. They have an artic-alpine common origin representing the final stages of the vicarious climax but are conditioned by aeolian regime but also edaphic factors. In the floristic structure of those groups could be distinguish the presence of a high number of artic-alpine elements that hold as well the edificator role in those coenoses.

The stepconditions of those species of the pastures (excesive harsh climate with short and cold summers, with long winters and 5-6 months snow, strong and almost permanent winds) allow to the biological form diversification, the adoptation of short port and the growing in pillows of many species. The short time of the vegetation (3-4 months) induces acceleration of the phenophase of alpine species; it is observed reduction of the sexual reproduction for the vegetative many times.

In that area it were noticed *Potentillo chrysocraspedae-Festucetum airoidis* Boşcaiu 1971, *Scorzonero roseae-Festucetum nigrescentis* (Puşcaru et al. 1956) Coldea 1987, *Violo declinatae-Nardetum* Simon 1966, *Phleo alpini-Deschampsietum caespitosae* (Krajina 1933) Coldea 1983.

Ecological characterization of central Italy dry pastures belonging to habitats 6210(*) and 6220*

Sabina Burrascano[1], *Emanuela Carli*[1], *Riccardo Copiz*[1], *Eva Del Vico*[1], *Laura Facioni*[1], *Francesca Pretto*[1], *Agnese Tilia*[1] *& Carlo Blasi*[1]

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In Italy dry grasslands are greatly spread in relation to the influence of Mediterranean climate, with maximum temperatures corresponding to the year driest period, and of traditional land use characterized by grazing activities. Such grasslands occur mainly on calcareous substrata along the Apennines chain, where site conditions and land use lead to the occurrence of very shallow soils.

Especially in central Apennines the most spread dry grasslands types are those dominated by *Bromus erectus* included in the Habitat 6210(*) and those referred to the habitat 6220* of the European Directive 92/43/EEC.

In our study we considered 215 phytosociological relevés, sampled in the Tyrrhenian sector of Central Italy (Latium), of pastures dominated by *Bromus erectus* or by annual species that are maintained by grazing traditional practices. Our aim is to evaluate the contribution of geographical and environmental factors in determining the floristic variation of the considered grasslands, in order to characterize the habitats of the studied communities.

We analysed the dataset through Non-metric Multi-Dimensional Scaling (NMDS), using relevés geographical coordinates for the initialization of the analysis. In order to understand which ecological factors determine the difference in structure and composition we calculated Kendall's Tau correlation coefficient between the ordination axis scores and geographical, topographical and climatic variables. Multi-Response Permutation Procedures (MRPP) were used to test the significance of the differences between *a priori* clusters based on geographical (mountain groups) and climatic units.

The axis of the NMDS are related mainly to factors critical to drought in these environments (percentage of stones on the ground, distance from the coast and summer rainfall) and to climate (altitude, minimum temperatures and winter stress). However, MRPP highlighted how both geographical and climatic units are mostly significantly different.

Our data witness how dry grasslands in the Tyrrhenian sector of central Apennines are related to climatic variables that indicate the most important sources of stress for vegetation in this area (drought and winter coldness).

Steppe communities of Upper Don river, Russia

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The territory of Upper Don is located in the north of Srednerusskaya Hill of the European Russia and is characterized by typical forest-steppe landscape. Paleogeographical researches showed that formation of steppe communities began in Late Holocene but in XVII-XVIII centuries they were destroyed and used as the ploughed fields (Gonaynyi, Aleksandrovskyi, Glasko, 2007). This direction of land using was kept for the last 300 years. Natural steppe communities saved in small plots. Now all of them are regionally protected areas.

Upper Don river has 5 steppe protected areas: "Srednyi Dybik" (13.5 ha), "Niznyi Dubik" (14.9 ha), "Tatinki" (23 ha), "Gorki" (34.8 ha), "Rykhotka" (30.2 ha) and some steppe areas outside protected zones. Investigation of them showed that steppe communities were formed on the slopes of ravines, on chernozem soil with limestone gravel. The abundance of herb layer is 60-70 % (till 95 %). The height of herbs is 10-45 cm, sometimes – till 100 cm (*Centaurea ruthenica*, *Lavatera thuringiaca*, *Echinops ritro*). The shrubs grow rare (*Cerasus friticosa*, *Chamaecytisus ruthenicus*). The concentration of plants is 35-50 species for 100 m^2. The description of vegetation allowed to point out 3 associations (Averinova, 2009):

Class *FESTUCO–BROMETEA* Br.-Bl. et Tx. 1943
Order *Festucetalia valesiacae* Br.-Bl. et Tx. ex Br.-Bl. 1949
Alliance *Festucion valesiacae* Klika 1931
Ass.: *Gypsophilo altissimae-Centauretum ruthenici* ass. nov.
Ass. *Lino flavi-Stipetum capillatae* ass. nov.
Subass. *L. f.-S. c. typicum* subass. nov.
Subass. *L. f.-S. c. astragaletosum onobrychis* subass. nov.
Ass. *Gentiano cruciatae-Stipetum pennatae* ass. nov.
Subass. *G. c.-S. p. typicum* subass. nov.
Subass. *G. c.-S. p. solidagetosum virgaurea* subass. nov.
Subass. *G. c.-S. p. stipetosum pulcherrimae* subass. nov.

These communities are very rare for the region and occupy small areas that is the result of agricultural activity. They have 34 rare and protected in this region species of plants. It means that the steppe communities are the centres of floristic and

phytocenotic diversity of Upper Don river. Reconstruction of steppe landscapes on their natural areas, which are now under agricultural press, will allow to save the typical landscape of northern forest-steppe of the European Russia.

In search of *Pulsatilla pratensis* populations

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In north-eastern Germany, most of the *Pulsatilla pratensis* populations have died out e.g., in Brandenburg and Berlin, only 22 of the former 482 populations have survived with more than 5 individuals. Research into their vitality (number of leaves, flowers and seeds) as well as their germination and establishment show effects of gene depression (infertility, longer germination time, low vitality, death).

Who knows of populations in the distribution range that I can investigate genetically (AFLP) to gain an overview of population size (adults and seedlings), vitality and genetic diversity within the population?

Environmental and plant richness changes as a result of long-term different disturbance intensities in Sub-mediterranean grassland (Central Italy)

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In the whole Europe, semi-natural calcareous grasslands are in strong decline in extension and threatened by abandonment (Riecken et al. 2002) and these managed pastures, being very rich-species ecosystems and representing priority habitat for European Union (92/43/EEC Directive) are noteworthy of conservation (Pärtel et al. 1996, Sebastià et al. 2008).

The study area is located in Central Italy at 1500 m a.s.l. and it is characterized by calcareous substratum, Northern aspect and a slope of 15-20°. Inside it traditional

pastoral activities are mowing at the end of June then grazing. In last decades these practices underwent a collapse and intermediate situations (only mowing) or abandonment occurred. In this study the results regarding long-term change due to management modification (mowing and grazing–data of 1982, mowing and abandonment–data of 2005) are compared for the comprehension of different disturbance regimes effects on floristic richness and ecological differentiation. Contrarily to Grime's theory (1973), the highest species richness is not noted in intermediately disturbed grassland, but in abandoned pasture; in unmanaged situation an increase of *Brachypodium genuense* is evidenced. This provokes floristic (66 % of whole flora) and soil parameters changes. The biggest shifts interest biomass and litter production, soil moisture, pH and nitrogen value. *B. genuense* has big dimension, strong vegetative capacity and high phytomass production that ensuing the formation of big litter amount, thus giving to this species a strong competitive ability. Early flowering strategy allows to avoid the period of top expansion of *B. genuense* and/or regenerative strategies (stolons first of all) consenting the competition with *B. genuense* for water and nutrients resources.

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Xerothermic grasslands of Borowa Góra hill (Lublin province, Tomaszów Lubelski county, SE Poland) – a potential Natura 2000 site

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Borowa Góra is a vast limestone hill located in the junction point of Roztocze upland, Wyzyna Zachodniowolynska upland and Kotlina Pobuza basin. The region where the hill is located, with SW-exposed slopes of the Solokija river valley is distinguished by the presence of xerothermic plant communities of *Festuco-Brometea* and *Trifolio-Geranietea sanguinei* and some of them are already protected

(e.g. „Zurawce“ Natura 2000 site PLH060029 and „Biala Góra“ site of ecological interest). The majority of of Borowa Góra hill grassland patches was ploughed and afforested in the end of the 20th century. Fortunately, most of the tree plantings do not seem to prosper in this dry and sunny environment and the grasslands are regenerating rapidly. Their good condition is best proven by the occurrence of various law protected plant species, e.g.: *Orchis purpurea*, *Orchis militaris*, *Platanthera chlorantha*, *Cypripedium calceolus*, *Muscari comosum*, *Linum flavum*, *Clematis recta*, *Orobanche lutea*, *Anemone sylvestris* and *Aster amellus*. Rare but not yet protected by the Polish law plant species are represented by *Stachys germanica*. The occurrence of orchid-rich dry grasslands of *Festuco-Brometea* makes this site worthy of protection. Therefore, the Borowa Góra hill was proposed as a Natura 2000 site in the beginning of 2008.

Different regeneration success of sandy old-fields in the forest-steppe region of Hungary

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Abandoned agricultural fields are potential sites for the regeneration of semi-natural grasslands, but still we know little about which species and plant communities can establish well on these new habitats. Moreover we have to face the methodological problems of measuring the success of regeneration.

According to a recent estimation, app. 300 000 ha of arable land have been abandoned in Hungary in the past 50 years, and the sandy region of Kiskunság in central Hungary was a focal area in this process. Spontaneous succession of these old-fields may be different depending on the elapsed time, the habitat characteristic and the available species pool.

We examined 161 old-fields (each sampled by a 400 m^2 plot) within sixteen, 25 km^2 sites dominated by different land use types that represent the main land-use forms in the Kiskunság (forest plantations, agricultural lands, and natural habitats). Old-fields were categorized into three age groups based on aerial photographs: fields abandoned 1-7, 8-20, and 21-57 years ago. The vegetation data was analysed by using different species groups such as neophytes and the characteristic species of natural habitats. The list of the latter ones was obtained through an intensive sampling (161 plots, 400 m^2 each) of natural habitats at the same study sites.

The success of regeneration could be indicated well with the characteristic species of present natural habitats. The number of these characteristic species increased with increasing old-field age and with the extent of natural dry grasslands with-

in500 m around the old-fields. The number of neophyte species decreased with with increasing old-field age, but did not depend on the surrounding landscape. Young old-fields were the most heavily affected by invasive plant species, probably because of the recent intensive spread of alien invasive species in the region. The main invasive species on old-fields were the perennial and clonal *Asclepias syriaca*, the annual and allergenic *Ambrosia artemisiifolia*, and the annual *Conyza canadensis*. Old-fields became similar but not the same as the remained semi-natural habitats in the region in even 50 years. We propose that due to the altered abiotic conditions (water availability) and biotic conditions (alien species) in the region these old fields will never completely resemble to their natural counterparts. Instead, these communities should be viewed as novel ecosystems, with still high conservation value.

Reconstruction of dry grassland on roadside slope in the SE Slovenia

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The grasslands in southeastern Slovenia are quite diverse and are classified into the order *Scorzonetelia* (*Festuco-Brometea*). The search took place on roadside slopes that was built in 1997. The network of permanent plots has been established and was resampled every year. The analyses show changes in floristic composition and in various plant traits. The species of *Festuco-Brometea* and *Trifolio-Geranietea* are considered as target species. The results show that the vegetation line develops towards dry grasslands, but it depends also on seed mixture that was applied on the slope and on fluctuation of climatic conditions.

How did changes in landscape management influence dry grasslands composition after the Velvet Revolution?

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The South Bohemian limestones region hosts specific grassland vegetation having character of terrestrial islands in agricultural and forested landscape. We resampled 21 localities with open seminatural vegetation in order to assess changes in plant traits due to changes in landscape management after more than 20 years. The set of 2×78 records (made before and after 1989 – a revolutionary year in the Czech Republic) was used for comparison. Based on species composition of old and new records, we compared interspecific associations, ecological indicator values, Mantel tests of similarity matrices and biological traits (BIOLFLOR database). Shifts of beta-diversity and in interspecific associations were revealed on sites during time. The apparent is the decrease in light demands and increase in nutrient demands on stands. There is a closer correlation between geographical distance and vegetation similarity in the current landscape meaning the vegetation becomes more homogeneous without local irregularities typically driven by site-specific management regimes in the past. Selected biological traits were tested only for species with significant frequency change between the two periods. Apparent changes are for (a) type of reproduction (tendency to vegetative reproduction in the new dataset), (b) life span (strong retreat of shirt-lived plants), (c) phenological period (shifts to early phases), (d) storage organs (retreat of plants with pleiocorm) and (e) vegetative propagation (increased abundance of rhizomatous species). Generally, the management changes were followed by successional changes within grasslands with the impoverishment of small-scaled diversity.

Xerothermic limestone grasslands on the Działy Grabowieckie region (Lublin Upland, SE Poland)

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Dzialy Grabowieckie region is situated in the eastern part of the Lublin Upland (SE Poland). The occurrence of xerothermic grasslands and shrubs is typical for this area. Thermophilous species can be found on balks, roadbanks and marginal parts of fields but the typical xerothermic plant associations occur on steep slopes with limestone cropping out. In the past the most common associations were

Inuletum ensifoliae and, on deeper layer of soli, *Thalictro-Salvietum pratensis*. At present, only small patches of *Thalictro-Salvietum pratensis* remained, however *Inuletum ensifoliae* reshapes in associations from *Trifolio-Geranietea* class. Another frequent on such habitats type of vegetation was, and still is a community with two codominating species: *Brachypodium pinnatum* and *Teucrium chamaedrys*. The classification of this community was confused. It was distinguished as separate association *Brachypodio-Teucrietum*, recognized as *Adonido-Brachypodietum pinnati* or *Origano-Brachypodietum*. The aim of this paper is characterization and classification vascular plant communities occurring on chalk slopes, especially that with *Brachypodium pinnatum* and *Teucrium chamaedrys*.

Main characteristics and spreading of the plant community ass. *Erysimo-Trifolietum* Micevski 1977 in the Republic of Macedonia

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Highland pastures in the territory of the Republic of Macedonia are secondary vegetation formations, they are taking about 521 000 ha. Field studies were realized during the year 2004 and 2005, on many locations in the NE part of the Republic of the Macedonia, where 72 vegetation relevés were made. Vegetation relevés (taken by our team and other authors) were added in the Turboveg data base (Hennekens, 2001). Various multivariate analyses were used for this purpose, involving computers programs as SYN-TAX (Podani, 2001), JUICE 6.4 (Tichy, 2006) and STATISTICA 7.0 (StatSoft, Inc., www.statsoft.com). After a comprehensive analysis it was concluded that the studied area is inhabited with the association *Erysimo-Trifolietum* Micevski 1977 (alliance *Trifolion cherleri*, order *Astragalo-Potentilletalia*, cl. *Festuco-Brometea*). The association *Erysimo-Trifolietum* Micevski 1977 is differentiated in two subassociations – subass. *scleranthetosum* subass. nova and subass. *brachypodietosum* subass. nova, beside already described subass. *onobrychetosum* Micevski 1977. The subassociations are characterized ecologically and floristically.

Key words: ass. *Erysimo-Trifolietum*, *Trifolion cherleri*, new subassociations, Republic of Macedonia

Species richness and threatened vascular plant species of the Sub-Pannonic steppic grasslands in the southern part of Krupinská planina Mts.

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The Sub-Pannonic grassland alliance *Festucion valesiacae* Klika 1931 with the dominance of *Festuca pseudodalmatica* and *Poa scabra* is a relict plant community in Slovakia. It extends on the Slovak territory from Hungarian volcanic mountains (Bükk, Matra). The most beautiful ground covers have been located in Krupinská planina Mts., on the andesites and tuffs in the southern part of Krupinská planina Mts. The Sub-Pannonic steppic grasslands (Natura 2000 code No. 6240), were studied at two localities: (i) Šipka hills (the nature reserve, 430 m a.s.l., where we found out 276 species) and (ii) Čierny hrad hills (332.2 m a.s.l., 262 species respectively). The examined steppic grassland association were *Inula oculus-christi-Festucetum pseudodalmaticae* Májovský et Jurko 1956. Except the dominant species *Festuca pseudodalmatica*, *Poa scabra*, *Cleistogenes serotina* we also recorded: *Allium flavum*, *Arenaria leptoclados*, *Erophila verna*, *Galium pedemontanum*, *S. sexangulare*, *Teucrium chamaedrys*, *Thymus pannonicus*, *Orlaya grandiflora*, *Potentilla arenaria* agg., *Veronica verna* etc. Except the high species richness of the *Inula oculus-christi-Festucetum pseudodalmaticae* community is valuable from ecological point of view. Many rare and endangered species, for example *Allium rotundum*, *Allium sphaerocephalon*, *Campanula macrostachya*, *Carduus collinus*, *Echium russicum*, *Iris pumila*, *Orchis purpurea*, *Pulsatilla pratensis*, *Stipa tirsa*, *Xeranthemum annuum* occur there. Furthermore the next existence of the steppic grasslands and the populations of the rare species are endangered. The reason is the overgrowing of natural seeding plants because the grazing ended. The risk factor is the expansion of non-native invasive species such as *Robinia pseudoacacia*, *Ailanthus altissima*, *Stenactis annua*, *Galinsoga parviflora*, *Veronica persica*, *Artemisia vulgaris*, *Picris hieracioides* agg., *Sambucus nigra*, etc. We propose to include the studied sites in the proposed area of Natura 2000 "Brezová stráň" (SKUEV0392).

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The basiphilous semi-dry grasslands (*Festuco-Brometea*) in N and NE Europe: gradient analysis and large-scale classification

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The aim of our study was to develop a comprehensive and consistent classification of the basiphilous semi-dry grasslands (*Festuco-Brometea*) in the Nordic (Scandinavian) and circum-Baltic regions. This area includes ten countries or parts of them, namely Norway, Sweden, Finland, Russia, Estonia, Latvia, Lithuania, Poland, Germany, and Denmark. Further, we aim to unravel gradients in species composition and species richness across the studied regions and reveal the role of relevant ecological factors structuring the complexity of the *Festuco-Brometea*.

For the purpose of this study, we made use of the phytosociological database of the "Working Group on Dry Grasslands in the Nordic and Baltic Region", which is a joint project of colleagues from all ten listed countries. Ultimately, our aim is to include in the database all available relevés (both published and unpublished) of the dry grasslands and related vegetation types from the study area. As prerequisites for inclusion of the plots into the database we consider the size of the relevés not to lie outside 1 m^3 and 100 m^3, and presence of basic meta-information on the locality of a relevé. Presently, the database contains some 8 000 of the ca. 20 000 suitable relevés we are aware of. For the present study, we attempted to enter at least all relevés showing obvious similarities to the *Festuco-Brometea*.

The first decisive step in any classification is to delimit the syntaxon in focus unambiguously throughout the studied data set. It is evident that this delimitation can neither be based on the original assignment of the relevés nor on an a priori classification of all vegetation types of that area (as such a system is not available). Thus, we used generally accepted diagnostic taxa of relevant classes and assigned each relevé to the one class whose diagnostic species prevailed. The obtained subset of the *Festuco-Brometea* relevés was than subjected to various classification analyses. We present the pros and cons of each approach used and present a new, robust phytosociological classification of the studied communities.

The World Index on Plot-Based Vegetation Databases – project and meta-analysis of available data

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Questions: How many vegetation relevés are available in electronic databases, how are they distributed in terms of geography and habitat types, what are their properties and what are potential uses?

Location: Global.

Methods: We collated the World Index of Plot-Based Vegetation Databases, a global metadatabase on vegetation databases within the framework of the International Association for Vegetation Science that is publicly available on the internet and will be updated continuously. For inclusion, databases need (i) to contain temporally and spatially explicit species co-occurrence data of photoautotrophic organisms for plots up to 10 000 m^3 (1 ha) and (ii) to be basically accessible to the scientific public. For this paper, we analysed the information on the databases that have been registered until April 2010.

Results: The registered 54 databases contain more than 1.4 million relevés (as of 21 March 2010). While presently, the majority of data is available for Europe, there are also several databases on all other continents except Antarctica. The data go back to 1910, but the vast majority has been collected during the last three decades. Predominant plot sizes range from 1 to 400 m^3. The databases also contain time series and nested-plot data but they are only a minority. We will present first analyses which fraction of the relevés are connected with structural parameters, soil characteristics or other plot-based environmental parameters.

Conclusions: Plot-based vegetation databases could make a significant contribution to ecoinformatics as they contain huge amounts of species occurrence records (in some regions exceeding the number of records in mapping or herbarium databases). Compared to these other flora-related databases, the databases included in our metadatabase are outstanding in so far as they contain explicit small-scale co-occurrence data often connected with measured environmental data and that they correspond to a spatial grain that is directly relevant to many ecological processes. Making the wealth of already digitised relevé data easily accessible via our metadatabase thus likely will stimulate many new and exciting large-scale ecological analyses.

European Dry Grassland Group (EDGG) – join the network of dry grassland researchers and conservationists

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The European Dry Grassland Group (EDGG) has been established in August 2008 as an informal network of dry grassland researchers and conservationists throughout Europe. Meanwhile, it gained nearly 500 members from more than 40 countries. Research interests of its members include all aspects of dry grasslands: flora, fauna, diversity, ecology, population biology, management, conservation, restoration, environmental legislation and education. EDGG has become an official Working Group of the International Association for Vegetation (IAVS). Presently, the EDGG has three regional subgroups (German Arbeitsgruppe Trockenrasen, Working Group on Dry Grasslands in the Nordic and Baltic Region, Mediterranean Dry Grasslands, South-East European Dry Grassland Group).

The basic aim of the EDGG is to stimulate the exchange of ideas and data as well as cooperation across national borders. For this purpose, EDGG has developed four major tools:

- the homepage (http://www.edgg.org);
- the newsletter with a quarterly periodicity (http://www.edgg.org/publications.htm);
- the mailing list for urgent issues; and
- annual conferences at varying topics and locations (http://www.edgg.org/events.htm).

During the short time of its existence, the EDGG provided its members with relevant information on the past and forthcoming scientific events and new publications. Moreover, a forum for questions, calls and other communication forms is available through the homepage or Bulletin of the EDGG. A specific focus of the EDGG and its regional subgroups is the establishment of national and supranational vegetation databases of dry grasslands and related vegetation types, and their subsequent connection and analysis.

The 7th European Dry Grassland Meeting will be held from 28 May to 1 June in Smolenice (Slovakia) with the main topic "Succession, restoration and management

of dry grasslands" (registration is already completed). In July 2010, there will be a joint EDGG Research Expedition in Ukraine, and in 2011 the 8th European Dry Grassland Meeting is scheduled for Uman', Ukraine.

Finally, we cordially invite all interested colleagues to join EDGG (without any obligations) and to contribute to its activities – just contact the first author, who is the membership administrator.

Festuco-Brometea communities of the Transylvanian Lowland (Romania) – a preliminary overview on syntaxonomy and biodiversity

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In the Transylvanian Lowland (Romania), extended dry grasslands still exist that are outstanding in diversity and conservation status compared to European standards. However, this treasure is not well documented so far. Despite a variety of local phytosociological studies by Romanian colleagues, three major issues have hardly been addressed before: (i) arrangement of the vegetation types within a consistent national or supranational classification based on modern methodological approaches; (ii) consideration of the bryophytes and lichens in these dry grassland stands; (iii) description and analysis of the scale-dependent diversity patterns in these communities.

In a joint Romanian-British-German-Turkish cooperation within the EDGG (1st EDGG Research Expedition), we aimed at collecting baseline data for all three aspects. For this purpose, we sampled the whole range of *Festuco-Brometea* communities occurring in different sites (many of them within Natura 2000 sites) in Transylvania, mainly in the districts of Cluj and Braşov. We applied two sampling designs, nested-plot sampling with plot sizes ranging from 1 cm^3 to 100 m^3 and

phytosociological relevés with a standardised plot size of 10 m^3. In both cases, we sampled vascular plants as well as terricolous bryophytes, lichens, and "algae", recorded major environmental data (altitude, aspect, inclination, microrelief, land use, structural data), and measured fundamental soil parameters.

The studied communities were mostly dominated by grasses, such as *Stipa capillata*, *S. lessingiana*, *S. pulcherrima*, *S. tirsa*, *Bothriochloa ischaemum*, *Brachypodium pinnatum*, *Briza media*, *Bromus erectus*, *Festuca rupicola*, *F. pallens*, *Helictotrichon decorum*, *Sesleria heuflerana*, as well as *Carex humilis* and *C. tomentosa*. The stands are also rich in perennial forbs, with genera such as *Campanula*, *Centaurea*, *Euphorbia*, *Inula*, *Iris*, *Linum*, *Potentilla*, *Salvia*, *Trifolium*, and *Veronica* represented by particularly many taxa. By contrast, therophytes, succulents as well as bryophytes and lichens are much less represented than in other European dry grasslands. We will present a preliminary proposal, in which higher syntaxonomic units (alliances, orders) to place the Transylvanian communities, based on statistically established (phi values) diagnostic species.

We found very high species richness values at all spatial scales, e.g. if compared to similar dry grassland types in Germany. The highest species densities were recorded in meso-xeric hay meadows (*Cirsio-Brachypodion*). Maximum species richness values were 5 (with 5 vascular plant species) on 1 cm^3, 8 (8) on 10 cm^3, 19 (17) on 100 cm^3, 45 (43) on 1 000 cm^3, 82 (81) on 1 m^3, 101 (99) on 10 m^3, and 131 (127) on 100 m^3. It appears that the values at 1 000 cm^3 and at 10 m^3 are possibly the highest ever recorded in any plant community worldwide.

We conclude that studying Transylvanian dry grasslands in more detail would be prominently important to understand the causes underlying the described biodiversity patterns and to place the occurring community types into a consistent continent-wide classification scheme. At the same time, these communities represent an outstanding and highly valuable part of Europe's natural heritage that needs stronger conservation efforts, in particular as many of the stands are threatened by land use changes.

Invasion of *Calamagrostis epigejos* in sandy dry grassland: effects on biodiversity and effectiveness of restoration measures

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The rhizomatous grass *Calamagrostis epigejos* has been expanding in northern Germany during recent decades. Among others, it invades various dry grassland communities to whose biodiversity it is a serious threat.

In an observational study in Höhbeck, Lower Saxony, Middle Elbe Valley, Germany, we analysed how fast *Calamagrostis* polycormons spread into intact dry grassland communities and how much they alter community structure and richness of vascular plants, bryophytes, lichens, and grasshoppers.

In an experimental study at the same sites, we compared the effectiveness of different management techniques, aiming at reducing the negative effect of *Calamagrostis* on conservation values. Particularly, we compared ploughing once at the beginning of the experiment, mowing once, twice, and four times a year as well as intensive grazing by sheep.

We found that the average spreading speed of *Calamagrostis* polycormons into other vegetation types is more than 1 m per year. Shortly after the first culms of *Calamagrostis* had occurred in a plot, the diversity of other plants decreased significantly. In grasshopper communities, the highly adapted specialists were replaced ubiquitous species during the course of invasion. After two years, only high-intensity management techniques, such as ploughing and mowing at least twice a year had significant effects, while grazing and mowing once a year had not.

A continuation of the experiment is necessary to assess the overall benefits of the different treatments (e.g. after two years ploughing was most effective in reducing *Calamagrostis* cover but least effective in increasing species richness).

Factors affecting diversity of plants in agricultural landscape

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The study area Malá Lehota belongs to economically marginal area with high proportion of semi-natural vegetation. In the presented work we applied a holistic approach in the study of factors affecting biodiversity of farmland habitats (e.g. meadows, pastures, orchards, grassland balks, road margins and small scale fields) in changing socio-economic conditions. This approach required us to look at environmental, management factors and other related factors e.g. landscape metric indices, socio-economic and legislation factors. Environmental factors and landscape metrics indices were found to be less important determinants of species richness, compared to the management factors of the studied sites. The results further strongly emphasize the importance of extensive traditional management for preservation of the greatest biodiversity in the study area.

Keywords: biodiversity, Shannon index, farmland habitats, Slovakia

Diversity of dry grassland vegetation in Slovakia

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The contribution brings an overview of the diversity of dry grassland vegetation (*Festuco-Brometea*) in Slovakia. Geographically, Slovakia includes the Western Carpathians and the northern part of the Pannonian Basin. In this territory, 21 dry grassland associations occur. They are classified in the alliances *Bromo pannonici-Festucion pallentis* (rocky Pannonian grasslands), *Diantho lumnitzerii-Seslerion* (dealpine *Sesleria*-dominated grasslands), *Festucion valesiacae* (narrow-leaved continental steppe grasslands), *Cirsio-Brachypodion pinnati* (sub-continental semi-dry grasslands), *Bromion erecti* (sub-atlantic semi-dry grasslands) and *Koelerio-Phleion phleoidis* (dry grasslands on acidic soils). We show the most valuable dry grassland sites, endangered steppe species and discuss the main threats which these vegetation types face at present. We also consider the appropriate management of the dry grassland types.

This contribution was supported by a grant through the EEA Financial Mechanism and the Norwegian Financial Mechanism and from the state budget of the Slovak Republic (SK0115), Science Grant Agency of Ministry of Education of the Slovak Republic and Slovak Academy of Sciences (VEGA 2/0181/09) and Slovak Research and Development Agency (APVT-51-015804).

Response of plant species diversity, functional groups, and species composition to management regimes in Pannonian dry grasslands of Lower Austria

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Dry grasslands of the Hainburger Berge, situated in the Pannonian region of Lower Austria, are a hot spot of rare, threatened and endangered plant species. They contain various thermo/xerophilous habitats, but less than 5 % are lacking of anthropogenic influence. As large areas secondary grasslands, there is a need of continuous management measures to restrain the succession by encroached scrubs and trees, and to assure long-term persistence of dry grassland species and viability of its populations in an open landscape.

To assess success of current management measures for compliance of protection targets, a monitoring framework of different livestock and varying grazing intensities was performed over a 5-year period. Multivariate statistics and Indicator species analysis revealed only weak relationship of diversity measures to management type, whereas species composition (of a total of 170 vascular plant species), functional groups and species abundance indicated consistent shifts in relation to grazing intensities, additionally affected by site characteristics. Usage and benefit of functional species groups, surrogate and target species are discussed in context of long-term preservation of highly valuable steppic grasslands of the Pannonian region.

Floristic diversity of grazed kermes oak stands, adjacent grasslands and phryganic communities

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Quercus coccifera L. is one of the most common species of the Mediterranean flora. Although it is a tree-like species, it is usually found as a shrub forming extensive shrublands, probably due to uncontrolled grazing and logging. The kermes oak forest stands found in Greece is of limited expansion, but of high ecological importance, and they are mainly located in the central and in the southern part of the country. The objective of this study was to compare floristic diversity of four kermes oak tree stands (dense kermes oak – herbaceous understorey, open kermes oak – herbaceous understorey, dense kermes oak – phryganic understorey, open kermes oak – phryganic understorey) and two adjacent open plant communities served as understorey controls; i.e. grasslands and phrygana. All the experimental areas had been long-time grazed by sheep and goats. Species composition and richness were measured. Floristic diversity indices were determined. It was found that canopy closure affects species composition in grassland and phryganic community as well. The grassland understorey control had higher floristic diversity than the two kermes oak – herbaceous understorey stands. On the contrary, open kermes oak – phryganic understorey had higher floristic diversity than dense kermes oak – phryganic understorey and the phrygana (control).

Keywords: canopy density, silvopastoral, species richness, long-time grazing

Dry grasslands in Slovakia – main environmental gradients and impact of management on species composition

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Extensive dataset from national grassland inventory in Slovakia consisting more than 16 000 floristic records was analysed by indirect gradient analysis. Altitude and moisture were detected as main environmental gradients determining grassland species composition. Dry part of the gradient was further analysed to determine main environmental factors influencing species composition of dry grasslands in Slovakia. Main gradient determining the variability of dry grassland vegetation is the gradient from open sandy grasslands to the closed semi-dry grasslands on relatively deep soils. Other important interpreted gradients represent gradient of soil acidity and climatic gradient from xeric dry grasslands to the dealpine grasslands with the presence of mountain species. The role of management present on the sites was analysed then by direct gradient analysis. The analysis confirmed significant impact of management measures on dry grassland vegetation, however variability explained by management measures is rather low.

Community structure changes during 15 years of grassland management experiment in the Poloniny National Park (NE Slovakia)

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The paper presents results of experimental research in 11 permanent plots established in 1994 and 1995 in the wide scale of meadow communities in the Poloniny National Park. The meadow communities of alliances *Cirsio-Brachypodion pinnati*, *Arrhenatherion elatioris*, *Calthion palustris*, *Molinion caerulae*, *Nardo strictae-Agrostion tenuis*, *Violion caninae* and *Calamagrostion arundinacae* are represented in permanent plots. The permanent plot consists typically of two managed and two not managed sub-plots.

The results after 15 years of experiment indicate that the succession processes in not managed plots are slower than we expected: changes in the community structure are rather quantitative than qualitative. The regular mowing of managed plots without soil fertilisation leaded in naturally nutrient-poor substrate to lack of nutrients in the soil and resulted in thinner and lower stands. The attempt to restore abandoned mountain grasslands dominated by *Calamagrostis arundinacea* and *Vaccinium myrtillus* did not bring positive effect after 15 years of re-established management and we conclude that the restoration of abandoned Poloniny meadows is long-term process with uncertain results.
The obtained knowledge allowed us to specify the management proposal for maintenance of meadow communities if high conservation value in the study region.
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The attractiveness of your neighbours: when does it matter?

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The outcome of plant-pollinator is influenced by several factors. While the effects of the density of floral resources have been intensively investigated, little is known about the effect of the spatial patterns. In a plant community, the spatial arrangement of neighbouring species affects the perception of the community pollinators are foraging in. Spatial aggregation of attractive species could deter pollinators to visit the less attractive ones whereas spatial dispersion of attractive individuals should decrease the intensity of this effect. The attractiveness of neighbouring species, its density and spatial arrangement will therefore determine the outcome of the plant-pollinator interactions. Here we present first results from a field experiment in which we tried to quantify the plant specific attractiveness by using model selection based on pollinator observations. We further more have tried to characterize the behaviour of the major pollinator groups in relation to the density of floral resources and their spatial arrangement.

Seminatural dry grassland management by mowing of *Calamagrostis epigeios* (L.) Roth in Hungary

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The *Calamagrostis epigeios* can slow down or arrest the old-field succession. We studied the role of this species in the West Cserhát-hills in Hungary, in abandoned vineyards. Diversity of *Calamagrostis* dominated patches varies from low to medium level. The most frequent species occurring together with *Calamagrostis* are *Dorycnium herbaceum*, *Inula ensifolia*, *Plantago media*, *Brachypodium pinnatum*, *Agrimonia eupatoria*. In May 2001 we established permanent quadrates to understand if *Calamagrostis* can be repressed with mowing.

There are 8 homogenous 3 × 6 m^3 plots on the study site. Half of the plots are mowed twice a year, the other half is left as control. Before and after cutting the percentage cover of species are recorded in 2 × 2 m quadrates. 8 years after the first cutting there was a significant decrease in the average cover of *Calamagrostis* (from 63.75 % to 2.88 %). The response of subordinated species was strong, the main cover of *Brachypodium pinnatum* increased from 1.62 to 23.88 %. The Shannon-diversity in all plots significantly changed. If we compare the average results of 2001 and 2006 years with t-test, p = 0.0111*, 2001 and 2006 p = 0.0282*, 2001 and 2009 p = 0.000397**

Mowing significantly increased species richness during the course of vegetation development.

The treatments twice a year successfully controls the *Calamagrostis epigeios*, and improved the balanced species composition.

Predicting distribution and succession changes of grassland vegetation in the selected model region of Devínska Kobyla Mts. using GIS (Landscape potential and GIS in modelling visual landscape change)

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Devínska Kobyla is situated near by Bratislava, Slovakia. The protected area of National Nature Reserve (NNR) is 114.38 ha. It represents one of the NATURA 2000 sites and also Important Plant Area. Since 1949, a continuous area of xerothermophilous pastures (at the time 85.8 % of the total area) had been greatly fragmented into the present mosaic vegetation of rocky and dry grasslands (33.4 %) – steppe communities along with sub-Mediterranean xerothermophilous oak woods *Corno-Quercetum* and *Pruno mahaleb-Quercetum pubescentis*. Altogether the forests communities cover now 50.7 % of the NNR. The prevailing vegetation types of the dry grasslands communities are *Poo badensis-Festucetum pallentis*, *Festuco pallentis-Caricetum humilis*, *Festuco vallesiacae-Stipetum capillatae*, *Polygalo majoris-Brachypodietum pinnati* and Pannonian fringe vegetation *Geranio sanguinei-Dictamnetum albae* and *Peucedanetum cervariae*. Grassland vegetation represents biotopes strongly threatened by changes in management and agriculture, by intensification of soil utilisation, or in the other hand by abandoning of fields and meadows. The primary aim is to evaluate the potential of the preservation of xerotherm vegetation communities. We focus on defining relationship between the potential of the abiotic land and the formation of vegetation. Predictive model of xerothermophilous vegetation of Devínska Kobyla Mts. is prepared using geographical information system (GIS). The model is based on the analysis of the relationship between various types of quantitatively defined geoecological fields and dynamics of vegetation change, which were derived from a chronological sequence of aerial photographs, with the use of factor and cluster analysis. It can be considered a definitive product of the research ready to be employed in the management of this valuable site. It gives arguments for revitalisation projects of nature conservation and landscape planning and proposals of suitable management in similar vegetation types in the other territories. Succession and dynamics of vegetation changes are also evaluated based on repeated phytocoenological relevés.

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Nature conservation of Grassland in Europe

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The purpose of our lecture is to emphasize the values of grassland in Europe. Values from a philosophical point of view include anthropocentric and biocentric aspects. Objectives are economic value, diversity of landscapes, habitats and species, but also subjective appraisals such as regional identity and aesthetic value.

Europe is responsible for nature conservation of European habitats and species. Based on the CBD (Convention on Biological Diversity), relating National Reports, the FFH-Directive and many other publications on nature conservation policies and activities we evaluate the trends of the quality and quantity of grassland in Europe.

Different grassland habitats and plant communities are restricted by national and European laws. Nevertheless, the laws don't cover all (endangered) grasslands and the survival of many grassland communities and species is not guarantied, yet. Furthermore, one can find a strong decline in the diversity and quantity in many parts of Europe.

Due to pressure on grasslands we discuss needs and modern strategies in nature conservation policy.

Transylvanian steppic grasslands – small scale diversity gradients in relation to habitat monitoring and biodiversity conservation

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Dry grasslands in Transylvania are recognised as rich in EU priority status biodiversity comprising both grassland habitat associations and rare species of Pannonic, Pontic, Continental and Alpine biogeographical distribution. They can be considered overall to be some of the richest grasslands in Europe. Furthermore, it is apparent to the eye that at the field scale, the grasslands are complex with

continual changeover of species association and of species presence, occasionally without obvious gradients in soil, slope or aspect.

This paper compares the partitioning of variation measured at the scale of 5 m mini-transects in terms of alpha (species density), beta (species changeover) and gamma (local/regional total) diversity between eco-environmental and management factors. It further considers the implications of this for biodiversity conservation in terms of monitoring and of developing and implementing management prescriptions.

Monitoring of grassland conservation status quality against a target status may highlight either alpha diversity, presence/absence of indicator species or gamma diversity as a total species list in terms of the focus for measurement. This paper further considers whether monitoring should include beta diversity as an expression of biodiversity value often ignored in traditional habitat mapping. The relationship between beta diversity and species ecology/functioning, and also its sensitivity to grassland habitat damage under adverse management, are discussed.

Regrassing with regional seed mixtures in the Bíle Karpaty Mountains

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In the Bíle Karpaty (White Carpathians) Protected Landscape Area, regional seed mixtures have been used to re-create grasslands on ex-arable land since 1999. This programme was started in the beginning of the 1990s, led by a local NGO in collaboration with the Bílé Karpaty PLA Administration, Zubří Grassland Research Station, and several local farmers. The seeds were collected in species-rich White Carpathian meadows and reproduced in seedbeds. To obtain these seeds, a combine harvester has been used and since 2007 also a brush harvester. The production is currently set to regrassing 60 ha of arable land per year at a rate of 20 kg/ha. To date, almost 500 hectares of arable land have been regrassed by site-specific seed mixtures at over 35 localities, mostly in the SW part.

In 2009, plant establishment and vegetation succession in the regrassed fields were assessed using phytosociological relevés which were then elaborated with methods of multivariate statistics. Results regarding both sown and spontaneously established species are presented in this paper.

Presence and abundance of *Pulsatilla patens* populations in nature reserves in north-eastern Poland

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Pulsatilla patens (Eastern pasque flowers) is listed in the Bern Convention (Council of Europe 1979) and Anex II of the European Habitats Directive (European Comunities 2004). In Poland, it has been a protected species since 1958 and is considered to be a rare and threatened species, although in the Red Book Data of Poland it is listed as a low risk (LR) taxon (Wójtowicz 2001). Populations of Eastern pasque flowers are unevenly distributed. In the 1970s and 1980s, most *Pulsatilla patens* sites were found in north-eastern Poland, where the populations of this plant were also numerous (Wójtowicz 2000). According to the climatic division of Poland (Wiszniewski & Chechłowski 1975), the north-eastern part of our country, called the Masurian and Białystok region, is distinguished by high precipitation, low insolation, relatively low temperatures, long duration of snow cover and a short plant growing season. Although this is the major area of the occurrence of Eastern pasque flower in Poland, until present no extensive research has been conducted on its populations in north-eastern Poland. The purpose of my investigation has been to establish the current distribution of populations of *Pulsatilla patens* in north-eastern Poland, to evaluate the abundance of these populations and to analyse the influence of the habitat and environmental factors on this plant. In my view, such studies will enable us to point to the reasons why *Pulsatilla patens* sites are disappearing or diminishing in abundance. This paper contains the results of the first stage of my investigations, which covered an area of 16 nature reserves, where in the past sites of *Pulsatilla patens* had been recorded. Analysis of the documentation regarding these nature reserves suggests that in 1990-1997 no stands of Eastern pasque flower was determined in 4 nature reserves (Gnilec, Łokieć, Rycerski Kierz, Góra Uszeście). Another inventory study, carried out in 2000-2007, demonstrated that three more sites had disappeared (in the nature reserves called Szelągówka, Kulka and Piłackie Wzgórza), so that the species was determined to grow in just 5 reserves, i.e. Stare Biele, Woronicza, Krasne, Krzemienne Góry, Kukle and Góra Pieszczana. However, the Eastern pasque flowers found there grew as single or several individuals, at the edges of such associations as *Serratulo-Pinetum*, *Peucedano-Pinetum*, *Vaccinio-Pinetum*, *Cladonio-Pinetum*, and in associations of the ordo *Quercetalia roboris*, distorted by prolonged anthropopression. The lack of current data (the latest records date back to the 1990s) concerning the nature reserves Sitki, Międzyrzecze and Kuriańskie Bagno, makes it impossible to verify whether there are sites of *Pulsatilla patens* in these locations.

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Production of forage in different altitudinal zones grasslands

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Grasslands are valuable areas and of vital importance as well, to the future of stock breeding in Greece. Apart from the goods they offer, they also ensure forage production able to cover the nutritional requirements of grazing animals at various seasons of the year. In this paper, the results of research that was conducted in four different grassland ecosystems in Epirus and Thessaly, during 2008 concerning botanical composition and forage production are presented. The research area was divided in four (4) different zones, that is: a) low elevation zone (two zones ate included), b) middle elevation zone and c) high elevation zone, where a total of sixteen (16) experimental plots were selected, four (4) plots in every zone. The results proved that a) grasses in all altitudinal zones were the dominant species (59.7 %), whereas forbs were kept in the lowest percentage(15.7), b) the largest forage production appeared in low elevation zone grasslands of Epirus with 3 510 kg/ha, whereas the lowest forage production appeared to be in high elevation zone grasslands with 2 118 kg/ha.

Key words: Grasslands, altitudinal zone, forage production species, composition

Vegetation succession and habitat restoration in lichen-rich inland drift sand on the Hulshorsterzand in the central Netherlands

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Vegetation succession and lichen diversity in the *Spergulo-Corynephoretum* and *Genisto-Callunetum* were studied on drift sands and in blown-out gravel-rich depressions inside the Hulshorsterzand on the Veluwe. In the period 1996-2006 changes in cryptogam-rich pioneer communities and their transformation into subsequent lichen-rich succession stages, ending in dry heath vegetation, were studied in permanent quadrats (PQs) and related to acidification in connection with ageing of nutrient-poor dune soil. It is assumed that the high atmospheric pollution of nitrogen compounds in this part of the Netherlands speeded-up the acidification. Grass and moss encroachment, including that of the neophyte *Campylopus introflexus*, negatively influenced the quantity of lichen-rich vegetation, but the species-richness persisted.

Habitat restoration measures from the early 1990s, aiming at restoring or recreating the drift-sand landscape with its high biodiversity, proved to be successful and had a follow-up in 2008.

Formation of vegetation of *Festucion valesiacae* Klika 1931 alliance in Ukraine

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Steppe vegetation belongs to one of the zonal vegetation types of Ukraine and had covered 30 % of its territory but now occupies only 2 % of its Forest-Steppe and Steppe zones. Due to the anthropogenic influence the “insularization of the steppe” has taken place, in other words, transferring from upland dominant vegetation to “anthropogenic relicts”, that is why the investigation and reservation of remained steppe localities of Ukraine is needed. Our investigation of steppe vegetation has been conducted during 1996-2009, about 600 of phytocoenological descriptions

have been made, and syntaxonomic scheme has been elaborated on their base. Syntaxonomic diversity is complied of 26 associations and 7 subassociations.

Communities of *Festucion valesiacae* Klika 1931 alliances are the most widespread among the other vegetation communities of *Festuco-Brometea* Br.-Bl. et R.Tx. 1943 class. They are formed under the influence of anthropogenic factor in place of extrazonal communities of *Cirsio-Brachypodion pinnati* Hadač et Klika 1944 em Krausch 1961 alliance as well as in place of zonal steppe meadow communities of *Fragario viridis-Trifolion montani* Korotchenko, Didukh, 1997 alliance and typical steppe communities of *Astragalo-Stipion* Knapp 1944 alliance. They are derivative, degraded at some extent gramineous grasslands, which are formed mainly under the pasture, burning, grazing. These' alliance communities occupy vast areas, especially in ravine-gully system near the small settlements; they have moderate floristic diversity (15-40 species for 100 m^2 depending on degree of anthropogenic stress).

Festuco valesiacae-Stipetum capillatae Sillinger 1931 association is one of the most representative in this alliance and has the less destroyed communities with significant tussock development (30-40 %). Communities of *Botriochloetum ischaemti* (Krist. 1937) Pop 1977 association occupy vast areas within the territory on slightly eroded loess or chernozem soils on the top of slopes of different exposition and steepness. Communities of *Stipetum capillatae* Dziubaltowski 1925 association are situated on upland sites and on the top of slopes to 40 degrees exposition with soil layer no less than 25 cm. Communities of *Festucetum valesiacae* Solodkova et al. 1986; Tkachenko et al. 1987 association are the most destroyed by pasturing activity and occupy the largest areas within investigated territory.

The syntaxonomy of steppe vegetation of the boundary between Forest-Steppe and Steppe of the right bank of the Dniepro region of Ukraine

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The ecotones are transitional zones between different ecosystems. In our days in Ukraine, they have been done partially. Our investigation is directed to the establishment of phytocoenotic features of the ecotone between natural zones. The object of our investigation is chosen the ecotone between forest-steppe and steppe zones of the right bank of the Dniepro region of Ukraine. 362 standard geobotanical relevés were perfomed by authors in 2004-2006. The database was formed with the help of the software Ficen2. The data processing was done by the method of the phytocoenotic tables reorganization. Microsoft Excel was used for editing and separating of syntaxonomical units of different ranges. As the result of

data obtained processing we ascertained that the steppe vegetation of the ecotone belongs to class *Festuco-Brometea*, order *Festucetalia valesiacae* and 5 alliances. The alliance *Fragario viridis-Trifolion montani* is presented by such associations: *Thymo marschalliani-Caricetum praecocis*, *Salvio pratensis-Poetum angustifoliae*, *Medicago romanicae-Poetum angustifoliae*, *Betonico officinalis-Trifolietum montani*, *Stipetum pennatae* and one variety. These cenoses occupy wetter ecotopes. The alliance *Artemisio-Kochion* is presented by association as *Agropyro pectinato-Kochietum prostratae*. It occupies drier ecotopes. The alliance *Festucion valesiacae* is presented by such associations: *Botriochloetum ischaemii*, *Salvio nemorasae-Festucetum valesiacae*, *Festuco valesiacae-Stipetum capillatae*, *Festucetum valesiacae*, *Festuco valesiacae-Caricetum humilis*, *Plantagini stepposae-Stipetum pulcherrimae*, *Stipetum capillatae*, 3 subassociations and 2 varieties. They had formed on the slopes under the influence of anthropogenic factors. The alliance *Artemisio marschalliani-Elytrigion intermediate* is presented by association as *Melico transsylvanicae-Lembotropetum nigricantis* var. *Stipa lessingiana*. It had formed on the slopes with intensive soil erosion and drainage. The alliance *Astragalo-Stipion* is presented by such associations: *Stipetum lessingianae*, *Thymo marschalliani-Crinitarietum villosae*, *Teucrio pannonici-Stipetum capillatae*, *Vinco herbaceae-Caraganetum fruticis*, *Astragalo austriaci-Salvietum nutantis* and one variety. They occupy dries ecotopes. Thereby, the steppe vegetation of the ecotone belongs to class *Festuco-Brometea*, order *Festucetalia valesiacae*, 5 alliances and from 19 associations, 3 subassociations and 5 varieties.

Dry grasslands on acid soils of Tríbeč Mountains (southwestern Slovakia)

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The paper offers new information about acidophilic dry grasslands extension on the quartzite that belongs into the group of extremely acid rocks. Quartzites intervene in the form of small islands as the residuum of Mesozoic cover of Tribeč Mountain (South-West Slovakia) and they create geomorphologically remarkable quartzitic hills in the marginal parts of the mountain. The area belongs into the phytogeographic Praecarpaticum district and it is connected with thermophilic Pannonian flora. Small scale acidophilic dry grassland vegetation intervenes in the mosaic with scrubby community of *Calluna vulgaris*, usually at the plane caps of quartzitic hills that used to be influenced by flooring and pasturage. *Festuca valesiaca* prevails in the species composition. Some of the xerophilic acidophytes and species of weak shallow soils (*Acetosella vulgaris*, *Aira caryophyllea*, *Pilosella officinarum*, *Jasione montana*, *Lychnis viscaria*, etc.) belong into the group of species with high stability. The vegetation comes under the variability of *Avenulo pratensis-Festucetum valesiacae* (*Koelerio-Phleion phleioidis*) association that has not been known in the Slovak area up till now.

Soil mechanical disturbance as determinant of plant and arbuscular mycorrhizal communities in calcareous grasslands

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Many plant species of semi-natural, calcareous grasslands are threatened by acidification or a lack of soil disturbance. Xeric sand calcareous grasslands, or sand steppe, is a habitat type declining because of these factors. We performed a randomized block experiment with two levels of soil disturbance, plowing and rotavation, in degraded, calcareous sandy grassland in southern Sweden, in order to find measures for conserving and expanding this kind of habitat. In addition, we used this setup to study changes in arbuscular mycorrhizal (AM) fungal community composition as a result of one-time plowing, as this group of organisms are not frequently studied in relation to restoration projects in spite of their importance for promoting high plant diversity.

We found that mechanical soil disturbance had no effect on pH, and caused only a small increase in extractable levels of phosphorus. Positive effects compared to control plots were seen on plot scale in plant species richness and Shannon index, two years after treatment, while on smaller scales the species richness showed the opposite response. Principal component analysis revealed plant community differences mainly between disturbed and control plots. Two years after disturbance, positive effects on threatened plant species where indicated by small increases in occurrences, but the two methods of disturbance favoured different species.

Soil disturbance significantly reduced AM fungal phylotype richness, and changed the AM fungal community composition. Most phylotypes, even closely related ones, showed little or no overlap in their distribution and occurred in either the control or disturbed plots.

From a plant perspective we conclude that these mechanical soil disturbance techniques may be insufficient to restore favorable soil conditions. However, if the pre-restoration pH is high, both plowing and rotavation could be used for restoring calcareous sandy grasslands.

Our results show that disturbance is a strong structuring force for AM fungal communities in semi-natural grassland. However, this is only relevant for restorational purposes if these differences translate into functional differences, something that further research within this area should focus on.

Floristic diversity of calcareous grasslands on Slavonian hills (Croatia)

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Slavonian hills are situated in the eastern part of Croatia, on the border of the Pannonian and Illyrian floristic area. Thanks to its location on the border of different climate influences (alpine from the west, dinaric to the south, pannonian from the east and north), great abundance and diversity of flora and vegetation is present in this area. Beside planty of areas covered by beech and oak forests, dry grasslands and lots of successional phases of the same, which are characterized by an amazing diverity of animals and plants form specific habitats of the Slavonian hills. The change in traditional land use (decreasing of grazing and mowing activities, increasing of certain agricultural and forestry activities), abandoning villages, etc. is leading to large scale losses of such habitats. Dry calcareous grasslands in this area have not yet been studied, so we have analysed their syntaxonomic status, floristic, ecological and syndynamic features. 30 vegetational relevés have been made following the standard Braun-Blanquet method. The relevés have been compared with the relevés of similar vegetation in the wider geographical region. Ecological characteristics, such as microclimate, geomorphology were also considered.

The system of the management of steppe-meadow communities in the Forest-Steppe zone of Ukraine as the prerequisite of its biodiversity conservation

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The steppe meadows of the *Galietalia veri* order (*Agrostion vinealis* and *Trifolion montani* alliances) occupied the large areas in the Forest-Steppe zone of Ukraine, especially at the Left-Bank of the Dnieper River. The present state of such communities is unsatisfactory due to unreasonable use which caused the essential transformation of the cenosis structure and sharp fall of the biodiversity level. The

regime of the protection not makes it possible to preserve the grassland communities because of the removal of anthropogenic pressure caused the fast replacement with woody and shrubby communities. The system of the management of steppe-meadows communities has been proposed. It was developed with due account taken of the present state of communities, the necessity of the accumulation and deprivation of the nutrients by plants during the vegetation period; the terms of the hay mowing were determined on the base of analysis of the duration of main phenological phases from dominating grasses in conditions of the Forest-Steppe zone of Ukraine; for determination of the permissible number of the cutting it was take into account the rate of the aftermath regrowth and the nutrients accumulation; the scheme of the mowing rotation were developed with due account taken of such peculiarities of the dominated grasses; the guidelines from the different grass farming manuals were used also. As the models for the system developed were used the steppe-meadow communities in the Ros', Pivdennyy Bug, Psel and Siverskyy Donets' rivers floodplains. The analysis was spent on the base of own phytosociological data collected from 1998 to 2009. In accordance with the proposed system for communities of *Galietalia veri* order the grazing pressure should not be more than 0.3-0.6 cattle per ha in dependence of the digression stage, the start of grazing period should not be early than I-II decades of May and the finish – not later than III decade of June – I decade of July; the grazing pass before the most grasses flowering with further single hay mowing; it is recommended to leave the reconstructive stripes along the pasture for the normal seed reproduction ensuring and the seed bank replenishment. Provided the mowing use only, the recommended the start of the cutting from I-II decades of May and finish – to the II-III decades of June by single-cutting use with the height of cutting of 3-4 cm; the 4-year scheme of the mowing rotation recommended also.

Effect of plot dimension on calcareous grassland restoration monitoring

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In restoration monitoring it is strongly recommended to document scale dependence by sampling at multiple scales to address the limitation caused by patters and ecological variation in sites. We evaluated the effect of grain (e. g. the dimension of the sampling unit) by using multivariate analysis for testing the simultaneous response of species composition using a before-after control-impact (BACI) design. The research was conducted in the Monte Buceto summit, a prevalently

calcareous massif on the Uccellina-Monte Amiata ridge, Tuscany, central Italy. The area is included in a Site of Community Importance (SCI, "Monte Labbro and Upper Albegna Valley"). Community diversity was compared 2 years before and two years after shrubs cutting of overgrown grasslands using data recorded with plots of different dimensions (0.25, 1 and 2 m^2). Results demonstrated that grain size influences the ability of discriminating among control and impact sites. Outcomes corroborate the hypothesis that a multi scale sampling could improve the monitoring efficiency in restoration ecology.

Xerophytes in the flora of after mining areas of Kadzielnianskie Range in Kielce (central Poland)

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The Kadzielnianskie Range is one of the Swietokrzyskie Mts. ranges, situated in whole within administrative borders of the city Kielce – the city of interesting history, geology and having rich and diversified plant cover. The characteristic feature of the city landscape are the ranges of elevations and single hills made of carbonate rocks with admixture of low percentage ores of lead, copper, silver and iron, which were exploited until second half of XX century. Development of the mining industry and rocks processing resulted in changes in the surface sculpture, and in the creation of new and different, than primary, abiotic conditions. In the new habitat conditions one can observe a phenomenon of spontaneous overgrowing by plants having specific ecological requirements. A numerous group in the vascular plants are xerophytes – the plants which are adjusted in terms of the structure and physiology to the present habitat conditions.

Succession changes of the pastures and meadows on the locality of Briac near Krupina town

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The paper contributes by the review of grassland vegetation in Slovakia, their history and progress. It is concerned with the comparison of structural changes, plant community diversity in the abandoned pasture and orchard meadow near Krupina.

The vegetation of abandoned grazing lands and meadows is a subject to the succession changes. The changes of abandoned pasture vegetation of Krupinska planina plain were studied marginally. The reason might be as the distance of area as the syntaxonomy difficult. On the abandoned pasture and orchard meadow were the changes of diversity studied from 2007 to 2009. The pasture vegetation was compared to the orchard meadow vegetation. The grazing land was used for grazing cattle and sheep right up until 1990. The orchard meadow is situated on the adjacent hill to the pasture. It is separated by the dried-up ditch where European hazel and acacia grow. In the last decade the meadow used to be mowed twice a year and grazed occasionally.

The species composition is gradually decreasing after the secondary succession. Some species do not have convenient conditions for surviving. If meadow and grassland vegetation predominates over wood species, there is the interest in the return of vegetation to its traditional land use management and higher species composition. The pasture vegetation is classified as the alliance *Cirsio-Brachypodion pinnati*. The xerothermic association in the area more affected by succession on the mild slope is alliance *Festucion valesiacae*. There were two plant communities identified in the orchard meadow. The first one was in the unmowed part, the association *Ranunculo bulbosi-Arrhenatheretum elatioris* and in the mowed part the association *Anthoxantho odorati-Agrostietum tenuis*. It also defines the indication taxa group of the associations and characterizes their environmental conditions.

Key words: Abandoned pastures, Orchard meadows, Grasslands, Secondary succession, Krupinská planina-plain, Classification. Syntaxonomy

Restoration potencial of soil seed banks in dry acidic grasslands

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The value of soil seed bank in restoration of grasslands is often disputed. Several studies consider it as an important propagule source with local genotypes while others stress the dissimilarities between aboveground vegetation and soil seed banks. To make the topic more complicated, species can show different seed longevities and can have different seed bank densities in contrasting communities.

Vegetation and seed bank of 22 stands was sampled in the Nyírség region (Pleistocene sand dunes, NE, Hungary). Permanent plots with up to 15 years' long data sets were surveyed while composition and dominance of persistent seed bank was assessed sampling soil in early spring and using the seedling emergence method. The studied communities included open acidic grasslands (*Corynephoretum canescentis*, *Festucetum vaginatae*), intact and degraded stands of perennial sandy pastures (*Potentillo arenariae-Festucetum pseudovinae*), sandy steppes (*Salvio-Festucetum rupicolae*) as well as differently aged former grasslands overgrown by or planted with the invasive, nitrogen-fixing black locust (*Robinia pseudoacacia*).

Total seed densities varied more than 25 times with the lowest values in some open acidic grasslands and the highest ones in repeatedly overgrazed degraded pastures. Specific seed densities varied by over two magnitudes from accidentally detected species to a few records above 10 000/m^2. Over 75 % of the totally recorded 180 taxa formed a detectably dense seed bank. Over 30 % of taxa were exclusively found in the soil including a large but ecologically irrelevant group of hygrophytes originating from surrounding wetlands (over 30 species, most frequently *Juncus articulatus* and *Typha angustifolia*). The most widespread seed bank taxa involved common acidophilous xerophytes: *Arenaria serpyllifolia*, *Anthemis ruthenica*, *Cerastium semidecandrum*, *Conyza canadensis*, *Myosotis stricta*, *Rumex acetosella*, *Veronica* spp.). Most wind-dispersed forbs and bulbous monocots lacked seed banks. Contrary to the widespread idea, successional dominant monocots often possessed dense seed banks, including the clonal *Carex stenophylla*, *Cynodon dactylon* and *Poa angustifolia*, suggesting they are having flexible strategies.

Restoration potential of contrasting communities as well as specific strategies in relation to vegetation fertility and dispersal capacity as a function of propagule size and shape are discussed with a special emphasis on species of conservation interest.

Providing adequate grassland management in Slovakia – case studies from the Biele Karpaty Mts.

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White Carpathians are part of the Slovak-Moravian Western Carpathians. There is a protected landscape area (PLA) on both sides of the mountains, founded in 1979 and 1980.

The White Carpathian meadows are the most outstanding feature of the area. Considerable part of them, well accessible to heavy machinery, was „recultivated" in 1980s, but their species richness is slowly increasing after 20 years of agricultural system changes.

Only hardly accessible meadows were saved, but consecutive lack of management contributed to succesive degeneration of majority of them. In opposite of this, beyond disadvantages of economic inefficiency, extensive agriculture practiced at large scale on smaller pieces of land, helped preserve biodiversity, traditions and rural landscapes of worse accessible farmsteads. We are sorry to say that this farming systems fades with ageing of community, abandonment of farmlands and dwellings, and their conversion to recreation objects.

Importance of low intensity farming systems for biodiversity conservation in White Carphatians is crucial. However, agri-environment payments are becoming increasingly attractive only to the larger-scale, more intensive and economically-orientated farmers, who use large, well accessible meadows and pastures. In Slovakia, the best sites, including nature reserves, which could be put into the agrienvironmental schemes as the first target are land parcels, where their owners are not interested in their management.

The best orchid sites were designated as natural reserves – in Slovak PLA mostly at extreme positions in strongly sloping or landslide areas. While Czech meadow natural reserves are quite large, Slovak ones are smaller, and they have extraordinary demands on manually done mosaic mowing. In Slovakia their management is not supported through the state budget recently and is managed by staff of PLA and supported by local NGOs. PLA botanist and zoologist supervise the management and customize it to the needs of protected species, both plants and invertebrates.

Nutrients limitations in the species rich thermophilous grasslands

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Species rich, semi-dry thermophilous grasslands of the Bílé Karpaty Mountains on the Czech-Slovak border accommodate in places as many as 55-75 vascular plant species per 1 m^2. While there are stands with compositionally similar communities scattered in neighbouring areas to this region, these are strikingly poorer in species. One of the presumptions of such outstanding species richness is believed to be due to low nutrients availability. Therefore, we focused on the diversity-nutrient availability relationship in the White Carpathian grasslands and grasslands of adjacent area.

Our data indicate that biomass is significantly poorer in nitrogen in the Bílé Karpaty Mts. than in neighbouring areas, and that productivity of these grasslands is strongly nitrogen-limited, which may enhance possibilities for local species coexistence. Thus, management history has probably shaped current species richness of these grasslands also through its effect on nutrient availability.

Soil perturbation as a restoration measure in decalcified sandy grassland

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The species-rich sandy calcareous grassland communities of southern Sweden are gradually disappearing due to lack of proper management, acidification and fertilization. In this study, experimental soil perturbation was performed in a degenerated sandy grassland to test the hypotheses that soil perturbation would: (a) decrease the availability of essential nutrients, (b) increase the soil $CaCO_3$ concentration and pH, and (c) select for desirable species. Three kinds of treatment were performed: (a) deep perturbation (1 m), (b) shallow perturbation (30 cm) and (c) no disturbance. The deep perturbation was designed to bring $CaCO_3$ up to the surface, whereas shallow perturbation was designed to investigate the effects of mechanical perturbation alone. Soil samples were collected, and soil pH, extractable P, NO^{3-} and NH^4 and the total amounts of Al, Ca, Fe, K, Mg, Mn, Na, P and Si were analysed. Vegetation and gap space were estimated by visual inspection and expressed as percent cover. Vascular plants were determined at species level,

while mosses and lichens were treated as groups. The total number of tussocks of the target species *Koeleria glauca* was counted. Beetles were sampled using pit-fall traps, counted and classified at species level. We showed that deep perturbation was successful in restoring the low nutrient levels and a high pH. Six red-listed beetle species associated with open, dry grasslands were found. Apart from the occurrence of the threatened species *Koeleria glauca*, the vegetation has yet to show significant response to the treatment. Seeding could be a suitable method of increasing the rate of succession, the alternative being to wait many years or even decades for the establishment of desirable flora.

Plant traits adapted in species rich grasslands

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Due to combination of many environmental factors, species rich grasslands originated in many places throughout the Europe but some of them are outstandingly species rich. The White Carpathian grasslands from the alliance of *Cirsio-Brachypodion* may serve as an example. They host nearly 130 species in a plot size of 100 m^2 and surpass species richness of similar grasslands in adjacent Moravian area about 40-60 species. Their species composition is adapted to ecological conditions with embodied special combination of plant traits. How do the plant traits differ in variously species rich grasslands remains unknown. Our comparison brought differences in proportion of some traits. Species richer grasslands show higher proportion of species reproducing both vegetatively and by seeds, lower proportion of species with c-life strategy and pollination by wind.

Conservation of the most valuable steppe territories of the Crimea (Ukraine)

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In Ukraine a row of quite big steppe territories have remained. A big part of them has a place in borders of the Crimea. However, in present the Crimea is the region with highly developed agriculture and, at the same time, it's a very important recreation centre. In view of it the biggest and the most valuable steppe plots have

remained in the remotest and the driest Crimean corners, in particular, at the east – Kerch Peninsula and at the west – Tarkhankut Peninsula.

Located at north of Kerch Peninsula Karalara and Osovyny steppe massifs (with a general area of more than 11 000 hectares) represents one of the biggest enclaves of entire feather-grass steppe in Europe. Here populations of dozens of species of rare flora and fauna have preserved. A considerable constituent of these steppes is breeding areas of the rare steppe birds (e.g. here last breeding areas of the little bustard (*Tetrax tetrax*) in Ukraine are present).

Not disturbed and disturbed in different level steppe complexes of Tarkhankut Peninsula (with a total area up to 20 000 hectares) have a high value as well. Here there are big fragments of feather-grass steppes (up to 10 % of the Tarkhankut Peninsula area), petrophilic steppes and unique flora of eroded coastal rocks. As well this territory is a site of growing of a row of endemic plant species.

Conservation of the biodiversity of both territories requires firstly giving them a status of reserved territories with a "strong" status to prevent their recreation building up. Taking into account that in current conditions to agree a creation of natural reserves here (that would be optimal) is not possible, then a creation of national parks is the only exit. Under pressure of community part of steppe territories of Tarkhankut Peninsula has been received status of National Park (area 10 900 hectares). And at the part of the territory of Karalara steppe a Regional Landscape Park was created (area 6 806 hectares). Despite to undoubted positivity of these facts it's necessary to mark that practical functioning and, that is the most important, practical realization of biodiversity protection in these parks will depend on their territory arrangement. Specifically, a basis for conservation of flora and fauna of these steppe complexes may compile only determination of the biggest part of their areas as completely reserved zones; e.g. that will mean a complete silence during season of bird breeding; and a reduction of recreational pressure. The other important aspect is necessity of their expanding with including adjacent a little destroyed and capable to restore steppe biotopes, and in case with Karalara steppe – increasing of the status up to National Park. Realization of these measures in present depends not only on efforts of Ukrainian nature conservation society but on the support of the world community.

Vegetation survey of the hay meadows in the proposed Natura 2000 site „Eastern Hills of Cluj" (Transylvania, Romania)

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Transylvania still harbors many traditional rural landscapes with species-rich grasslands of vast extent. These paradisiacal places for naturalists are threatened by recent land use changes, including intensification and land development projects as well as land use abandonment.

Our study area is located on the southeastern Somes-Plateau, adjacent to the Transylvanian Lowland. It is a proposed Natura 2000 Site named „Eastern Hills of Cluj" (Dealurile Clujului Est), characterized by numerous hill ridges, which are covered mainly by pastures and meadows with only some patches of Dacian oak-hornbeam forests.

The grassland vegetation ranges from xerophytic associations of the class *Festuco-Brometea* on south-facing slopes to hygrophilous associations of the class *Molinio-Arrhenatheretea* on north-facing slopes. A valuable particularity of the area are the extensively used hay meadows, which are in better conditions than in other parts of Transylvania, where they were affected through intensive pasturing and land cultivation. They serve as a habitat for populations of *Maculinea* spp. butterflies with their interesting "ménage à trois" between the butterflies, host plants and host ants.

Our aims are to carry out a vegetation survey of the hay meadows and their small-scale biodiversity, to study the population biology of the host plants of *Maculinea* spp. and to determine possible integrative conservation measures for the hay meadows. In this contribution we want to present the preliminary results of the vegetation analysis.

Phytosociologycal investigation of *Festuca pseudovaginata* (Penksza 2005) in open sand grassland Hungary

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Soil and vegetation are good indicators of changes in the environment. On the examined area is semi-arid, extreme dry where open grassland is the typical vegetation in the Carpathian Basin. Soils are dry, sandy with vegetation types of xerotherm characteristics with dominant endemic species of *Festuca vaginata*. We examined natural and anthropogenic environments. The urbanization caused growth of nitrate content in the degraded, shallow, sandy soils, while the physiognomy of the vegetation remained the same with some changes in the species composition: the amount of weeds and species resistant to disturbing grew; the *Cynodon dactylon* became dominant on grasslands. A new species, *Festuca pseudovaginata* was identified. This species adapted to the new environment changed by humans. Its economical importance is that animal stock is eating it more readily. Soil characteristics were examined based on the average soil samples and their laboratory examinations. Measured soil parameters play an important role in establishing the background of the state of plant nutrition, furthermore to outline pedological differences between different vegetation, animal stock or land use intensities. Pedological examinations resulted that soil parameters were different between the two associations dominated by *Festuca vaginata* and *Festuca pseudovaginata* species.

Orobanche arenaria Borkh. (*Orobanchaceae*) in Poland: distribution and ecological description

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Orobanche arenaria Borkh. (*Orobanchaceae*) was reported from Poland mainly from Lower Silesia and Pomerania. The majority of records go back to the beginning of the 20th century and have not been found since. Three new sites of *O. arenaria* were discovered during floristic investigations in the Wyzyna Malopolska upland in central Poland. The new localities are concentrated in the Ponidzie area (Garb Pinczowski ridge and Niecka Polaniecka basin). *O. arenaria* parasitized only *Ar-*

temisia campestris at the localities. The altitudinal range of the populations was between 190 and ca. 240 m. The species was mostly observed as a single specimen or sometimes as clusters consisting of three to ten specimens in sites immediately adjacent to the previous year's specimens.

At the new localities, the species prefers dry, loose sandy and gravelled substrates with a high calcium carbonate content, often with calcareous stones. It occupies slopes with a different degree of incline (3º-20º), with a southern exposure, or sporadically flat areas. The places are light, well insolated, exceptionally with some mosaic shading from trees, and usually comprise extensively used fields: fallows, pastures, slopes of river valleys as well as secondary habitats such as sand pits and gravel pits. Specific combinations of thermophilic xerothermic grasslands and grasslands on sands are typical plant formations in which *O. arenaria* occurs. Species of the *Festuco-Brometea* class and the *Cirsio-Brachypodion pinnati* association, or interchangeably species of the *Koelerio glaucae-Corynephoretea* canescentis class dominate in the species composition of the communities.

The aim of study was to estimate the size and habitat requirements of new population from Malopolska Upland as well as show differences in some morphological traits of individuals growing in these populations.

Anacamptis pyramidalis re-discovered in Poland

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The poster describes a new locality of *Anacamptis pyramidalis*, rare species of orchid recognized as extinct in Poland for 76 years. It was found in the summer of 2009 in Dolna Odra SCI, in the south west part of Zachodniopomorskie Region. *Anacamptis pyramidalis* is a species of open habitats: variable humidity meadows with *Molinia caerulea*, xerothermic grasslands, sparse woods and clearings.

Gentianella germanica (Willd.) Börner in the central part of Poland – protecion and threat

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Gentianella germanica is a montane species. It is represents Alpine-Central European distribution type. In Polish mountains this species grows in the Sudety Mts. and in the West Carpatians. Lowland localities occur in the Malopolska Upland, in the Cracow-Czestochowa Upland and in the Silesian Upland. In the mountain it grows in mat grass communities of the order Nardetalia and in higher stands in high mountain grasslands of the order *Caricetalia curvulae*, in lowlands in communities of the alliance *Molinion caerulae*, order Nardetalia and class *Festuco-Brometea* (Broz; 1988; Zajac 1996; Piekos-Mirkowa, Mirek 2003). Broz (1988) reports that in southern Poland the natural range of *Gentianella germanica* is limited to mountains and uplands. Populations in the Swietokrzyska Land are mostly historical. Within Poland it is included into regional Red Lists. In the Swietokrzyska Land it is classified as rare species (R; Broz 1990). In the central part of Poland localities of *Gentianella germanica* are located in the national park, in the projected nature reserve, in the landscape parks, in the ecological area and in the Natura 2000 ecological network. It is strictly protected (Regulation of the Minister of Environment of 24th July 2004).

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Overview of small-scale specially protected areas, which protect communities of dry grasslands and sandy steppes in the Czech Republic

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Presently, there are 2 215 small-scale specially protected areas (SSPA) in the territory of the Czech Republic. Overview of SSPA, in which dry grassland and sandy steppe communities (classes *Festuco-Brometea* and *Festucetea vaginatae*) are protected, does not exist. Information about subject of protection in each single SSPA can be found in the Digital register of the Central List of Nature Conservation (AOPK ČR 2010), but these data are very brief and sometimes insufficient exactly formulated. Detailed information can be found only for individual SSPA or eventually for their regional sets (e.g. Mackovčin & Sedláček (eds.) 1999-2009: Chráněná území ČR. Praha: AOPK ČR a EkoCentrum Brno). A complete overview for the whole territory of the Czech Republic is missing. Since dry grasslands and sandy steppes contain a large number of specially protected and endangered species of plants and animals, these localities are object of interest of nature conservation and various researches. For this reason we decided to make overview of protected steppe localities of the Czech Republic, which would contain detailed information on each of them and should serve as a practical tool for nature conservation and researchers. Gathering of all SSPA ordinances and their excerption in order to gain information on subjects of protection was the basis of its creation. Missing or insufficient data were supplemented using other sources (management plans, inventory surveys). In case of doubts whether protected communities belong to the class *Festuco-Brometea* or *Festucetea vaginatae* phytosociological relevés obtained from the Czech National Phytosociological Database were analysed.

The impact of fertilization and cutting frequency on evapotranspiration and infiltration in moderately species-rich grassland

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Agricultural grasslands and pastures are amongst the most species-rich ecosystems in Europe. Increased fertilization and land use intensification led to a decrease in plant diversity in the last decades. Whilst much research focused on the impact of land use change on botanical biodiversity, little is known about the response of important ecosystem functions (e.g. nutrient retention and water cycling) in those habitats.

We conducted a full factorial grassland management experiment (GRASSMAN) including two cutting frequencies (one cutting/three cuttings per year) and two fertilization treatments (no fertilizer added/NPK fertilization) at a moderately species-rich grassland site at the Solling Mountains. Evapotranspiration and infiltration were measured in the growing season 2009 with small weighable lysimeters comprising undisturbed soil monoliths and vegetation. Additionally we measured above and belowground biomass, rel. water content of aboveground biomass, root length density, plant biodiversity and climatic factors (i.e. air temperature, global radiation, precipitation, relative humidity).

We could demonstrate that evapotranspiration of all treatments is mostly determined by air vapour pressure deficit and the amount of infiltration is dependent on precipitation. Fertilization led to an increase in evapotranspiration and a decrease in infiltration, while cutting frequency had no significant impact on neither of the variables.

Main differences among the treatments were an increased aboveground biomass production as well as increased rel. water contents of aboveground biomass in fertilized plots, both positively correlated with evapotranspiration. Infiltration was positively correlated with species richness and negatively correlated with evapotranspiration.

Assessing changes in patterns of vascular plant and bryophyte communities in olive groves

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During the last century, in the Mediterranean region, profound changes in landscape structure were recorded, mainly determined by changes in land use. These changes are due to the increased extension of urban areas and the progressive abandonment of agricultural lands. Consequently, large areas formerly devoted to agriculture have been transformed into a abandoned fields of different successional stages, thickets and forests. Understanding spatial and temporal patterns and processes after abandonment of agricultural practices is a key issue for the management policies leading to land restoration and reclamation in Mediterranean semiarid environment. In this context, the olive groves represent a component of great importance to combine biodiversity conservation with local environmentally sustainable development, since these systems show high levels of biodiversity and play an important role in the rural developments. Moreover, olive groves comprise a typical example of traditional, extensive cultivation, which is abandoned. A study was conducted in olive groves of Regional Park of Maremma (Tuscany, central Italy), in order to analyse the changes of vascular plant and bryophyte community patterns at different successional stages of abandon, considering three land uses: cultivated, short-time abandoned and long-time abandoned olive groves. Relationship between land use and plant community diversity was verified by uni and multivariate analysis of variance. Results showed differences in community diversity of vascular plants and bryophytes among different land uses. In particular short-time abandoned community showed the highest number of species underlying the importance of this vegetation type for conservation purposes. Moreover in abandoned olive groves plant species richness was higher than in cultivated fields. Our results suggest that abandoned olive groves it may be important to restore and conserve abandoned olive groves to maintain good levels of environmental heterogeneity and the conservation of naturalistic interest communities.

The role of molehill disturbances in maintaining high grassland diversity under different management regimes

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Disturbances are one of the main factors determining grassland community composition. However, the effect of disturbances is not unified, and different disturbances may have distinct effects on plant community dynamics. Classifying disturbances according to their scale and predictability (i.e. spatial/temporal autocorrelation) helps in estimating their effect. It is predicted that environmental heterogeneity will increase with small and unpredictable disturbances. On the other hand, disturbances are expected to homogenize the habitat when they are large in scale and predictable, because only species adapted to the specific disturbance may survive. Therefore, larger and more predictable disturbances are predicted to decrease trait variability and species diversity, while small-scale unpredictable disturbances will increase them. Many management methods in semi-natural ecosystems, such as the European grasslands, may be considered as large-scale disturbances, but their relative predictability differs. For example, the effect of mowing is assumed to be more spatially and temporally correlated relative to grazing, thus more predictable from the plants' point of view. Natural disturbances created by fossorial animals, such as moles, may be considered as small-scale and unpredictable relative to mowing and grazing. Because mole activity is less predictable, it is expected to have weaker effect on trait and species selection and thus to be secondary to management in shaping grassland communities. However, the smaller scale of mole activity increases habitat heterogeneity, and therefore it may increase species and trait diversity. Here we present data from a study conducted in the Swabian Alb, Germany, in which we compared community species composition and trait variation between undisturbed vegetation and molehills in several grasslands experiencing different management (either mowing or grazing). We tested the hypothesis that since mowing has stronger homogenizing effect on grassland communities, the presence of molehill disturbances contributes more to trait and species heterogeneity in mown grasslands relative to grazed ones.

Riparian dry grassland species and their communities in river terraces: examples from western Poland

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Excepting some places, usually situated on the edges of the river valleys, with special conditions (formed by linear river erosion; often accompanied by suitable soil, warm exposure etc.), typical dry grasslands are not common vegetation types within river corridors of Central Europe. However, environmental conditions in large floodplains are often so changeable, especially if groundwater level is concerned, that there are many sites which sporadically become inundated though usually, in summer, they remain entirely dry for a long time. In such conditions nothing but seasonally drought-tolerant species are able to grow permanently.

Basing on both regional phytocoenological literature, as well as my own in-field geobotanical observations from the River Warta (a large tributary of Odra in western part of Poland), I would like to present an outline review of regional plant communities and their diagnostic species which may be attributed to mesic-dry grassland or other (semi-)thermophilous, herbaceous types of riparian vegetation. Paying a little more attention to chosen examples I am going to focus on both species and their communities which are at least regionally (in Wielkopolska, Poland) more or less distinctly linked to large river valleys as far as their distribution range is concerned (i.e. the so called River Corridor Plants), e.g. *Carex praecox*, *Silene tatarica* or *Melampyrum cristatum*.

Semi-dry grasslands of the *Bromion erecti* Br.-Bl. et Moor 1936 alliance in Polish Sudeten Mts. – differentiation, distribution and dynamical tendencies

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In Polish part of the Sudeten Mts., semi-dry grasslands of the *Bromion erecti* alliance are limited to rare limestone outcrops. This species rich vegetation still occurs in the Kaczawskie Mts. (Western Sudeten Mts.), the Orlickie Foothills (Central Sudeten Mts.) and the Krowiarki range (Eastern Sudeten Mts.), moreover small areas of poor forms exist in the Sowie Mts. (Central Sudeten Mts.).

The first documentation of these plant communities in the Sudeten Mts. was made in 1992 and two associations were distinguished: *Gentiano-Koelerietum* Knapp 1942 ex Bornkamm 1960 and *Onobrychido-Brometum* Th. Müller 1966. Almost all semi-dry grasslands became abandoned in the end of 20th century; only a few patches have been still in extensive or in some cases intensive use. The changes of grasslands composition and structure were examined during long term research in patches extensively and intensively used, in abandoned grasslands where expansion of *Calamagrostis epigejos* or *Brachypodium pinnatum* took place and in areas with succession of shrubs. Moreover reaction for regular fire and possibility of grassland spontaneous rebuilding after removal of shrubs were tested.

In all areas but extensively used, decrease of species number was observed. The most intensive changes of structure and composition took place in patches colonized by *Calamagrotis epigejos* where grasslands turned into poor aggregation of expansive species, in patches overgrown by shrubs which lost almost all dry grassland species, in intensively used grasslands transformed into dry meadows, and in fired patches turned into monospecies *Inula salicina* aggregation, the poorest community developed in habitat of the *Brometalia erecti* grasslands.

Small-scale diversity and dynamics of species-rich calcareous grasslands of NP Slovenský raj

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Vegetation diversity and dynamic was studied on permanent monitoring plots of model area Kopanec-Javorina – National Park of Slovenský Raj. Two main ecological gradients were identified: succession, showing overgrowing of grasslands by trees and soil reaction. The comparison of time series of relevés is showing that low dynamic was recorded on the plots with stable use, like regularly mowed plots or those, which became forest.

Different parameters of diversity were analysed on 17 permanent plots in 1996--2000. Number of species in relevé as species diversity indicator and value of Shannon index of total species diversity were in correlation with parameter b of regression equation. Smaller similarity with different indicators has parameter a, which is model number of species per square metre.
Species richest relevés were found on locality Kopanec. We recorded 75 species per m^2 and 109 on area of 25 m^2, which is one of the richest grassland types on European level.

In the first years after grassland abandonment is species diversity usually increased in most of mesophilous and dry grasslands. It is enriched by species sensitive for disturbances like mowing or grazing.

Expansion of trees or grasses was observed on mesophilous and dry grasslands after abandonment or lack of management. We can distinguish 4 expanding grasses: *Calamagrostis varia* with *Carex alba*, *Brachypodium pinnatum*, *Arrhenatherum elatius* and Calamagrostis *arundinacea*. Coniferous tree species use to overgrow these types of grasslands. Most dominant is spruce; on drier and rocky soils pine and *Larix* sp. Succession series with broadleaved trees (hazel, willow, birch) are rare, as well as beach. Wet grasslands are overgrown mainly with broadleaved trees, grey alder and shrubby willows. Pine is spreaded on fens mainly.

We have investigated also decreasing of species richness of grasslands as a consequence of overgrowing by trees and shrubs. We have established twin plots in area under solitaire trees and in area in vicinity not influenced by tree canopy. Decreasing of number of species was analysed by regression analyses.

Mapping of grassland vegetation in Slovakia – application of results in agroenvironmental schemes and Natura 2000

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During NATURA 2000 network preparation, national grassland inventory has been carried out in 1999-2007. It was coordinated by DAPHNE IAE and more than 150 experts-botanists from relevant institutions took part in the work. The Grassland and Peatland Information Systems have been created containing data on more than 17 000 localities. In the databases there are more than 950 000 records on species occurrence, as well as on the management of the localities and their threats.

Based on gathered data the unique information system on distribution and quality of grassland vegetation was developed – Information System of Grasslands and Peatlands (ISGP). The comparable system for Natura 2000 was developed also in Czech Republic, which is more detailed in scale of mapping, but it doesn't contains information on species composition as it is in case of Slovak ISGP. According to geobotanic paradigm – species composition is reflecting ecological conditions of the site – is this information decisive for identification of vegetation (habitat) type as well as for evaluation of its status.

Due to used scale of mapping of grasslands and peatlands (1:25 000 resp. 1:10 000), the recorded localities are large (in average more than 15 ha in grasslands and 2.5 ha in peatlands). The high heterogeneity (beta-diversity) of recorded sites is resulting from this fact. We have developed a methodology to identify vegetation types and assess their representativity according to presence of diagnostic taxa for particular type. More diagnostic taxa recorded in locality means higher representativity of particular vegetation type. The decisive information that determines accuracy of identification is proper definition of diagnostic species group for particular vegetation type (Šeffer et al. 2005).

The information was used for NATURA 2000 preparation and there were also used for agri-environmental programme. According them the subsidies for valuable semi-natural grasslands have been distributed. More than 500 millions of Slovak crowns are spent yearly for the management of semi-natural grasslands in the frame of agri-environmental programme since 2004. The scheme for their protection is applied on the area more than 100 000 hectares.

Management model of habitat *6260 Pannonic sand steppes

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Pannonic sand steppes are characterised by open sand grassland communities usually dominated by tussock-forming, narrow leaved grasses *Festuca vaginata* and *Stipa borysthenica*. They are endemic habitats of the Pannonian biogeographical region, located mainly in Hungary, but extending into Lower Austria, Slovakia, Romania, Serbia and Bulgaria. The conservation value of open sand steppe grasslands is linked to a number of unique endemic plant and animal species. Sand steppes and shifting sand areas are considered to be one of the most endangered habitats in Central Europe. While at the beginning of the 20th century, sands were still widespread, by now they have been reduced dramatically through stabilizing measures, intensive agricultural and forestry use and changes in traditional land use. Pannonic sand steppes could be maintained without management if the ecological conditions which allowed shifting dunes, including uncontrolled wind erosion, were allowed to be present. Sand dunes have been stabilised to such an extent that, without appropriate management, natural succession leads to the formation of scrub and woodland or at least invasion by expansive grasses and alien species.

Management model for this habitat from annex I of the Habitats Directive was prepared. Different management alternatives that can be considered "best practice" were described, including the main items and parameters of the proposed management activities, which should be adapted to the particular situation at the local level. The models could be useful for the preparation of site-specific management plans with reference to targeted habitats, as well as for the practical realization of conservation measures "in the field", taking local constraints into account in a variety of similar Natura 2000 areas.

The best available information has been used for the elaboration of these documents, which take into account previous experience and best practice developed in different countries, results of management activities implemented in conservation projects and management guidelines produced at national and regional level. More information can be found on following web page: http://ec.europa.eu/environment/nature/natura2000/management/habitats/models_en.htm

Grassland restoration with sowing of low-diversity seed mixtures in former sunflower and cereal fields

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Recovery of native vegetation in arable lands can be accelerated by sowing low diversity seed mixtures. In our study we assessed the effectiveness of sowing low diversity seed mixtures containing native grass species in restoration of alkali and loess grasslands. We addressed the following questions: (i) How fast can short-lived weedy species typical after abandonment be suppressed by sowing low-diversity seed mixtures? (ii) Can noxious perennial weedy species hamper the success of restoration? (iii) Can the recovery of grasslands be accelerated towards the target native alkali and loess grasslands sowing low diversity mixtures followed up by mowing? In Egyek-Pusztakócs grassland-marshland system (Hortobágy National Park, East-Hungary), in 10 former alfalfa fields were chosen to restoration. The alkali mixture contained *Festuca pseudovina* and *Poa angustifolia*; whereas the loess mixture *F. rupicola*, *Bromus inermis* and *Poa angustifolia*. In the sown fields the percentage cover of vascular plants was recorded in 4 permanent plots per field, and ten aboveground biomass samples per field was collected in the first three years after sowing. The target grasslands for restoration were alkali (*Festucion pseudovinae*) and loess grasslands (*Festucion rupicolae*). From the second year onwards a high perennial grass cover was typical in all restored fields, which prevented the establishment of short lived weed species. However, the dense perennial grass cover and the accumulated litter also hampered the spontaneous immigration of

those specialist species which are characteristic to the reference grasslands. The noxious perennial weed, *Cirsium arvense*, was not suppressed by the sowing and following mowing once per year. It was present in high cover even in the third year. These results suggest that sowing low-diversity seed mixtures is effective in the suppression of short-lived weedy species. However, further management is necessary to reduce and/or eliminate *Cirsium arvense* (e.g. mowing multiple times a year, or early mowing in May). The restoration of species-rich loess grasslands also requires further management; e.g., to facilitate the immigration of grassland specialist species by moderate grazing or transfer of diaspores by hay.

Accumulated litter suppresses weeds in grassland restoration

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In most of the grassland restorations with seed sowing the performance of sown species and their role in weed suppression are studied. The effect of litter accumulation on species richness and phytomass of weeds, however, were often neglected. In our study we assessed the role of accumulated litter and phytomass of sown grasses both in weed suppression. We aimed at to test the following hypotheses: (i) With increasing amounts of litter the species richness decreases. (iii) The phytomass of weedy forbs is negatively correlated with the amount of litter and phytomass of sown graminoids. (iii) Higher amounts of accumulated litter are typical in the early years in restored fields than in reference grasslands. The study area was situated in the Hortobágy National Park, Egyek-Pusztakócs in East-Hungary. We studied the early phytomass dynamics in 20 former crop fields after sowing of basic seed mixtures (2-3 grasses) in a density of 20-25 kg/ha. In the first three years after seed sowing the in every field within one randomly placed 25 m^2 area 10 phytomass samples were collected in early June. The phytomass samples were dried (2 weeks, 25°C), than sorted to sown grasses, forbs and litter. Within the forb group the phytomass of weeds were handled separately. The vegetation was dominated by annual weedy species in the first year after sowing. During the second and third year weeds were replaced by clonal grasses. Significantly lower herbaceous phytomass was sampled in the second year after sowing, while the amount of litter had increased significantly. These litter scores were higher than that of in the reference grasslands. We found a strong negative correlation between the litter and forb phytomass. This correlation was much stronger, than the correlation between the phytomass of sown grasses and that of the forbs. The evenness scores for litter were also much higher in the samples than that of for the phytomass of sown grasses. Our results suggest that litter accumulation has a more important role in survival and establishment of forb weedy species, than the competitive exclusion of sown grasses.

A review of *Saturejon montanae* distribution on the Balkans

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Xerothermic grassland communities are widespread in Eastern Europe and on the Balkans. The specific location of the Balkan peninsula between Mediterranean zone and Central and Eastern Europe and variety of different factors in past and nowadays as soil types, basic rocks, isolation and ets, lead to forming of specific flora and vegetation on the Balkans. There are some alliances whose distribution is restricted only on Balkans as: *Saturejo-Thymion*, *Koelerio-Festucion dalmaticae*, *Scabioso-Trifolion dalmaticae* and *Saturejon montanae*. *Saturejon montanae* includes open to semi-closed xerotermic grassland communities, distributed in the zone of *Quercion frainetto*, rich of lots endemics. Up to now its distribution is located to Bulgaria and eastern Serbia. We gathered all available relevés from different literature sources and Bulgarian Database and analysed them using Juice Programme. As a result we made a review of its distribution on the Balkans and analysed its syntaxonomical position.

Management of dry Mediterranean Grasslands: the case study from the Ćićarija (Istria, Croatia) Spatial Protected Area (SPA) of Natura 2000

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Most of grasslands area in Istria, as well on Cicarija has been completely abandoned due to progressive succession of healing to shrubs and trees. In certain smaller areas pasture is uncontrolled, which leads to changes in botanical composition and reduction of plant diversity. At the same time, abandonment of cutting on meadows results the reduction of yield and feed value of grasslands, and expansion of undesirable plant species (Vitasovic Kosic et al. 2009).

Grassland vegetation in the area of Cicarija mountainous plateau belongs mostly to the *Festuco-Brometea* Br.Bl. et R.Tx. 1943. class, *Scorzonero-Chrysopogonetalia* H-ic et Ht. (1956) 1958 order (Kaligaric 1997). This community is developed at relatively deep, brown soils and is usually on the stoneless surface used as meadows, as well as pastures (Vitasovic Kosic & Britvec 2006).

The vegetation study on Cicarija (530-740 m a.s.l.) was performed during 2009 through 73 phytosociological relevés (with total of 428 plant taxa). Four different grasslands management (mowing, grazing, abandoned mowing and abandoned grazing) were researched. All data were submitted to multivariate statistical analysis. The phytosociological analysis has permitted to characterize 5 associations, 2 alliances and 2 orders.

Despite the fact that this community is used extensive, it provides fodder of good quality. In its floristic composition there is a large share of the protein-rich species from the *Fabaceae* family (*Anthyllis vulneraria*, *Hippocrepis comosa*, *Lotus corniculatus* ssp. *hirsutus*) and *Asteraceae* family (*Scorzonera villosa*). Although, biomass production is relatively small, because the community occupy very large areas, their significance for the extensive cattle breeding is large (for example as a basis for the production of sheep cheese).

The results of this research could provide guidelines for management of grassland in the studied areas, which will contribute to the improvement of the ecological sheep production, as well as to preservation of the diversity of flora and vegetation especially in territory of Spatial Protected Area (SPA) of Natura 2000.

Restoration of steppe vegetation on the territory of museum-reserve "Kulikovo pole" (Tula region, Russia)

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Museum-reserve "Kulikovo pole" is located in the Upper Don (Srednerussaya Hill). This is a historical place, where Kulikovskaya battle was held and (1380) and that is why the main goal of the museum is to restore natural vegetation of that time (Museum-reserve, 1999). Typical modern vegetation of the area is northern forest-steppe.

First experiments of steppe restoration on the small area (0.4 ha) began in 1986. The experiment had 2 variants: 1) transplantation of steppe swards from natural plots; 2) sowing of herb mixes which were cut on natural plots of Kulikovo pole.

The best results were achieved in variant 1 because after 3-4 years these steppe communities became similar to natural steppe habitats. In 2002 these experiments were repeated on larger areas (from 2 till 5 ha). The experiment with transplantation of *Stipa* swards in natural meadow-steppe community was organized also (Danilov 2005).

We described the different plots of "anthropogenic steppe" after 10 years and our results showed the differences between them in flora, structure of vegetation and productivity. Comparative analyses showed that the experiments with "improving" of meadow-steppe community gave results which are very similar to natural steppe communities.

In 2003 we organized new experiment. During the first year *Stipa* seeds (*S. pennata*, *S. capillata*, *S. pulcherrhima*) were sowed in lines. The distance between lines was 50 cm. The following year the seeds of other herbal steppe plants (*Linum flavum*, *Delphinium cuneatum*, *Elisanthe viscosa*, *Centaurea ruthenica*, *Iris aphylla*, *Trinia multicaulis*, *Lavatera thuringiaca*, *Onobrychis arenaria*, *Coronilla varia*, *Galium verum*, *Genista tinctoria*, *Medicago falcata*, *Veronica teucrium*, *Pyrethrum corymbosum*, *Allium oleraceum*, *A. flavescens*, *A. rotundum*) were planted between *Stipa*-lines. In the 4th year of experiment the abundance of *Stipa* sp. was 55-65 %, species concentration was 18-24 for sq. meter. But now this community is not steppe vegetation typically because it has a lot of weeds. We are sure that during natural succession of vegetation vitality and abundance of steppe plants will increase, vitality and abundance of weeds will decrease. In this case steppe communities with typical structure will be formed faster.

For studying of biology and ecology of steppe plants Collection Garden was done.

Components of floristic diversity of the remaining valonia oak silvopastoral grasslands of Greece

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Valonia oak (*Quercus ithaburensis* ssp. *macrolepis* (Kotschy) Hedge & Yaltirik) is one of the few deciduous oak species met in the xerothermic conditions of the eastern Mediterranean; a fact of great ecological importance since it is a photophilous species that forms open canopy forests, permitting adequate light to reach the ground, thus sustaining an exceptionally rich grassland flora. Since these areas have been traditionally used by livestock, they are considered as the main tradi-

tional silvopastoral system for Greece; they may be considered as the dehesas-like systems of the east Mediterranean countries. Their use goes back in ancient times as they are mentioned by Homer and many ancient rhetoricians and historians. Nowadays, the valonia oak silvopastoral grasslands are considered degraded as a result of intense exploitation by human. The importance of a full registration of their vegetation elements stems from the characteristic ecotopes and biotopes they form. They are mentioned in the technical handbook of the Corine classification system (code: 41.791) and in the Annexes of the 92/43/EC Regulation (code: 9350). For the effective evaluation and sustainable management of the remnant ecotopes of valonia oak and the establishment of refined monitoring systems, a detailed description of vegetation together with the determination of their biodiversity characteristics are needed. This paper comes along with these lines by setting as its major goals to determine and compare the floristic diversity measures, and to explore in a comparative manner the impact of man-made activities on vegetation and floristic diversity of the most characteristic, pure valonia oak silvopastoral grasslands of Greece. It was found that the highest floristic diversity is associated with intermediate grazing disturbance (Pentalofos, Lesvos island), while floristic diversity seemed to be inversely related to a) tree and mostly shrub crown coverage, (b) time since last silviculture activity, and (c) soil inclination.

Keywords: individual-based rarefaction, Renyi's diversity ordering diagrams, Solow's randomization test, *Quercus ithaburensis* ssp. *macrolepis*

Changes in narrow-leaved dry grasslands during growing season

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In Central European narrow-leaved dry grasslands we can observe changes in number of species and their cover during growing season. The aim of this study was to evaluate variation in vegetation relevés recorded at the same site but in different period of the vegetation season. Therefore I analysed dataset of permanent plots sampled in three distinct periods – spring, summer and early autumn. Classification based on relevés of one season is unique, because comparison of classifications between seasons revealed significant discrepancies. Despite the fact that between spring diagnostic species occurs several spring ephemerals and there is lowest total sum of occurring species in the autumn, results of classification of spring and autumn relevés were surprisingly more similar than other combinations. Detrended correspondence analysis (DCA) revealed also changes in the main ecological factors influencing the vegetation during seasons.

Soil seed banks of alpine dry grassland habitats and implications for nature conservation

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Due to the decline of traditional agriculture, species rich dry grasslands are among the most threatened habitats in Europe. The dry grasslands of Switzerland declined dramatically by 90 % over the past 60 years due to intensification of agriculture, abandonment, conversion of grassland into settlement area and afforestation. Soil seed banks are a source for re-establishment of species which are lost from the above-ground vegetation. Hence, maintenance and restoration of species rich dry grasslands will also depend on their soil seed bank. We studied the seed bank diversity and its relation to aboveground vegetation and seed longevity of 23 dry grassland sites of lower elevations of the Swiss Alps (alliances *Mesobromion*, *Xerobromion*, *Cirsio-Brachypodion*, *Stipo-Poion*). The seed bank was investigated using the seedling emergence method. For each of the recorded 231 species the seed accumulation index (SAI) was calculated. Only 45 % of the species established a seed bank: 35 % built a short-term persistent seed bank (e.g. *Dianthus carthusianorum* s.l. and *Phleum phleoides*), only 10 % were able to establish a long-term persistent seed bank (e.g. *Cardus defloratus* s. str. and *Koeleria macrantha*). Alliances differed significantly in the mean SAI of their species, the Mesobromion showed the lowest tendency of species to accumulate seeds in the soil and thus to establish a long-term persistent seed bank. Owing to the lacking persistence of many dry grassland species in the seed bank there is a high risk of extinction if the species is also absent from aboveground vegetation. In comparison with other studies from mesic and alluvial grasslands, we conclude that the density and diversity of soil seed banks decline with decreasing soil water availability. Therefore, dry grassland communities are most disadvantageous to re-establish form the soil seed-bank. Our findings strongly support the high importance of conserving still existing dry grassland sites.

The importance of dry grasslands for preservation of ant communities in cultural landscape of central Slovakia

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Dry grassland ant communities are especially species rich, when compared to other grassland habitats across Slovakia. High diversity and richness of ants may be seen as consequence of (i) specific structure of dry grassland habitats allowing intensive insolation of soil surface, (ii) currently low or absent management-induced disturbance, and (iii) long-term existence of dry grasslands within the cultural landscape. Here we report on the structure of ground-foraging ant assemblages, with special regard to dry grasslands. Our study was carried out in the Štiavnické vrchy Mts. (Central Slovakia), a region with historically well developed grassland areas. We established a set of 25 research plots within south-orientated grassland habitats, representing five different grassland types, which typically occur across the study area; e.g. humid managed and humid abandoned grasslands, mesic managed and mesic abandoned grasslands and dry abandoned grassland habitats. Each habitat type was represented by 5 independent plots. Using the standard pitfall trap method we sampled 6 689 workers of ants belonging to 35 different species during the growing season of 2008 and 10 days of trap exposure. The total number of recorded species was highest for the dry grasslands (23), and decreased with increasing habitat humidity (15 sp. for mesic grasslands, 13 sp. for wet abandoned and 12 sp. for wet managed grasslands). The highest ant species richness per site was also recorded from the five dry grassland plots and was negatively correlated with mean vegetation height. Low structural habitat complexity of dry grassland plots, typical by presence of bare soil, exposed bedrock, lichens and moss patches, plus significantly lower vegetation height distinguished the dry grassland habitat from the rest of studied grassland types. Specific habitat structure probably contributed to the composition of associated ant assemblages – typical by increased proportion of *Tetramorium caespitum*, *T. moravicum* and *Tapinoma ambiguum* and exclusive presence of several thermophylic species such as *Messor structor*, *Tetramorium ferox*, *Ponera testacea* and genus *Plagiolepis*. On the other hand, several species common at humid and mesic grassland habitats, were absent from dry grassland assemblages. Our results suggest that dry grassland habitats host unique ant communities and emphasize their importance for conservation of rare Slovak steppe fauna.

Delimitation of *Festuco-Brometea* and *Trifolio-Geranietea*: where should we draw the line?

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Dry grasslands of the class *Festuco-Brometea* and fringe vegetation of the class *Trifolio-Geranietea* are connected, both in time and space, by a continuum of intermediate stands. Although 'typical' stands of both classes are clearly different in physiognomy and species composition, the delimitation of the classes is sometimes difficult when working with real data. Using a comprehensive regional data set from Eastern Austria, I want to address the following questions: What are the best diagnostic species for *Festuco-Brometea* and *Trifolio-Geranietea* in the study area? Which criteria should be applied to assign individual relevés to one of the two classes? The data set used in this case study consists of ca. 300 relevés of *Festuco-Brometea* and ca. 120 relevés of *Trifolio-Geranietea*. All relevés were sampled in the Vienna Woods (Wienerwald) which is the north-easternmost part of the Alps. The relevés were assigned to phytosociological alliances by expert judgement, usually following the assignment of the original author. For all vascular plant species, the total cover value (i.e. the average cover including zero values) was calculated on the alliance level. Diagnostic species for both the alliance and the class level were identified with total cover value ratio and phi value (based on cover) as fidelity measures. It is proposed that the assignment of individual relevés to one of the two classes should be based on the summarised cover value of diagnostic species.

Dry grassland vegetation of southern Karelia 50 years after: changes and their reasons

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The meadow vegetation of Karelia was describe in details in mid 1900th. 50 years already have passed since that time. The structure of dry grassland vegetation has been sufficiently changed. What changes can we observe?

The direct comparison is complicated because the differences in methodological approach to plant community. Dominant approach was replaced with ecological and floristic criteria. However even the perfunctory comparison shows quite bright results. The number of clearly delimited large syntaxa of dry meadows keeps approximately the same level (5 syntaxa in 2000th versus 6 ones in 1950th). However

two of them (*Nardus stricta* and *Festuca ovina* communities) are came extinct while one new has been introduced (*Anthriscus sylvestris*). One of community types came rare (*Deschampsia caespitosa* type). Mainly this can be explained by the changes in ecological space of region dry grasslands. Most of low productive grasslands on nutrient low lands have been abandoned while many new grasslands on nitrogen rich soils of former fields have appeared instead.

Development and degradation of dry serpentine grassland communities in south-western Poland

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Lower Silesia – the south-western part of the country – is the only region of Poland with serpentine outcrops. Dry grasslands form there small patches dispersed among the vegetation covering slopes of the hills.

There will be presented results of the research whose objective was to describe how the environmental factors control the succession of vegetation. The vegetation and soil samples were collected from 77 plots scattered over the various succession stages in 21 dry grassland patches.

The hierarchical agglomerative classification has split the complete set of vegetation samples into 7 groups. Two of them comprise early succession stages characterized by poor vegetation developing on the initial soils in abandoned quarries and four further – the mature dry grassland stages with different species composition. The last group includes samples from degraded dry grasslands patches, characterized by a spectacular expansion of high grass species, above all *Calamagrostis epigejos*.

Canonical correspondence analysis ordination shows that among the 26 examined environmental variables there are eight which significantly influence the vegetation pattern of the studied dry grasslands. The main direction of the site variation from the pioneer succession stages through the mature dry grasslands to their degraded forms is determined by soil depth and available phosphorus, as well as (in a lesser way) exchangeable nickel and mineral nitrogen content. These variables are correlated with the first CCA axis. Exchangeable calcium content and pH are strongly correlated with the second CCA axis. They diversify sites within the pioneer stages and the mature grasslands.

Excursions guides

Dry grasslands of Tematínske vrchy Mts. – biodiversity and conservation

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Introduction

Tematínske vrchy Mts. are located in the south-western Slovakia on the eastern edge of the Váh River valley between the towns Nové Mesto nad Váhom and Piešťany (Figs. 1, 2). This area represents one of the western-most outposts of the Western Carpathian Mts. built by a calcareous bedrock. The location between the Pannonian Basin and outer Carpathian mountain ridges is well reflected in the floristic composition of the local vegetation typical by common occurrence of both Pontic-Pannonian and sub-Mediterranean thermophilous species and dealpine montane and sub-montane Carpathian species. Thus in spite of a small extent (the area of about 7 by 10 km, altitudes hardly reaching 700 m), the Tematínske vrchy Mts. represent an area with extraordinary natural value.

This island of thermophilous calcareous vegetation differs from the surroundings at the first sight – the hilly landscape covered by light-green deciduous forests and dark-green patches of planted pine stands combined with patches of open rocky grasslands and conspicuous white gravel screes on the steepest slopes. During a hot summer day the atmosphere and the smell of air resembles the Mediterranean landscape by the warm feeling from each stone, air filled with the etheric smell of the aromatic plants and the noise of myriads of cicadas. The sun-exposed slopes are the best place to absorb the earth heat during the first spring days as well as to suffer by sunstrike during the top summer season. The vegetation reacts accordingly forming the first botanical paradise for the early spring field trips and transforming into almost desert in the hottest summer days. Do not forget to protect your head and eyes against strong solar radiation by a hat or cap and glasses. Also the rest of your body would need protection, light long trousers would keep you comfortable also in the stands of spiny bushes and would protect you against the ticks which are very frequent and dangerous due to the spread of encephalitis

and borreliosis (check properly whether you have collected them after the trip, too). Keep in mind that there are only few natural springs in the area and take sufficient drinking water for your trip.

Tematínske vrchy Mts. represent a part of the bigger mountain range called Považský Inovec Mts. with the highest peak Inovec (1042 m). The mountain range separates basins of the Váh and Nitra rivers. There are many monuments in or near the mountain range, including Great Moravian hillfort Kostolec near Ducové, Hlohovec Castle, Beckov Castle, Topoľčany Castle and Tematín Castle. A treasure of axe-shaped iron coins from the Great Moravian period has been found in the Hrádok area. Traces of the Great Moravian fortified settlement found in the village have been destroyed by construction activities. The Tematín Castle is recently a ruin. The castle was originally built in the second half of the 13th century. It was fundamentally reconstructed by the Thurzo family, owners of the castle from 1524. The last owner was Miklós Bercsényi, general of the anti-Habsburg insurrection army. The castle was turned into ruins after it was sieged in 1710 as a part of the suppression of the anti-Habsburg uprising.

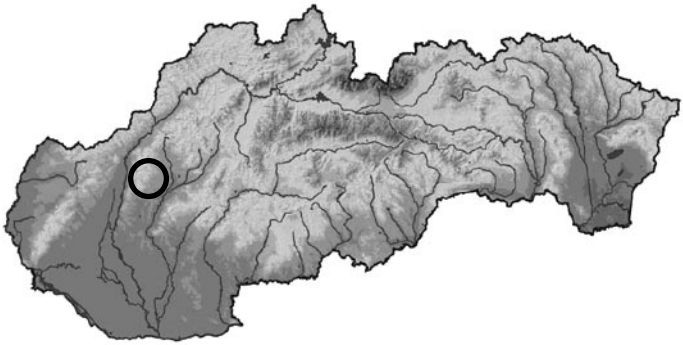

Fig. 1 Location of the Tematínske vrchy Mts. in Slovakia and the Western Carpathian Mts.

Thanks to its natural values the area of the Tematínske vrchy Mts. was included into the national list of Areas of European importance (code SKUEV 0380) in 2004. This area involves the cadasters of villages Hrádok, Lúka, Modrová and Stará Lehota covering the area of 2471.27 ha (Fig. 2). In the whole area, the level II of nature conservation measures is valid, in the national reserves the strict level V is valid. Within the SKUEV Tematínske vrchy, three national nature reserves (NPR) are located: a) In the **National Nature Reserve (NPR) Javorníček** (declared in 1982, area of 15.06 ha) the conservation is focussed on the rock and scree communities with occurrence of numerous Western Carpathian species. The extention of the reserve by a dry oak forest with abundant *Anacamptis pyramidalis* is in preparation. b) The **National Nature Reserve (NPR) Tematínska lesostep** (declared in 1976, area of 59.67 ha) is dominated by open thermophilous forests of *Quercus pubescens* and rocky dry grassland communities, partly disturbed by the of non-native *Pinus nigra* and *Fraxinus ornus* plantations. c) The **Nature Reserve (PR) Kňaží vrch**

(declared in 1988, area of 150.94 ha) represents a large area of *Quercus pubescens* forests in combination with dry rocky grasslands less affected by the afforestation of non-native woody species.

Ten habitat types of European importance were indicated in the SKUEV Tematínske vrchy, together with two plants of European importance (*Puslatilla grandis*, *Dianthus praecox* subsp. *lumnitzeri*) and 12 animal species of European importance (*Vertigo moulinsiana*, *Colias myrmidone*, *Eriogaster catax*, *Callimorpha quadripunctaria*, *Rosalia alpina*, *Cerambyx cerdo*, *Lucanus cervus*, *Bombina variegata*, *Aquila heliaca*, *Caprimulgus europaeus*, *Dendrocopos leucotos*, *Ficedula parva*).

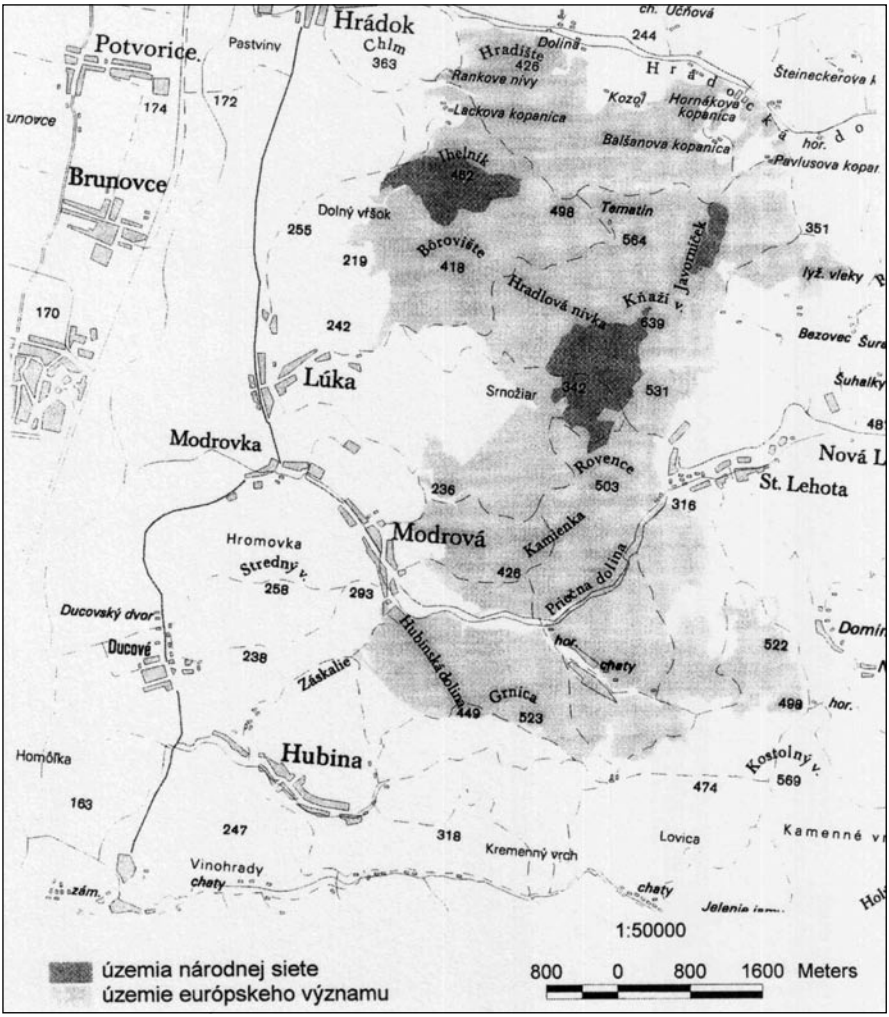

Fig. 2 Area of European importance (SKUEV) Tematínske vrchy (light grey) and the location of nature reserves (from the left side: Tematínska lesostep, Kňaží vrch and Javorníček).

History of botanical research and nature conservation

The region has been studied by botanists since the beginning of the 19th century. Most of them made the excursions to the ruin of Tematín Castle. A. Rochel who belonged to the first of such explorers found *Draba lasiocarpa* in the castle surroundings which is *locus classicus* of this species. Ľudovít Holuby published the list of important plant species in the region of Tematín in 1899. The first phytosociological overview of the Tematínske vrchy Mts. was published in 1930 by Pavel Sillinger. Besides the fact that this work provides an excellent reading it is a valuable source of botanical and landscape-historical information on the region. Since Sillinger's research the vegetation has changed dramatically – decreasing intensity of grazing and increasing activities of foresters led to the transformation of numerous open pastures to dense stands of pine (*Pinus nigra*, *P. sylvestris*), juniper (*Juniperus communis*) or ash (*Fraxinus ornus*). Some of these changes are reflected in the phytosociological monographie of Štefan Maglocký (1979) where the local dry grassland communities are documented by individual phytosociological relevés. Š. Maglocký started also with the first ecological and microclimatic measurements (Maglocký 1978). The special xeric habitat conditions have later inspired numerous botanists to perform their ecological research in the region. In the 1990th, the Tematínske vrchy Mts. became a favourite destination of frequent excursions, field works and field courses. Ladislav Mucina has organized most of them for students of the Vienna University, but also he supervised the theses of Sofie Wikberg and Monika Janišová focussing on population biology of *Carex humilis*, *Festuca pallens* and *Sesleria albicans*, the data of which were at least partly collected in the area of the Tematínske vrchy Mts. (Janišová 2000, Wikberg 2002).

In spite of the nature conservation measures (declaration of nature reserves in 1976, 1982 and 1988), the area remained insufficiently known and many natural values remained uncovered. The necessity of research continuation and providing the appropriate management regimes in the area has led the state nature conservancy organisation (Administration of Protected Landscape Area Biele Karpaty) to cooperate with the regional non-governmental organisations KOZA and Pre Prírodu. The review of their most recent research results was published by Májsky & Rajcová (2006).

In comparison to the botanical research, the zoological inventories were performed much later, not earlier than in the 80th of the 20th century and the first comprehensive works were published just recently.

Climatic, geological and pedological conditions

The area has a mild climate with mean annual temperatures between 8 and 9°C and mean temperature during the growing season 15°C. The warmest month is July (mean monthly temperature of 18.9°C), the coldest month is January (mean monthly temperature –1.8°C). The precipitation totals are usually 600-700 mm. The snow cover reaches 8-10 cm and covers the land surface usually for no more than 30 days. Meso- and microclimatic factors play a crucial role in formation and evolution of vegetation cover in the region.

Almost the whole area of the SKUEV Tematínske vrchy is built by calcareous bedrock of the triassic age (mesozoic), mostly dolomites and limestones. Only in the southern part of the area the schists and quarzites emerge on the terrain surface. Quaternary sediments form some marginal parts on the area. Among soil types, rendzinas are most widespread. They are generally developed in a thin layer while on steep south-facing slopes dolomitic screes prevail.

Thanks to the prevailing southern slope aspect, dolomitic bedrock and lack of surface streams the area of SKUEV Tematínske vrchy represents a dry and warm island within the Carpathian forests. Numerous xero- and thermophilous plant and animal species inhabited the area during the interglacial period and found here the refugee until the recent days. Since the Middle Ages the landscape has been intensively modified by people which either cut the forests or used them as pastures. The area of open rocky grasslands has spread significantly, thus encouraging survival of xerophilous species. Strong deforestation in combination with intensive grazing caused the erosion on the steepest slopes. Since the second half of the 20th century plantations of non-native woody species have been established to prevent further erosion. The stands of *Pinus nigra* and *Fraxinus ornus* suppressed the native woody species and caused the damage to precious dry grassland habitats. The recent trends in nature conservation and land utilization by the private owners prefer gradual removing of non-native plantations, cessation of grassland aforestation and encouragemnet of oak plantations.

Flora

The flora in the area represents a typical example of diffusion of Carpathian and Pannonian elements. The sun-exposed southern slopes are habitats of *Quercus pubescens*. In Slovakia, it reaches the northern border of its overall distribution including the central and eastern Europe, Asia Minor and Caucasus. The thermophilous flora is represented also by *Quercus cerris*, *Carex humilis*, *Poa badensis*, *Oryzopsis virescens*, *Scorzonera austriaca*, *Jurinea mollis*, *Trinia glauca*, *Dianthus praecox* subsp. *lumnitzeri* and *Fumana procumbens*. The Carpathian elements are less numerous represented mainly by calciphilous demontane and dealpine species such as *Sesleria albicans*, *Thesium alpinum*, *Phyteuma orbiculare*, *Acinos alpinus*. Among the prealpine species the following occur in the local grasslands: *Biscutella laevigata*, *Coronilla coronata*, *Daphne cneorum*, *Hornungia petraea* and *Thlaspi montanum*. The relation to the Carpathian vegetation is obvious also thanks to the occurrence of *Lunaria rediviva*, *Aconitum vulparia* and *Dentaria enneaphyllos* in the local beech forests. Other species important from the phytogeographical or conservational points of view are: *Draba lasiocarpa* (*locus classicus* in Tematín), *Trinia glauca*, *Daphne cneorum*, *Dictamnus albus*, *Verbascum phoeniceum* (all of these species reach here the northern limit of their distribution within the western or the whole Slovakia). *Daphne cneorum* and *Onosma visianii* are critically endangered species having only limited number of localities in Slovakia. The orchids *Anacamptis pyramidalis* and *Limodorum abortivum* belong to the most endangered species of the Slovak flora, in the Tematínske vrchy Mts. they have abundant and stabile populations. Besides them, another sixteen orchid species occur in the region (e.g. *Dactylorhiza majalis*,

D. sambucina, *Orchis militaris*, *O. pallens*). Plants of European importance *Dianthus praecox* subsp. *lumnitzeri* and *Pulsatilla grandis* are very frequent in the region. In the vicinity of Lúka nad Váhom the occurrence of *Carex hallerana* was recorded on its only locality in Slovakia (Dostál & Červenka 1992). The taxon *Centaurea tematinensis* was described by Domin in 1930 from Kňaží vrch nearby the Tematín Castle (*locus classicus*, southern slope, 550-600 m a.s.l.). Recently, some authors consider it to be a Pannonian sub-endemic species (Futák 1971, Maglocký 1983, Kliment 1999) and the other regard it as synonymum of *Colymbada badensis* (Marhold & Hindák 1998). *Bromus monocladus*, endemic species of the Western Carpathians is frequent in the region.

Vegetation

The habitat conditions on the southern and northern slopes differ strongly so that different types of climax communities have developed (Fig. 3). The forest communities are dominant in the region. Most common are the Carpathian oak-hornbeam forests (*Carici pilosae-Carpinenion betuli*) with islands of oak forests with *Quercus cerris* (*Quercetum pertraeae-cerris*) and sub-Mediterranean xero-thermophilous oak forests (*Quercion pubescentis-petraeae*) with *Quercus petraea* dominating the tree layer and *Cornus mas* the shrub layer. At higher altitudes and on the northern slopes the calciphilous beech forests (*Cephalanthero-Fagenion*) occur. Restricted area is occupied by the mixed lime-maple forests (*Tilio-Acerenion*).

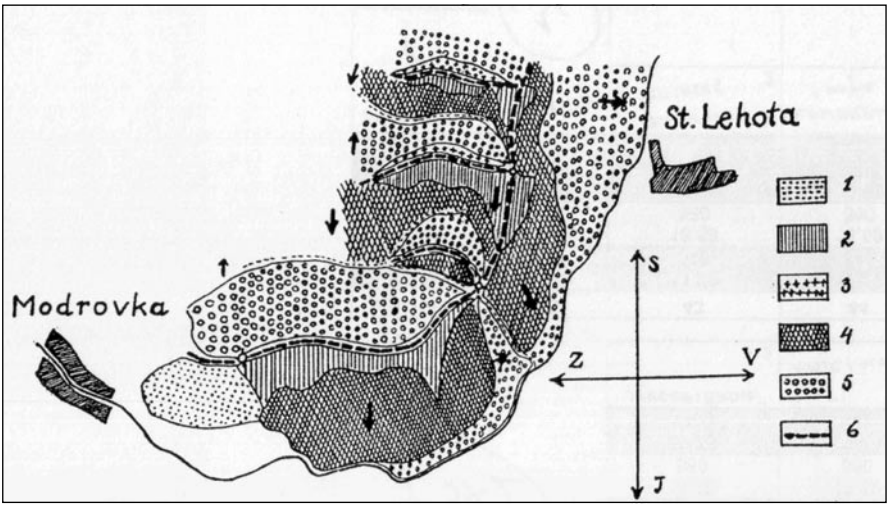

Fig. 3 Distribution of the main vegetation types in the Tematínske vrchy Mts. (locality Kamienka-Rovence) in relation to the slope aspect: 1 – steppe pastures of the *Festucion valesiacae* alliance, 2 – gravel screes and open rocky grasslands of the *Bromo pannonici-Festucion pallentis* alliance, 3 – closed grasslands of the *Diantho lumnitzeri-Seslerion* alliance, 4 – xerophilous oak (*Quercus pubescens*) forests, 5 – beech forests and mixed forests (*Fagus sylvatica, Carpinus betulus, Quercus petraea*), 6 – the ridge line. According to Sillinger (1930) with sligt modification.

The synopsis of dry grassland communities occurring in the region is as follows:
Class *Festuco-Brometea* Br.-Bl. et Tüxen ex Soó 1947
Order *Festucetalia valesiacae* Br.-Bl. et Tüxen ex Br.-Bl. 1949
Alliance *Festucion valesiacae* Klika 1931
Ass. *Festuco valesiacae-Stipetum capillatae* Sillinger 1930
Ass. *Festuco rupicolae-Caricetum humilis* Klika 1939
Order *Stipo pulcherrimae-Festucetalia pallentis* Pop 1968
Alliance *Bromo pannonici-Festucion pallentis* Zólyomi 1966
Ass. *Poo badensis-Festucetum pallentis* Klika 1931 corr. Zólyomi 1966 nom. invers. propos.
Ass. *Festuco pallentis-Caricetum humilis* Sillinger 1930 corr. Guterman et Mucina 1993
Alliance *Diantho lumnitzeri-Seslerion* (Soó 1971) Chytrý et Mucina in Mucina et al. 1993
Ass. *Minuartio setaceae-Seslerietum calcariae* Klika 1931 nom. invers. propos. et nom. mut. propos.

Among dry grassland communities, the vegetation of alliances *Bromo pannonici-Festucion pallentis* and *Diantho lumnitzeri-Seslerion* are most widely distributed. Their syntaxonomy was revised just recently (Fig. 4) and the delimitation of both the associations and alliances was supported also by formulation of formal definitions (Janišová & Dúbravková 2010).

Rocky Pannonian grasslands of ***Bromo pannonici-Festucion pallentis*** (Fig. 5) represent open dry grasslands on limestone and dolomite bedrock in the Pannonian region and lower peri-Carpathian mountain ranges or Inner-Carpathian basins (intermontane basins of northern and central Slovakia) with warm and dry climate. They inhabit mild or steep sun-exposed slopes with shallow soils and karst rocky fields. The regular periods of summer drought act as limiting factor in formation of open communities dominated by competitively week but stress-tolerant species. In Slovakia, the floristic composition and the overall structure of these communities are affected mainly by the geographical location, microclimatic features and bedrock type. Numerous rare and endemic species grow in these communities (e.g. *Campanula xylocarpa*, *Dianthus praecox* subsp. *lumnitzeri*, *Draba lasiocarpa*, *Onosma tornensis*). Caespitose grasses (*Festuca pallens*, *Sesleria heufleriana*) or graminoids (*Carex humilis*) dominate in these communities and determine substantially their syntaxonomical classification.

In Slovakia, the extremely dry and warm habitats dominated by *Festuca pallens* are classified to two associations vicarious in their geographical distribution: *Poo badensis-Festucetum pallentis* (south-western Carpathian margins) and *Campanulo divergentiformis-Festucetum pallentis* (southern Carpathian margin in the Slovak-Hungarian karst region). In both associations special drought-adapted species groups are abundant such as succulents (*Jovibarba globifera*, *Sedum* spec. div.), chamaephyts (*Fumana procumbens*, *Draba lasiocarpa*, *Teucrium montanum*, *Thymus praecox*, *T. pannonicus*) and ephemeral terophyts (*Erophila verna* agg., *Cerastium brachypetallum*, *C. semidecandrum*, *Holosteum umbellatum*, *Hornungia petraea*, *Saxifraga tridactylites*).

Among *Carex humilis*-dominated communities three associations can be recognized in Slovak dry grasslands: *Festuco pallentis-Caricetum humilis* (western Slovakia), *Poo badensis-Caricetum humilis* (southern Slovakia) and *Orthantho luteae-Caricetum humilis* (north-western and central Slovakia). Typical is a marked vegetation structure (fairy rings or „Hexenringe") formed by the dominant *Carex humilis* and occurence of numerous chamaephyts of genera *Thymus*, *Teucrium*, *Helianthemum* and *Rhodax*.

West-Pannonian rocky steppes on calcareous bedrock of ***Poo badensis-Festucetum pallentis*** represent the most xerophilous community of the alliance including early successional stages as well as primary rocky grasslands in climatically and edaphically specific habitats. The stands are low and open, soils shallow and poorly developed, often with the highest percentage cover of dolomite gravel or rocky outcrops. Stands are usually dominated by tussocks of *Festuca pallens*. Succulents (*Jovibarba hirta*, *Sedum acre*, *S. album*, *S. sexangulare*) and chamaephytes (*Alyssum montanum*, *Fumana procumbens*, *Helianthemum nummularium* agg., *Teucrium montanum* and *Thymus praecox*) are constantly present. Among forbs, *Leontodon incanus*, *Potentilla arenaria* agg. and *Sanguisorba minor* are very frequent, still non of them reaches higher cover or dominance. These communities have a marked seasonal dynamics with a numerous terophytes (*Cerastium brachypetalum*, *C. pumilum*, *Erophila verna* agg., *Hornungia petraea*, *Saxifraga tridactylites* and *Holosteum umbellatum*) developing in early spring and a very diverse cryptogamic flora reaching the highest percentage cover during wet periods. In Slovakia, the association occurs in the western part of the country where it inhabits steeper, often eroded slopes over limestones and dolomites at altitudes between 250 and 500 m. It was documented from the Malé Karpaty Mts., Považský Inovec Mts. and from the southern-most part of the Strážovské vrchy Mts. In the past, this vegetation has spread due to intensive grazing. Recently, it is endangered by forest succession (locally speeded up by artificial plantation of *Pinus* spec. div. and *Fraxinus ornus*), atmospheric nitrogen deposition and subsequent invasion of competitive grasses. Outside Slovakia, this vegetation occurs in the Pavlovské vrchy Mts. in southern Moravia and in the north-eastern Austria.

West-Pannonian *Carex humilis*-grasslands of ***Festuco pallentis-Caricetum humilis*** are open and low-growing dry grasslands are dominated by *Carex humilis* which forms typical ring-tussocks and determines the overall structure of this community. High abundance is usually achieved by *Festuca pallens* and other thermophilous species adapted to extremely dry summers such as dwarf shrubs (chamaephytes) *Alyssum montanum*, *Helianthemum nummularium* agg., *Fumana procumbens*, *Potentilla arenaria* agg., *Teucrium montanum*, *Thymus praecox* and *Rhodax canus* as well as spring ephemeral terophytes (e.g. *Erophila verna* agg., *Holosteum umbellatum*, *Hornungia petraea*, *Saxifraga tridactylites*). The last mentioned species group is especially species-rich occupying gaps in the open vegetation where its abundance fluctuates strongly not only during the vegetation season but also among the years. In a similar manner, bryophytes (*Thuidium abietinum*, *Tortella inclinata* and *T. tortuosa*, etc.) reach the highest cover during wet springs and autumns. In several localities, the rare bryophyte species *Pleurochaete squarrosa* occurs as well. The stands occur on shallow soils (rendzinas) over carbonate bedrock (dolomites and limestones) in ridge plateaus or gentle south- or south-west-facing slopes at

altitudes from 220 to 500 (650) m. This vegetation frequently grows in mosaic with the *Poo badensis-Festucetum pallentis* association by which it is replaced in extremely steep and dry habitats. Previously grazed stands are recently endangered mainly by succession of competitive woody and grass species. As they are habitats of numerous rare and vulnerable species, these communities require an effective conservation. In Slovakia, the distribution is restricted to the lower mountains on the south-western Carpathian periphery having its centre in the Považský Inovec Mts. and Malé Karpaty Mts. Isolated localities are in the Strážovské vrchy Mts. and Hornonitrianska kotlina Basin. Outside Slovakia this vegetation occurs in north-eastern Austria.

Within the association *Festuco pallentis-Caricetum humilis* we distinguish two variants which were already recognized by Futák (1947). Variant with *Potentilla arenaria* agg., *Stipa joannis*, *Silene otites*, *Campanula sibirica*, *Helianthemum nummularium* agg., *Onosma visianii* and *Trinia glauca* is distributed in the Považský Inovec Mts., Malé Karpaty Mts. (including locality Devínska Kobyla connecting the Slovak and Austrian distribution area), and the southern-most part of Strážovské vrchy Mts. Variant with *Potentilla heptaphylla*, *Rhodax canus*, *Dorycnium pentaphyllum* agg., *Helichrysum arenarium* and *Daphne cneorum* occurs in the Strážovské vrchy Mts. at altitudes up to 650 m. Species *Potentilla heptaphylla* and *Rhodax canus* replace species *Potentilla arenaria* agg. and *Helianthemum nummularium* agg. from the former variant as vicariants.

Dealpine *Sesleria*-grasslands of ***Diantho lumnitzeri-Seslerion*** represent communities dominated by *Sesleria albicans* at lower altitudes (colline to submontane belt). They occupy usually cooler and moister (often north-facing or inverse) locations in the warm peri-Carpathian calcareous mountains. Typical is presence of numerous dealpine species which are usually distributed in the subalpine and alpine belt but occasionally occur in relic localities of lower altitudinal belts. Among them *Acinos alpinus*, *Biscutella laevigata*, *Carduus glaucinus*, *Leontodon incanus*, *Phyteuma orbiculare*, *Polygala amara* subsp. *brachyptera*, *Saxifraga paniculata* and *Thesium alpinum* are the most frequent. Thermophilous *Festuco-Brometea* species (*Anthericum ramosum*, *Asperula cynanchica*, *Globularia punctata*, *Helianthemum nummularium* agg., *Hippocrepis comosa*, *Potentilla arenaria* agg., *Sanguisorba minor*, *Teucrium montanum* and *Thymus praecox*) differentiate these communities from *Sesleria*-dominated communities of higher altitudes belonging to the alliance *Astero alpini-Seslerion calcariae* and suballiance *Pulsatillo slavicae-Caricenion humilis* Uhlířová in Kliment et al. 2005. Bryophytes are usually present with high cover, in closed stands *Ditrichum flexicaule* and *Hypnum cupressiforme* are most common while in open rocky habitats *Homalothecium phillipeanum* and *Tortella tortuosa* prevail. These communities are bound to calcareous bedrock (limestones and dolomites) and rendzina soils which are rather deep with high humus content. They inhabit upper ridge slopes or steep rock cliffs some of which were presumably never covered by closed forests. Wood cutting and grazing contributed to spread of this vegetation in the past. Recently, many of its relic localities are endangered by succession or afforestation and need a strict conservation. The communities of the *Diantho lumnitzeri-Seslerion* are distributed mainly at the periphery of central European mountains, the Alps and the Carpathians. Similar vegetation in Switzer-

land, France and Germany is classified within the *Xero-Bromion* (Br.-Bl. et Moor 1938) Moravec in Holub et al. 1967 alliance.

Dry peri-Carpathian *Sesleria albicans*-grasslands of ***Minuartio setaceae-Seslerietum calcariae*** are closed, uniform and moderately species-rich grasslands are dominated by *Sesleria albicans*. Among all *Sesleria*-dominated communities, they contain most thermophilous species penetrating from the neighbouring associations *Festuco pallentis-Caricetum humilis* and *Poo badensis-Festucetum pallentis*, e.g. *Alyssum montanum*, *Dianthus praecox* subsp. *lumnitzeri*, *Jurinea mollis* and *Viola collina*. Species *Anthericum ramosum*, *Carex humilis*, *Genista pilosa* and *Teucrium montanum* reach the highest constancy and percentage cover. Dealpine species diagnostic for the *Diantho lumnitzeri-Seslerion* (e.g. *Biscutella laevigata*, *Leontodon incanus*, *Phyteuma orbiculare* and *Thlaspi montanum*) are also frequent. *Hypnum cupressiforme* and *Thuidium abietinum* dominate the moss layer. In Slovakia, this vegetation occurs in warm regions in its western part, where it is confined to cooler and moister north-facing slopes at altitudes from 280 to 675 (750) m. Rendzina soils are moderately deep, slightly alcaline and rich in humus. Best developed stands were recorded in the Považský Inovec Mts. and Malé Karpaty Mts., while this vegetation occurs also in the Strážovské vrchy Mts. and Hornonitrianska kotlina Basin. Outside Slovakia, the community is known from southern Moravia and Lower Austria.

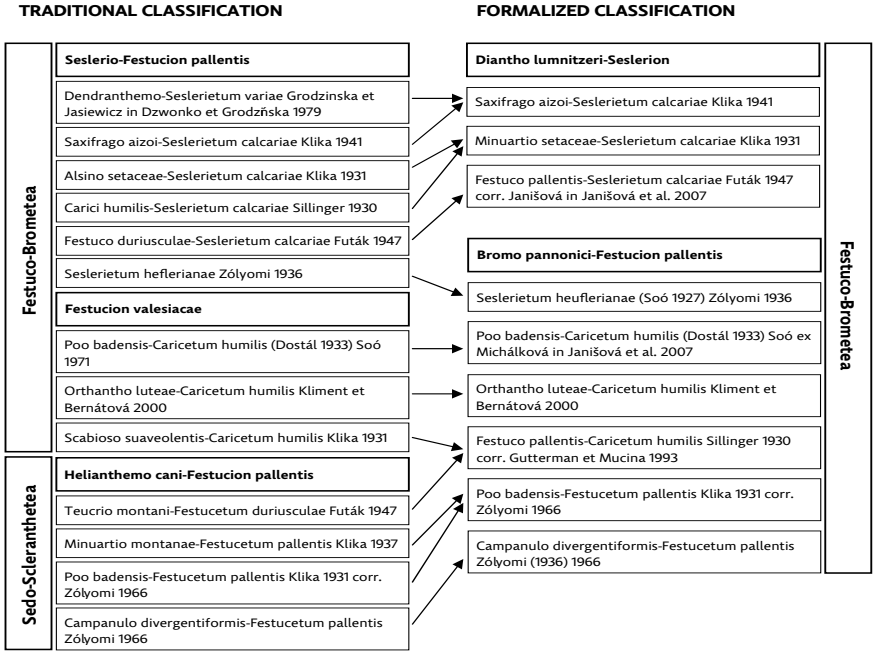

Fig. 4 Scheme of the main changes and shifts at both the association and alliance levels made during the syntaxonomical revision. The so-called traditional classification scheme is based on Mucina & Maglocký (1985). According to Janišová & Dúbravková (2010).


h
e
g
f
d
c
b
a

Fig. 5 The typical vegetation types in the Tematínske vrchy Mts. and the gradual lost of open grassland habitats shown in the photographs of Bôrovište from Hradlová nivka taken since 1970. The upper picture made by Štefan Maglocký in 1970: a - *Festuco pallentis-Caricetum humilis* with *Stipa capillata*, b – fragment of thermophilous oak forests (*Quercus pubescens*), c – *Festuco pallentis-Caricetum humilis* on the plateaus, d – zonale oak-hornbeam forests, e – *Minuartio setaceae-Seslerietum calcariae* on the north-facing slopes, f – open vegetation of *Poo badensis-Festucetum pallentis* on the south-facing slopes, g – valley of the river Váh, h – Malé Karpaty Mts. on the horizon. Pictures in the middle: the same view to Bôrovište in 1993 (left) and 2005 (right), both photos made by M. Janišová. The bottom picture shows the recent situation, the photo taken on 5 April 2010 by M. Janišová.

List of vascular plants occurring in dry and sub-xerophilous grasslands and in their contact communities (mainly fringes and transitions to the thermophilous oak forests) in the Tematínske vrchy Mts. (nomenclature follows Marhold & Hindák 1998):

Acer campestre
Achillea collina
Achillea distans
Achillea pannonica
Acinos alpinus
Acinos arvensis
Acosta rhenana
Adonis vernalis
Agrimonia eupatoria
Allium flavum
Allium ochroleucum
Allium rotundum
Allium senescens
Allium sphaerocephalon
Alyssum calycinum
Alyssum montanum

Anemone sylvestris
Antennaria dioica
Anthericum ramosum
Anthyllis vulneraria
Arabis auriculata
Arabis hirsuta agg.
Arenaria serpyllifolia agg. (incl. *A. leptoclados*)
Artemisia campestris
Asperula cynanchica
Asperula tinctoria
Asplenium ruta-muraria
Asplenium trichomanes
Aster amelloides
Astragalus onobrychis
Aurinia saxatilis
Avenula pubescens
Betonica officinalis
Biscutella laevigata
Bothriochloa ischaemum
Botrychium lunaria
Brachypodium pinnatum
Briza media
Bromus erectus
Bromus monocladus
Bupleurum falcatum
Bupleurum longifolium
Camelina microcarpa
Campanula bononiensis
Campanula farinosa
Campanula glomerata
Campanula moravica
Campanula rapunculoides
Campanula sibirica
Cardaminopsis arenosa
Carduus collinus
Carduus glaucinus
Carex alba
Carex caryophyllea
Carex humilis
Carex michelii
Carlina vulgaris
Caucalis platycarpos
Centaurium erythraea
Cephalanthera rubra
Cerastium brachypetalum
Cerastium pumilum
Cerasus fruticosus
Chamaecytisus austriacus
Chamaecytisus supinus
Chondrilla juncea
Chrisopogon gryllus
Cleistogenes serotina
Clinopodium vulgare
Colymbada badensis (Centaurea tematinensis)
Cornus mas
Coronilla coronata
Cotoneaster integerrimus
Crataegus monogyna
Crataegus oxyacantha
Crinitina linosyris
Cuscuta epithymum
Cyanus triumfettii
Dactylis glomerata
Dactylis polygama
Daphne cneorum
Dianthus carthusianorum
Dianthus praecox subsp. *lumnitzeri*
Digitalis grandiflora
Diplotaxis muralis
Dorycnium germanicum
Dorycnium herbaceum
Draba lasiocarpa
Echium vulgare
Elytrigia intermedia
Erophila verna agg.
Eryngium campestre
Erysimum odoratum
Euphrasia stricta
Festuca pallens
Festuca pseudovina
Festuca rubra
Festuca rupicola
Festuca stricta
Festuca valesiaca
Fragaria moschata
Fragaria viridis
Fraxinus ornus
Fumana procumbens
Galium album
Galium austriacum
Galium glaucum
Galium schultesii

Genista pilosa
Genista tinctoria
Geranium robertianum
Geranium sanguineum
Globularia punctata
Gymnadenia conopsea
Helianthemum grandiflorum subsp. *obscurum*
Helichrysum arenarium
Hieracium murorum
Hippocrepis comosa
Holosteum umbellatum
Hornungia petraea
Hylotelephium maximum
Hypericum perforatum
Inula ensifolia
Inula hirta
Jovibarba globifera subsp. *hirta*
Juniperus communis
Jurinea mollis
Knautia kitaibelii
Koeleria macrantha
Koeleria pyramidata
Lactuca perennis
Lactuca viminea
Lembotropis nigricans
Leontodon hispidus
Leontodon incanus
Leopoldia comosa
Leucanthemum vulgare agg.
Ligustrum vulgare
Limodorum abortivum
Linaria genistifolia
Linum tenuifolium
Listera ovata
Lithospermum purpurocaeruleum
Lotus corniculatus
Medicago falcata
Medicago lupulina
Medicago monspeliaca
Melampyrum nemorosum
Melica ciliata
Melica nutans
Melica transsylvanica
Melilotus officinalis
Melissa melissophyllum
Minuartia langii
Minuartia rubra
Minuartia verna
Ononis spinosa
Onosma visianii
Orchis militaris
Orchis purpurea
Origanum vulgare
Ornithogalum umbellatum
Orobanche caryophyllacea
Orobanche elatior
Oryzopsis virescens
Petrorhagia prolifera
Peucedanum cervaria
Phleum phleoides
Phyteuma orbiculare
Picris hieracioides
Pilosella bauhinii
Pilosella officinarum
Pimpinella nigra
Pimpinella saxifraga
Pinus nigra
Pinus sylvestris
Plantago lanceolata
Plantago media
Poa angustifolia
Poa badensis
Poa bulbosa
Poa compressa
Polygala amara subsp. *brachyptera*
Polygonatum odoratum
Polypodium vulgare
Potentilla arenaria
Potentilla argentea
Potentilla filiformis
Potentilla heptaphylla
Potentilla tabernaemontani
Primula veris subsp. *canescens*
Prunella laciniata
Pseudolysimachion spicatum
Pulsatilla grandis
Pulsatilla slavica & P. subslavica
Pyrethrum corymbosum
Pyrus pyraster
Quercus cerris
Quercus petraea
Quercus pubescens
Ranunculus bulbosus

Rhamnus catharticus
Rosa pimpinellifolia
Sanguisorba minor
Saxifraga paniculata
Saxifraga tridactylites
Scabiosa canescens
Scabiosa ochroleuca
Scorzonera austriaca
Securigera varia
Sedum acre
Sedum album
Sedum sexangulare
Senecio jacobea
Seseli hippomarathrum
Seseli osseum
Sesleria albicans
Sideritis montana
Silene nemoralis
Silene nutans
Silene otites agg.
Silene vulgaris
Sorbus aria
Sorbus aucuparia
Spiraea media
Stachys recta
Stipa capillata
Stipa eriocaulis
Stipa joanis
Symphytum tuberosum
Tephroseris integrifolia
Teucrium botrys
Teucrium chamaedrys
Teucrium montanum
Thalictrum minus
Thesium alpinum
Thesium linophyllon
Thlaspi montanum
Thlaspi perfoliatum
Thymus pannonicus
Thymus praecox
Tilia cordata
Tithymalus cyparissias
Tithymalus epithymoides
Tragopogon dubius
Trausteinera globosa
Trifolium arvense
Trifolium campestre
Trifolium dubium
Trifolium montanum
Trinia glauca
Verbascum chaixii subsp. *austriacum*
Verbascum lychnitis
Veronica austriaca
Veronica teucrium
Vincetoxicum hirundinaria
Viola collina
Viola hirta
Viola rupestris

List of the selected bryophytes and lichens occurring in the dry grassland communities (the rare species are in bold, the more complete list can be found in Plášek et al. 2006):

Arthothelium lirellans
Bacidina neosquamulosa
Bryum argenteum
Catapyrenium laniculatum
Cladonia furcata
Cladonia polycarpoides
Cladonia pyxidata subsp. *chlorophaea*
Coelocaulon muricatum
Ctenidium molluscum
Ditrichum flexicaule
Fulgensia fulgens
Grimmia pulvinata
Hylocomium splendens
Hypnum cupressiforme
Neckera crispa
Parmelina quercina
Peltigera rufescens
Placolecis opaca
Plagiomnium undulatum
Pleurochaete squarrosa
Rhytidiadelphus triquetrus
Rhytidium rugosum
Thuidium abietinum
Toninia sedifolia
Tortella inclinata
Tortella tortuosa
Tortula intermedia

Fauna

Characteristic feature of local fauna is also a common occurrence of Carpathian and Mediterranean elements and extreme richness of invertebrates. The area has extremely high diversity of butterflies and moths, about 1800 species have been recorded during the inventory research 15 year ago (Janovský a kol. 1997).

List of interesting animal species occurring in the region
(species of European importance are in bold)

Molluscs
Vertigo moulinsiana (periglacial relict, inhabits calcareous springs with tufa formation, recorded in Modrová valley, critically endangered), *Petasina filicina* (East-alpine element, the only site in Slovakia where this species was found, is in Modrová valley, critically endangered)

Spiders
Eresus niger (thermophilous species, rare in Slovakia), *Atypus piceus* (rare).

Insects
Mantis religiosa (Praying Mantis, thermophilous species), *Saga pedo* (very rare thermophilous species of locust).

Cicadas
Lyristes plebejus (Mediterranean species, very rare, records from Modrová in 1946 and Kňaží vrch in 2000), *Cicada orni* (Mediterranean species, very rare, records from Modrová in 1946 and Kňaží vrch in 2001).

Butterflies
Parnassius mnemosyne (clouded Apollo), *Maculinea arion*, *Polyommatus slovacus* (a new species for fauna of Slovakia described from Lúka in 1997, thermophilous, threatened by loss of open habitats by succession, afforestation, the most vital population in Slovakia was found in the area), ***Colias myrmidone*** (extremely endangered, life cycle tied to *Cytisus*, recorded on the edges of the area).

Other insects
Marumba quercus, *Lycaena dispar*, ***Euplagia quadripunctaria, Eriogaster catax.***

Beetles (life cycle of the following species is tied to decaying trees (oak, beech)
Rosalia alpina, Cerambyx cerdo, Lucanus cervus (Stag Beetle).

Amphibians
Bufo bufo (Common Toad), ***Bufo viridis*** (Green Toad), ***Rana dalmatina*** (Spring-frog), *Rana temporaria*, *Salamandra salamandra* (Salamander), ***Bombina variegata.***

Reptiles
Zamenis longissimus (*Elaphe longissima*, Aesculap-adder, thermophilous species, the biggest snake species in Slovakia), ***Coronella austriaca*** (Smooth-snake),

Anguis fragilis (Slow-worm), *Natrix natrix*, *Podarcis muralis* (Wall-lizard), *Lacerta agilis* (Sand-lizard), ***Lacerta viridis*** (Green-lizard, the biggest of lizard species in Slovakia, thermophilous species).

Birds
Aquila heliaca, *Bubo bubo*, *Columba oenas*, *Upupa epops*, ***Caprimulgus europaeus***, ***Dendrocopos leucotos***, ***Ficedula parva***.

Bats
Pipistrellus pipistrellus, *Plecotus austriacus*, ***Eptesicus serotinus***, ***Rhinilopus hipposideros***, ***Barbastella barbastellus***, ***Myotis mystacinus***, ***Nyctalus noctula***, ***Myotis myotis***.

Other mammals
Erinaceus concolor, *Felis silvestris*, *Glis* (*Myoxus*) *glis*, *Martes foina*, *Martes martes*, *Meles meles*, *Micromys minutus*, *Mustela erminea*, *Muscardinus avellanarius*, *Mustela nivalis*, *Mustela putorius*, *Sciurus vulgaris*, *Sorex araneus*, *Sorex minutus*.

Nature conservation and NGO activities

The non-governmental organisation Pre Prírodu (Civic Association For Nature) has been active in the area of the Tematínske vrchy Mts. since 1999. It was established in Trenčín on 22 April 1998 (symbolically on the Earth Day). It associates volunteers, professional conservationists and the public to protect natural values of the Middle Považie region. It has the following principal aims: a/ to support, organize and implement projects and initiatives focused on conservation of natural values, with highest priorities given to practical conservation work and survey of the most valuable parts of nature; b/ to provide services in the field of conservation and environmental management as well as environmental education for schools, citizens, local governments, entrepreneurs and others and c/ to support all kinds of actions which aim at sustaining natural and cultural values and are directed towards the sustainable living. The number of active members varies between 20 and 30. The implementation of the organisation activities depends widely on volunteers, partners and cooperating organisations which vary from regional to international ones. Its main strategic and professional partner is the State Nature Conservancy of the Slovak Republic – Administration of Protected Landscape Area Biele Karpaty. Other important partners are local governments and environmental NGOs. The activities of this organisation were supported by foundations, sponsors, municipalities and individual donors.

During the last twelve years the organisation has been involved in the following projects and activities:

- practical conservation in more than twenty protected areas (different types of grasslands) in the districts Trenčín, Nové Mesto nad Váhom, Ilava and Skalica;
- purchase and lease of land in nature reserves in order to ensure a proper conservation management and protection of rare species and habitats there

(long-term lease of 40 ha in Tematínske vrchy Mts., purchase of 2.62 ha and lease of 18 ha in the Nature Reserve Beckovské Skalice);
- rescue of threatened plant and animal species, e.g. project "Anura – Caudata" for amphibians or "SOS – traditional fruit varieties";
- support of biological and ecological research in the region, e.g. project "Tree of Knowledge" – publishing of results of inventory research;
- presentations, discussions, guided tours, information boards in villages, schools and protected areas;
- weekend work camps and summer conservation work camps (since 1998 more than 50 weekend camps and more than 25 summer camps);
- applied projects – habitat mapping, planting trees, ecological/environmental assessment;
- publishing and distribution of promotional materials about protected areas, calendars, postcards, exhibition „Seven Wonders of Nature", publishing of 40 issues of the environmental newsletter „Trenčín 21" (in cooperation with CEA Trenčín).

Projects focussing on the Tematínske vrchy Mts.

Project title: **Preservation and long-term stabilization of selected thermophilous habitats of the EECONET core zone of the Area of European importance Považský Inovec Mts. – Tematínske Hills.**
Funding: EECONET Action Fund (EAF) Netherlands.
Project period: 2000-2006.
Budget: conservation management 33 591 €, lease 5 797 €.

Project title: **Ten for Nature** (conservation management, international exchange and networking of ten European NGOs dealing with nature conservation)
Funding: Stichting DOEN via EAF Netherlands.
Project period: 2002-2004.
Budget: conservation management approximately 8 000 €.

Project title: **Communities for Tematínske Hills** (Preservation of dry species-rich grasslands in Tematínske vrchy Mts.)
Funding: The Royal Netherlands Embassy Bratislava, Matra Knip Programme.
Project period: 2005-2006.
Budget: conservation management 2 692 €.

Project title: **Micro-regions for Nature**
Funding: EEA Financial Mechanism, the Norwegian Financial Mechanism and the state budget of the Slovak Republic through Ekopolis Foundation.
Project period: 2009-2010.
Budget: conservation management in Tematínske vrchy Mts. 2 000 €.

Choice of the project area – Why the Tematínske vrchy Mts.?

Outstanding natural values (confirmed by researchers and conservationists) contributed to inclusion of the area to European networks of nature areas (EECONET,

NATURA 2000). Within EECONET the area has been ranked as the core area of European importance. In 2003, the whole area was designated as an Area of European Importance within the NATURA 2000 network (SKUEV 0380). Habitats to be preserved by the project actions are "steppe and semi-steppe" xerophilous and thermophilous grasslands and open forest habitats (registered as non-productive forest land). Individual grassland localities are small and scattered in a mosaic pattern in the forest complex of native oak and beech woodlands (total area of dry grasslands in the Tematínske vrchy Mts. is about 100 ha). These habitats are extremely rich in plant and animal species of Mediterranean origin which survive on the northernmost edge of their distribution area in Europe. The habitats thus represent refuges or „islands of biodiversity" for endangered, threatened and rare species, species of European importance or national importance. Some of these habitats are natural originating during the glacial periods. Some are semi-natural, influenced by humans since several centuries (agriculture – grazing in forests, clearing of forests).

About 40 years ago the forest management in the area carried out a project of anti-erosion measures. Plantations of non-native woody species – pine (*Pinus nigra*), ash (*Fraxinus ornus*) were planted on many of these species-rich grasslands. At that time conservation efforts in the area were weak and could not prevent the afforestation. Due to the afforestation some grassland localities were overgrown by pines and became lost. The rest of these habitats was more or less threatened by succession towards forest communities caused by aggressive non-native species (mainly *Pinus nigra*). Loss of open habitats caused an irreversible loss of populations of rare plants and invertebrates and the existence of these „islands of biodiversity" was at risk. A practical conservation action was urgently needed. According to the management plans the non-native trees and shrubs had to be cut down and removed from the selected localities.

The principal aim of the above mentioned NGO projects was preservation and stabilisation of species-rich dry grasslands in Tematínske vrchy Mts. by means of long-term lease of land and emergency conservation actions. The following activities were carried out during 1999-2006:

Conservation management and land lease:

a) survey of the current state of selected dry grasslands (total area explored 75-100 ha) with emphasis on distribution of non-native species and setting priorities for removal of non-native vegetation;
b) analysis of current ownership of concerned habitats;
c) negotiations with landowners, long-term lease of land;
d) design of the Action Management Plan (AMP) for each land unit, continuous review and update of the AMPs;
e) approval of the management plans by authorities and landowners;
f) emergency conservation actions „in situ" – removal of non-native conifers done by contractors, volunteers and cooperating organisations with a small involvement of local people (approx. 25 ha cleaned);
g) monitoring of the effects of conservation measures in cooperation with students of ecology and the State Nature Conservancy.

Promotion and education:
a) guided excursions for the public in the Tematínske vrchy Mts.;
b) installation of four outdoor information boards;
c) establishment of Information Point in the village Lúka (regularly updated);
d) lectures at local schools;
e) children fund-raising campaign „Children for Tematínske Hills" – sending postcards to local authorities asking for their contribution towards the preservation of the area;
f) conservation work camps for volunteers.

Communication wit local authorities and stakeholders:
a) individual meetings with local mayors and landowners;
b) presentations of the project to local councils, local landowners associations, micro-regional associations, etc.

Publications:
a) poster „Tematínske Hills" – informational map and promotional texts and photos;
b) brochure „Natural Values of Tematínske Hills" – collection of studies and inventories;
c) leaflet on the natural values of Tematínske vrchy Mts.

Land leased from the private owners for conservation purposes encompasses total area of 40.63 ha. The period of lease varied from 5 to 30 years. The following private owners leased their land to the association Pre Prírodu: Forest Associations Pasienkový urbár Modrová, Starý urbár Modrová and Lesná spoločnosť Hlávky Modrová; Forest Land Association Urbár and Srnožať Modrovka; Forest Association Lúka and Municipality Lúka. Total lease costs were 5 797 €. The leased plots include the whole area of the nature reserves (NPR Tematínska lesostep, NPR Javorníček, NR Kňaží vrch) which represent the most valuable dry grasslands in the region (15 ha). During the selection of plots suitable for leasing the following facts were taken into consideration: presence of important plant and animal species; presence of non-native conifers, their density, vitality and potential for regeneration; effectiveness of the conservation measures and willingness of the owners to lease. Up to these days, the conservation management has been completed on the area of approx. 25 ha (including the most valuable habitats). There are still approx. 15 ha to be cleaned. Works will continue in spring-summer period of 2010. Cutting of non-native conifers was done by contractors. During conservation weekend work camps and summer work camps young volunteers removed the dead biomass of trees from the project areas. The biomass was left to decay on edges of the localities. All work was done under the guidance of the State Nature Conservancy. The number of volunteers and contractors exceeded two hundreds. Removal of overgrown pine trees was a single action that needs not to be repeated. The state of cleared plots must be monitored. Other conservation measures (mowing and grazing) are not necessary. Due to the special xeric habitat conditions, low biomass production and drought the dead biomass is not cumulated in the dry grassland habitats and secondary succession does not advance here. However, it is necessary to cooperate

with the foresters to influence the composition of forest stands in preference of native species, e.g. oaks.

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Excursion guide to the protected areas Žalostiná, Štefanová and Bučkova jama in the Biele Karpaty Mts.

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Introduction

Protected areas Žalostiná, Štefanová and Bučkova jama are part of the Site of Community Interest (SCI) „Žalostiná“, which is located in the Žalostiná massif (622 m a.s.l.) in the western part of the Protected Landscape Area (PLA) Biele Karpaty Mts. (Fig. 1).

The territory of the Biele Karpaty Mts. is a good example of symbiosis between the people and nature. The special type of “lonely house” settlements called “kopanice” is typical for this region. In the 15th century, people from villages on the foothill colonized the remote parts of the Biele Karpaty Mts. with the aim to acquire new land (Pozdišovský 1976). Thus the mosaic of little settlements, small fields, meadows and orchards with deciduous forests around has arisen. During the 20th century a lot of people left their land and found better job in towns. Collectivization in agriculture also had a negative impact on grasslands with increasing fertilization and land reclamation. Some grasslands were preserved by being declared as nature reserves and some remained intact in inaccessible areas. Thanks the nature conservation and the activities of people still living and farming in the remote places the uniqueness of local country-side remains preserved.

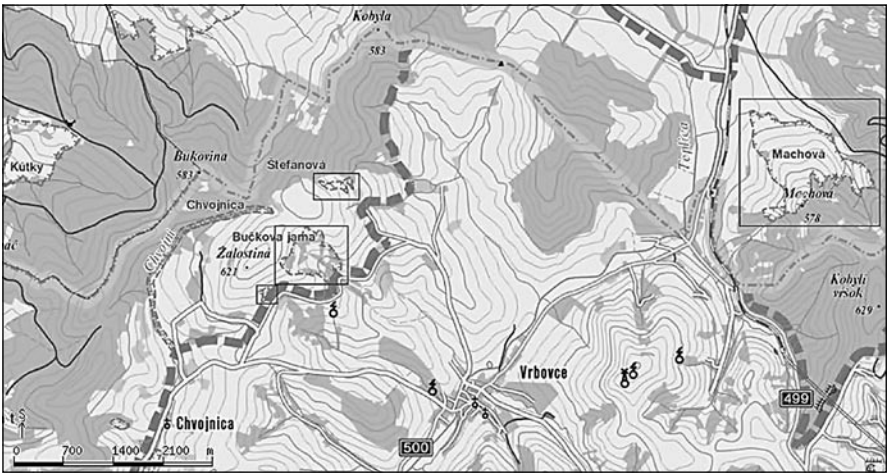

Fig. 1 Location of visited localities in the Biele Karpaty Mts.

Area description

Geologically, the Biele Karpaty Mts. belongs to the Western Carpathians, which originated during orogenetic processes in Mesozoic era and Tertiary (Stráník & Janečková 1992). They are formed by flysch zone and a klippen belt. Most of the area is based on Magura flysch formed by Cretaceous and Paleogenic sea sediments. Flysch consists of alternating sandstone and rock clay layers of variable thickness (from several centimetres to metres). A typical phenomenon frequently occurring on flysch sediments are landslides, which model the terrain, locally uncover the bedrock and create the patchwork of dry and moist sites. Softly shaped ridge of Žalostiná massif and its hillsides were affected by large landslides and rich mosaic of biotopes was created there. In the massif of Žalostiná the groundwater level is in a very small depth and that is why numerous springs occur there. In the sprigs surroundings the tufa deposits occur frequently. The prevailing soil type in this region is kambisol. This part of Biele Karpaty Mts. belongs to the warm region (average temperature in July is 18-19°C, precipitation in the vegetation season is 350-450 mm) (Lapin et al. 2002).

Nature protection

The best orchid sites and spring fens of the territory of Žalostiná massif were designated as natural monuments (NM) in 1990s: NM Žalostiná (2.11 ha), NM Bučkova jama (38.46 ha) and NM Štefanová (5.47 ha). All of them represent a fine-grained mosaic of mowed orchid meadows, with springs and fens. Forests cover a considerable part of the locality Bučkova jama. Valuable old orchards were maintained near NM Štefanová. These three localities (natural monuments) interconnected by larger meadows and old orchards form Site of Community Interest (SCI) Žalostiná with total area of 226 ha.

Meadows, wetlands and forests in this area represent valuable natural habitats of Community importance (* – priority habitat):

6210* Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometea*) – important orchid sites
6510 Lowland hay meadows
7220* Petrifying springs with tufa formation (*Cratoneurion*)
7230 Alkaline fens
6430 Hygrophilous tall-herb fringe communities of plains and of the mountain to alpine levels
9130 Beech and fir-beech forests

Vegetation

The most valuable vegetation types in the localities Žalostiná, Bučkova jama and Štefanová are species-rich grasslands and spring fens. The sub-xerophilous meadows belong to the associaton *Brachypodio pinnati-Molinietum arundinaceae* Klika 1939 (*Bromion erecti* Koch 1926; Škodová 2007). They are famous for their high species richness: sometimes, up to 80 species of vascular plants may occur in a plot of just 25 m^2. Such incredible species diversity is a result of the long-term care of grasslands (regular mowing and grazing), rather variable environmental condi-

tions in micro-relief and special phytogeographical position on the boundary of the Thermophyticum and the Mesophyticum. The detailed description of all grassland communities occurring in Biele Karpaty Mts. was published in Jongepierová (2008) and Škodová et al. (2008).

The very early detailed botanical research of local grasslands was made by Sillinger (1929). The species-rich meadow communities he used to call "meadows with *Carex montana*". These meadows consist of two layers: tall grasses (*Bromus erectus*, *Arrhenatherum elatius*, *Brachypodium pinnatum*, *Avenula pubescens*), small caespitose grasses and graminoids (*Carex montana*, *Carex caryophyllea*, *Festuca rupicola*) and numerous dicots (*Cirsium pannonicum*, *Betonica officinalis*, *Trifolium rubens*, *Trifolium montanum*, *Potentilla alba*, *Geranium sanguineum*, *Serratula tinctoria*, *Lathyrus latifolius*). In regularly mown grasslands there are usually several subdominants with cover about 25 %. The co-existence of species with different environmental requirement is notable. Thanks the varied micro-relief, xerophilous species (e.g. *Helianthemum grandiflorum* subsp. *obscurum*, *Astragalus danicus*, *Scorzonera purpurea*, *Polygala major*) can grow on small area together with mesophilous species (e.g. *Galium boreale*, *Serratula tinctoria*, *Sanguisorba officinalis*, *Betonica officinalis*) and the fringe species (*Geranium sanguineum*, *Trifolium medium*, *Astrantia major*). Numerous rare and vulnerable species of vascular plants, especially orchids, occur in grasslands of this association (*Gymnadenia conopsea*, *Ophrys holubyana*, *Platanthera bifolia*, *Traunsteinera globosa*, *Scorzonera purpurea*, *Danthonia alpina*, *Gladiolus imbricatus*, *Iris graminea*).

An example of a phytosociological relevé from the locality Bučkova jama:
Biele Karpaty Mts., Vrbovce, Bučkova jama, mowed meadow, longitude: 17°26'18", latitude: 48°49'14", aspect: south, slope: 5°, E1: 100 %, E0: 2, 5 × 5 m, 10.6.1999, I. Škodová.

E1: *Brachypodium pinnatum* 3, *Bromus erectus* 3, *Cirsium pannonicum* 2b, *Anthoxanthum odoratum* 2a, *Carex montana* 2a, *Briza media* 2a, *Filipendula vulgaris* 2a, *Agrostis capillaris* 2a, *Festuca rubra* 2a, *Aquilegia vulgaris* 1, *Dactylis glomerata* 1, *Festuca rupicola* 1, *Campanula glomerata* 1, *Galium verum* 1, *Genista tinctoria* 1, *Helianthemum grandiflorum* subsp. *obscurum* 1, *Luzula campestris* 1, *Plantago lanceolata* 1, *Primula veris* 1, *Salvia pratensis* 1, *Thesium linophyllon* 1, *Trifolium montanum* 1, *Trisetum flavescens* 1, *Carex caryophyllea* 1, *Betonica officinalis* 1, *Koeleria pyramidata* 1, *Potentilla alba* 1, *Leontodon hispidus* 1, *Carex flacca* 1, *Carex panicea* 1, *Danthonia alpina* 1, *Achillea millefolium* agg. +, *Prunella vulgaris* +, *Ranunculus polyanthemos* +, *Jacea pratensis* +, *Pyrethrum corymbosum* +, *Chamaecytisus supinus* +, *Thymus pulegioides* +, *Tragopogon orientalis* +, *Ajuga reptans* +, *Cruciata glabra* +, *Trommsdorfia maculata* +, *Carlina acaulis* +, *Danthonia decumbens* +, *Lathyrus pratensis* +, *Leucanthemum vulgare* +, *Linum catharticum* +, *Acetosa* pratensis +, *Lotus corniculatus* +, *Trifolium alpestre* +, *Trifolium medium* +, *Viola canina* +, *Anthericum ramosum* +, *Bupleurum falcatum* +, *Avenula pubescens* +, *Tithymalus cyparisias* +, *Gymnadenia conopsea* +, *Plantago media* +, *Viola hirta* +, *Festuca pratensis* +, *Pimpinella saxifraga* +, *Carex tomentosa* +, *Equisetum arvense* +, *Scorzonera purpurea* +, *Melampyrum cristatum* +, *Trifolium rubens* +, *Potentilla heptaphylla* +, *Leontodon hispidus* +, *Platanthera bifolia* +, *Rosa canina* agg. +, *Medicago lupulina* r, *Ajuga genevensis* r, *Crataegus monogyna* r, *Orchis mascula* r, *Crepis biennis* r, *Taraxacum officinale* r, *Arabis hirsuta* r.
E0: *Plagiomnium rostratum* +, *Eurhynchium hians* +, *Brachythecium salebrosum* +, *Calliergonella cuspidata* +, *Thuidium philibertii* +, *Fissidens taxifolius* +, *Lophcolea bidentata* +, *Hypnum cupressiforme* +.
(The used scale of dominance and abundance is according to Westhoff & van der Maarel 1973)

Low productive vegetation of spring fens belongs to the association *Carici flavae-Cratoneuretum filiciny* Kovács & Felföldy 1960 (*Caricion davallianae* Klika 1934). This association is well developed in locality Žalostiná. *Eriophorum angustifolium*, *E. latifolium*, *Carex panicea*, *C. flacca* and *C. flava* dominate in the community. Several orchids as *Dactylorhiza majalis*, *Dactylorhiza incarnata*, *Epipactis palustris* and *Gymnadenia densiflora* occur there. Typical fen mosses such as *Cratoneuron filicinum*, *Palustriella commutata* or *Campylium stellatum* are present.

An example of phytosociological relevé from the locality Žalostiná:
Biele Karpaty Mts., Vrbovce, Žalostiná, spring fen, longitude: 17°25'36", latitude: 48°48'47", aspect: 0, slope: 0°, E1: 80 %, E0: 20 %, 5 × 5 m, 11.7.1997, I. Škodová.
Equisetum palustre 3, *Eriophorum angustifolium* 3, *Valeriana dioica* 2b, *Cirsium rivulare* 2a, *Epipactis palustris* 2a, *Carex flacca* 1, *Carex panicea* 1, *Dactylorhiza majalis* 1, *Equisetum fluviatile* 1, *Eriophorum latifolium* 1, *Carex flava* +, *Eupatorium cannabinum* +, *Lythrum salicaria* +, *Aquilegia vulgaris* r, *Mentha longifolia* r, *Salix cinerea* r, *Tussilago farfara* r.
(Mosses were not recorded, the used scale of dominance and abundance is according to Westhoff & van der Maarel 1973)

On the waterlogged slope in the locality Žalostiná the community of *Cirsietum rivularis* Nowiński 1927 (*Calthion* Tüxen 1939) has developed. Some fragments could be found also in locality Bučkova jama. *Cirsium rivulare* usually dominates in this grassland. Frequent herbs are *Lythrum salicaria*, *Lysimachia nummularia*, *Equisetum palustre* or *Valeriana dioica*. Low sedges and rushes are also present there (*Carex flava*, *Carex flacca*, *Juncus inflexus*). In the moss layer the following species prevail: *Caliergonella cuspidata*, *Plagiomnium elatum*, *Rhitidiadelphus squarrosus* (Škodová et al. 2008).

An example of a phytosociological relevé from the locality Žalostiná:
Biele Karpaty Mts., Vrbovce, Žalostiná, spring fen on the slope, longitude: 17°25'46", latitude: 48°48'53", aspect: south, slope: 15°, E1: 100 %, E0: 20, 5 × 5 m, 11.7.1997, I. Škodová.
Cirsium rivulare 3, *Juncus inflexus* 3, *Equisetum palustre* 2b, *Epipactis palustris* 2b, *Carex flava* 2a, *Mentha longifolia* 2a, *Eriophorum angustifolium* 1, *Eupatorium cannabinum* 1, *Equisetum fluviatile* 1, *Lythrum salicaria* 1, *Carex panicea* 1, *Valeriana dioica* 1, *Gymnadenia densiflora* +, *Carex flacca* +, *Lysimachia nummularia* +, *Equisetum arvense* +, *Galium verum* r, *Lathyrus pratensis* r, *Ranunculus polyanthemos* r.
(Mosses were not recorded, the used scale of dominance and abundance is according to Westhoff & van der Maarel 1973)

In the surroundings of the visited localities mainly mixed hornbeam and oak forests (*Carpinion betuli*) occur. The ditches and valleys arisen by landslides are occupied by beech forests (*Fagion*). The name of locality "Bučkova jama" means "the beech ditch".

Flora

The meadows and spring fens host a lot of orchids. In the sparse grasslands on tufa deposits numerous rare species like *Ophrys holubyana*, *Orchis militaris*, *Gymnadenia densiflora* occur. In sub-xerophilous meadows and on the forest edges one can find *Orchis mascula* subsp. *signifera*, *Orchis ustulata*, *Gymnadenia conopsea*, *Coeloglossum viride*, *Platanthera chlorantha*, *Dactylorhiza sambucina*, *Traunsteinera globosa*, *Orchis*

pallens. On wet sites, *Dactylorhiza incarnata*, *Dactylorhiza majalis*, *Epipactis palustris* occur. In the surrounding forests, orchids like *Epipactis microphylla*, *Epipactis muelleri*, *Orchis purpurea*, *Cephalanthera damasonium* and *Cephalanthera longifolia* could be found. Other rare and interesting plant species in the territory are as follows: *Danthonia alpina*, *Iris graminea*, *Lilium bulbiferum*, *Scorzonea purpurea*, *Ophioglossum vulgatum*, *Salix rosmarinifolia*. In the massif of Žalostiná, small population of *Serratula lycopifolia* (species of Community importance) occurs. It is the single recent locality in Slovakia. On the other side of the mountain ridge, in the Czech part of the Biele Karpaty Mts., rich populations of this species occur in meadows.

Zoology

Some groups of invertebrates have been studied during the last 15 years in this area (*Lepidoptera*, *Mollusca*, *Coleoptera*, *Hymenoptera*, *Arachnida*) as well as *Mammalia* and *Aves*. Several species of Community importance live here, which are target species of Site of Community Interest „Žalostiná" (they are printed in bold style). ***Vertigo moulinsiana*** and ***Vertigo angustior*** (*Mollusca*) live in the moss layer in the spring fens (Deván 2005).

Interesting insects in the territory are represented by ***Lucanus cervus***, *Zyras humeralis*, *Carabus ullrichi*, *Carabus scheidleri*, *Nicrophorus humator* (*Coleoptera*), ***Maculinea nausithous***, ***Maculinea teleius***, ***Colias myrmidone***, ***Lycaena dispar***, ***Callimorpha quadripunctaria*** (*priority species), ***Eriogaster catax*****,** *Brenthis hecate* and *Brenthis ino* (*Lepidoptera*). *Argogorytes mystaceus*, *Dolichurus corniculus* and *Chrisis hirsuta* belong to the rare hymenopterans (*Hymenoptera*) (http://www.bielekarpaty.sk/uzochrana.html).

Bombina variegata (*Amphibia*) occur in shallow pools. In the brook valleys and other wet habitats *Slamandra salamandra*, *Triturus vulgaris*, *Rana dalmatina*, *Hyla arborea* and rarely *Bufo bufo* occur (*Amphibia*).

If you are watchful you can see *Lacerta agilis* or *Anguis fragilis* in the grass and *Elaphe longissima* (*Reptilia*) in the forest.

In the territory of Žalostiná a lot of bird species occur, for example *Coturnix coturnix*, *Crex crex*, *Scolopax rusticola*, *Pernis apivorus*, *Jynx torquilla* and *Ficedula albicollis* (*Aves*). Small mammals are represented for example by *Micromys minutus*, from the bigger mammals *Capreolus capreolus* and *Sus scrofa* are common here. Large populations of the alien species *Dama dama* have unfavourable influence on the local forests.

Management

In the past, the upper part of the Žalostiná massif was covered by a sparse Carpathian oak-hornbeam forests (*Carpinion betuli*) alternating with semidry grasslands with steep species like *Sipa tirsa* and *Pulsatilla grandis* (*Brachypodio pinnati-Molinietum arundinaceae* Klika 1939 *stipetosum stenophyllae* Klika 1939) (Deván 2005, Tlusták 1975). Since the end of the 15th century, the territory was partly deforested and the

large grasslands and spring fens were formed. As this territory is located nearby two large lowlands (Borská nížina lowland and Dolnomoravský úval lowland) the termophilous species could migrate here. In the second half of 20th century, a big part of meadows in the Žalostiná massif was ploughed up and transformed to the sowed grasslands with dominant *Dactylis glomerata*, and the steep grasslands were completely destroyed.

Only hardly accessible meadows were saved from re-cultivations, but consecutive lack of management contributed to successive degeneration of a large part of them. Extensive agriculture practiced on smaller land plots helped to preserve the biodiversity, traditions and rural landscapes of worse accessible farmsteads, as can be seen in Štefanová. Unfortunately, this farming system fades with ageing of community, abandonment of farmlands and dwellings, and their conversion to recreation objects.

As a result of soil water-logging and a hilly terrain all these meadows have extraordinary demands on manually done mowing. The owners are not interested in their management and that is why meadows are managed by staff of PLA and supported by local NGOs since 1993. Summer work camps for volunteers are organized annually and hay is removed from the localities (Fig. 2). Botanists and zoologists from the PLA supervise the management and customize it to the needs of protected species, both plants and invertebrates. A special approach is applied to fens, which are mowed in autumn to allow seeds maturation of rare wetland species. *Sanguisorba officinalis* populations are mowed after reproduction of endangered butterflies *Maculinea*, because mowing during un-appropriate period could lead to damage of their populations. Bad timed mowing of *Chamaecytisus* means the same danger

Fig. 2 Participants of summer work camp in the locality Bučkova jama.

for extremely rare butterfly *Colias myrmidone*, for which these localities represent the last refuges in the region.

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Fig. 3 *Brachypodio pinnati-Molinietum arundinaceae* in the Žalostiná massif. Mesophilous species like *Betonica officinalis* and *Sanguisorba officinalis* grow together with xerophilous species *Helianthemum grandiflorum* subsp. *obscurum*.

List of vascular plants occuring on visited localities
(Nomenclature of species is according to Marhold & Hindák 1998)

Acetosa pratensis
Agrimonia eupatoria
Agrostis capillaris
Achillea millefolium agg.
Ajuga genevensis
Ajuga reptans
Alchemilla glaucescens
Allium carinatum
Allium oleraceum
Allium scorodoprasum
Alopecurus pratensis
Anemone sylvestris
Anthericum ramosum
Anthoxanthum odoratum
Anthriscus sylvestris
Anthyllis vulneraria
Aquilegia vulgaris
Arabis glabra
Arabis hirsuta
Arrhenatherum elatius
Asperula cynanchica
Astragalus cicer
Astragalus danicus
Astragalus glycyphylos
Astrantia major
Avenula pubescens
Bellis perennis
Betonica officinalis
Brachypodium pinnatum
Brachypodium sylvaticum
Briza media
Bromus erectus
Bupleurum falcatum
Calamagrostis epigejos

Campanula glomerata
Campanula patula
Campanula persicifolia
Campanula rapunculoides
Campanula trachelium
Carex caryophyllea
Carex flacca
Carex flava agg.
Carex hirta
Carex michelii
Carex montana
Carex pallescens
Carex panicea
Carex sylvatica
Carex tomentosa
Carlina acaulis
Carlina vulgaris
Carum carvi
Centaurium erythraea
Cephalanthera damasonium
Cephalanthera longifolia
Cerastium holosteoides
Cerinthe minor
Cirsium arvense
Cirsium oleraceum
Cirsium palustre
Cirsium pannonicum
Cirsium rivulare
Clinopodium vulgare
Coeloglossum viride
Colchicum autumnale
Colymbada scabiosa
Convolvulus arvensis
Crepis biennis
Crepis praemorsa
Cruciata glabra
Cynosurus cristatus
Dactylis glomerata
Dactylorhiza incarnata
Dactylorhiza majalis
Dactylorhiza sambucina
Danthonia alpina
Danthonia decumbens
Daucus carota
Dianthus carthusianorum
Dorycnium pentaphyllum
Epipactis microphylla
Epipactis muelleri
Epipactis palustris
Equisetum arvense
Equisetum fluviatile
Equisetum palustre
Eriophorum angustifolium
Eriophorum latifolium
Eupatorium cannabinum
Euphrasia rostkoviana
Festuca pratensis
Festuca rubra
Festuca rupicola
Filipendula vulgaris
Fragaria vesca
Fragaria viridis
Fraxinus excelsior
Galium album
Galium boreale
Galium verum
Genista tinctoria
Gentiana cruciata
Geranium pratense
Geranium sanguineum
Gymnadenia conopsea
Gymnadenia densiflora
Helianthemum grandiflorum
subsp. *obscurum*
Heracleum sphondylium
Hypericum maculatum
Hypericum perforatum
Chamaecytisus supinus
Inula salicina
Iris graminea
Jacea pratensis
Juncus inflexus
Knautia arvensis
Knautia kitaibelii
Koeleria pyramidata
Lathyrus latifolius
Lathyrus pratensis
Leontodon hispidus
Leucanthemum vulgare
Lilium bulbiferum
Linum catharticum
Listera ovata
Lotus corniculatus
Luzula campestris
Luzula multiflora
Lysimachia nummularia

Lysimachia vulgaris
Lythrum salicaria
Medicago falcata
Medicago lupulina
Melampyrum cristatum
Mentha longifolia
Myosotis arvensis
Onobrychis viciifolia
Ononis spinosa
Ophioglossum vulgatum
Ophrys holubyana
Orchis mascula subsp. *signifera*
Orchis morio
Orchis pallens
Orchis purpurea
Orchis ustulata
Ornithogalum kochii
Peucedanum cervaria
Phleum pratense
Pilosella bauhinii
Pilosella officinarum
Pimpinella saxifraga
Plantago lanceolata
Plantago media
Platanthera bifolia
Platanthera chlorantha
Poa angustifolia
Poa pratensis
Polygala major
Polygala vulgaris
Polygonatum odoratum
Potentilla alba
Potentilla erecta
Potentilla heptaphylla
Primula veris
Prunella grandiflora
Prunella laciniata
Prunella vulgaris
Pyrethrum corymbosum
R. auricomus agg.
Ranunculus acris
Ranunculus bulbosus
Ranunculus polyanthemos
Rhinanthus minor
Rosa canina agg.
Rosa gallica
Salix rosmarinifolia
Salvia pratensis
Salvia verticillata
Sanguisorba minor
Sanguisorba officinalis
Scabiosa ochroleuca
Scorzonera purpurea
Securigera varia
Sedum sexangulare
Serratula lycopifolia
Serratula tinctoria
Silene nutans
Stellaria graminea
Symphytum tuberosum
Taraxacum officinale
Teucrium chamaedrys
Thesium linophyllon
Thymus pannonicus
Thymus pulegioides
Tithymalus cyparissias
Tithymalus esula
Tragopogon orientalis
Traunsteinera globosa
Trifolium alpestre
Trifolium medium
Trifolium montanum
Trifolium ochroleucon
Trifolium pratense
Trifolium repens
Trifolium rubens
Trisetum flavescens
Trommsdorffia maculata
Tussilago farfara
Valeriana dioica
Valeriana officinalis
Valeriana stolonifera subsp. *angustifolia*
Veronica chamaedrys
Veronica officinalis
Veronica teucrium
Vicia cracca
Vicia lathyroides
Vicia sepium
Vicia tenuifilia
Viola canina
Viola hirta
Viola reichenbachiana
Viola riviniana

List of bryophytes occuring on visited localities

Abietinella abietina
Brachythecium albicans
Brachythecium salebrosum
Bryum capillare
Calliergonella cuspidata
Campylium stellatum
Cirriphyllum piliferum
Cratoneuron filicinum
Ctenidium molluscum
Dicranum bonjeanii
Eurhynchium hians
Fissidens dubius
Fissidens taxifolius
Homalothecium lutescens
Hylocomium splendens
Lophocolea bidentata
Palustriella commutata
Plagiochila porelloides
Plagiomnium elatum
Plagiomnium rostratum
Plagiomnium undulatum
Rhodobryum ontariense
Rhytidiadelphus squarrosus
Rhytidiadelphus triquetrus
Rhytidium rugosum
Thuidium philibertii

Machová nature reserve in the Bílé Karpaty Mts.

Machová

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Locality description

The Machová nature reserve was declared in 1987. It is a complex of meadows in a mosaic of tree and shrub hedges, forest fragments and scattered solitary oaks and lime trees. It is situated on the northern side of the Machová hill, about 4 km south from Javorník nad Veličkou. The nature reserve (including its buffer zone) covers an area of 262.6 ha. The altitude of the locality ranges from 365 m a.s.l. (alluvium of the Rybnický potok brook) to 578.9 m a.s.l. (top of the Machová hill). Majority of the meadow slopes has western, northern or north-eastern orientation. Geological bedrock of the reserve is tertiary flysch consisting of calcareous claystones, marlstones and sandstones. At the slope foots, in terrain depressions and in brook valleys flysch is overlaid with Quaternary sediments. Overwhelming soil type is cambisol, usually somehow affected by the gley process. Main stream of the locality is the Rybnický potok brook, which originates by the confluence of several smaller streams in the eastern part of the reserve and than flows along its north-eastern and northern margin. The whole area belongs to the Váh river catchment. The local climate is moderately warm (Quitt 1971). Phytogeographically Machová belongs to the part of the Forest White Carpathians, one of the mesophytic regions of the Czech Republic (Skalický 1988). However, there is a strong effect of the nearby thermophytic Steppic White Carpathians which is obvious in both flora and vegetation.

Vegetation

Main vegetation type on the prevailing mesophilous and in summer usually drying grassland habitats are species-rich meadows of the association of *Brachypodio pinnati-Molinietum arundinaceae* Klika 1939 (on the transition of the alliances of *Bromion erecti* Koch 1926 and *Cirsio-Brachypodion pinnati* Hadač et Klika ex Klika 1951). Typical phenomenon of these meadows are numerous transitions to thermophilous fringe vegetation of the alliance of *Geranion sanguinei* Tüxen in Müller 1962, or mesophilous fringes from the *Trifolion medii* Müller 1962 alliance. In the alluvial parts along the Rybnický potok brook also vegetation close to the *Deschampsion cespitosae* Horvatić 1930 or *Arrhenatherion elatioris* Luquet 1926 alliances occurs. Wet meadows of the alliance of *Calthion palustris* Tüxen 1937 are less often. Important element of the reserve is the calcareous spring fen with tufa deposits, situated in the lower part of the north-eastern slopes in the Rybnický potok brook valley. It is very valuable for its well-developed vegetation of the *Caricion davallianae* Klika 1934 alliance (association *Carici flavae-Cratoneuretum filicini* Kovács et Felföldy 1960).

Apart from mesic to xeric scrubs from the *Berberidion* Br.-Bl. 1950 alliance, which form linear hedges, also stands with *Salix cinerea* (possibly belonging to the alliance of *Salicion cinereae* Th. Müller et Görs ex Passarge 1961) are characteristic. Forest vegetation is represented by fragments of the Carpathian oak-hornbeam forests (*Carici pilosae-Carpinetum* Neuhäusl et Neuhäuslová 1964) as well as by the Carpathian beech forests (*Carici pilosae-Fagetum* Oberdorfer 1957) surrounding the reserve from northeast to south. Especially on the western slopes various patches of thermophilous oak forests are scattered (vegetation of the alliance of *Quercion petraeae* Zólyomi et Jakucs ex Jakucs 1960, close to the *Potentillo albae-Quercetum* Libbert 1933 association). In the Rybnický potok brook valley ash-alder alluvial forests from the suballiance of *Alnenion glutinoso-incanae* Oberdorfer 1953 are developed.

Flora

About 570 taxa of vascular plants were found in the reserve in last several years. According to the red list of the Czech Republic 12 of these taxa are critically endangered, 27 taxa are endangered and 45 are vulnerable (Procházka 2001, supplementary also Batoušek 2005 and Trávníček 2000). For list of the most interesting species see Tab. 1. Approximately 130 of the species can be classified as ruderal or alien for the locality (i.e. also native species of the regional flora, which are not native for the reserve itself however). They are concentrated along small roads and farm-tracks, in the surroundings of small private fishponds on the reserve's north-eastern margin, in a re-grassed old field in the north-western part and at several illegal heaps of game-feed (maize, beet, corn, etc.).

Interesting plant species of the Machová nature reserve

Aethusa cynapioides
Agrostis vinealis
Allium carinatum
Anacamptis pyramidalis
Anthericum ramosum
Aquilegia vulgaris
Arum cylindraceum
Asperula tinctoria
Astragalus danicus
Avenula pratensis
Botrychium lunaria
Bromus ramosus
Calamagrostis canescens
Campanula cervicaria
Carex flava
Carex hordeistichos
Carex chabertii
Carex lepidocarpa
Carex michelii
Carex paniculata
Carex pendula
Centaurea stenolepis
Centaurium erythraea
Cephalanthera damasonium
Cephalanthera longifolia
Cerastium lucorum
Cerinthe minor
Cirsium pannonicum
Cornus mas
Crepis praemorsa
Cyperus fuscus
Dactylorhiza incarnata
Dactylorhiza majalis subsp. *majalis*
Dactylorhiza sambucina
Danthonia alpina
Daphne mezereum
Dianthus superbus subsp. *superbus*
Dorycnium herbaceum
Elytrigia intermedia
Epipactis leutei / E. voethii

Epipactis microphylla
Epipactis palustris
Eriophorum latifolium
Erysimum odoratum
Euphorbia amygdaloides
Euphorbia villosa
Euphorbia virgata
Galeopsis angustifolia
Galium boreale
Gladiolus imbricatus
Gymnadenia conopsea
Gymnadenia densiflora
Hieracium cymosum
Hippocrepis comosa
Hypochaeris maculata
Chamaecytisus virescens
Inula hirta
Inula salicina
Iris graminea
Iris sibirica
Iris variegata
Laserpitium latifolium
Laserpitium prutenicum
Lathyrus latifolius
Leucanthemum margaritae
Libanotis pyrenaica
Lilium martagon
Linum flavum
Listera ovata
Loranthus europaeus
Malus sylvestris
Melampyrum cristatum
Melittis melissophyllum
Neottia nidus-avis
Nepeta nuda
Ophioglossum vulgatum
Orchis mascula subsp. *signifera*
Orchis militaris
Orchis morio
Orchis ustulata
Orobanche alba subsp. *major*
Orobanche lutea
Parnassia palustris
Peucedanum cervaria
Platanthera bifolia
Polygala amarella subsp. *amarella*
Potentilla alba
Prunella grandiflora
Prunella laciniata
Pseudolysimachion maritimum
Pseudolysimachion maritimum × *spurium*
Pseudolysimachion orchideum
Pulmonaria angustifolia
Pulmonaria mollis
Pulsatilla grandis
Pyrola rotundifolia
Pyrus pyraster
Rosa gallica
Salix rosmarinifolia
Saxifraga bulbifera
Scorzonera hispanica
Scorzonera purpurea
Scrophularia umbrosa
Serratula tinctoria
Silene noctiflora
Stachys alpina
Staphylea pinnata
Tetragonolobus maritimus
Thalictrum lucidum
Thesium linophyllon
Traunsteinera globosa
Trifolium alpestre
Trifolium ochroleucon
Trifolium rubens
Triglochin palustris
Valeriana dioica
Valeriana stolonifera subsp. *angustifolia*
Veronica teucrium
Viola canina subsp. *ruppii*

Fauna

Main group of animals in the Machová nature reserve are invertebrates, especially insects. The best known orders here are *Lepidoptera* and *Orthoptera*. From the notable butterfly and moth species living here should be mentioned *Brenthis hecate*, *Lycaena dispar*, *Lemonia dumi*, *Rhyparia purpurata*, and *Endromis versicolora*. Until

few years ago also *Colias myrmidone* used to be known from here, but recently is this species observed just occasionally in the Moravian part of the White Carpathians. Probably the most interesting species here is tiny moth *Tebenna chingana*, found in the reserve for the first time in the 1993 by Vladimír Elsner (at the time it was the first finding of the species in the Czech Republic – Laštůvka et al. 1994). Its caterpillars live on *Inula hirta* and *I. salicina*. In Central Europe it is only known from the White Carpathians (except from Machová: Jazevčí national nature reserve and the surroundings of the village of Radějov). Nearest other populations are known from Ukraine and from the Chingan mountains in Central Asia, where it was originally described as a species (Laštůvka et al. 2008).

The rarest species from the *Orthoptera* order are *Polysarcus denticauda* (Holuša et al. 2007) and especially *Pseudopodisma nagyi*, a bush cricket, which has been detected in the Czech Republic only here so far, reaching here the westernmost border of its distribution range (Holuša et al. 2008). Another important grasshopper species is *Conocephalus fuscus* (Čejchan 1983, 1986).

Diptera are represented by a plenty of species, mostly from the *Tipulidae* and *Limoniidae* families. *Ellipteroides adrastea* (*Limoniidae*) is in the Czech Republic known only here and in close Čertoryje National Nature Reserve.

The tufa-forming spring fen mentioned above is very interesting also for its malacofauna. Probably the most important mollusc species living here is *Vertigo angustior*, a species preserved by the European law as one of the Natura 2000 species.

Management

Machová nature reserve is nowadays mown in a patchwork and at different dates. This is mainly with respect to the invertebrates, which suffer especially severely from mowing the whole locality at the same time. Such a management tries to imitate at least partially traditional maintenance lasting here as long as the middle of the 20. century, during which small parts of meadows were mown by their owners gradually and in various terms.

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Pulmonaria angustifolia

Devínska Kobyla and Sandberg National Nature Reserve and Protected Site

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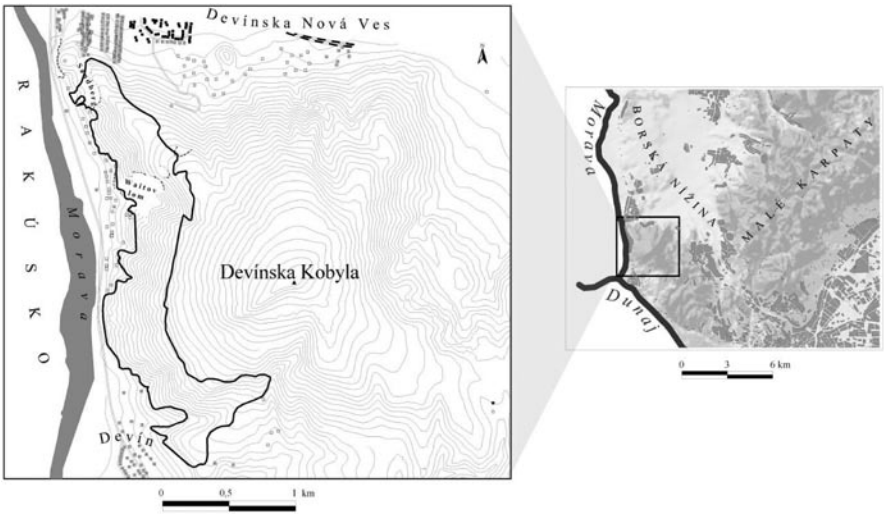
Geography

The National Natural Reserve (NNR) Devínska Kobyla and the protected site Sandberg, a well known botanical, palaeontological and geological localities, are the southern-most parts of the Protected Landscape Area Malé Karpaty, called also Devínske Karpaty, located between the Morava and Danube rivers, where the Carpathian Mountains meet with the Pannonian Basin. The Slovak-Austrian border, the municipal parts of Bratislava, former villages Devínska Nová Ves and Devín, surround it also. This unique geographical position resulted in the extraordinary physical-geographical conditions, such as topography and climate, with specific, rare and rich species steppe flora and fauna. From a morphometrical point of view Devínska Kobyla has an approximately symmetrical shape and is distinctive by its peripheral slopes, with slope angle ranging from 25 to 30°, and by vaulted central part where slope angles range from 10 to 15°. Its elevation ranges from 135 at the Danube, and Morava floodplain, to 514 m, at its highest point. The altitudinal difference between the Morava River (135 m) and the top of Devínska Kobyla Hill (514 m) is 379 m. Total area of reservation is 114.38 ha and it represents one of the NATURA 2000 sites and also the Important Plant Area (IPA). It is located about



10 km from centre of Bratislava, the capital city of Slovakia. The unique area of the instructive path is maximum 2880 m long and 825 m width, with plenty of natural details to look at and the breathtaking panoramic view of the confluence of the Danube and Morava rivers, the Devín castle and the Austrian Hainburg hills. In good weather conditions even the Alps may be visible.

Geology and paleontology

In term of geology, Devínska Kobyla represents a very interesting territory "a treasure of geological processes", remarkable especially for its Neogene fauna from the surrounding of Devínska Nová Ves village. About 300 million years ago the mountain was part of the pre-continent Pangea. Several times subsequently the area was covered by the sea and during this period limestone and dolomite were formed (found in Devínska hradná skala rock, Weitov lom quarry). The unique range of the Carpathians begins by the Devín castle rock on the confluence of two rivers Dunaj and Morava. Southern slopes of the NNR are created mainly by grey limestones, dolomites and carbonate breccia, the strata are 160-180 million years old. The top of the hill Devínska Kobyla with the same name, which is not part of the reserve, is formed by Mesozoic quartzite. The territory of the sand pit Sandberg represents a stratotype locality for stratigraphical sub-stage called "devín", which was discovered because of sand mining. Rock remains of Neogene Sea that covered the Vienna basin create its area. It is also a Neogene paleontological locality of the European importance. More than 300 species of fossil organisms (algae, fungi, marine invertebrates and vertebrates, especially mammals) are known from there. With regard to the terrestrial ones, rare findings of primates *Sivapithecus* sp., occurs only in this locality within Slovakia (Feráková et al. 1997, Hegedüšová 2009).

Soils

The prevailing soil types on shallow and dry places are the eutric cambisols developed on the Mesozoic quartzite and on diluvia of carbonate-silicate deposits. They are mostly covered with oak-hornbeam forests. The rendzic leptosols are developed on limestones and dolomites covered mainly with dry grasslands and open Mediterranean xero-thermophilous oak forests. Regosols and sands are less frequent (Sandberg, Merice) developed on sandstones (Bedrna 1997).

Climate

The climate of the NNR Devínska Kobyla is sub-continental, summer-warm, moderate dry with mild winter (Holec 1997). The extra warm and dry climate is characteristic for sun-exposed, south-western steep slopes. The mean annual temperature is 9°C, with maximum temperature 32.8°C and minimum temperature –15.5°C. The mean annual precipitation is 604.9 mm. of which 360.1 mm falls in the vegetation season (March, September). The monthly rain sums vary considerably between the years, and long periods of drought are common (in 2003). This type of climate supports the development of forest-steppe vegetation.

Landscape history and nature conservation

Due to its favourable geographical location and climatic conditions Devínska Kobyla and its surrounding was one of the first parts of Slovakia to be inhabited (Viceníková et al. 2002). Neolithic people built the first dwellings in this area on the left side of the riverbank Dunaj between 5000 and 3500 BC. The strategic position of this place, the cliff (altitude of 212 m) at the confluence of the Dunaj and Morava was an ideal place for a fort. Its owner could control the famous trade route along the Danube as well as one branch of the Amber Road. That is why the site had become a strategic military post in the time of the Bronze and Iron Age (900 BC). In the Younger Iron Age, the territory was populated with Celts, which started to cut down the trees. At the times of the Roman Empire, Devin was still an important military station. In that period the Romans started growing wine grape in vineyards on the Devínska Kobyla hills. Devín fortress was first mentioned in the documents from 864 AD under the name Dowina. During the Greater Moravian Empire (9th century), the castle was a significant boundary fortress as well as one of the political and administrative centres. Two Slavonic fortresses (Sandberg and quarry) were built on the hillsides of Devínska Kobyla to protect the kingdom of prince Rastislav. After the fall of the Greater Moravian Empire, the castle served as a boundary castle of the Hungarian state. It witnessed also invasion of Turkish armies, German and Croatian colonisation (Devínska Nová Ves village). In 1809, the castle was destroyed by the Napoleonic troops. Since 1965 the archaeological research in the castle area and partial reconstruction of the ruins have been made.

Devínska Kobyla is included nowadays in the Protected Landscape Area Malé Karpaty Mts. (PLA). It was proposed as an Important Plant Area with total area of 127 ha in 2004. The NNR Devínska Kobyla was originally established as two separate reserves, the first one Sandberg in 1964 and the State Nature Reserve Devínska Kobyla on SW slopes with thermophilous vegetation (27.97 ha) in 1965. Both reserves were united in 1986 and the part Merice above Devín village was added. This area is under the fourth level of nature protection. A nature trail across the western slope was opened in 1988 and renewed in 2000.

Vegetation, flora and fauna

The typical feature of Devínska Kobyla and Sandberg is a high flora and also fauna biodiversity, due to the unique position, the heterogeneity of its geological substratum, the specific climatic conditions, the human influence and the vicinity of the Malé Karpaty Mts. The original vegetation was formed by oak-hornbeam forests, xero-thermophilous oak forests with *Quercus pubescens* on steep slopes with a limestone base and rocky grasslands, which are conserved in spite of human influence (vineyards, orchards, grazing, burning of grasslands, afforestation by non-native trees e.g. *Pinus nigra*, *Fraxinus ornus*). Since 1949, a continuous area of xero-thermophilous pastures (at the time 85.8 % of the total area) has been greatly fragmented into the present mosaic vegetation of rocky and dry grasslands (33.4 %) – steppe communities along with sub-Mediterranean xero-thermophilous oak woods *Corno-Quercetum* and *Pruno mahaleb-Quercetum pubescentis*. Among the trees on the south-western slopes we can find *Cerasus fruticosa*, *C. mahaleb*,

Cornus mas, *Quercus pubescens*, *Q. cerris* and *Ulmus minor*. Nowadays, the forests communities cover now 50.7 % of the NNR. On the northern slopes beech forests as *Melico uniflorae-Fagetum* and fragments of *Carici pilosae- Fagetum* and *Carici albae-Fagetum* are developed. *Fagus sylvatica* reaches here the lowest altitudes in the Western Carpathians Mts. On screes there are stands with *Tilia cordata* and *Acer campestre*, which belong to the alliance *Tilio-Acerion*. The most frequently occurring community in the NNR is *Carici pilosae-Carpinetum* with characteristic spring aspect created by *Galanthus nivalis*, later replaced by *Hepatica nobilis*, *Corydalis cava* and *Anemone ranunculoides*. Among non-native trees *Robinia pseudoacacia* and *Syringa vulgaris* are the most common. The continuous human impact on the area has increased the diversity of plant species. Cutting down and burning the woods created more space for plant species and communities that are typical of rocky areas. In phytosociological terms they belong to the class of Euro-Siberian steppes, *Festuco-Brometea*. The prevailing vegetation types of the xero-thermophilous grasslands communities are *Poo badensis-Festucetum pallentis*, *Festuco pallentis-Caricetum humilis*, *Festuco valesiacae-Stipetum capillatae*, *Polygalo majoris-Brachypodietum pinnati* and Pannonian fringe vegetation *Geranio sanguinei-Dictamnetum albae* and *Peucedanetum cervariae*. The stands of *Festuco valesiacae-Stipetum capillatae* (alliance *Festucion valesiacae*) represent a type of continental steppe. These communities were traditionally maintained by extensive grazing, mowing and burning.

According to the phytogeographical division of Slovakia (Futák 1984), Devínska Kobyla is situated on the border of two phytogeographical regions: the region of Pannonian flora and the region of West Carpathian flora. Finally it belongs to the region Eupannonicum with close phytogeographic relationship to the Hundsheimer hills in Austria. In Devínska Kobyla we can find Western Carpathian, Pannonian and Mediterranean species growing together, and reaching the most western or northern boundaries of their natural occurrence. In the species composition of vegetation xero-thermophilous and calciphilous elements dominate. Altogether, more than 1500 vascular plant species and subspecies including adventive taxa (Feráková et Hodálová unpubl.) were recorded here. All communities host a high number of endangered and rare species. 376 are threatened and 33 of them categorized as critically endangered (CR), endangered (EN) and vulnerable (VU), as well as 10 species in the category extinct (EX) are included in the Red Data Book, Vol. 5 of the Slovak and Czech Republics (Čeřovký et al., 1999). Species such as *Conringia austriaca*, *Ononis pussila*, *Orobanche artemisiae-campestris*, *O. teucrii*, *Peucedanum arenarium* and on the limestone rocks *Rhamnus saxatilis* subsp. *saxatilis* were recorded here and nowhere else in Slovakia. *Gypsophila paniculata* is on the verge of extinction. A famous spring aspect is created by *Adonis vernalis*, *Pulsatilla pratensis* subsp. *bohemica* and *P. grandis*, later joined by *Iris pumila* in three colour tones – purple, yellow and white. The rare orchids *Anacamptis pyramidalis*, *Ophrys apifera*, *O. holoserica*, *O. insectifera*, *O. sphegodes*, *Orchis morio*, *O. tridentata* subsp. *tridentata*, *O. ustulata* subsp. *ustulata* bloom in May together with *Stipa* grasses. On the steep slopes and open sands with the shallowest substratum colline calcareous grasslands can be found. The dominating *Festuca pallens* is accompanied by *Fumana procumbens*, *Linum tenuifolium*, *Potentilla arenaria and Scorzonera austriaca.* On the gentle slopes *Carex humilis* is dominant with numerous chamaephytes and ephem-

eral therophytes such as *Allysum montanum*, *Globularia punctata*, *Helianthemum nummularium*, *Jurinea mollis*, *Thymus praecox*, *Teucrium montanum* and *T. chamaedrys*. On the rocky and moderately deep soils *Stipa capillata* and *Festuca valesiaca* stands are developed. The extra-zonal vegetation is represented by the Pannonian fringe vegetation with common species *Geranium sanguineum*, *Dictamnus albus*, *Cyanus triumfettii*, *Anemone sylvestris* and *Tephroseris integrifolia*. In those parts of the forests that are more exposed to sunlight it is possible to find the originally Mediterranean species *Smyrnium perfoliaum*, which was rare in the past and is quickly spreading nowadays. An important feature of the floristic composition of the NNR is occurrence of various species and hybrids of the genus *Viola*. The area of the NNR is important also because of the diversity of cryptogams: 110 lichen species, 100 bryophyte species and 331 fungi have been recorded.

From the zoological point of view Devínska Kobyla is one of the places with the highest biodiversity in Slovakia. According to the zoogeographical classification of terrestrial bio-cycle of Slovakia (Jedlička & Kalivodová 2002), the area of the NNR belongs to the region of West Carpathians, province of Pannonian steppe, part Devínska Kobyla Mts., on a border of region of deciduous forests and steppes. It is particularly characterized by a high abundance of thermophilous and xerophilous species of insects, which create unique zoological communities. A lot of species reach the most northern boundary of their natural occurrence. A many species are rare, such as insect *Mantispa styriaca*, beetles *Lucanus cervus*, *Oryctes nasicornis*, *Rosalia alpina* and butterflies *Zanclegnatha tarsicristalis*, *Yponemeuta vigintipunctatus* and *Procris gerryon.* Xerothermic species including cicadas (*Tibicina haematodes*), crickets (*Gryllus desertus*), neuroptera (*Ascalaphus macaronius*), spiders (*Eresus cinnaberinus*), grasshoppers (*Saga pedo*) and *Mantis religiosa* contribute to the exotic atmosphere. *Mantis religiosa*, with two coloured varieties, is the only representative of *Mantodae*. A lot of them are protected and endangered, e.g. *Papilio machaon*, *Iphiclides podalirius*, *Ascalaphus macaronius*, *Lucanus cervus*, *Parnassius mnemosine*. On the open sandy places *Meloe violaceus* is also frequent. Altogether, 44 species of the terrestrial gastropods were found here. The most abundant are *Granaria frumentum*, *Balea biplicata* and *Truncatellina cylindrical.* The amphibians are represented by *Bufo bufo*, *Bufo viridis* and *Salamandra salamandra*. In the southern slopes emerald coloured of male lizard *Lacerta viridis* can be frequently seen. From the reptiles there are also *Anguis fragilis*, *Natrix natrix* and *N. tesselata*. The deciduous forests are the home of *Elaphe longissima*, the biggest snake in Slovakia. The endangered bird species, which nest here, are *Corvus corax*, *Falco subbuteo*, *Tichodroma muraria* and *Upupa epops*. The sandstone walls of Sandberg are attractive with the appearance of European bee-eaters *Merops apiaster*. Mammals are not as strongly represented as other animal groups. Among the typical representative of rodents (*Rodentia*) are *Sciurus vulgaris*, *Microtus arvalis* and *Glis glis*. The *Lagomorpha* represents *Lepus europaeus*. The typical representatives of *Carnivora* are *Meles meles* and *Vulpes vulpes*. *Artiodactyla* are here represent by *Capreolus capreolus* and *Sus scrofa*.

Threats

The present state of vegetation on the Devínska Kobyla NNR is conditioned predominantly by succession (Hegedüšová 2009). The xero-thermophilous grassland vegetation is strongly threatened by changes in management, and soil conditions, the first of all by abandonment of the traditional use of the landscape and an inappropriate human intervention. During the state afforestation programme many non-native species were planted, mostly *Pinus nigra* further *Prunus serotina* and *Aesculus hippocastanum*. Obscuration and needles cast, which changes pH of soils, are liable for the treat of many rare endangered species. Big problems are especially soil erosion caused by cyclists who ride on the sensitive south-western slopes and construction of new open fires. The absence of grazing, meadow cutting, and burning resulted in spreading of competitively strong grasses such as *Bromus erectus*, *Arrhenatherum elatius* and shrubs *Crataegus* sp., *Rosa* sp. div. and *Prunus spinosa*. The diversity of the plant communities was declining and many species disappeared. Another big problem is represented by non-native plant species, which grow in surrounding of gardens, spread to the protected area and make it difficult for native species to survive.

The nomenclature of vascular plants follows Marhold & Hindák (1998). The nomenclature of syntaxa has been unified according to Janišová (2007).

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Appendix 1.

Short list of Vascular plants of the National Nature Reserve Devínska Kobyla

Acer campestre
Acer platanoides
Acer pseudoplatanus
Acinos arvensis
Adonis vernalis
Agrimonia eupatoria
Agrostis capillaris
Achillea collina
Achillea millefolium agg.
Achillea pannonica
Achillea setacea
Alliaria petiolata
Allium flavum
Allium senescens subsp. *montanum*
Alyssum montanum
Anacamptis pyramidalis
Anemone sylvestris
Anthericum ramosum
Anthyllis vulneraria
Arabidopsis thaliana
Arabis hirsuta
Arabis turrita
Arenaria serpyllifolia agg.
Arrhenatherum elatius
Artemisia absinthium
Artemisia campestris
Asparagus officinalis
Asperula cynanchica
Asperula tinctoria
Aster amelloides
Astragalus onobrychis
Avenula pratensis
Berberis vulgaris
Betonica officinalis
Bothriochloa ischaemum
Brachypodium pinnatum
Brachypodium sylvaticum
Briza media
Bromus erectus
Bromus hordeaceus
Bupleurum falcatum
Camelina microcarpa
Campanula bononiensis
Campanula glomerata
Campanula rotundifolia
Campanula sibirica
Cerasus vulgaris
Cerasus fruticosa
Cerasus mahaleb
Carex alba
Carex caryophyllea
Carex hirta
Carex humilis
Carex michelii
Carex pilosa
Carlina acaulis

Carlina vulgaris
Carpinus betulus
Centaurea stoebe s.lat.
Centaurea triumfettii
Cerastium arvense
Cerastium brachypetalum
Cerastium glomeratum
Cerastium glutinosum
Cerastium semidecandrum
Clematis recta
Colymbada scabiosa
Conringia austriaca
Convallaria majalis
Conyza canadensis
Cornus mas
Corydalis cava
Corydalis pumila
Corydalis solida
Corylus avellana
Cotoneaster integerrimus
Cotoneaster tomentosus
Crataegus laevigata
Crataegus monogyna
Crinitina linosyris
Cruciata glabra
Cuscuta species
Cyanus triumfetti
Cynodon dactylon
Dactylis glomerata
Daucus carota
Dianthus deltoides
Dianthus pontederae
Dictamnus albus
Dorycnium herbaceum
Echium vulgare
Elytrigia intermedia
Erophila verna
Eryngium campestre
Erysimum diffusum agg.
Erysimum odoratum
Euonymus europaeus
Euonymus verrucosus
Fagus sylvatica
Falcaria vulgaris
Fallopia convolvulus
Festuca pallens subsp. *pallens*
Festuca pratensis agg.
Festuca rubra
Festuca rupicola
Festuca valesiaca
Fragaria vesca
Fragaria viridis
Fraxinus excelsior
Fraxinus ornus
Fumana procumbens
Galanthus nivalis
Galeobdolon luteum
Galium glaucum
Galium odoratum
Galium pycnotrichum
Galium verum
Genista germanica
Genista pilosa
Genista tinctoria
Geranium sanguineum
Geranium sylvaticum
Geum urbanum
Glechoma hederacea
Globularia punctata
Grammica campestris
Gypsophila paniculata
Hedera helix
Helianthemum grandiflorum
Helianthemum grandiflorum subsp. *obscurum*
Helichrysum arenarium
Hepatica nobilis
Heracleum sphondylium
Hesperis tristis
Hieracium sabaudum
Himantoglossum adriaticum
Holosteum umbellatum
Hypericum perforatum
Hypochaeris radicata
Chamaecytisus austriacus
Chamaecytisus hirsutus
Chamaecytisus supinus
Chondrilla juncea
Chrysopogon gryllus
Inula conyza
Inula ensifolia
Inula hirta
Inula oculus-christi
Iris pumila

Iris variegata
Juniperus communis
Jurinea mollis
Koeleria macrantha
Lamium maculatum
Lathraea squamaria
Lathyrus vernus
Lembotropis nigricans
Leontodon hispidus
Leopoldia comosa
Libanotis pyrenaica
Ligustrum vulgare
Lilium martagon
Linaria genistifolia
Linum catharticum
Linum flavum
Linum hirsutum
Linum tenuifolium
Lithospermum purpurocaeruleum
Lonicera xylosteum
Lotus borbasii
Lotus corniculatus
Medicago falcata
Medicago lupulina
Medicago minima
Medicago monspeliaca
Melica ciliata
Melica nutans
Melica transsilvanica
Melica uniflora
Melilotus officinalis
Minuartia glaucina
Minuartia rubra
Minuartia setacea
Muscari neglectum
Myosotis ramosissima
Myosotis stricta
Nonnea pulla
Odontites vulgaris
Onobrychis viciifolia
Ononis pusilla
Ononis spinosa
Ophrys apifera
Ophrys holoserica
Ophrys insectifera
Ophrys sphegodes
Orchis militaris
Orchis morio
Orchis tridentata subsp. *tridentata*
Orchis ustulata subsp. *ustulata*
Origanum vulgare
Ornithogalum kochii
Orobanche artemisiae-campestris
Orobanche caryophyllacea
Orobanche lutea
Orobanche teucrii
Orthantha lutea
Petrorhagia saxifraga
Peucedanum alsaticum
Peucedanum arenarium
Peucedanum carvifolia
Peucedanum cervaria
Peucedanum oreoselinum
Phelipanche arenaria
Phleum phleoides
Phleum pratense
Pilosella bauhinii
Pilosella macrantha
Pilosella officinarum
Pimpinella saxifraga agg.
Plantago lanceolata
Plantago media
Poa angustifolia
Poa bulbosa
Poa pratensis
Polygonatum multiflorum
Polygonatum odoratum
Populus tremula
Potentilla arenaria
Primula veris
Prunella laciniata
Prunella vulgaris
Prunus spinosa
Pseudolysimachion spicatum
Pulmonaria mollis
Pulmonaria officinalis
Pulsatilla grandis
Pulsatilla pratensis subsp. *bohemica*
Pyrethrum corymbosum
Quercus cerris
Quercus petraea
Quercus pubescens
Ranunculus bulbosus
Reseda lutea

Rhamnus cathartica
Rhamnus saxatilis subsp. *saxatilis*
Rhodax canus
Robinia pseudacacia
Rosa canina agg.
Rosa pimpinellifolia
Rosa rubiginosa
Salsola kali
Salvia nemorosa
Salvia pratensis
Sanguisorba minor
Scabiosa ochroleuca
Scorzonera austriaca
Scorsonera hispanica
Scorzonera purpurea
Securigera varia
Sedum acre
Sedum album
Sedum sexangulare
Senecio jacobaea
Seseli hippomarathrum
Seseli osseum
Silene otites
Silene vulgaris
Smyrnium perfoliatum
Stachys recta
Stipa capillata
Stipa joannis
Stipa pulcherrima
Syringa vulgaris
Swida sanguinea
Taraxacum sect. *Erythrosperma*
Taraxacum serotinum
Tephroseris integrifolia
Teucrium chamaedrys
Teucrium montanum
Thalictrum minus
Thesium linophyllon
Thlaspi perfoliatum
Thymus pannonicus
Thymus praecox
Tilia cordata
Tilia platyphyllos
Tithymalus cyparissias
Tithymalus seguierianus
Tragopogon dubius
Tragopogon orientalis
Trifolium alpestre
Trommsdorfia maculata
Ulmus minor
Valeriana stolonifera subsp. *angustifolia*
Verbascum lychnitis
Verbascum phoeniceum
Veronica austriaca
Veronica hederifolia agg.
Veronica chamaedrys
Veronica officinalis
Veronica prostrata
Viburnum lantana
Vicia tenuifolia
Vincetoxicum hirundinaria
Viola alba subsp. *alba*
Viola ambigua
Viola canina
Viola hirta
Viola kitaibeliana
Viola mirabilis
Viola odorata
Viola reichenbachiana
Viola riviniana
Viola rupestris
Viola suavis
Viola tricolor
Xeranthemum annuum

Pavel Deván – memories and bibliography

Pavel's hurdle race

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Almost nobody lives his life easily, without problems. Paľo Deván from the hamlet U Devánov, that was his introduction when we met for the first time in 1974 at the Horský park campus in Bratislava. He has had a harsh destiny since his childhood. Firstly, he lost his eye in an accidental shooting at Myjavské kopanice. Secondly, the destiny played a game with him, when he was a young secondary school student interested in butterflies. He had a brain tumour and had to undergo a neurological surgery. Paľo defeated his illness. He overrun the Death as well as the communist comrades, who suspected his peasant origin.

We met at the Faculty of Natural Sciences of the Comenius University, both studying biology, though I was a year older. We were roommates, involved in many student activities, for example removal of non-native pines at Devínska Kobyla. We could talk all the time, cover millions of themes, sometimes very different from our major – zoology. Paľo never betrayed his beloved butterflies but continuously he switched to hydrobiology, where he became interested in mayflies. As a return to his roots he studied mayflies of the river Myjava and wrote his graduation thesis about these insects. He graduated in 1979. He was attracted by basic research – as a student he worked for a renowned hydrobiologist Dr. Rotschein – but soon he realized that an academic career is not his way. He felt that nature could benefit more from a conservationist than from a researcher, therefore he became the conservationist. When I returned from the military service in 1979 I found him working for nature conservation in my native Trenčín. Both of us were getting ready for the postgraduate exams and that kept us in touch. When we passed the exams, I started working at the Slovak Academy of Sciences. That was not the best choice for myself. Paľo knew it and suggested to join him to work in Trenčín at the District Conservation Agency. We experienced there the pioneer years of nature conservation. Paľo with his typical farmer stubbornness was fighting against narrow-minded officials who wanted to devastate the environment.

I was his companion in the fight, taming him from time to time. He was restless, full of energy, totally devoted to his conservation work. Besides the work he suc-

ceeded to accomplish his postgraduate studies and achieve an academic degree CSc. (equivalent of PhD.) which he used to make jokes of. We worked hard on designation of protected areas in the Trenčín region and soon became well known. In a decade we accomplished designation of twenty seven small scale protected areas and some protected trees in the Trenčín district and published a booklet Nature Conservation in the Trenčín district. In 1987 he directed his effort towards the Protected Landscape Area (PLA) Biele Karpaty, where he continued in building up a network of nature reserves and nature monuments with new, active colleagues. As the personnel of the PLA Administration was growing Pavel gained capacity to continue his hydrobiological research. He investigated watercourses of the White Carpathians as well as the other ones filling up white spaces on the hydrobiological research map. His charisma influenced many young students, participants of the voluntary conservation camps, who decided to study biology and ecology in depths. Who knows what their fate would be if it were not for him. I can mention his sister Betka (he made her to do a botanical research of the Nature Reserve Bindárka nearby Trenčín) or his students Tomáš Derka, Iveta Pohoriljaková Škodová and Sylva Hladůvková Mertanová. Our Lord will or a fate was it that one of his students was Katarína Gajdoštinová, who became his wife in 1992. As an excellent botanist she contributed to his botanical knowledge. She did something very important for him – she caused that he quit with alcohol abuse. He was no more addicted to alcohol but he remained addicted to his family, wife, three children and hard work. He worked too much – mentally as well as physically. When his family moved to the house in Adamovské Kochanovce in 2003 his farmer instincts kept him taking care of the house, garden, animals.

At work he oriented his attention towards conservation management of grasslands and succeeded to engage the other colleagues into this type of work. When equipment for the conservation management measures was not available, he initiated establishment of the non-governmental organisation KOZA (Carpathian Association of Altruistic Conservationists). KOZA or later on a Civic Association Pre Prírodu were able to raise money for the equipment and carry out the conservation measures in the region.

In the nineties Paľo felt lack of data about insects of the Trenčín and Myjava regions. That made him change his subject from aquatic invertebrates to terrestrial ones: *Hymenoptera*, families *Sphecidae*, *Pompilidae*, *Chrysididae* and ants. He was not a car driver therefore he travelled the region on his bicycle. Often me or other colleagues served him as drivers on his insect exploring trips. He collected and determined enormous quantity of samples, shared information about his records in many publications and made hundreds of records into nature conservation databases. It is a pity that he was not able to determine all samples. His older son is decided to continue his work. Hopefully, he will finish it.

It is paradoxical and symbolical, that butterflies which attracted Pavel to biology and conservation were present at his last struggle. The struggle he lost. It is sad to say that he would not enjoy results of the current project for rescue of blue butterflies (genus *Maculinea*), which he wrote. He passed away and left us work on conservation issues alone. Since we do not posses his knowledge we will need his advice often. I believe he is watching us and will give us a sign that we do what he wanted to do.

Palino, I hope we will not disappoint you and will work for nature conservation as much as we can.

Pavel Deván – the hydrobiologist

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Pavel Deván began studying mayflies as a student of dr. Eva Ertlová at the Institute of Zoology (Faculty of Natural Sciences of the Comenius University) in Bratislava. Originally he planned to study protozoan – ciliates. The work with ciliates exhausts eyesight. As a boy Pavel lost one of his eyes, therefore he had to study something larger. He tried to investigate midges (*Chironomidae*), which were equally small and he had to quit. Finally, his adviser suggested mayflies (*Ephemeroptera*) which are bigger and preparation of microscopic specimen is less demanding for sight. He published his first papers with results of the complex hydrobiological research of the Belá river watershed in Tatra Mts. The research was coordinated by the Institute of Fishery and Hydrobiology under the leadership of dr. Milan Ertl. He cooperated with Iľja Krno, at that time a young assistant at the Institute of Zoology, nowadays a professor at the Ecology Department of the Faculty of Natural Sciences of the Comenius University. They published a scientific work where they described the first finds for Slovakia of species *Baetis melanonyx* Pictet, 1843 and *Caenis beskidensis* Sowa, 1973 (Krno & Deván 1982). Results from Belá river he published in two works (Deván 1982, 1984). In cooperation with Ladislav Mucina (Deván & Mucina 1986) he published the contribution on mayfly communities of Belá river in the renowned international journal *Hydrobiology*. His interest in speleology and cooperation with Trenčín speleologists resulted in the work on a drift of aquatic invertebrates in the Brestovská cave in Roháče Mts. (Deván 1985).

In the following years he returned from Tatra Mts. back to his Myjava roots and studied macrozoobentos, and mayflies of Myjava river. He studied and published data on macrozoobentos of the regulated part of the upper Myjava river together with his adviser (Deván & Ertlová 1984). Mayfly communities and autecology of mayflies on the upper Myjava river were subject of his doctoral thesis which he presented in 1989 and published in segments (Deván 1992a; 1993a,c,d; 1994). He was extremely hard-working and besides his conservation work he managed to study fauna and ecology of mayflies on various territories within Slovakia. He covered mayflies in the frame of a collective study oriented on seasonal dynamics and production of hydrozoocenosis in the river Turiec (Krno et al. 1991). Deván & Krno (1996) evaluated mayfly communities in the frame of a complex hydrobiological study of the river Turiec catchment area. They addressed also autecology analyzing relationships of individual species to various types of substrate and they evaluated production of fourteen species. Pavel Deván recorded several new mayfly species for fauna of Slovakia. He published individually finds of the following species: *Baetis beskidensis* Sowa, 1972, *Baetis liebenaue* Keffermüller, 1974, *Baetis subalpinus* Bengtsson, 1917, *Rhithrogena carpatoalpina* Klonowska, Olechowska, Sartori et Weichselbaumer, 1987 a *Ecdyonurus cf. zelleri* (Deván 1991). Together with his student and follower Tomáš Derka he published finds of *Cloeon praetextum*

Bengtsson, 1914, *Ecdyonurus* cf. *austriacus*, *Electrogena ujhelyi* (Sowa, 1981) and *Rhithrogena austriaca* Sowa et Weichselbaumer, 1988 (Derka & Deván 1999).

Pavel Deván published numerous works of faunistic and ecological character, for example works on mayflies of the Tríbeč and Pohronský Inovec Mts. (Deván 1989), Východné Karpaty Mts. (Deván 1992b), Sikenica stream (Deván 1993b), Horná Nitra region and Vtáčnik Mts. (Deván 1993e). He worked on mayfly fauna in the southern part of Malé Karpaty Mts. (Deván 1995a), southern Pohronie and Poiplie regions (Deván 1996a). He made contribution to knowledge of mayflies in the Štiavnické vrchy Mts. (Deván 1996b). Within Považský Inovec Mts. he studied mayflies of Chotina stream, Trebichavský stream (Deván et al. 1986), Hôrčanský stream (Deván 1995b) and Svinica stream (Deván et al. 2004). Within Strážovské vrchy Mts. he covered Manínsky stream and several other localities (Ertlová et al. 1983), Havránkova dolina and Machnáč streams (Deván 2005a). In his other works he pursued mayflies of the Biele Karpaty Mts. (Deván 1997a,b, 1999a,c 2000a, 2002) and lowland waters (Deván 1999b, 2000b, 2001b,c). He worked out the Red List of mayflies of Slovakia (Deván 2001a). Besides scientific works he published several popular papers about rare species of Slovak mayflies.

Pavel Deván made enormous unforgettable contribution to the history of hydrological and mainly ephemeropterological research in Slovakia. His name will be forever inscribed in the name of a mayfly species *Massartella devani* from Roraima table mountain in Venezuela (Derka 2002).

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Notes

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Origins and Evolutionary Assembly of Dry Grasslands of Central Europe: Ideas, Data, Perspectives

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There is no doubt today that some of European steppes are natural and old (at least of Late Miocene age). Less clear is the origin of dry grasslands of Central Europe found in rocky habitats, steep slopes, inland dunes, and salinised soils. The macroclimate and pedo-hydrologic mesic conditions of modern Central Europe is a habitat template of temperate deciduous forests, and grasslands (such as mesic hay meadows) occurring under such conditions should be clearly seen as man-made and main-maintained. Grasslands (mostly sedgelands in fact) in stressful habitats such as flooded and/or salinised alluvia and flats might possess natural core. Climatically stressed high-altitudes support "climatogenic" alpine grasslands. Xeric habitats, suffering at least seasonal drought, while being exposed to disturbance by increased soil erosion (rocky outcrops, steep and strongly insolated slopes on "warm" substrates are home of complex, species-rich and highly dynamic grasslands. These are sometimes called rocky steppes. This paper attempt to pull together palaeoecological evidence, insights of predictive modelling, data on plant distribution and current vegetation patterns as well as cutting-edge genomic (molecular phylogenetic, phylogeographic, population-genetic) studies in order to elucidate the origins of the enigmatic xeric grasslands.

Three hypotheses will be put to proof. First hypothesis implies that the Central European (zoomed on circum-pannonian) grasslands are Tertiary relics, hence having roots as deep as the Ukrainian steppes. The second (clearly opposing) hypothesis claims that these grasslands are a result of Roman and post-Roman intensive deforestation of the region, hence are man-made and their further survival is unthinkable without intensive intervention of man. The third hypothesis ranks the xeric rocky grasslands as Pleistocene creations reflecting repeated (cyclic) dynamics involving shrinking (and possible disassembly) during the pleniglacial and re-assembly during warm interglacials. Topography and shift of vegetation belts, in response to Pleistocene glacial cycles driven by Milankovich forcings, complicate the vegetation assembly patterns in a very interesting manner, offering fascinating outlooks for enquiry of evolutionary community ecology into evolutionary assembly of these grasslands.