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EUROPEAN VEGETATION SURVEY



# BOOK OF ABSTRACTS

*„Flora, vegetation, environment  
and land-use at large scale”*



29 APRIL–2 MAY, 2010 UNIVERSITY OF PÉCS, HUNGARY





# ABSTRACTS

19th EVS Workshop

“Flora, vegetation, environment and land-use at large scale”

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# LECTURES

FLORA, VEGETATION,  
ENVIRONMENT  
AND LAND-USE  
AT LARGE SCALE

# HOT-SPOTS OF GLACIAL RELICT PLANTS IN CENTRAL BALKAN RANGE AND IN RILA MTS

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The current study aims to discover the distribution, ecological dependences and threats to the selected glacial relict plants in Bulgarian mountains. Within a preliminary selection, a list of 35 species was elaborated. During 2009, these species were studied in Central Balkan Range and Rila Mts. The populations are localized and information about their habitats and vegetation affiliation was collected. Special attention was paid to the threats including climate change and human impact.

Within 50 locations in the Balkan Range, 14 glacial relict plants were registered. Five of them are calcicole, other five are found only of silicate and the rest are indifferent.

In 65 locations in Rila Mts, 26 glacial relicts were studied. Sixteen of them are distributed only in this mountain and other 7 species are common for both regions.

Quite characteristic is the location of all the plants in a narrow strip at the mountain ridge at altitudes 1500-2000 m in Balkan Range. They occupy mostly northern exposures. In the Rila Mts, their ecological niche is confined to limited space at altitudes above 2000 m and the species abundance is low. Strong competition with the dominant species such as *Festuca* spp., *Nardus stricta*, *Juniperus sibirica*, *Pinus mugo* cause significant pressure on the populations. Restriction of the appropriate habitats for the glacial relicts is caused by the increasing distribution of some dominants (e.g. *Juniperus sibirica*), changes in the habitats as a result of drought, trampling and pollution by the increasing tourist activities.

The populations of glacial relict plants survive in unfavourable conditions in the studied regions. If climate warming really happens, these populations will suffer even more. Plots for long lasting monitoring will be organized. The project results should include recommendations for rapid measures for further preservation of the glacial relict plants.

This project is funded by European Economic Area Grant Program under project number BG0034.



# MODELLING THE POTENTIAL DISTRIBUTION OF THE MAIN FOREST TYPES OF ITALY

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In recent years, predictive modelling of species distribution has become an important tool to assess several questions in biodiversity conservation and climate change research.

The study area is the whole Italian Peninsula, an area geographically isolated from the rest of Europe by the Alps that covers a total of 301.338 km<sup>2</sup>.

An Ecological Niche Model for the 27 most important tree species of the forest communities in Italy has been elaborated using Random Forest, the best modelling technique for our aim, as resulted from the predictive performances in a previous study, where several models were tested.

National Forest Service of Italy provided forest composition data of IN.DE.FO. project (1995). These data have been used to calculate the Importance Value (IV) for each of the following species: *Abies alba*, *Acer campestre*, *Acer obsatum*, *Acer pseudoplatanus*, *Alnus cordata*, *Alnus glutinosa*, *Carpinus betulus*, *Carpinus orientalis*, *Castanea sativa*, *Fagus sylvatica*, *Fraxinus excelsior*, *Fraxinus ornatus*, *Larix decidua*, *Ostrya carpinifolia*, *Picea abies*, *Pinus halepensis*, *Pinus pinaster*, *Pinus sylvestris*, *Populus tremula*, *Quercus cerris*, *Quercus ilex*, *Quercus petraea*, *Quercus pubescens*, *Quercus robur*, *Quercus suber*, *Tilia cordata*, *Ulmus minor*. After a validation procedure, we elaborated through GIS software a vector matrix of 6417 sample forest plots distributed on a 3×3 km grid based on Importance Value (IV). IV is a measure of tree species composition which combines density and dominance. In monotypic stands, IV could reach a maximum value of 200.

We utilized the following predictors in grid format: climatic and bioclimatic data, topographic and geological maps. Climatic variables were chosen to be more meaningful for their influence on the growth and distribution of tree species and considered representative of others more directly related to them. We used: Annual mean temperature (MeanT), Minimum temperature of the coldest month (MinT), Maximum temperature of the hottest month (MaxT), Summer precipitation (PS), Winter precipitation (PW), Total annual precipitation (PTot).

Then, the resulting matrix was processed with a filter derived from the present CorineLand-Cover to compute in the final processing the level of the human-induced landscape fragmentation. Therefore, we carried out Cluster analysis to identify and classify the investigated species into groups, involving similarity in ecological characteristics.

# DIVERSITY-PRODUCTIVITY RELATIONSHIP IN TEMPERATE FORESTS

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The relationship between diversity and productivity of temperate zone vegetation is usually described by unimodal or so-called hump-back model, which predicts highest species numbers at intermediate productivity levels and a drop in species diversity towards the highly productive habitats. According to the competitive exclusion theory, this drop is caused by more intense competition or by decreased heterogeneity of limiting resources. However, these findings are based mainly on grassland or wetland studies and data on deciduous forests are scarce. We decided to check whether forest data show the same pattern as published earlier for grasslands.

Plant species diversity of temperate European forests mainly reflects the diversity of their herb layer rather than tree layer. Therefore, we focused our study on the herb layer. We compiled available data from Czech, Slovak, German and Russian forests, resulting in a dataset of nearly 200 plots. Plots were recorded as phytosociological relevés of 100 m<sup>2</sup>. Species richness (expressed as the number of herb-layer species per plot) and biomass (dry weight of clipped biomass per 1 m<sup>2</sup> of herb layer) were estimated for each plot. In these forests, biomass weight essentially represents the herb-layer productivity. The dataset covered a long environmental gradient from nutrient-poor acidophilous oak forests (1 g biomass dry weight/m<sup>2</sup>) to very productive birch-poplar and alder forests (290 g/m<sup>2</sup>).

In contrast to the conclusions of previous studies, the relationship between herb-layer species richness and productivity in our data was best explained by the linear model. We conclude that although the unimodal (hump-back) model is suitable for non-forest vegetation, it may not adequately describe the species richness-productivity relationship in temperate deciduous forests.

We hypothesize that in forests, light availability in the herb layer is reduced due to tree canopy, thus preventing the development of high biomass in the herb layer. Therefore, total herb-layer biomass is too small to allow competitive exclusion and decline in species richness to occur even in productive forests.



# ASSESSING THE SPATIO-TEMPORAL VARIABILITY IN THE COMMUNITY STRUCTURE OF SAND GRASSLANDS

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Assessing within-stand variability in community composition and structure might help to understand future states and possible transformations due to global changes. The spatial variability of open sand steppes (*Festucetum vaginatae*) was surveyed at regional scale along a 200 km long NW-SE transect in Hungary. The transect represents a gradient of climate and land use with a slight increase of continentality and human disturbances from Gönyű to Fülöpháza. Temporal variability was also monitored between 1996 and 2009 in two sites: at Csévharaszt and at Fülöpháza. Vegetation was sampled at multiple scales and with various sampling designs. Repeated vegetation mapping (within 40 x 100 m areas with 5x5 m resolution), 2x2 m and 4x4 m permanent plots distributed in 50 ha areas, and line-intercept sampling (by recording the presence of plant species along 52 m long circular belt transects of 5x5 cm contiguous micro-quadrates) were used. The number of species and species combinations decreased along the NW-SE gradient, while the proportion of sand grassland specialists and annuals of continental and submediterranean character increased. *Festuca vaginata* was gradually replaced by *Stipa borysthena* due to repeated slight droughts. Serious droughts caused temporal diversity collapse and local mass extinction of dominant grasses. Gaps were colonized first by annuals and mosses then were occupied by valuable perennial sand grassland specialists. Species density slightly decreased in wet years and abruptly decreased during droughts. However, diversity recovered quickly with a maximum in two years after drought. Five times higher relative interannual variability was found for the diversity of species combinations at the more arid site, while the relative temporal variability of total abundance did not show consistent patterns. The larger spatio-temporal variability of community structure found in the more arid site suggests larger vulnerability to climatic and landuse changes.

# RELATIVE IMPORTANCE OF PROPAGULE PRESSURE AND LAND USE TO THE LEVEL OF INVASION IN DIFFERENT NON-FOREST HABITATS

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Plant invasion is one of the most serious threats to biodiversity and ecosystem functions worldwide. It is well-known from the scientific literature that both propagule pressure and disturbances influence the level of invasion. Landscape Ecological Vegetation Database & Map of Hungary (MÉTA database, <http://www.novenyzetiterkep.hu>) contains data on the level of invasion (binary data: the habitat is invaded or not), cover of invasive species in the surrounding landscape (a measure of propagule pressure) and land use (the main source of disturbance). Generalized additive models were fitted to data from the database, and explained variances were calculated separately for the following habitats: Non peaty reed and *Typha* beds (B1a), Non-tussock beds of large sedges (B5), *Molinia* meadows (D2), Salt meadows (F2), *Arrhenatherum* hay meadows (E1), Open sand steppes (G1), Slope steppes (H3a), Forest steppe meadows (H4), Closed steppes on loess, clay and tufas (H5a).

Propagule pressure explains more variation than land use in each habitat except salt meadows. The explained variation is highest in slope steppes and forest steppe meadows. These habitats are only extensively used; therefore the relative role of land use is low here. Other distinctive feature of these two habitats is that their abiotic conditions do not differ from the surrounding areas, thus invasive species occurring in the surroundings can invade them.

In the marshes and wet meadows, the relative importance of land use increases with decreasing water level. In the dry- and semi-dry grasslands land use explains more variation in habitats occurring in lowlands (G1, H5a) than in habitats occurring in hilly and mountain areas (E1, H3a, H4).



# CLASSIFICATION AND ORDINATION OF NORTHERN BOREAL AND SWAMP FORESTS IN THE WEST SIBERIAN PLAIN

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Classification of northern boreal and swamp forests in the West Siberian plain has been developed using the Braun-Blanquet approach. Syntaxa were assigned to two classes, 4 orders, 5 alliances and 6 associations. Extending the European classification system to Siberian region was accompanied by corrections of diagnostic features of the class *Vaccinio-Piceetea* and two orders - *Piceetalia excelsaea* and *Pinetalia sylvestris*. At the same time, a special order *Ledo palustris-Laricetalia cajanderi* includes north boreal forests widespread in long frozen soils and permafrost. Results of DCA ordination demonstrate the main ecological subdivisions of north boreal vegetation and good syntaxonomic boundary between zonal coniferous forests and swamp forests.

Prodromus of north boreal vegetation in West Siberia:

Class *Vaccinio-Piceetea* BR.-BL. in BR.-BL. *et al.* 1939

Ord. *Piceetalia excelsaea* PAWŁOWSKI *et al.* 1928

All. *Aconito rubicundi-Abietion sibiricae* ANENKHONOV *et* CHYTRY 1998

Ass. *Rubo arcticus-Abietetum sibiricae* ass. nova

Subass. Typicum

Subass. *Betuletosum pendulae*

Subass. *Violetosum palustris*

All. *Vaccinio myrtilli-Pinion sibiricae* all. nova

Ass. *Vaccinio myrtilli-Pinion sibiricae* ass. nova

Ord. *Pinetalia sylvestris* OBERD. 1957

All. *Cladonio stellaris-Pinion sylvestris* all. nova

Ass. *Pino sibiricae-Pinetum sylvestris* ass. nova

Subass. Typicum

Var. *Cladonia cornuta*

Var. Typicum

Subass. *Ledetosum palustre*

Ord. *Ledo palustris-Laricetalia cajanderi* ERMAKOV in ERMAKOV *et* ALSYNBAYEV 2004

All. *Pino sibiricae-Laricion sibiricae* ERMAKOV in ERMAKOV *et* ALSYNBAYEV 2004

Ass. *Melampyro pratense-Laricetum sibiricae* ass. nova

Subass. Typicum

Subass. *Pinetosum sylvestris*

Ass. *Ledo-Pinetum sibiricae* ass. nova

Class. *Oxycocco-Sphagnetetea* BR.-BL. *et* TX. *ex* WESTHOFF *et al.* 1946

Ord. *Sphagnetalia medii* KÄSTNER *et* FLÖSSNER 1933

All. *Oxycocco-Empetrium hermaphroditum* NORDHAGEN *ex* DU RIETZ 1954

Ass. *Empetro subholarcticae-Sphagnetum fuscum* SMAGIN 2007

Var. typicum

Var. *Cladonia stellaris*

# PHYTODIVERSITY OF HIGH MOUNTAIN PASTURES AND HAY MEADOWS IN THE GREATER CAUCASUS, AZERBAIJAN

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With more than 6,300 vascular plant species the Caucasus is the most important hotspot of biodiversity and endemism in Europe. We conducted a vegetation survey in grasslands on the northern macroslope of the Greater Caucasus around the mountain Shahdag and recorded more than 600 species of higher plants. Two traditional land use systems prevail. Semi-nomadic livestock husbandry uses the alpine zone as summer pastures. The economy of small mountain villages in the subalpine belt is based on small-scale farming and sedentary livestock keeping with its need of winter fodder from hay meadows. An increase of livestock numbers since the break-down of the Soviet Union led to degradation of high mountain rangelands and a loss of biodiversity. To investigate the magnitude of these impacts we established a randomised sampling design with stratification by geomorphology and altitude (1800-3500 m a.s.l.) and validation by remote sensing data. In the years 2007 and 2008 we examined species' composition, standing biomass and site parameters in 194 plots. By means of cluster analysis and multivariate ordination we revealed 13 vegetation types and their driving site factors. Mean species numbers per 100 m<sup>2</sup> range from 67 species on subalpine meadows over 50 on a tragacanthic community and 51 on alpine mats to only 25 species at summer camp sites.



# CONCEPT FOR MONITORING RESTORATION OF FLOODPLAIN FOREST ON THE DANUBE

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Despite the fact that the Upper Danube floodplains of Bavaria were largely disconnected from river dynamics by embankment, straightening and hydroelectric dams, ca. 2100 ha of hardwood riparian forest survived between Neuburg and Ingolstadt. To restore ecological functions and biodiversity a permanent flow of up to 5 m<sup>3</sup>/s will be allowed back into an ancient system of old oxbows, and controlled floods of up to 30 m<sup>3</sup>/s will be allowed during peak discharge of the Danube.

To achieve a monitoring system that is balanced with respect to important current and expected environmental factors, we selected permanent phytosociological plots according to a stratified random design based on the following parameters mapped out in GIS:

1. longitudinal position between hydroelectric dams  
(5 sections representing groundwater regime)
2. position in the projected flooding area (yes/no)
3. relative elevation above water course level (</>1,25 m)
4. distance to the new water course (</>25 m)

Within the resulting strata, 117 plots of 200 m<sup>2</sup> were located randomly, marked permanently and subjected to baseline sampling in 2008 and 2009. Indirect and direct gradient analysis of forest vegetation in relation to terrain (as a proxy for groundwater and flooding regime) and soil properties identifies key factors controlling species composition before the onset of restoration, and allows us to develop a model of expected effects, which will be put to a test by future monitoring.

# ALPINE VEGETATION IN SCOTLAND AND UKRAINE PROCESSES AND CHANGES IN THE PAST FIVE TO SEVEN DECADES

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Changes in high-mountain vegetation in the 20th century were caused by shifts in land use and management, acidic deposition and air-borne eutrophication, and climatic changes. While the alpine plant communities are relatively highly sensitive to the present global warming changes, effects of changing management have been often underrated. In our meta-analysis, we merge results from three studies using phytosociological relevés re-visited after five to seven decades. Our aim is to assess the magnitude and causes of changes in alpine vegetation in two climatically contrasting regions: oceanic Scottish Highlands and sub-continental Ukrainian Carpathians.

The first study is a re-visitation survey of the NW-Scottish Highlands alpine vegetation (ca. 800-1100 m a.s.l.) spanning the second half of the twentieth century. It has shown considerable shift from moss- and lichen-dominated heaths towards increased dominance of more generalist graminoid species such as *Nardus stricta* and *Carex bigelowii*. There has been a marked decline in specialised Arctic-alpine species including *Racomitrium lanuginosum* and *Minuartia sedoides*.

The second case is a re-visitation of alpine vegetation (ca. 1700-1900 m a.s.l.) of the Mt. Pop Ivan in Marmarosh, Ukraine, between the 1930s and 2007. Vegetation has homogenized, cover of tall grasses *Calamagrostis* spp. and of the shrubby species e.g. *Rhododendron kotschyi* and *Juniperus nana* has increased. On contrary, low grasses and forbs have decreased. These changes indicate lowered pasturing impact since the pre-II WW period, which can be linked to difficult accessibility of the area in the Cold War decades.

The third re-visitation connects to the latter one. Compared are high-mountain spruce forests of Mt. Pop Ivan in elevations between 1260 and 1575 m a.s.l., recorded in 1938 and in 1997-2006 again. Relative importance of altitude on vegetation variability was higher in the 1930s than in the 1990s-2000s, which indicates homogenization. Species richness decreased by one-third. Originally sparse spruce woodland with many grassland („polonina“) species has turned into a closed forest.

Our three case studies document multiple and interacting effects of atmospheric nitrogen deposition, climate change and, probably most importantly, pasturing impact, which has decreased in the past decades. Subsequent processes have changed character of alpine environments and conservation-valued vegetation assemblages.



# USING LARGE-SCALE VEGETATION DATABASES TO DETECT TEMPORAL CHANGES IN SPECIES COMPOSITION OF VEGETATION TYPES

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Within the framework of the German Biodiversity Exploratory Project a large German vegetation database was constructed with the aim to reveal inter-relationships between biodiversity of different taxa, ecosystem processes and land-use types at different geographical scales. The main focus of the project is on grassland and forest vegetation. Grassland habitats as well as forests have undergone massive changes in the last decades partly as a result of changing management practices or abandonment, increased nutrient input and climate change. Our aim in the present study is to analyse the magnitude of these changes and to relate them to specific environmental factors and plant species properties. From the large database we have analysed two representative subsets of distinct vegetation types (Beech forest: *Fagion*, 2221 relevés; Semi-dry grassland: *Mesobromion*, 5222 relevés) comprising published and unpublished relevés from various authors and different years. As a measure for temporal change, we calculated the relative frequency of all phanerogamous species for every year and tested for an increase or decrease in relative frequency by applying generalized linear regression models. In the *Mesobromion* dataset 66 species showed a significant decrease or increase, whereas in the *Fagion* dataset 61 species exhibited a significant temporal trend. A common feature of both sets was a decrease of species characteristic of nutrient poor conditions, seen in lower Ellenberg N indicator values of decreasing compared to increasing species. In addition, the temporal trends in the *Mesobromion* reflected altered management practices, and in particular increasing degree of abandonment. In the *Fagion* dataset, the increasing and decreasing species indicated changes in forest structure and increased nutrient and temperature regime. This analysis points to the value of vegetation databases as historic archives of environmental conditions. In particular, the combination with trait databases offers new approaches to relate observed changes to underlying causes.

# HOW FLORA CHANGES WHEN MANAGEMENT ALTERATES: HALF-CENTURY RECORDS FROM ESTONIA

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Abandonment, afforestation, drainage and fertilization are the main changes that have influenced Estonian grasslands in the 20th century. Most of these processes lead to the loss of grassland habitats and to decline of species-richness. Using the vegetation map compiled for Estonia in 1934-1950 (along with species lists are available from the same period), raster images from the 1950s and basic map from 2002 we described the dynamics of species-rich grasslands in two ~500 km<sup>2</sup> regions of Estonia which differ in historical land use. In the 1950s, the grasslands in Central-Estonia were larger than in Southern-Estonia, but this difference has disappeared by now.

Our aim was to evaluate how such a process of homogenization has influenced contemporary species composition. Our analysis revealed fragmentation of former species-rich semi-natural grasslands. In Central-Estonia, original grasslands were divided into 2.3 fragments on average during the study period and the total remnant area was 100 times smaller than the original. In Southern-Estonia, original grasslands were divided into 2.0 fragments and their area has decreased 7 times on average.

Further analysis showed that 60% of species-rich grasslands in Central-Estonia has turned to forest and 25% to arable land. The changes in Southern-Estonia have been different, 30% of grassland area is arable land and 25% is forest. We found that the similarity in species composition between two study periods was only 13% (Jaccard similarity index) in Central-Estonia and 10% in Southern-Estonia. It revealed that beside the lost species some typical grassland species were less frequent compared to the 1950s, while some ruderal and nitrophilous species were more frequent in 2009.

We will present changes in distribution of species specializing to different habitat types (grassland species, ruderal species etc.) and emphasize the dynamics of grassland species in light of general changes in land use.



# A COMPARISON OF TWO SAMPLING SCHEMES IN PHYTOSOCIOLOGY - PREFERENTIAL AND STRATIFIED RANDOM

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Sampling design is an important issue in phytosociological methodology. Preferentially positioned relevés, which prevail in phytosociological databases, can provide biased results due to different author's experience or judgment. Therefore, the stratified-random sampling design is considered as a promising alternative. The aim of this study is to compare effects of preferential and random stratified sampling on the results of vegetation studies. Two parallel analyses of forest vegetation were performed in two different areas of the Czech Republic, comparing random-stratified data sets with a selection of relevés of forest vegetation from the same areas, obtained from the Czech National Phytosociological Database. The following properties of these datasets were compared: 1) number and percentage cover of vascular plant species per relevé, 2) number, percentage cover and proportional number of endangered species per relevé, 3) number, percentage cover and proportional number of invasive species per relevé, 4) number, percentage cover and proportional number of neophytes per relevé, 5) sample rarefaction curves for all species, endangered species, invasive species and neophytes 6) beta diversity, calculated as mean Jaccard dissimilarity and 7) patterns in ordination diagrams. The analysis showed that in the preferentially sampled relevés the number, percentage cover and proportional number of endangered species per relevé, as well as beta diversity, were higher than in the relevés sampled following the stratified-random design. However, the properties regarding the vascular plant species, invasive species and neophytes provided inconsistent results (i.e. differences between the two datasets were significant only in one study area), partly depending on the purpose of original studies and local idiosyncrasies of the two studied areas.

# SPECIES COMPOSITION OF CEREAL FIELDS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS AND MANAGEMENT REGIME IN CENTRAL ITALY

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Crop production systems in Central Italy can be characterized by considerable heterogeneity. There are huge, nearly weedless intensive fields, while many low-input agricultural systems can also be found. Similar diversity can be experienced in the geography of the region, since arable fields are distributed from the sea level to the high mountain ranges. In this study, 76 arable fields (in total 760 x 1 square metre plots) were sampled in the regions of Marche and Umbria. Explanatory variables were recorded for each field, reflecting 1) large-scale spatial trends, 2) site specific, abiotic environmental conditions, 3) local biotic and field management characters. The specific objectives of this study were (a) to determine the relative importance of environmental variables and field management regime on weed species composition and richness, (b) to analyse the effects of the employed explanatory variables on species composition.

The relationship between environmental factors and species composition of arable fields was examined by redundancy analysis. Effects of environmental variables on intensive and extensive fields are supposed to differ; therefore the data set was divided into two parts according to management regime. Importance of environmental factors was tested for the total data set and separately for the two subsets as well. Significant variables and species richness were compared between management types. Most of the explained variation in weed species composition was related to large scale spatial trends (altitude, distance from sea, mean annual precipitation and temperature) in both intensive and low input systems. Numerous site specific, abiotic environmental conditions (physical character and nutrient content of soil, exposition and slope of fields) also explained a large part of the total variation, especially in case of low-input fields. The least variation of the whole dataset was explained by local biotic and field management characters (field size, type, rotation, cover, height of crop) and nearly all of them influenced only the low-input fields. Nevertheless, it must be mentioned that one of the most important explanatory variables (from this latter group) for the whole dataset is the regime of management (low-input or intensive). There were significant differences between the species composition and richness of low-input and intensive fields.



# BIOCLIMATIC INTERPRETATION OF HABITAT DISTRIBUTION IN A HILLY LANDSCAPE OF THE PANNONIAN ECOREGION

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Bioclimatic models are widely used tools for assessing plant or vegetation responses to the environment. Parameters derived from temperature and precipitation data were created in order to generate more biologically meaningful variables for the interpretations. The BIOCLIM model which represents annual trends, seasonality and extreme or limiting environmental factors, connected with occurrence of vegetation types was used for the analyses. In South-Transdanubia, as a prominent hilly landscape of Hungary in the Pannonian Ecoregion, correlations were revealed between 59 MÉTA habitat types and regional ranges of bioclimatic variables. Our aim was to evaluate to what extent can bioclimatic conditions can affect actual habitat distribution in this region. Relations of semi-natural habitat types with positive significance pointed out to vegetation complexes among woody (e.g. closed and open dry deciduous forests) and non-woody habitat types (e.g. marshes and mesotrophic meadows). Because of the correlations among some bioclimatic parameters, functional subsets of them were used for characterizing the effects of temperature and humidity conditions on habitat occurrence. Under the recent past climatic period (1960-1990), third of habitat types were established to be directly influenced by climatic conditions. Among representative woody habitat types of the region (e.g. riverine or swamp woodlands, mesic deciduous woodlands) there was a number of negative correlations with terms of temperature group, and some positive correlations with terms of precipitation group, especially by a strong negative correlation with seasonality variables. Several non-woody habitat types (e.g. marshes, eu- and mesotrophic meadows and tall herbs) could have been characterized by selected bioclimatic variables of temperature group by positive and negative correlation merely. According to our results, significant woody habitat types - riverine and swamp woodlands, mesic deciduous woodlands - are controlled by climatic temperature and precipitation. Among significant non-woody habitat types, marshes are also controlled by both climatic and edaphic conditions in this region. Relations between relevant habitat types and climatic variables were visualized using the GIS software DigiTerra Map. BIOCLIM variables can be properly used to predict potential vegetation responses under several climate scenarios in the future.

# AN ANNOTATED GEOGRAPHICAL CHECKLIST OF THE ITALIAN SYNTAXA

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A database on the geographical distribution of lower-rank syntaxa of the Italian vegetation is presented.

Plant communities quoted at the level of association in the available literature are stored in a grid of Operational Geographic Units (OGU) corresponding to the quadrates of the Italian floristic grid. Each square of the grid encompasses both precise GPS localization of relevés as well as descriptive records of locations or distribution areas of relevés or communities.

A geographical synopsis of lower-rank syntaxa of the Italian vegetation is obtained.

The structure of the data-model is used to produce presence-absence matrices for quantitative analysis of the distribution of associations or any syntaxon of higher rank according to the syntaxonomical system.

Geostatistical analysis using geographical information systems is attempted in order to parameterize associations at the landscape level (OGU level). For the parametrical analysis, parallel geographical grids are tested.

Applications of the database enable us to explore patterns of similarity among the distributions of different associations (chorological groups of associations, provincialism), patterns of geographic changes in community distribution along topographical gradients and to test changes in the physical scenario of selected individual communities along geographical gradients. A different insight in the patterns of synonymy and reassessment among syntaxa on the basis of a geographical treatise is expected.



# (SUB-)REGIONAL DISTRIBUTION PATTERN AND PHYTOCOENOLOGICAL SCALE OF A (SUB-) COSMOPOLITAN AQUATIC SPECIES: *WOLFFIA ARHIZA* IN POLAND

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*Wolffia arhiza* (spotless watermeal), the smallest vascular plant species, is also known for its more or less worldwide geographical distribution (with native or naturalized localities reported from at least 5 continents: Europe, Africa, Asia, N. America and Australia). Considering the tiny size of this little floating aquatic plant, its ability to proliferate vegetatively, and other adaptations to freshwater environments, there should be no surprise that the species has been reported from many countries. However, there is no published map of global, as well as European range of *W. arhiza*.

In Europe, where spotless watermeal has been reported from many sites, it is often regarded as a rare and threatened species, e.g. in: parts of Poland, Germany, Czech Republic, Spain, or Croatia, whereas in some other countries (e.g. in Hungary) it is sometimes considered to be rather expansive. In this context some basic questions arise: whether this is a 'natural rarity' or 'ephemeral' character of the species or rather a reflection of our poor knowledge on regional distribution of this not-easily perceptible plant, or perhaps indeed the number of localities of *W. arhiza* has recently increased at least in some areas? Another important question is whether the rarity of the species in some regions may be attributed to certain natural reasons or if the species chorology has more or less detectable ecological backgrounds?

I believe such and similar questions need consideration in both phytogeographical and ecological studies which should be carried out also in sub-regional or local scales.

In this presentation I would like to include: (1) an outline summary of what is generally known about the spotless watermeal range in Europe; (2) an updated national distribution map (a cartogram) of *Wolffia arhiza* in Poland; (3) a regional and sub-regional interpretation of the species distribution pattern and (4) its ecological backgrounds, i.e. the species' phytocoenological scale derived from recent observations in middle part of Wielkopolska (Western Poland). The presented general results are based on a critical survey of botanical literature supplemented by some unpublished observations from the last decade, whereas the detailed analysis was made using my unpublished field data from investigations carried out in 2007-2009 in the valley of the River Warta (central Wielkopolska, Poland).

# THE AQUATIC VEGETATION OF THE DANUBE RIVER'S BASIN IN BULGARIA – CLASSIFICATION, ECOLOGICAL PECULIARITIES AND PROBLEMS

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The most representative region in Bulgaria for the distribution of the typical freshwater vegetation is the Danube River and the Danube's former floodplains. Most of the typical syntaxa, established in this region, from the classes of Lemnetea (7 associations), Potametea (13 associations), Charetea (1 community) and Phragmitetea (12 associations) are well-known and widespread in central and other parts of Europe. But there are also some specific peculiarities especially in the syntaxa from Isoeto-Nanojuncetea (probably 3 or 4 associations). The differences are determined from the specific climatic and water conditions of the Bulgarian part of Danube River, where the influence of the Mediterranean climate is a stronger one than in Middle Europe. The distribution of the typical aquatic vegetation (the classes of Lemnetea, Potametea, Charetea) in Bulgaria (including and mostly along the Danube River) has been dramatically reduced during the last 60 years. The surviving natural wetlands now are 1/20 part from their former range in Bulgaria. On the territories of some former wetlands along the Danube River, the areas occupied from the communities of Phragmitetea were increased on the places of the typical aquatic vegetation, because of the drainages and other negative human activities. The communities of Isoeto-Nanojuncetea are negatively impacted from the big hydro-power plant „Iron Gate” between Serbia and Romania, which causes non natural and big changes in the water level of Danube River.



# DISPERSAL LIMITATION OF EUROPEAN BEECH FOREST SPECIES: WHAT PHYTOSOCIOLOGICAL DATA TELL US ABOUT POST-GLACIAL MIGRATION

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The post-glacial migration of European beech (*Fagus sylvatica*) has been addressed by many studies using either genetic or fossil data or a combination of both. In contrast to this, only little is known about the migration history of its understorey species. In a review of phytosociological literature, we identified 110 species with a high fidelity to beech forests. The distribution range of European beech forests was divided into 40 geographical regions, and the presence or absence of each species was recorded for each region. We compared overall species numbers per region and numbers of narrow-range species (species present in < 10 regions). A multiple regression model was used to test for the explanatory value of three potential diversity controls: range in elevation, soil type diversity, and distance to the nearest potential refuge area. Hierarchical clustering of the narrow-range species was performed.

The highest number of "beech forest species" are found in the S Alps, the N Apennines, and the NW Dinaric mountains. With increasing distance from this centre of diversity, species numbers are decreasing, reaching minimum in NW and N Europe. When only narrow-range species are taken into consideration, the highest species diversity is observed in the S Apennines, and although the S Alps, N Apennines, and NW Dinaric mountains still reach high species numbers, secondary maxima are found in N Spain, the Carpathians, and Greece. Distance to the nearest potential refuge area is the strongest predictor of beech forest species richness, while altitudinal range and soil type diversity had little or no predictive value. Cluster analysis of the narrow-range species revealed six main geographical clusters which are in good concordance with the glacial refuge areas of beech and other temperate tree species as estimated in recent studies.

Our findings support the hypothesis that the distribution of many beech forest species is limited by post-glacial dispersal rather than by their environmental requirements. The results provide also evidence that most of the studied species have been closely affiliated with beech for at least one glacial cycle, and that the current distribution of understorey species is a good indicator for the localisation of glacial refuge areas of temperate forests.



# LECTURES

VEGETATION OF  
EUROPEAN RIVERS  
AND FLOODPLAINS

# GRASSLANDS COMMUNITIES STRUCTURE VARIES WITH FLOODING REGIME AND MANAGEMENT: EXAMPLE FROM THE LOW LOIRE VALLEY (FRANCE)

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Situated in the north-west region in France, a large habitat diversity spread along the 220 km of the low Loire valley. Flood plain grasslands inhabited a major part of the alluvial plain (50% of the riverbed) and are generally surrounded by a dense landscape network while they may somehow appear as large open field areas. Other habitats are mudflats, reed beds, sandbanks and poplar plantations. Oxbow lakes can also be found along the river together with islands of various surfaces. In the estuarine portion of the valley, submitted to tidal influences, vegetation is made of halophyte and sub-halophyte plant communities. Phytosociological analysis were carried out and identified several habitats of Community Interest within the EU territory. Accordingly, Natura 2000 areas have been identified and delimited. Wet grasslands belong to Thermo-Atlantic grasslands type. They showed contrast in their structure according to their elevation position and mesophilous, meso-hygrophilous and hygrophilous communities have been distinguished. Vegetation was described along transects following the elevation gradient which represents different flooding regimes. Grassland communities were characterized using Ellenberg moisture values. These grasslands are submitted to agro-environmental schemes and are managed either by grazing, mowing or both. Vegetation composition and structure were analyzed according to management practices in order to distinguish the management type which appear favourable to the grassland conservation value sensu Habitats Directive and to better identified requirement for species of particular conservation value.



# FLOODPLAIN FORESTS ALONG THE MURA RIVER IN SLOVENIA

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The study took place along the Mura river in eastern Slovenia, on the banks of the Mura river. This part of Slovenia has continental climate: the mean annual precipitation is 800 mm and mean annual temperature is 9,2 °C. We defined floodplain forests as forests where water table is usually at or near the surface, and land is covered periodically or at least occasionally with shallow water.

We searched for the main forest vegetation types on river banks of river Mura and investigated the main ecological gradients in these forests. We tested whether the main vegetation types and ecological gradients can be detected in the area explained by water distance and we modelled response curves of the main edifiers of the forests.

The relevés from the region have been subject to analyses performed by standard programs for vegetation analysis, such as Arc-Map, CANOCO, Pc-Ord, Statistica, Syn-Tax etc.

The classification of the flooded forests of river Mura has revealed three clusters corresponding to three associations; *Salicetum albae* ISSLER 1926, *Fraxino-Ulmetum effusae* SLAVNIČ 1952 var. *Prunus padus* VUKELIĆ et BARIČEVIĆ 2004, *Genisto elatae-Quercetum roboris* HORVAT 1938 *carpinetosum betuli* HORVAT 1938. This three associations thrive along moisture and nutrient gradient presented by Ellenberg indicator values, being *Salicetum* on the most humid sites over *Fraxino-Ulmetum* to *Genisto-Quercetum* on the driest. Moisture and nutrient indicator values have been correlated to distance from the main stream of the river Mura and from the nearest water stream. Both nutrient and moisture are negatively correlated to both distances. At the same time, it has been established that *Salicetum albae* has been found near to the water and *Genisto-Quercetum* at the most distant sites, whereas *Fraxino-Ulmetum* has an intermediate position. In the case of life forms, correlation with distance from the main stream has been very highly significant only in the case of therophytes. The proportion of neophytes is strongly significantly, negatively correlated with distance from the nearest stream. Species response curves fitted using HOF models describe relationships between the main tree species of flooded forests and environmental variables distance from the main stream and distance the nearest stream. *Carpinus betulus* and *Quercus robur* respond to both distances, *Fraxinus angustifolia* does not respond to neither of them and *Salix alba* and *Populus nigra* respond only to distance from the main stream.

# MICROREGIONAL VEGETATION PATTERN OF THE FLOODPLAINS OF THE GREAT HUNGARIAN PLAIN ON THE SAMPLE AREAS OF CSONGRÁD COUNTY

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Csongrád county situated in the Great Hungarian Plain in Southeast Hungary has three main rivers (Tisza, Hármas-Körös, Maros). Their floodplains belong to the Crisicum Flora District of the Pannonian floristic province. The aim of my research was to specify the border of floodplain microregions, identify their habitat-composition with complex landscape ecological analysis using data of surface deposits, genetic soil-types, geomorphology, hydrogeography and vegetation. The landscape-level vegetation-pattern was studied with 35 ha-sized, hexagonal-grid based MÉTA-maps (Hungarian Habitat Map Database), whereas the local habitat patterns with 1:4000 vectoric maps. I ordered the habitats according to their typical patterns, role in zonation and connections of biogeocological factors into habitat-complexes and more comprehensive vegetational landscape-types. Five vegetational landscape-types were identified which are the active floodplain (active floodplain's oxbow-lakes; navyy-holes; grassland, forest, arable land and orchard mosaics of active floodplain; river-banks; dyke-vegetation); the saved-side non-saline low floodplain (saved-side oxbow lakes; mosaics of non-saline grasslands, swamps and forests; saved-side low floodplains with channels, boundaries and arable lands); the floodplain moor-landscape (mixed eutrophic and moor-lake wetlands at loessland-border; mosaics of moor and floodplain habitats at sandland-border); the saved-side low floodplain secondary saline landscape (*Achillea* and meadow-steppe subtypes); the saved-side lag-surfaces of high floodplains (sand and loess lag-surfaces). Five floodplain microregions were identified. The floodplain moor-landscape appears just in the South-Tisza Valley. The floodplain meadows are present in the active floodplain rather in the Hármas-Körös Floodplain and in the upper part of Lower Maros Floodplain as a result of landscape use. The eutrophic reed-grasses, *Butomus*, *Eleocharis*, *Alisma*, *Oenanthe* dominated swamps appear mainly alongside the river Tisza and Hármas-Körös, while the annual wet pioneer vegetation, willow-shrubs and hard-wooden alluvial forests in the Lower Maros Valley. Secondary saline landscapes developed mainly in the South Tisza Valley and in the Hármas-Körös Floodplain. The dominance of the loess-steppe grassland and salt-berm vegetation covered lag-surfaces separates the microregions of Körösszög and Bácsársarok incorporating all the habitats of Crisicum, so the Körösszög has the highest habitat-diversity.



# ENVIRONMENTAL FACTORS INFLUENCING THE FORMATION OF VEGETATION IN MIDDLE-SIZED STREAMS IN LATVIA

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The aim of study was to examine the role of different environmental factors (stream width, depth, substrate, overgrowing, shading and flow type) for formation of macrophyte vegetation in middle-sized lowland streams in Latvia. The composition of the vegetation at 107 stream sites distributed throughout Latvia was studied in summers of 2007- 2009.

Due to the lack of the standardized national method, for macrophyte surveys a methodology developed for the STAR (Standardization of River Classification) project was used. Sampling and sample processing were done according to the STAR protocols. The species composition and abundance of macrophytes were estimated using a nine-degree scale.

The stream stretches studied can be grouped into five groups with different stream velocity and substrates: (1) fast flowing streams on gravelly substrate, (2) slow flowing streams on gravelly substrate, (3) fast flowing streams on sandy substrate, (4) slow flowing streams on sandy substrate and (5) slow flowing streams with soft, silty substrate.

The results confirm that each stream group has different primary factors controlling diversity and abundance of the macrophytes in streams. In fast and slow flowing streams on gravelly substrate there are mostly bryophytes and sparse helophyte stands. In narrow, fast flowing streams the formation of aquatic vegetation is limited by stream velocity and shading created by the river banks. More diverse species composition and denser macrophyte cover are characteristic for slow flowing streams on gravelly and stony substrates, particularly if the depth of water does not exceed one meter. The macrophyte composition in streams on sandy substrate significantly differed from the other sites. In fast flowing streams on sandy substrate the macrophyte composition was species poor, with sparse cover. In such streams typically *Sparganium emersum* and *Elodea canadensis* dominate. Due to higher stream velocity, unstable substrate and strong effect of the spring floods conditions for the vegetation formation in fast flowing streams on sandy substrate are inappropriate.

The most frequent species in the investigated streams were *Sparganium emersum*, *Sparganium erectum* s.l., *Veronica beccabunga*, *Nuphar lutea*, as well as the invasive species *Elodea canadensis*. The species richness ranged from 1 to 24 species per site.

# THE INFLUENCE OF CLIMATIC CONDITIONS TO DISTRIBUTION OF FLOODPLAIN VEGETATION IN THE FOREST AND FOREST-STEPPE ZONES OF THE PLAIN PART OF UKRAINE

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Meadow vegetation is the prevailing type of vegetation in floodplains of the forest and forest-steppe zones of the plain regions of Ukraine. The meadow vegetation of the floodplains of the 36 large and middle rivers has been studied during 2008-2009 with the aim of determination of the peculiarities of its territorial distribution in compliance with environment conditions. The relevés were made in transects 5 m wide across the floodplain with plot size of 25 m<sup>2</sup> (in rare cases of 16 m<sup>2</sup>). 704 relevés were used for analysis and processed by TWINSPAN modified algorithm in JUICE program. The range of altitude, latitude and longitude for syntaxa were calculated in STATISTICA software. As a result, we obtained 16 clusters which corresponded to alliance level within *Molinio-Arrhenatheretea* and *Phragmito-Magnocaricetea* classes in the most cases, two clusters corresponded to class level (*Koelerio-Corynephoretea* and *Festuco-Puccinellietea*) and two alliances (*Festucion pratensis* and *Alopecurion pratense*) included several clusters (two and three respectively) taking into account their considerable distribution and amplitude. The distribution of syntaxa in dependence on altitude has been revealed that communities of *Trifolion montani*, *Agrostio stoloniferae-Beckmannion eruciformis* (*Festuco-Puccinellietea*) and two types of *Festucion* (xerophytic and halophytic) are preferred the sites with lower altitude, but *Cynosurion*, *Molinion* and *Deschampsion* – more high sites. The analysis of the latitudinal distribution of syntaxa has shown that communities of *Corynephorion*, *Cynosurion*, *Sparganio-Glycerion*, *Molinion* and *Deschampsion* prefer more northern regions, but communities of halophytic vegetation (halophytic types of *Festucion* and *Alopecurion* also *Agrostio stoloniferae-Beckmannion eruciformis*) have a propensity to more southern regions. The longitudinal distribution of syntaxa revealed that communities of *Corynephorion*, *Cynosurion*, *Molinion* and *Deschampsion* are more distributed in western regions, but *Trifolion montani*, xerophytic and halophytic types of *Festucion* and *Agrostio stoloniferae-Beckmannion eruciformis* – in eastern regions. Thus, the role of climate in the differentiation of the floodplain meadow vegetation is considerable in spite of well known azonality of such vegetation. It can be explained by the changes of the environment conditions under the gradients of aridity-humidity and oceanic-continental climate.



# ECOLOGY AND REGENERATION OF ALLUVIAL FOREST COMMUNITIES IN NORTHWESTERN AZERBAIJAN

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We studied forest structure, species composition, regeneration and successional trends of alluvial forest communities in northwestern Azerbaijan on the southern slope of the eastern Greater Caucasus. The alluvial forests are developed on a fan system with a convex cross-section and an altitudinal range from 600 to 200 m a.s.l. along the total length of the system of about 10 km. Based on 71 vegetation samples and 59 samples of forest structure eight plant communities were distinguished by means of a cluster analysis. Indirect ordination revealed that location on the fan, water supply and soil texture were the most important factors for the establishment of the different vegetation types.

By restricting the dataset to established mature woody species on the one hand (canopy) and to the respective regeneration of woody species on the other hand we analyzed potential successional trends within the forest stands. The strongest compositional difference between canopy and regeneration occurred within poplar stands, while the hardwood communities dominated by different trees (*Quercus*, *Carpinus*, *Fraxinus*, *Acer*, *Pterocarya*) appear to be more stable in terms of successional trends. Stands of *Populus nigra* and *P. alba* are restricted to frequently flooded sites next to the riverbed. Their regeneration strongly depends on the presence of bare soils created by natural river dynamics. In case of vanishing river dynamics different hardwood communities replace *Populus* stands regardless of the groundwater level. Our results underline the importance of natural dynamics for the regeneration of typical floodplain species like *Populus nigra* that is highly threatened in Central Europe because of extensive river regulation measures.

# SPECIES COMPETITIVE RESPONSES ALONG FLOODING GRADIENT

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Plant communities are controlled by assembly rules corresponding to abiotic and biotic filters acting on the species pool. Along flooding gradients, both species tolerance and plant-plant interactions could be modified. Wet grasslands submitted to a gradient of flooding duration have thus been chosen to investigate assembly rules and in particular, the tradeoff between competitive abilities of species and their ability to tolerate constraint in the framework provided by the niche concept. We hypothesized that the variation in species competitive responses is related to the intensity of the abiotic constraint, here the flooding duration.

An in situ experiment was designed to distinguish the relative importance in abiotic factors and plant-plant interactions in the structure of three communities along a flooding gradient (hygrophyllous, mesohydrophyllous and mesophyllous). Fundamental and realized niches of 12 species characteristic of these communities have been accordingly determined.

Fundamental niches differed significantly amongst species along the flooding conditions gradient. As expected, the range of the species niche has been found to be modified with the presence of competitor for many species. Furthermore, an increase of the intensity of the flooding constraint (i.e. the height of water or the flooding duration) led to the reduction of the competitive interactions magnitude.

As expected hypothesis, the tradeoff between stress tolerance and competitive abilities explains plant communities pattern of presence observed in situ. For example, species like *Glyceria fluitans* are restricted to the long-flooded zones of the gradient, as they show poor competitive ability when exposed to more competitive species. This experiment shows that the ecological niche concept is useful for the understanding of assembly rules of communities along a constraint gradient and provided testable hypothesis.



# FLOOD-PLAIN FORESTS OF THE KAMCHATKA PENINSULA (RUSSIAN FAR EAST) AND THEIR DYNAMICS

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Flood-plain forest communities of Kamchatka Peninsula are formed by *Salix udensis* (Japanese fantail willow), *S. schwerinii* (Schwerin willow), *Alnus hirsuta* (Manchurian alder), *Populus suaveolens* (Mongolian poplar) and *Chosenia arbutifolia*. Several dominant types of riparian woods are found: pure *Chosenia arbutifolia*, mixed *Ch. arbutifolia* and *Populus suaveolens*, pure *P. suaveolens*, mixed *P. suaveolens* and *Alnus hirsuta*, pure *A. hirsuta*, mixed *Salix udensis* and *S. schwerinii* and pure *S. udensis* communities. The riparian woods were studied on 140 sample plots (20 x 20 m); their ecology and structure were described. The floristic composition was represented by 76 species of vascular plants, 102 species of bryophytes and 153 species of epiphytic lichens. The herbaceous layer included large herbs and grasses: *Urtica platyphylla*, *Filipendula camtschatica*, *Senecio cannabifolius*, *Calamagrostis langsdorffii* and *Matteuccia struthiopteris*. The plant community classification was elaborated taking into account not only the floristic composition but also the abundance of species. The syntaxonomic range of relevant groups obtained was ranked according to the Russian phytosociological tradition. The vegetation was classified into 9 associations and 4 formations. By the means of Braun-Blanquet approach the arborescent galleries of tall willows, chosenia and poplar were placed into the alliance *Chosenion arbutifoliae* SINELNIKOVA 1995 of the order *Populetalia laurifolio-suaveolentis* MIRKIN *et al.* of the class *Salicetea purpurea* MOOR 1958. Alder woods were considered to be vicariants of the alliance *Alnion incanae* PAWLOWSKI *et al.* 1928 of the class *Quercu-Fagetea*. The dynamics patterns of riparian forests were analysed. Chosenia and willow pioneer communities thrive with regular deep watering. Their seeds usually germinate on fresh pebble deposits at the flowing water edge. Chosenia groves emerge on river pebbles in 10-20 years. The period of their intensive growth lasts about 30-35 years. Chosenia trees are not long-lived and start to decline at the age of 70-80 years. Poplar often grows in mixed groves with chosenia. The period of poplar trees growth lasts about 110 years; at the age of 140-150 years they start to decline. Poplar communities tend to take over and succeed the chosenia groves. Alder woods are met in the central part of the flood-plain, beside terraces. The plant succession of flood-plain communities is closely related to the river valley dynamics.

# STRUCTURE AND SPECIES COMPOSITION OF PASTURED ALLUVIAL FORESTS ALONG THE KURA RIVER IN AZERBAIJAN (CAUCASUS)

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Extended floodplain forests made up of *Populus alba* and *P. nigra* intermixed with oak forests still exist at the middle reaches of the Kura river in the Transcaucasian depression. The forests are on the one hand effected by unregulated natural dynamics of the braided plain river and on the other hand by permanent grazing of water buffaloes, cattle and sheep. These circumstances offer the possibility to study ancient woodland types that were widespread in European floodplains until rivers were regulated and agriculture as well as forestry intensified. Furthermore, the analysed forests represent a link between Central European floodplain forests and the Irano-Turanian Tugai forests of Central Asia that are characterised by softwoods only.

Based on 37 vegetation relevés in combination with data on stand structure the forests are described and the influence of site conditions as well as utilisation pressure is analysed by multivariate ordination. A total of 196 vascular plant species – among them 44 woody plants – were recorded. Cluster analysis revealed five vegetation types that can be in parts interpreted as a succession line from softwood to hardwood forests: Young *Tamarix ramosissima*–*Populus nigra* stands are the initial forest state on islands and at the riverside. They develop into high grown *Populus alba* forests rich in lianas like *Smilax excelsa*, *Periploca graeca* and *Vitis vinifera*. In older poplar stands *Quercus robur* becomes predominating and is associated with *Crataegus* sp., *Pyrus* sp. and *Malus orientalis* promoted by livestock grazing. The formerly widespread *Ulmus minor* is frequently present in older floodplain forests but with only small stems. Annual herb species and grasses from the adjacent steppes form the understorey vegetation of the park-like and strongly grazed *Quercus robur* forests on the terraces, that are fed by groundwater. Zonal forests are absent in this semi-arid landscape.



# LANDSCAPE HISTORY AND VEGETATION DYNAMICS BY THE RIVER TISZA, HUNGARY

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The second longest river of Hungary and the Carpathian Basin is the Tisza which crosses the Great Hungarian Plain. Observing the landscape history of the Tisza, the last 250 years can be divided into three parts: 1. Traditional use of the landscape without alien species (until the middle of the 20<sup>th</sup> century). 2. Traditional use of the landscape after invasion of alien species (from the middle of the 20<sup>th</sup> century to the 80's). 3. Abandonment of the traditional use after invasion of alien species (from the end of the 80's). Until the beginning of the 20th century, floodplain meadows dominated the structure of the landscape. From the 1930's, the replacement of the floodplain meadows and native woodlands with plantations of alien species (*Populus × euramericana*, *Acer negundo*, *Fraxinus pennsylvanica*) and the establishment of large-scale cultivation on the floodway also commenced at this time. At the end of the 1980's simultaneously with the abandonment of the remainder pastures and haymeadows, the cultivation of several arable fields also ceased, and these areas were invaded in a few years by the previously introduced indigo bush (*Amorpha fruticosa*). The sudden increase in the amount of propagules, together with the high-level floods of the late 1990's, led to the serious infestation of all the grasslands, wooded hayfields and woodlands. To look at these large scale processes, we prepared and analysed a habitat map, which was made on a 18 km section along the Tisza river. Nowadays 62% of the habitat patches are woodlands and plantations while before the 1950's only 13% were woodland. In the 1880's, 56% of the habitat patches were meadows, whereas today 15%. These patches have the highest nature conservation value and they are the "oldest" habitats, because 88% of them are continuously meadow habitats from 1880. Although the habitats of the analysed sites are valuable locally, they are devastated by invasive alien species. 49% of the abandoned arable fields are non native woodlands or indigo bush, and 99% of the woodland patches are affected by invasive species. The continuous alterations of the landscape instigated to control the river system, have led to unprecedented change. This has had an impact on the competition between the species and has caused the loss of a number of habitats. The value of the landscape is vanishing even more seriously before our very eyes. The land-use will significantly determine the destiny of this region in the future, just as it did in the past.



# LECTURES

USE AND ABUSE OF  
ECOLOGICAL  
INDICATOR VALUES

# CHANGES IN ELLENBERG INDICATOR VALUES AFTER 65 YEARS OF FERTILIZER APPLICATION IN A GRASSLAND: REAL TRENDS VERSUS ARTEFACTS

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As environmental factors are often correlated in the nature, observational approaches can fail to reveal factors that causally affect species composition of vegetation. Species indicator values like Ellenberg's are based on observations of species occurrences across habitats, therefore they also suffer from this problem. Experiments can distinguish real causalities from non-causal correlations, but their duration is usually too short to allow for development of full species composition of relatively stable plant communities as we find them in the nature. Therefore data from long-term experiments are extremely valuable.

The Rengen Grassland Experiment is the oldest well designed fertilizer experiment in Central Europe. It was established in an oligotrophic grassland in the Eifel Mountains, West Germany in 1941. Six fertilizer treatments (Ca, CaN, CaNP, CaNP-KCl, CaNP-K<sub>2</sub>SO<sub>4</sub>, and unfertilized control) were applied annually in five complete randomized blocks.

We sampled species composition of experimental plots in 2006, compared it with phytosociological associations and calculated mean Ellenberg indicator values (EIVs) for each treatment. The control plots supported oligotrophic *Nardus* grassland (*Polygalo-Nardetum*, *Violion caninae*). Vegetation in the Ca and CaN treatments resembled montane meadows of *Geranio-Trisetetum* (*Polygono-Trisetion*). Transitional types between *Poo-Trisetetum* and *Arrhenatheretum* (both *Arrhenatherion*) developed in the CaNP treatment. In the CaNP-KCl and CaNP-K<sub>2</sub>SO<sub>4</sub> treatments, vegetation corresponded to the mesotrophic *Arrhenatheretum* meadow. Major discontinuity in species composition was found between control, Ca and CaN treatments, and all treatments with P application. Thus, long-term fertilizer application creates plant communities from different phytosociological alliances and classes, even within a distance of a few meters.

EIVs for both nutrients and soil reaction were considerably higher in P treatments than in Ca and CaN treatments. EIVs for nutrients thus indicate availability of P rather than N in this P-limited ecosystem. Surprisingly, control plots had significantly lower EIVs for continentality and moisture, although these factors were not manipulated in the experiment. This shows that due to their correlated nature, EIVs can erroneously indicate changes in factors that actually did not change, but co-varied with factors that did change.



# DIVERSITY RESPONSES TO MANAGEMENT INTENSITY IN BEECH COPPICES IN CENTRAL-APENNINES (ITALY)

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Species number changes refer to only a basic aspect of biodiversity. Exploring the functionality of diversity patterns allows to discover ecological processes acting in the background. We examined the vascular plant diversity responses to different intensity levels of forest management on beech coppices at forest patch and plot scale. Some forest structural parameters were also studied to explain possible diversity differences.

We applied probabilistic sampling in beech forests at four hills (two with still active coppice management and two with abandoned management) at the Monti Sibillini (Apennines, central-Italy). Floristic data were collected in 83 plots (20-22 per each site), each 20m x 20m in size. Species were grouped into Social Behaviour Types (SBT). The species richness of five SBT groups was compared to reveal the functionality of responses to management.

Our results indicate that plots of the compared forest types do not differ in species richness of the studied behaviour groups. Considering bigger spatial scale, surprisingly the species pool of forest specialists is poorer in abandoned coppices respect to active ones. As for forest generalists, the number of pooled species is similar for both management intensity levels on forest patch scale and on plot scale. It proved to be an unforeseen result that the pool of non-forest species is not differing with respect to management. Marginal species have had a minor importance in abandoned coppices at forest scale already, but at the plot level, their richness has similar magnitude as in coppiced forests. There is no difference between differently managed forests at both scales in richness of gap species.

As a structural consequence of the different management, coppiced forest patches have significantly higher cover of emergent trees, higher density of shrubby individuals but less number of subordinated trees.

On higher spatial scale detected impoverished species pool of forest specialist and marginal species is a result of competitive exclusion process acting in maturing, structurally homogenized, closed-canopy abandoned beech coppices. The distinct responses of species groups detected highlight the importance of studying diversity patterns in a more detailed way. These results, especially considering their spatial validity can better help drawing management plans than single plot-scale analyzed simple species richness data.

# CORRELATIONS BETWEEN THE RAMENSKY'S SCALES ESTIMATIONS FOR FOREST COMMUNITIES AND MEASURED ECOLOGICAL SITE PARAMETERS

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Soil fertility indices for 380 sample plots located at forest communities of NW Russia were estimated using the Ramensky scale. At the same sample plots the thickness of morphological soil horizons down to 0,5 m depth was measured at 20 points, granulometric composition was estimated and the mixed samples for chemical analyses from each horizon were taken. In the soil cut of 1-1,3 m depth the deepest soil horizons were measured and analysed. As a result, for each sample plot the concentration of nitrogen and its amount per hectare in 1 m and 0.2 m layers were estimated using the chemical analyses.

Correlations between the Ramensky's scales estimations of soil fertility and the concentration of nitrogen and its amount per hectare in the 1 m and 0.2 m were calculated. Strong correlations were found between the Ramensky's scales estimations of soil fertility and the amount of nitrogen per hectare in the 1 m and 0.2 m in case when they were calculated separately for well-drained sites and for paludified forests.

The correlation between Ramensky's estimations of soil moisture and the ground water table were studied at 21 permanent sample plots during 3 seasons. Measuring of the ground water table was carried out every 5 days in spring and autumn and every 10 days in summer. Strong correlations between the Ramensky's scale estimations of soil moisture and the number of days with the ground water table above 20 cm were found.

Strong multiple correlations between the site index (the tree-layer height at the age of 70 years) and the Ramensky's scales estimations of soil moisture and fertility for spruce, pine, and birch were found.

These correlations were used for simulating the forest dynamics in the changing conditions of drainage and fertilization.



# USING ELLENBERG INDICATOR VALUES TO CLASSIFY VEGETATION

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We propose a new non-probabilistic measure of similarity to be used in vegetation science. The measure is based on the concept of ecological similarity, which is to be distinguished from compositional similarity. The measure is analogous to the frequently used Sørensen-Dice's index of compositional similarity, but it uses information on ecological similarities of species to calculate ecological similarities of biotic communities. We show how Ellenberg indicator values may be used and abused to quantify ecological similarities of species and how the new measure may be used to classify vegetation.

# ASSESSING THE IMPACTS OF ENVIRONMENTAL CHANGE ON SCOTTISH UPLAND VEGETATION USING SPECIES ATTRIBUTE ANALYSIS

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Environmental change in the Scottish uplands over recent decades has been rapid and complex, with the effects of multiple and interacting drivers of change impacting on the vegetation. However, quantifying longer-term trends in plant community composition over an ecologically meaningful timescale is a major challenge due to a lack of suitable baseline data. In this study, we exploit a rare opportunity to re-visit plots in key communities of the North-West Highlands first surveyed in 1956-58 in order to investigate the influence of environmental change on observed community change in dwarf-shrub heaths, grasslands, alpine heaths, ombrogenous mires and soligenous mires. Original plot data was extracted from the volume "Plant Communities of the Scottish Highlands" (McVean & Ratcliffe, 1962), which aimed to describe and classify upland plant communities in this area. Species composition change is characterised by increased dominance of generalist upland graminoid species, with reductions in the cover and frequency of dwarf-shrubs, forbs and lichens. We use species attributes, including Ellenberg indicator values, climatic preferences and biogeographic distribution data, to provide a proxy measure for environmental change. The results suggest that over the past 50 years the North-West Highlands, which were previously thought to have remained relatively unchanged, have become warmer and drier with more acidified soil. Species with a hyper-oceanic, oceanic or sub-oceanic element to their distribution have increased at the expense of Arctic-montane and boreo-Arctic-montane species. These results are compared with analyses relating environmental variables to vegetation change, and the similarities and differences between these approaches are discussed.

## References

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# EFFECT OF SPECIES NUMBER AND ECOLOGICAL TOLERANCE ON BIOINDICATION WITH ELLENBERG INDICATOR VALUES

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Several previous studies have suggested that the number of species is probably not very important for estimating EIVs for sites unless there are very few species. However, it is possible that for sites occurring at extreme ends of an environmental gradient, EIV calculated by averaging of EIVs of more species will be shifted towards the middle part of the gradient, because species richer sites involve more generalists, which have their mean value near the middle part of the gradient. In addition, serious errors might result from the fact that species differ in their tolerances to environmental factors (niche breadths) and species with a broad niche (generalists) are poorer indicators than species with a narrow niche (specialists). In this presentation we address these issues by testing the hypotheses that the accuracy of bioindication of site conditions based on EIVs depends on (1) ecological tolerances of species and (2) number of species recorded at a site and involved in the calculation of site values. We used two independent vegetation data sets in which an environmental variable (temperature or pH) corresponding to one of the Ellenberg indicator values was measured. For each site, we computed summarized information about the degree of species specialization. Separately for each data set, we identified relative ecological tolerance of each species along the environmental gradient by calculating species response curves. We tested whether correlation between the mean EIVs for sites and measured environmental variables is better if EIVs are calculated from sites with (1) more species for which EIV is defined, (2) higher degree of species specialization and (3) combination of both conditions. We obtained a clear result: Elimination of records with both small number of species with defined EIVs and low proportion of generalists tended to decrease the data set variation in both tested data sets. To improve accuracy of bioindication of site conditions through EIVs, it would be highly desirable to improve indicator systems by adding some measure of ecological tolerance and using this measure as a weight when calculating site mean EIV values.



# POSTERS

FLORA, VEGETATION,  
ENVIRONMENT  
AND LAND-USE  
AT LARGE SCALE

# SEED BANK COMPOSITION AS AN INDICATOR OF LAND USE DISTURBANCE AND RESILIENCE OF SMALL WETLAND VEGETATION IN EAST AFRICA

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Because of their higher water suitability and better soil properties for agriculture, together with the growing population the use pressure of small wetlands in East Africa is increasing. In this context a multidisciplinary project SWEA (Agricultural use and vulnerability of small wetlands in East Africa) tries to evaluate the dimension of this impacts as well as the influence of socioeconomic aspects on the decision making of the agricultural utilisation of this wetlands. To evaluate the wetland's vegetation resilience under different land use intensities and histories (durations), this work focuses on the analysis of vegetation and the soil seed bank. We sampled in different types of land uses in four wetlands, two in Kenya (Tegu and Rumuruti) and two in Tanzania (Malinda and Lukozi). To evaluate the impact of the land use on the resilience of the vegetation, we also sampled soil seed bank using cores of 113 cm<sup>3</sup> and sampling two soil layers (0-4 and 20-24 cm) and 3 repetitions per plot. The bigger amount of plots was taken in cultivated areas under different land use histories, but we also surveyed other land use types like grasslands and fallow areas and comparing with stands of semi-natural vegetation (mainly *Cyperus papyrus* and *Typha* spp. stand). The preliminary results of seed bank's density and species composition as well as its comparison with the above ground vegetation will be discussed.



# ASSESSMENT OF SPATIAL DISTRIBUTION, COMPOSITION AND STRUCTURE OF FOREST PLANTATIONS IN THE SOUTH-WESTERN PART OF MOSCOW REGION

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During the last centuries forests of the central part of Russian plain were affected by heavy human influence such as felling, fires and agricultural use. At present active suburban construction is expanded near the large cities. The transformation of vegetation cover led to increase of forest fragmentation, to simplification of species and age-classes composition of ecosystems and to change of typological and taxonomic diversities. Forest planting is a way to maintain the natural potential of the area. So the actual problem is to reveal comparative characteristics of natural and artificial reforestation.

In this study, an assessment of an area of 480,000 ha in south-western part of Moscow region is made. Forest plantations which are mostly composed from main forest forming species – Norway spruce and Scotch pine account for 12% of total forest area. We analyzed the spatial distribution of plantations within the study area and their association with relief components and with local landscapes. The assessment of forest plantation structure and composition was made on the basis of forest inventory data, remote sensing data and ground-based measurements. As a result, the actualization of plantation boundaries was made and features of forest plantations which distinguished them from natural forests were detected. Our objective was to select age classes that would represent the major structural changes that take place in forest plantation circle. We selected the following age classes: 1) 1-7 years – Pre-thicket stage (before closure of the forest canopy); 2) 8-20 years – Thicket stage (degradation of undercover vegetation due of poor light conditions); 3) 21-40 years – Pole stage; 4) 41-60 years – Closed-maturing (or middle-aged) stage (the stand structure is rather simple with one tree layer); 5) 81-100 years – Mature stage; 6) more 100 years – Old-aged stage (accumulation of dead wood, vertical and horizontal stand structure becomes more complex, etc.).

Our research showed that with the course of time the process of mixed spruce-broadleaved forest restoration took place [1]. But depending on the past land use (whether plantations were established on arable or cutover lands) the processes of forest reconstruction run in different ways.

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# THE SOUTH-EAST EUROPEAN DRY GRASSLAND GROUP (SEEDGG) AND ITS SUPRANATIONAL VEGETATION DATABASE: PROJECT, OVERVIEW OF AVAILABLE DATA AND FIRST ANALYSES

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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, Slovakia, 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<sup>2</sup> 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 Podolia, 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.



# SYNTAXONOMICAL CHECKLIST OF WEED COMMUNITIES OF THE UKRAINE: CLASS *STELLARIETEA MEDIAE*

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Weed communities were studied in the cereal, corn (tobacco, vegetables, maize, sunflower) crops, orchards, vineyards, rose and lavender plantations, nitrophilous ruderal habitats on the territory of the Ukraine, including Ukrainian Carpathians and the Crimean peninsula by different authors in 1982-2008. Weed communities of *Stellarietea mediae* are presented by 92 associations, 5 orders, 19 alliances. Thus, 57 associations, 14 alliances, 4 orders have been revealed in the Crimea (19 associations have been described for the first time), in the Carpathians are 7 associations, 4 alliances, 3 orders (3 associations are new ones). Coenotic richness of synanthropic vegetation and a large part of new syntaxa (47 associations, 5 alliances) are determined by original ecological-geographical, soil-climatic conditions of different zones and belts, and also by variety of the arable cultures. However, the synanthropic vegetation of the Ukraine is characterized by a middle level of coenodiversity unlike the communities described in Western Europe, where more than 49 alliances are identified. *Stellarietea mediae* Tx. et al. in Tx. ex VON ROCHOW 1951 - *Aperetalia spicae-venti* Tx. & Tx. in MALATO-BELIZ et al. 1960: *Scleranthion annui* (KRUS. & VLIEG. 1939) SISS. in WESTH. et al. 1946 (4 ass.); *Centaureion cyani* LACUŠIĆ 1962 (2 ass.); *Papaverion rhoeae* V.SL. 1987 (3 ass.); *Centaureetalia cyani* Tx. et al. in Tx. ex VON ROCHOW 1951: *Anthemio ruthenicae-Sisymbrium orientale* V.SL. 1990 (2 ass.); *Caucalidion lappulae* Tx. ex VON ROCHOW 1951 (3 ass.); *Chenopodio albi-Descurainion sophiae* V.SL. et al. in V.SL. 1988 (3 ass.); *Erysimo repandi-Lycopsion orientalis* V.SL. 1996 (2 ass.); *Atriplici-Chenopodietalia albi* (Tx. 1937) NORDHAGEN 1940; *Amarantho blitoidis-Echinochloion crusgalli* V.SL. 1988 (4 ass.); *Eu-Polygono-Chenopodion polyspermi* KOCH 1926 em SISS. in WESTH. et al. 1946 (5 ass.); *Lactucion tataricae* RUDAKOV in MIRKIN et al. 1985 (1 ass.); *Panico-Setarion* SISS. in WESTH. et al. 1946 (10 ass.); *Polygono-Chenopodion* KOCH 1926 em. SISS. in WESTH. et al. 1946 (4 ass.); *Sisymbrietalia* J.Tx. ex MATUSZK. 1962 em GÖRS 1966: *Atriplicion nitensis* PASSARGE 1978 (6 ass.); *Bromo-Hordeion murini* (ALLORGE 1922) LOHM. 1950 (10 ass.); *Chenopodion glauci* HEJNÝ 1974 (2 ass.); *Chenopodion muralis* BR.-BL. (1931) 1936 (2 ass.); *Malvion neglectae* GUTTE 1972 (3 ass.); *Sisymbrium officinalis* Tx. et al. ex VON ROCHOW 1951 (23 ass.); *Eragrostietalia* Tx. in POII 1966: *Eragrostion* Tx. ex OBERD. 1954 (3 ass.).

# CORRELATION BETWEEN RECENT SEED ASSEMBLAGES AND VEGETATION IN SPRING FENS

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Sediment samples of spring fens are widely used to interpret their historical and recent vegetation. The actual relationship between recent vegetation and seed presence in the soil sample is actually unclear. There are limited species caught in macrofossil analyses. We designed a methodical study to answer some important questions. How many percent of actual vegetation can be recorded in the used fen sample? Is the traditional sample amount (100 ml) representative enough? Does bigger sample bring better interpretation? We study spring fens (*Scheuchzerio-Caricetea fuscae*, *Caricion davalliane*) in the West Carpathians. We collected vegetation and macrofossil samples. Phytosociological records were sampled from the plots of 1 m<sup>2</sup> around macrofossil sample points. Then we recorded the nearest mature individual of a species within 5 m and all species within 50 m. Macrofossil samples were taken from two layers. Surface samples contained recent seed deposition (to 5 cm), the deeper (5-10 cm) seed bank. Three amounts of sediment were taken (100, 200, 300 ml) to find out differences in species number.



# WHY DO THE VERGES OF THE GREAT HUNGARIAN PLAIN HAVE GREAT IMPORTANCE FOR NATURE CONSERVATION?

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In the fragmented agricultural landscape of the Great Hungarian Plain the plant species of Pannonian loess steppe, which show the original vegetation often survived only in verges (boundaries, field margins). Verges are few (on average 2-15, max. 50) meters wide lawn strips running along roads, railways, borderlines and ditches. Two main types of the verges can be distinguished in the landscape: The primary verges take a slice of the original vegetation with several protected or endangered plant species of steppe. The secondary verges are abandoned from arable field, valuable species are found on these habitats only rarely. Our study was undertaken in the Csanádi-hát loess region (SE Hungary) (approx. 940 km<sup>2</sup>). During the 10-year long investigation in each mapping unit of the Central Europaeen Flora Mapping System (approx. 6.5×5.5 km) of this area the average number of the protected plant species was 5.5. Among these species 1.0 (18.6%) species was found only in coherent areas (meadow, forest, arable land etc.), 0.4 species (6.6%) occurred both in coherent areas and verges and 4.2 species (74.9%!) occurred only in verges. In the Csanádi-hát considering the number of habitats and the size of populations 90-100% of the protected plant species *Adonis vernalis*, *Ajuga laxmannii*, *Anchusa barrelieri*, *Clematis integrifolia*, *Inula germanica*, *Oxytropis pilosa*, *Prunus tenella*, *Silene bupleuroides* and the *Vinca herbacea* were found in the verges. Further species *Carduus hamulosus*, *Linaria biebersteinii*, *Ornithogalum brevistylum*, *Phlomis tuberosa*, *Sternbergia colchiciflora* etc. have also significant populations in roadsides and boundaries. At present, the verges are in general not protected. In Csanádi-hát in each mapping unit of the flora mapping system 71.0% of the protected plant species was found in unprotected verges only. These small grassland fragments are supposedly also of great importance in other loess lowland areas (e.g. Central and E Hungary, W Romania, N Serbia). The verges are very endangered because of lack of treatment (mowing, grazing), shrubs, ploughing and pollution. The preservation of the verges needs new nature conservation strategies in the Pannonian Biogeographical Region. Establishment of numerous small nature reserves (including further Natura 2000 sites) in the primary verges is necessary as well as realization of adequate treatment.

# SYNTAXONOMIC STUDIES ON THE RUDERAL PLANT COMMUNITIES IN ÓBUDA AND BÉKÁSMEGYER

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Óbuda and Békásmegyer districts of Budapest are situated in Buda, right side of the Danube River. Considering their structure, extensive building estates and houses with gardens are equally typical. The study area is located on the right side of the narrow belt of the Danube plain that is bordered with Pilis and Buda hills. From a phytogeographical point of view, the area is situated on the border of Praematricum and Pilisiense floristic regions. From geographical point of view, the studied urbanised areas associated directly with hilly areas and Danube floodplain, which are rich in nature conservation values.

Although several papers have been published since the end of the 19th century on the flora and vegetation of the semi natural parts of this area, data on ruderal vegetation in urbanised parts have not been presented yet. Only few floristic publications are available on ruderal habitats.

The aim of this study is to conduct a syntaxonomic survey on the dominant ruderal vegetation on roadsides, edges and street islands. One hundred-seven phytosociological records were carried out according to the standard procedures of the BRAUN-BLANQUET school during the optimal growth stage (flowering) of dominant and characteristic species: in late spring-early summer between 2005 and 2009. Before numerical analyses, the BRAUN-BLANQUET values were transformed according to van der MAAREL. Dissimilarity among relevés was measured by similarity ratio; the clustering method was complete linkage. Numerical analysis was done by the SYNTAX package.

Based on the numerical analyses seven groups of relevés are separated by both ordination and classification. Five of them were identified well; two of them can be considered transitional groups. Two groups belong to the *Onopordion acanthii* alliance; they were indentified as *Carduo-Onopordetum acanthii* and *Carduetum acanthoidis* associations. *Carduus acanthoides* is a characteristic and constant species in both associations, *Onopordum acanthium* is a differential species of the *Carduo-Onopordetum acanthii*. Besides, presence of *Dauco-Melilotion* species can be observed in *Onopordion acanthii* relevés. The third group was identified as an *Echio-Melilotetum albi*, in which *Echium vulgare* and *Melilotus officinale* are diagnostic species. Other well identified groups are *Lepidietum drabae* and *Hordeetum murini* communities. The two transitional groups are characterised by *Sisymbrium*, *Dauco-Melilotion* and *Onopordion* species.



# 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 publically 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<sup>2</sup> (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<sup>2</sup>. 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 7<sup>th</sup> 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.



# THE USE OF THE MARKOV CHAIN MODEL BASED ON MONITORING FOR THE STAND GROWTH PROGNOSIS

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Predicting dynamics of natural resources, including forest, and comparison of alternative strategies in the nature management, are widely recognized applications for modelling. We studied the Oranienbaum Park (the total area is 161 ha) in the North-West part of Russia. The park is located in the southern coast of the Gulf of Finland, 40 kilometres west from St. Petersburg. The broadleaved species (lime, oak and ash) were dominant in the stand composition. The basis for the study was the total enumeration and inventory of 13256 sample trees that were measured (height, DBH, vitality class) and mapped at scale 1:500 twice - in 1981 and 2003.

Increase in DBH in two diameter classes (5-8 cm) through the 22-year time period was the most realistic according the monitoring results for all the vitality class groups of trees. The temporal patterns of changes in vitality classes of lime-trees showed high probability of the shifting from 1<sup>st</sup> and 2<sup>nd</sup> vitality classes to the 2<sup>nd</sup> vitality class. The probability of the transition from the 3<sup>rd</sup> vitality class to the 2<sup>nd</sup> strongly increased when the diameter class increased. The transition probability from the 3<sup>rd</sup> vitality class to the 4<sup>th</sup> (dead trees) increased with the decrease of initial diameter.

Using the Markov Chain Model, we studied the development of the lime and oak stands in the Park. Model verification was done on the independent data, obtained from the two different parks, situated in St. Petersburg. The verification results suggest that the models BROLST1\_lime and BROLS1\_oak could be applied for simulation of other tree species and stands as soon as empirical dataset will become available.

For input data we used (1) the actual distribution of the trees that had the certain vitality and diameter class among the density rang; (2) the empirically obtained transition probabilities of transition of trees over the 22-year time step. The 22 year time-step was dictated by the time period between two consecutive inventories.

The model, in its present form, has good prospects for qualitative and quantitative predictions not only for lime and oak stands in the park but also for other lime and oak stands in the regions with similar climate and soil conditions.

# LAND-USE CHANGE AND REPEATED VEGETATION MAPPING IN ABANDONED VINEYARDS IN THE WESTERN-CSERHÁT

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Successional pressures resulting from reduced human land use and grazing have resulted in vegetation type conversion in the Western-Cserhát. The vegetation of abandoned vineyards on loess soils was investigated in 1997 and again in 2009. During the research we used 2 × 2 m permanent plots to discover the most relevant changes of vegetation. The number of permanent plots was 40, and we made detailed vegetation map at a scale 1:5000. Vegetation types were defined on the basis of their species composition and abundance pattern. The north and west slopes of the hill were different before the research, and during the whole period. Comparison of the two data sets revealed that the vegetation in 1997 differed significantly from the vegetation in 2009. Part of this difference could be explained by secondary succession. Species richness and diversity decreased continuously, and the average total biomass significantly increased during the 12-year-long study. On the north facing slope the analysis showed that species indicating nutrient rich and most humid conditions, like *Cytisus austriacus*, *Dorycnium herbaceum* and *Brachypodium pinnatum*, were more abundant in the 2009 samples than before. Vegetation within this area has shown a tendency toward proliferation of shrubs onto sites that were previously dominated by grasses. On the west facing slope of the hill, the most abundant species was *Andropogon ischaemum*, which successfully transformed the formerly *Festuca rupicola* and *Inula ensifolia* dominated plots. The analysis showed that the most conservative vegetation type was *Arrhenatherum elatius* and *Calamagrostis epigeios* dominated type. The 12-year-long study revealed that species richness and diversity significantly decreased during the course of secondary succession, therefore effective and appropriate nature conservation management is essential for controlling the monodominant grass species and shrubs, and for improving a balanced species composition in secondary dry grasslands in Hungary.



# COMPARATIVE ANALYSIS OF ARABLE WEED FLORA OF DIFFERENT CROPS IN SOUTHWESTERN HUNGARY

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Segetal weed vegetation in Hungary has changed greatly in recent decades, mainly through diversity decrease of arable field flora. Our research was carried out in Southwestern Hungary, within the frame of the Fifth Nationwide Arable Weed Survey, between 2007 and 2008.

In total 720 relevés were collected in four periods. Cereals, stubble fields and row crops were included in our data collection. Different cultures showed a distinctive separation by considering their species composition. We compared our dataset also with earlier findings. The results showed a significant change in species composition especially in the case of problematic and endangered weed species.

The dataset consisted of 285 species, which belong to 46 families. The dominance of summer annuals and rhizomatous geophytes doubled in the last four decades. The spreading of this latter group can be explained by deep and regular soil management regime. It is important to emphasize that bulbous geophytes have become nearly extinct from the arable fields. Species richness was higher in the summer relevés, the highest diversity was detected in cereal fields.

# FORB FRINGES AND FOREST EDGE COMMUNITIES (CLASS *TRIFOLIO-GERANIETEA* *SANGUINEI* TH. MÜLLER 1962) IN THE WESTERN PART OF UKRAINE

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The fringe communities in Ukraine have not been known sufficiently so far. Preliminary information about the diversity of the forb fringes and forest edge communities was very scanty. The main goal of the study was to investigate the diversity of fringe vegetation in the western part of Ukraine, where we expected to find the large part of the associations with central-European range.

A survey of plant communities of the class *Trifolio-Geranietea sanguinei* TH. MÜLLER 1962 in the western part of Ukraine has been made. Data were analyzed using JUICE (Tichy, 2002) software. The correlation with environmental factors was investigated using canonical correspondence analysis (CCA).

Communities from the alliances *Geranion sanguinei* TX. in TH. MÜLLER 1962 (xerothermic, previously carbonatophilous), *Trifolion medii* TH. MÜLLER 1962 (mesophitic, often nitrophilous), *Teucrium scorodoniae* DE FOUCAULT *et al.* 1983 (acidophilous on the gleic soils) and *Melampyrion pratensis* PASSARGE 1979 (acidophilous on the sandy soils) are distinguished. Besides, communities seem to belong to the *Dictamnno albi-Ferulagion galbaniferae* (VAN GILS *et al.* 1975) DE FOUCAULT *et al.* 1983, these are described in the south-west regions (Transcarpathia, Podillia and Bukovyna).

So, fringe vegetation of the class *Trifolio-Geranietea sanguinei* TH. MÜLLER 1962 in the western part of Ukraine is sufficiently diverse. We can expect some new associations in the eastern regions and in the Crimea, where floras are quite different.



# THE IMPACT OF LAND USE HISTORY ON GROUND VEGETATION IN LOWLAND WOODLANDS A CASE STUDY FROM THE ELBE BASIN, CZECH REPUBLIC

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All recent forests of Europe were influenced by humans in the past. This impact was especially strong in long-colonized landscapes of lowlands. Analyzing sets of historical maps from different periods, we can identify continuous forest patches which were not deforested since the creation of the oldest map. This type of forest has been denoted „ancient woodland“. Forests that originated later, in the more recent time, have been called „recent woodland“. Between ancient and recent woodlands, there exist considerable differences in the composition of the herb layer. Different types of management are further related to the changes of structure and chemism of soils lasting for years.

The site of our research is situated in the Elbe Basin, Central-East Bohemia. It has a nicely fragmented land-cover with numerous woods of different sizes and good information sources on its history. In 2009 we have collected a set of 142 phytocenological relevés in forests, stratified according to continuity (ancient/recent) and naturalness (natural/artificial) tree layer composition. Furthermore, soil samples were collected to be analyzed. The key research issues concern (i) impact of the historical continuity of the forest cover to ground vegetation, (ii) relationships among soil properties and vegetation composition. From the perspective of species traits, we will focus our attention on dispersal and establishment strategies, comparing the presence of different functional groups

# CONTROLS OF VEGETATION CHANGE IN ABANDONED COPPICE-WITH-STANDARDS

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After many centuries of relatively stable management in lowland woodlands of Central Europe, the recent abandonment of coppicing caused dramatic changes in their composition and diversity. While this process is well documented from various parts of Europe, only little is known about factors which control the rate of this process.

Therefore, we collected a data set of 122 vegetation plots repeatedly observed in early 1950s and early 2000s in the Děvín Wood (SE part of the Czech Republic). The forest vegetation of the Wood comprises xerothermic oak communities (*Quercion pubescenti-petraeae*), mesophilous oak-hornbeam forests (*Carpinion*), and ravine forests dominated by large-leaved lime (*Tilio-Acerion*).

Our previous analyses showed that forest vegetation of the Děvín Wood experienced dramatic decrease in species richness, marked shift from xerothermic to mesic communities and significant taxonomic homogenization during last 50 years. In this paper, we go further and link the rate of observed changes to 1) site topography (e.g. incoming solar radiation and topographically controlled soil moisture), 2) time since last canopy disturbance (i.e. last coppicing cycle) and 3) magnitude of community invasion by alien plant – *Impatiens parviflora*.

We aimed to test the hypotheses that 1) the vegetation on drier and warmer sites changes slower because of environmental constrains, 2) the herb layer of forests with younger canopy changes slower because of conditions that resemble previous coppicing more closely, and 3) the invasion of alien plants contributes to the observed change by disrupting organization of local communities.



# COENOLOGICAL DIFFERENTIATION OF *PEUCEDANUM* SPECIES (SECT. *PEUCEDANUM*) STANDS IN THE CARPATHIAN BASIN

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In the area of the Carpathian Basin and Central-Europe, the genus *Peucedanum* (sect. *Peucedanum*) includes mostly species of SE-European origin: *P. officinale* L., *P. longifolium* WALST. & KIT., *P. rochelimum* HEUFF. and *P. tauricum* M. BIEB. These taxa have close relationships with *P. ruthenicum* M. BIEB. and *P. coriaceum* REICHENB., raising doubts about the specific status of all taxa. Our studies related to the ecological indicators (moisture requirement W), put in evidence particular species groups and contribute to the coenological differentiation of the *Peucedanum*-species stands. *Peucedanum officinale* group: *P. officinale*, *Aster sedifolius* subsp. *sedifolius*, *Odontites lutea*, *Aster linosyris*, *Festuca pseudovina*, *Artemisia pontica*, *Ranunculus pedatus*, *Scorzonera cana*; char.: semi-dry and semi-humid habitats, salt marshes, alliances *Festucion pseudovinae*, *Peucedano officinale-Asterion sedifolii* (*Peucedano-Asteretum sedifolii* Soó 1947 corr. BORHIDI 1996); *Peucedanum longifolium* group: *P. longifolium*, *Allium flavum*, *Centaurea atropurpurea*, *Asperula capitata*, *Dianthus spiculifolius*, *Silene flavescens*, *Campanula crassipes*, *Seseli gracile*, *Sesleria filifolia*, *Helictotrichon decorum*; char.: xeric (mostly moesic), calcareous rocky places, alliance: *Seslerion rigidae* (*Asperulo capitatae-Seslerietum rigidae* (ZÓLYOMI 1939) COLDEA 1991, *Seslerietum filifoliae* ZÓLYOMI 1939); *Peucedanum rochelimum* group: *P. rochelimum*, *Narcissus radiiflorus*, *Sanguisorba officinalis*, *Gentiana pneumonanthe*, *Iris sibirica*, *Serratula tinctoria*, *Cirsium canum*, *Inula salicina*, *Ranunculus polyanthemos*, char.: moist-wet and mesic habitats, alliances: *Molinion*, *Filipendulion* (*Peucedano rochelimum-Molinietum caeruleae* BOSCAIU 1965); *Peucedanum tauricum* group: *P. tauricum*, *Inula ensifolia*, *Thalictrum minus*, *Galium glaucum*, *Anthericum ramosum*, *Muscari tenuiflorum*, *Asparagus officinalis*, *Elymus hispidus*; char.: xerothermic fringe and steppic habitats, alliance: *Geranion sanguinei*, and with transgressive species (*Astragalus monspessulanus*, *Vinca herbacea*, *Iris aphylla*, *Salvia nutans*, *S. transylvanica*) transitions to *Festuco-Brometea* syntaxa; (*Inulo ensifoliae-Peucedanetum taurici* Kovács J. A. 2009, *Cariceto humilis-Festucetum rupicolae* Soó 1947 corr. Kovács 2002).

# THE COMPARATIVE ANALYSIS OF THE INFLUENCE OF DIFFERENT ENVIRONMENTAL FACTORS ON THE SPECIES RICHNESS OF THE SOUTH URAL FOREST COMMUNITIES

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The influence of three main environmental factors – warmth (W), moisture (M), soil fertility (F) on the species richness (alpha-diversity) of the South Ural forest communities was investigated in the frame of syntaxonomy on the basis of more than 2000 relevés. The syntaxonomy includes three principal classes: *Quercus-Fagetea* BR.-BL. in VLIEGER in VLIEGER 1937 (QF, 27 ass., species richness from 27 to 74), *Brachypodio pinnati-Betuletea pendulae* ERMAKOV *et al.* 1991 (BB, 10 ass., species richness from 42 to 72), *Vaccinio-Piceetea* BR.-BL. in BR.-BL., SISS. et VLIEGER 1939 (VP, 11 ass., species richness from 28 to 65). The environmental conditions were estimated by Landolt's scales for each association.

We showed distribution diapasons of three classes along investigated factors:

QF: W – 2.84-3.67, M – 2.43-3.61, F – 2.63-3.82;

BB: W – 2.87-3.28, M – 1.95-2.78, F – 2.31-2.92;

VP: W – 2.79-3.12, M – 1.65-3.22, F – 2.20-2.67.

For the comparison of the input of W, M and F factors in the formation of the species richness we use a new allometric index proposed by us called the rate of species richness change (RSRC), which is a measure of the change in the species richness in 0,1 Landolt's scale gradation. RSRC reflects nonlinear relation of species richness and ecological gradients. It increases in extreme environment. The maximal RSRC (W, 7.8) was revealed for VP boreal forests of extreme high mountain habitats and the minimal RSRC (F, 0.8) - for QF nemoral forests on rich soils.

The row classes of forest vegetation from maximal to minimal RSRC were identical for all three factors (VP – BB – QF). The mean RSRC for all classes was 4.9, 3.8 and 1.6 for W, F and M correspondingly. On this basis, we consider that factor W (summarized influence of elevation above sea level and exposition) is the principal factor determining the species richness of South Ural forest communities. The second important factor is F, but its role is overrated by positive correlation with factor W. Factor M influences species richness of VP and especially of QF. The last class has a broad distribution along gradient of factor M from xerothermic communities with *Quercus robur* to flood-plain forests with *Alnus incana* and *Padus avium*.

This investigation is supported by the program «Biodiversity» (the subprogram «Diversity and monitoring of Russian forests ecosystems»).



# IS TOP SOIL REMOVAL A POSSIBLE WAY FOR RESTORATION OF PANNONIAN SALINE HABITATS?

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Inland saline habitats of the Pannonian basin represent a specific variety of halophytic communities which depend on soil salinity and moisture-level gradient. Many localities suffer from the changes of water regime due to river regulations and lack of management. Our experiment is testing the effect of top soil removal as a restoration method.

The experiment was conducted in Kamenínske slanisko Nature Reserve (southern Slovakia). The experimental plots were established in 3 different levels of degradation (Level 1 – relatively well-preserved halophytic stand with *Camphorosma annua*, *Puccinellia distans* and *Artemisia monogyna*; Level 2 – moderately degraded stand with *Plantago maritima* subsp. *salsa* and *Limonium gmelinii* with a slight cover of generalists; Level 3 – heavily degraded stand with dominance of ruderals like *Dipsacus fullonum* or *Cirsium arvense*).

A completely randomized design was used with four replicates per each level. The frequency of vascular plants was recorded in a 50 cm × 50 cm square area. Removal of the soil was carried out in 2008 directly after first data sampling into the depth. Data of the vegetation samplings from 2008 and 2009 were analyzed using Detrended (DCA) and Canonical Correspondence Analysis (CCA) for testing the correlation between vegetation removal and the vegetation changes in time of each level. The results in DCA confirm the important role of salinity (Axis 1) as a factor determining species composition. Top soil removal moved the vegetation in all three levels back to earlier stages of succession, although removed plots were colonized by halophytic species only in levels 1 and 2. While the change after a year in Level 1 is minimal, Level 2 has a considerable trend for positive regeneration. The plots in Level 3 were colonized mostly by ruderals, even more aggressively compared to the reference plots. The CCA diagram demonstrates two species (*Plantago maritima* subsp. *salsa* and *Limonium gmelinii*) responding positively to the vegetation removal and Level 3 has the highest impact of disturbance (P=0.002, 19%).

Our results show that top soil removal could be a promising restoration method of saline habitats. However, it can only be applied where there is probability of a viable seed bank of halophytes and the seed rain from species in close surroundings. Crucial factor is the soil salinity, too. On degraded soils such as Level 3 the top soil removal is very limited due to the advanced desalinization processes.

# THE ORNAMENTAL, AROMATIC AND EDIBLE VEGETAL SPECIES FROM LĂPUȘ REGION (TRANSYLVANIA)

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The Lăpuș region is delimited by the Tibles and Gutâi massifs in the North, by the Breaza summit and the Preluca massif in the South, and in the East it is stretching towards Năsăud, the separation of the water being the limit, while in the West it opens towards the depression of Baia Mare. This region is crossed by the Lăpuș river.

The Lăpuș river is limited on one side and the other by a diverse vegetation, imposed by the relief and the ecological factors. At the sources of the river from the heart of the mountains, the vegetation is formed by forests of spruce fir and of spruce fir mingled with fir. Downstream, the river's margins are limited by beech forests and beech-hornbeam groves and in front of the Târgu Lăpuș town, in the meadow exist crops. In the gorge of the Lăpuș, starting with the Răzoare locality, dominant are the beech-hornbeam groves. These expand from the river bed and up to the summits of the mountains which limit the river bed. They are very well made woods having in the grassy layer a flora as it follows: *Galanthus nivalis*, *Primula acaulis*, *Anemone nemorosa*, *Crocus heuffelianus*, *Helleborus purpurascens*.

In some places, the river bed is limited by low grounds with excessive humidity upon which there are willow groves, have in the shrubs layer *Crataegus monogyna*, *Corylus avellana*, *Cornus mas*, *Cornus sanguinea*.

Even though the afforested areas are dominant here and there, we can find meso-hygrophitic grasslands which are enlightened by species as *Agrostis stolonifera*, *Trifolium repens*, *Lotus corniculatus*, *Lolium perenne*, *Caltha laeta*. These species place themselves on plane, humid sections, covered with fertile alluvial soil.

In Lăpuș's villages exist a great tradition about utilised plant species in lot of directions.

In the forests, on meadow and next of villages are developing honey plants, drug plants, industrial plants and a lot of edible plants, aromatic plants and ornamental plants.

From 60 ornamental plants, the most frequent are: *Erythronium dens-canis* var. *niveum*, *Crocus heuffelianus* var. *niveum*, *Convallaria majalis*, *Galanthus nivalis*, etc.

An important cultural aspect is that the people in the Lăpuș's villages use a lot of edible and aromatic plants such as: *Ranunculus ficaria*, *Allium ursinum*, *Cirsium canum*, *Origanum vulgare*, *Cardamine pratensis*.



# A NEW SOURCE OF INFORMATION FOR VEGETATION SCIENCE: TRADITIONAL ECOLOGICAL KNOWLEDGE OF HERDSMEN IN AN ALKALI LANDSCAPE (HORTOBÁGY, HUNGARY)

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**Introduction:** Vegetation science and conservation biology in Europe – as opposed to North America and the tropics – surprisingly rarely takes advantage of the traditional ecological knowledge of peasants and herdsmen. We studied the relationship between the ecological knowledge of herdsmen and scientific knowledge. We also looked at how this knowledge is applicable to conservation management of alkali steppes.

**Methods, area:** We collected data on the knowledge on plants, vegetation and its dynamics of herdsmen (60) and professionals (15) in the Hortobágy, the largest steppe in Central Europe, by semi-structured interviews and participatory observations during field activities (grazing). The main habitat types are short grass steppe (*Artemisio-* and *Achilleo-Festucetum pseudovinae*) interspersed with patches of barren salt flats (*Camphorosmetum annuae*), saline meadows (*Agrostio-Alopecuretum pratensis*) and marshes (*Schoenoplectus*, *Bolboschoenus* etc.).

**Results and discussion:** Unexpectedly, more than 90% of plant names, 100% of habitat names, nearly 100% of the knowledge on habitats, and cca. 80% on landscape history are independent of scientific knowledge. This result is surprising, given that one of the most important botanical institutions has been within a 50 km distance for nearly 200 years, and the steppe has been a tourist destination and a workplace for professionals for about 100 years.

Although there is some overlap between the knowledge of herdsmen and professionals, they are mainly independent. Traditional knowledge includes several elements that scientific knowledge does not. For instance, only a small part of the traditional folk names of the vegetation appears in the botanical literature. Little is known on the changes during the last decades in the quality of pastures, in certain details of the changes in grazing methods, on the effects of the spread of reed and accumulation of dry plant matter, and the effects of early spring and late fall grazing, as well as extensive manuring. Oddly, herding is a necessary malady for botanists, because grazing is required to the maintenance of the natural vegetation, but the behaviour of herdsmen is often incomprehensible and difficult to influence. Some botanists are not interested in the knowledge of herdsmen.

# IMPORTANCE OF GERMINATION SUCCESS IN PLANT INVASION

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Invasive species cause great ecological problems in many parts of the world. One of the reasons of their success is that they can escape their natural enemies in the invaded range. *Centaurea stoebe* is a well known invasive forb in the Northern United States, and it is a common plant species of dry and semidry grasslands in its native European range.

Our research focuses on the differences of germination success of European and American *Centaurea stoebe* (spotted knapweed) populations. Our hypothesis suggests that spotted knapweed seeds collected from the invaded range germinate potentially better than the native seeds, while natives are more exposed to the infections of different microorganisms.

We collected spotted knapweed seeds from 10 invaded populations and 10 native populations and set up germination experiments in Petri dishes. We also weighed and compared the seeds from the different populations and correlated the results with the germination success.

We found differences in the size, and germination between the native and the invasive populations. The seeds of the invasive populations were significantly heavier and more germinative. Native populations were exposed significantly higher to microbial infections.

Our results suggest that native plant species have an inhibitory control already at an early stage of their development, microorganisms on seed surfaces play an important role in regulating their numbers, while at the invaded range these regulating factors are not as effective or are completely missing. Our finding supports the enemy release hypothesis of the invasive plant species.



# STATE OF NATURALNESS AND DEGREE OF DEGRADATION IN ANDESITE SLOPE STEPPES OF THE BÖRZSÖNY MOUNTAINS

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The aim of our work is to evaluate the state of naturalness and degradation of andesite slope steppes of the Börzsöny Mountains (Northern Hungary, Matricum floristic district). These grasslands are traditionally identified in Hungary as the community *Potentillo-Festucetum pseudodalmaticae*. In the neighbouring Slovakia community of *Potentillo-Festucetum pseudodalmaticae* described from East-Slovakia is distinguished from that of *Inulo-Festucetum pseudodalmaticae* described from South-Slovakia, both developing among similar conditions.

In the studied region, overpopulation of game has been a serious problem of nature conservation for decades. Dry slope steppes are particularly threatened by the mouflon.

65 relevés of 16 square metres size (localised by GPS) were made in the Mountains. During the field work 11 different types of andesite slope steppes have been studied: *Bothriochloa ischaemum*, *Chrysopogon gryllus*, *Cleistogenes serotina*, *Elymus hispidus*, *Festuca pseudodalmatica*, *Festuca pallens*, *Poa scabra*, *Stipa dasyphylla*, *Stipa pulcherrima*, *Stipa tirsia* and *Stipa pennata* dominated ones. We compiled the synthetic table of these types. Slope steppes were compared and evaluated concerning their field conditions (exposure, degree of slope, thickness and rubble content of the soil), ecological and syntaxonomical indicator values (Borhidi's SBT, life form, Zólyomi's W-value) and also by calculating their unweighted means. The mentioned parameters were analysed by multivariate statistical methods with the application of the PAST and SYN-TAX software.

Studied stands grow at 150–700 m a.s.l, on erubase soil formed on andesite or andesite tuff baserock, principally on south or south-western facing slopes of 10–30 degree. The coverage of grass layer is 65–95%. The closest stands are composed of *Elymus hispidus* and *Stipa tirsia*, while the pioneer types dominated by *Poa scabra* are the most open ones.

Grassland types are determined by field conditions, degree of degradation and the process of succession, as well.

Degradation series was constructed based on Borhidi's SBT-values, and so was drought resistance series on the basis of Zólyomi's W-values. Concerning degradation, outstanding types are those dominated by *Bothriochloa ischaemum*, *Cleistogenes serotina*, *Elymus hispidus* and *Stipa pennata*. Best is the state of naturalness in case of the slope steppes dominated by clump-forming *Festuca pallens*, *F. pseudodalmatica*, *Stipa dasyphylla* and *S. pulcherrima* species.

# WHAT FACTORS ARE RESPONSIBLE FOR VARIABLE SPECIES RICHNESS OF CIRSIO-BRACHYPODION GRASSLANDS IN THE CZECH REPUBLIC?

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Grasslands of the White Carpathians (Czech Republic) belong to the most species-rich habitats in Europe. They exceed compositionally similar communities of neighbouring areas in south-eastern Moravia in their species richness by up to 50%. Despite their evident contrasting diversity, ecological drivers of species richness in the White Carpathians and the adjacent areas of Moravia have not been studied so far. Our study addresses possible reasons for various species richness of grasslands in these two regions, which share the same regional species pool. Grasslands of the *Cirsio-Brachypodium* alliance were studied on scales of 1 and 100 m<sup>2</sup>, and various ecological factors (productivity, soil pH, conductivity, soil depth, soil type, bedrock, cover and depth of litter, cover of herb and moss layer etc.) were recorded on both scales.

In terms of range of studied factors, the two regions differ neither in productivity and soil depth, factors generally regarded as influential diversity drivers, nor in cover of herb and moss layer and depth of litter. Higher pH and conductivity was encountered in south-eastern Moravia, while higher litter cover was found in the White Carpathians. Further analyses revealed that species richness within compared regions and on different scales is driven by different sets of factors. Diversity of the White Carpathian grasslands is highest in places with high herb biomass and on gentle slopes, while in south-eastern Moravia high diversity is connected with clayey soils and high moss cover. When analysing data from both regions together, species richness peaks in places with low pH, on gentle slopes with high herb cover and mowing management. On steeper slopes, grasslands on clayey soils are most species-rich.



# CHANGES IN OCCURRENCE AND DISTRIBUTION PATTERN OF WET MEADOWS (MOLINION KOCH 1926) IN NE SLOVENIA

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Wet meadows are rare and endangered due to suburbanization, expansion of infrastructure, loss of natural environment. As a consequence, we deal today with the rapid decline of these sensitive ecosystems, which also host many endangered plant and animal species.

In the temperate climate the presence of wet meadows is in many cases a result of human management and that of the man's influence on environmental conditions.

The aim of our research was to find the major abiotic factors including human-related ones, which determine the presence of these wet meadows in NE Slovenia (Goričko) as well as those that might be responsible for the decline of their area. We catalogued all wet meadow areas (157 meadow polygons) and compared them with condition in year 2005 (461 polygons). We analyzed potential factors that can influence the distribution of the meadows in the region: distance to roads, distance to water bodies, distance to springs, elevation, aspect, slope, and topographic position.

We first performed Principal Components Analysis (PCA) to characterize the effects of variables on the studied wet meadows. Secondly, we built a generalised linear model to explain the presence of the wet meadows with the same variable set.

Wet meadows of Goričko are found to occur mostly on flat, plane areas, but not on hill tops or ridges. Distance from roads and water bodies seem to increase their likelihood of presence, however in a non-linear way. The greatest probability was found for areas in a medium distance from these linear elements.

The results support our hypothesis that wet meadows in Goricko depend on human management (distance to roads), and also point out some basic natural requirements (distance to water: neither on the shore, nor on too dry sites). From these we conclude that the conservation of these valuable (semi)natural areas in NE Slovenia greatly depend on human decisions and so on management.

# ECOLOGICAL INVESTIGATION OF HABITAT 7220 \*PETRIFYING SPRINGS WITH TUFA FORMATION (CRATUNEURON) IN NATURA 2000 SITE LOZENSKA MT. (BULGARIA)

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Despite the dry conditions on ridges and south slopes of NATURA 2000 site Lozenska Mt, there are several spring communities situated in their outskirts. We investigated the water regime in the area and collected rain water- and soil solution samples in order to clarify the source and chemical composition of spring water. Habitat 7220 \*Petrifying springs with tufa formation (Cratuneuron) is usually with a very limited expansion in the field, which necessitates preservation of its surroundings as well as the whole hydrological regime. In addition, we elaborated management measures for the area and proposed extension of the NATURA 2000 site in order to include all localities of habitat 7220 in the mountain.



# THE EXPERIENCE OF IDENTIFICATION AND MAPPING OF BIOLOGICALLY VALUABLE FORESTS IN THE MURMANSK REGION

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The biologically valuable forests (BVF) are forest ecosystems in which rare species listed in Red Data Books and other species intolerant to forestry activities occur. The aim of our study was to create the method of BVF identification and mapping in Murmansk region. The study was based on releves published in previous years and 80 sample plots laid in 2006-2009 in Lapland State Reserve and in the central part of Murmansk region induced by forestry and industrial air pollution.

The following criteria of BVF were used: 1) the presence of specialized species that depend on specific characteristics of the forest and not able to survive in the commercially used forests; 2) the presence of old trees and big parts of dead trees (old-growth forest); 3) the absence of traces of human influence (virgin forest); 4) the presence of indicator species that have high demands to the habitat conditions of BVF, but not so high as specialized species; 5) the presence of biological and/or landscape key-elements that are specific components, which make the forest suitable for existence of specialized species. Forest communities belonging to rare plant associations were also joint to BVF.

The forest plant associations for Murmansk region were established and dichotomous keys for identification of forest plant associations were constructed.

Spruce BVF. In Murmansk region BVF are mostly represented by spruce forests and among them by forests located near streams and at flood-plains. Spruce old-growth forests usually have no traces of fire and are potentially suitable for growth of Red Data Book and specialized species such as *Actaea erythrocarpa*, *Evernia divaricata*. Rare associations of spruce forests are *Piceetum cladinosum* and *Piceetum fusci sphagnosum*.

Pine BVF represented by old-growth forests with rare lichens and fungi. Their stands usually consisting of several generations of pine appeared due to repeated surface fires.

Birch and willow BVF mostly connected with streams and flood-plains. Rare association of birch forests is *Betuletum cladinosum*.

Aspen is rather rare species in Murmansk region. Many specialized species of mosses, lichens and fungi are connected with *Populus tremula* trees.

The results of the study could be the base for compilation of the instruction for identification of BVF in Murmansk region. This instruction will be used in forest inventory for the purpose of reservation of BVF.

# NATURE MANAGEMENT: IS THERE ANY IMPACT ON VEGETATION STRUCTURE? – A LITHUANIAN EXAMPLE

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Dramatic changes in land use and country's economy have manifested in the structure of vegetation cover during the last decades. The state of natural and seminatural open grassland communities is particularly subject to these changes. Significance and impact of economic activity imitation measures, initiated by the EU nature protection standards, upon the ecosystems in Lithuania was discussed.

Grassland and wetland management measures have been implemented within the frames of rural development programme. In 2009, regular haymaking was declared in 36.4 thousand ha, which nearly corresponds to the natural meadow area. However, the effect upon country's vegetation structure is assumed to be low. The above-discussed measures are used almost solely on the sown grassland areas due to different attitude of administrating institutions towards rural development programmes. The measures are not attractive to land users in order to practise them in natural habitats (only 1.1 thousand ha of maintained wetlands were declared).

By implementing Habitats Directive, the country obligates to warrant favourable conservation status of EU habitat types. Nature management plans for about 130 NATURA 2000 sites were worked out and the measures for open habitat maintenance were foreseen (shrub and tall herb removal, haymaking, grazing, etc.). The effect of measures upon bogs (7110, 7120), mires (7140) and fens (7160, 7230) is only of local significance: nature management activity involves only 1% of the total area of the mentioned habitats. There are no data on the activity in the areas of natural grassland habitats.



# ROBINIA PSEUDACACIA DISTRIBUTION PATTERNS IN NE SLOVENIA

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*Robinia pseudacacia* L. was introduced in Europe at the beginning of the 17<sup>th</sup> century and is being considered to be an invasive species also in Slovenia. Our study area is located in NE Slovenia, in Pomurje region. The aim of our study was to find explanations for the current occurrence pattern of the species. The broader region was split into three geomorphologically distinct sub-regions: the area along Mura River, under influence of floods, the lowland alluvial terrace with intensive agriculture and the hilly region of Goričko. Areas dominated by *R. pseudacacia* have been mapped in the lowland part in the field in a 4 km by 3 km sample plot in 2009. For the other two regions we used data from Slovenian Forest Service dating to 2006.

We analyzed potential factors that can influence the distribution of the species in the region: distance to roads, distance to water bodies, elevation, land use and soil type.

We performed a spatial sampling stratified for prevalence on the resulting maps to collect observations on the relationship between *R. pseudacacia* presence and potentially influential factors. We performed Principal Components Analysis to characterize the effects of variables on *R. pseudacacia*.

*R. pseudacacia* was found to occur mostly in parcels designated as grasslands and forests. Distance from roads and water bodies seems to decrease species presence, but this effect is site-dependent. Dependence on soil also differs in the three sub-regions: the species is likely to occur in riparian soil along Mura River, dystric cambisol on Holocene alluvial gravel in lowland and dystric cambisol on Pliocene argil in Goričko.

We did not find a good relation between elevation and species presence, this factor apparently does not influence the distribution of the species in the region.

The effects of the various factors on the spatial distribution of the species were not uniform over the three areas, which draws our attention to the significance of human decisions. They are to a certain degree correlated to geomorphologic and ecological factors, but they depend also on economical and social circumstances. *R. pseudacacia* expands naturally but is also being planted by farmers and so its expansion is directed as well. Our results also show that human decisions might also affect the species expansion to a different degree and in different ways in three areas. Therefore, we intend to relate the species distribution to social factors as well, in the future.

# CHANGES OF ECOLOGICAL BEHAVIOUR OF PLANT SPECIES: WEED VEGETATION IN NW-SE BALKAN GRADIENT

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On the basis of 4507 relevés of weed vegetation from NW Balkans changes of weed species behaviour were investigated. Two alliances in particular were the object of our study: *Scleranthion annui* with center of distribution in Central Europe and *Caucalidion lappulae* that has its distribution center in warmer parts of Europe. It has already been stated by Holzner (1978) that there is an evident shift in growth optimum of characteristic species of those alliances as they reach the edge of their distribution. Changes in species composition, species behaviour and habitat characteristics were detected along south-north gradient (from Macedonia to Slovenia).

*Caucalidion* stands thrive in wider range of soil reaction in the south and plant communities are species richer. Similar is evident in *Scleranthion* but in inverse gradient from south up north. Another evidence of changes is decline of species characteristic for alliances towards the edge of their distribution range away from optimal climate.



# THERMOPHILOUS BEECH FORESTS 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 are present in this area. Thermophilous beech forests in this area have not yet been studied, so we have analysed their syntaxonomic status, floristic, ecological and syndynamic features. 37 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. Surface soil layer was analyzed in all sampled plots. Other ecological characteristics, such as microclimate, geomorphology, Ellenberg indicator values, were also considered. Vegetation-site relationships were examined by using methods of direct gradient analysis. This type of vegetation develops through the succession of the pubescent oak forests on the shallow carbonate soils of mostly southern expositions. It is characterized by a high proportion of thermophilic species of the *Quercetalia pubescentis* order. As far as synecological conditions are concerned, these forests can be compared to the stands as *Ostryo-Fagetum* and *Laserpitio-Fagetum* in the western part of Croatia, from which they differ by the absence of the species such as *Ostrya carpinifolia*, *Laserpitium latifolium*, *Carex alba*, *Sorbus aria*, *Erica carnea*, etc.

# TWO PLANT ASSOCIATIONS OF ALLIANCE TRIFOLION RESUPINATI IN BULGARIA

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In this study, ass. *Hordeeto-Caricetum distantis* and ass. *Cynosureto-Caricetum hirtae* from southeastern Bulgaria are presented. The associations are characterized floristically and ecologically. Both associations belong to alliance *Trifolion resupinati*, which is distributed in South Balkans and includes lowland meadows influenced by sub-Mediterranean climate. Due to these climate conditions, numerous therophyte species are present in the flora: 25.7% for *Hordeeto-Caricetum distantis* and 21.7% for *Cynosureto-Caricetum hirtae*. Euro-Asiatic floristic elements prevailed in *Hordeeto-Caricetum distantis* (18%), followed by Euro-Mediterranean ones (15.6%). In *Cynosureto-Caricetum hirtae* most numerous are Euro-Mediterranean species (17%) and Euro-Asiatic species (15%). Association *Hordeeto-Caricetum distantis* has subhalophyllous character, especially subassociation *juncetosum gerardii*.



# DISPERSAL OF WETLAND PLANT SPECIES WITHIN THE POND SYSTEMS AND ITS RELATIONSHIP TO VEGETATION

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Dispersal of plant propagules is an important factor influencing vegetation patterns. Central-European pond systems are habitats with high diversity of propagule dispersal modes. Using seedling-emergence analysis of sediments collected in fishponds and fish storage ponds, connecting ditches, tools used in fishpond management, gumboots, vehicles etc. we studied propagule dispersal within a South-Bohemian pond system. We performed also the feeding experiment focusing on ichthyochory. The species composition and propagule density of each species represented in the seed bank and sediments used for analysis of dispersal vectors were compared with the data about recent flora and vegetation of fishponds and fish storage ponds. The most common species in all samples were e.g. *Juncus bufonius* and *Rorippa palustris*. We confirmed their dispersal by more different ways including ichthyochory. Seeds of *Alnus glutinosa* and *Lycopus europaeus* were detected in large amounts in the drifts floating in water, which fed the fish storage ponds. These species occurred only rarely in ponds due to unsuitable conditions, but they were common on wet places in the surroundings of the ponds. Small seeds of *Coleanthus subtilis* were found in sediments collected from gumboots and tools used in fishpond management. The species was common in vegetation and seed bank of several fishponds, while it was only exceptionally found in fish storage ponds. Comparing the species composition in sediments from different dispersal vectors, the floating drifts were very poor in species but the propagules occurred there in large quantities. The species rich sediment samples from vehicles included wetland, ruderal, meadow and other species but the number of their seeds was low. Smooth and small seeds of wetland annuals, which survived well when passing through the fish digestive tract followed by incubation in the water, are best adapted for ichthyochory. Even after passing through the fish, these species needed large temperature or moisture fluctuations for germination. We conclude that the most common wetland plant species have not only an ability to grow in various conditions but also to disperse by many various ways. Many ruderal species possess some “wetland dispersal adaptation”; these species have an ability to expand into wetland habitats. The seed bank and vegetation on a locality need not reflect much propagule influx due to strong species selection by habitat conditions.

# MORPHOLOGICAL AND MOLECULAR GENETIC TRAITS OF THE HUNGARIAN BEAR'S EAR (*PRIMULA HUNGARICA* BORBÁS 1895 S. AMPL.)

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Hungarian bear's ear is an relict species endemic to the Trans-Danube Mountains. The scientific name given in the title has been neglected by most authors; and a nomenclatural stock-taking demonstrates the taxonomic doubts upon the well documented host sect. *Auricula*. Even the taxonomy of *P. auricula* has always been controversial and never been completely solved. Hungarian bear's ear with its debated position has been ranked by several authors at species (*P. hungarica*), subspecies or variety level under *P. auricula* or, in addition, *P. balbisii*.

Morphological and molecular genetic analyses were carried out in 2007-2009 on six subpopulations in Hungary. By detailed analysis of morphological characters the leaf and floral characters are plastic in general but quite constant for certain subpopulations. It seems to be caused by environmental factors as well as by the age of the individuals. It should be supposed that phenotypic plasticity lead to the confusion around this taxon. Denticulation of the leaves together with – especially in young individuals – narrower or broader obovate shape is also variable. The lighter yellow coloured and fragrant flower resembles more to *P. auricula* and less to *P. balbisii*. The farinose and glandular hairs, which cover the leaf surfaces and margins are sometimes absent or fade away with age. The bracts are sometimes asymmetrically longer as described for.

rDNA internal transcribed spacer (ITS) region sequence analysis and ITS2 secondary structure models were used to detect the genetic properties of six subpopulations representing the species' range in Hungary, and prove the relation of samples comparatively to those of given by Zhang & Kadereit (2004) with the only Hungarian sample from the Vértes Mts.

All samples in Hungary are characterized by cladistical-phylogenetical synapomorphy to *P. balbisii* (Zhang 2002, Zhang & Kadereit 2004), but, as we found, they differ from its type specimen by one characteristic base change found in the first helix of the constructed ITS2 secondary structure model. By a novel typification and synonymization of Zhang & Kadereit (2005) *P. hungarica* BORB. 1895 has been enrolled under *Primula* sect. *Auricula* subsect. *Euauricula* 1. *Primula auricula* L.

Based upon the observed morphological and molecular differences we are assuming in congruence with previously published molecular studies an ongoing geographical and ecological isolation of *P. hungarica* population.



# LAND-USE CHANGES AND HABITAT FRAGMENTATION IN THE NORTHWESTERN PART OF THE GREAT HUNGARIAN PLAIN IN THE LAST TWO CENTURIES

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The landscape is under pressure of deep human impacts in the northwestern part of the Great Hungarian Plain (in Pesti-síkság area, near the capital Budapest). Authors aimed to explore the land-use history of the catchment area of Sződrákosi stream in the last two centuries. In connection with land-use, our study examines the devastation of natural habitats too. The population of this area has grown to almost ten times during the last two centuries and nowadays the extension of built-up areas is eleven times larger than in the second half of the 18th century. These processes have caused rapid increase in the extension of arable fields until the mid-20th century. Among the natural and semi-natural habitats, the extension of dry meadows was eighteen times larger in the 18th century than mid-20th century. This habitat type currently is regenerating on arable fields which were abandoned in the last few decades. Since the second half of the 18th century, wet meadows have decreased by 71% because of expansion of vegetable and strawberry growing along the streams and declining animal husbandry. The areas of orchards, vineyards, forests and tree plantations have increased, but the latter one (which has grown to more than 3.5 times larger during the last two centuries) consist mostly of non-native tree species (black locust, Scotch and Austrian pine). As the effects of drainage and ploughing, the lowest proportion of marshes and fens was observed in the second half of the 19th century (only 0.4%). Nowadays the extension of these habitats and still waters is the largest, because agriculture has declined and several new fishponds were created.

Our results show close correspondence between written documents and historical maps. From a landscape protection view, the most considerable problem is the fragmentation and isolation of natural habitats. Nowadays the number of habitat patches of dry and wet meadows, marshes and fens are five times bigger than in the end of 18th century. The other conservation problem is the small average size of semi-natural habitat patches (e.g. the size of dry and wet meadows were decreased by 98% till today). These conditions cause low regeneration potential of habitats which limit the success of landscape rehabilitation. Noteworthy is the fact that the flora of regenerating patches is mostly poor, and in addition, the rapid spread of several invasive species (e.g. Common Milkweed, Goldenrod species) is also striking.

# WEED ASSEMBLAGES IN FORMER SUNFLOWER, CEREAL AND ALFALFA FIELDS IN THE HORTOBÁGY, HUNGARY

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Changes in the agricultural structure in the last few decades caused a high abandonment rate of croplands in Central- and Eastern-Europe. The first years after ceased agricultural use in croplands are characterized by the increasing dominance of weedy assemblages. Therefore, in abandoned areas surrounded by native habitats weed control is very important task. Planning actions for weed control is important to know in which croplands is such action really necessary (e.g. invasive and/or perennial weed species can occur in high abundance). We studied the weed assemblages in former sunflower, cereal and alfalfa fields (in solonetz and chernozem soils) in the Hortobágy National Park (East-Hungary). The first year vegetation after ploughing was recorded in 26, former sunflower (7), cereal (10) and alfalfa (9) fields (percentage cover of vascular species). In most of former alfalfa fields *Matricaria inodora* and *Capsella bursa-pastoris* were the most frequent weeds with high cover. In some fields, *Polygonum aviculare*, *Bromus arvensis*, *Consolida regalis*, *Chenopodium album* were also frequent. *Matricaria inodora* and *Cirsium arvense* were also detected with the highest cover. Only in one of the fields were *Chenopodium album* dominance detected. The weed assemblage of the cereal fields was more diverse than that of the others. The most characteristic species were *Matricaria inodora*, *Fumaria schleicheri*, *Capsella bursa-pastoris*, *Bromus arvensis* and *Consolida regalis*. The detected short-lived assemblages in most fields can be suppressed by mowing. The high cover of *Cirsium arvense* in several former cereal and sunflower fields cannot be easily suppressed; therefore, it can threaten latter conservation actions like grassland restorations.



# LAND USE AND VEGETATION TYPES OF THE *PINUS BRUTIA* FORESTS IN TURKEY

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*Pinus brutia* TEN. is named as a “kizilcam” in Turkish corresponding to the word “redpine” in English which is because of its reddish young sprouts. It is one of the important natural tree species of the Mediterranean region. Total forest area of Turkey is 21.8 million hectare, which consists of 26% of land area of the country. The largest forest area of this species is in Turkey, with more than 3.1 million hectares which comprises about 37% of the total land of coniferous forests in Turkey, distributed in the Mediterranean, Aegean and Marmara Region. *Pinus brutia* forests show degraded conditions at present. This situation is not only a reflection of ecological conditions but also in several areas, a result of illegal or legal overcutting, meadow management for winter fodder, uncontrolled grazing and forest fires occurring in the course of several centuries. Ministry of Environment and Forestry established a lots of provenance trial in Turkey. One of them is Turkish Red Pine Provenance Trial. Also the Government established the Global Climate Change Coordination Assembly to monitor land use, land-use change and forestry. Most vegetation studies on these forests have been made from a phytosociological perspective but present knowledge on these types of vegetation is sparse and in many cases not very accurate, so we are developing a project to address some of the main aspects of the *Pinus brutia* communities in Turkey, that could serve for a better understanding of the Turkish landscape and to give the basis for a better way to conserve them. Also there is no syntaxonomical classification based on quantitative analyses of the redpine forests yet. This study is a statistical approach to vegetation types and general knowledge about land use practice of the *Pinus brutia* species in Turkey. Many releves of *Pinus brutia* dominated vegetation units were involved from published and unpublished data. The releves were georeferenced and analyzed using modern methods of multivariate statistics, including direct and indirect ordinations. TWINSpan and agglomerative cluster analyses. The revealed gradients and releve clusters were ecologically and geographically interpreted.

Keywords: *Pinus brutia*, numerical analyses, syntaxonomy, vegetation classification, land use, TWINSpan

# REFORESTATION AFTER CLEAR-CUTTING OF TAIGA SPRUCE FORESTS: ECOLOGICAL OUTCOMES, SUCCESSIONS AND PATHWAYS

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Clear-cutting is a major disturbance in the Russian European taiga forest ecosystem. The studies are conducted on the dynamics of the vegetation after clear-cutting of spruce boreal forests from 1983 year till our days. The aim of the study was to assess trends in floristic composition, and mechanisms of spatial-temporal natural dynamics of plant populations.

Strong scientific basis for forest landscape restoration suggests adequate knowledge of successive dynamics of species which dominate in the lower layers of forests inside of gaps formed in the canopy due to management actions (cutting trees). The 'floristic relay' of those species depends drastically on the forest type and the kind and strength of the disturbance. Early successional tree species in the boreal forest (*Populus tremula* L., *Betula pendula* ROTH and *B. pubescens* EHRH.) have to compete with herbs and *Rubus idaeus* L. that grow aggressively after disturbance. The present paper is a synthesis of field, theoretical and modelling studies on the joint dynamics of two pairs of species overgrowing a spruce forest clear-cut: *Betula pendula* and *Calamagrostis epigeios* (L.) ROTH.

The processes that regulate the clonal growth of plants in the early successional stages largely determine the spatio-temporal structure in the early communities. Each successional stage features specific pathways of individual ontogenesis in the dominating species, and those pathways may differ depending on habitat conditions. Therefore, we suggest that the course of ontogenesis determines the population response to habitat disturbance. The linear and nonlinear matrix models for age-stage-structured populations produce certain quantitative characteristics to compare the population status and dynamics of various local populations of the same species and of different (successive) species. The nonlinear expansions of those models incorporate the density-dependent effects responsible for various outcomes of the interrelated dynamics as a function of the initial conditions created by the disturbance. Further management scenarios, if affecting the structure of dominating populations at different phases of the succession, may also change the nonlinear dynamics, hence predetermine the outcome of early succession. This enables prediction of the course of disturbance- or/and scenario-driven population dynamics, thus contributing to the scientific basis of forest restoration.



# THREATENING FACTORS OF THE SWAMP FOREST OF ÓCSA

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Ocsa was covered by extended wet habitats before the river control and great drainage of the Great Hungarian Plain of the 19<sup>th</sup> century. The remnant of the swamp forests of Ocsa remained in a relatively natural state, though usually were used as coppice. The main threatening factors of these elder forests are the continuous desiccation and the mass expansion of invasive species. According to my hypothesis the ratio of the invasive tree species is less in the more natural elder swamp forests than in the managed stands.

Long-term data of groundwater wells were used to analyse the desiccation of the area in question. To investigate the invasive species, 6 managed sites (preparatory cutting after 2000, “managed”) and 6 more natural sites (last cut during or before the 2<sup>nd</sup> World War, “control”) were assigned on a 20 hectares area. Within each site, 80 random point sampling units were used to prepare the list of plant species of the herb- and shrub-layer (under 3 m). On every site a “TERMERD” query was filled (a complex survey method created in 1984 to determine the naturalness of a forest stand).

On the “managed” sites the ratio of the invaders is higher than of the control area. Especially boxelder (*Acer negundo*) has high ratio. Invasive species appear on the “control” areas also, but with significantly lower ratio, and mainly on higher sites.

# PHYTOGEOGRAPHICAL DIVERSITY OF DRY ACIDOPHILOUS PINE FORESTS IN CENTRAL EUROPE

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The dry acidophilous Scots pine forests with rich lichen and moss layer occupy large places from 70° N in Finland to the 50° N in southern Poland and Ukraine. The westernmost localities lie in northeastern Scotland and the easternmost ones at the Ural Mts. There are large areas of pine monocultures outside of the natural distribution. Pine-oak forests occupied these places formerly. All above-mentioned facts (phytogeographic distribution, origin and history of stands) seriously complicate the classification of Scots pine forest communities in sense of Braun-Blanquet system of syntaxa.

There are two main approaches:

(i) Traditional - the alliance *Dicrano-Pinion* is classified among coniferous forest of the class *Vaccinio-Piceetea* and order *Piceetalia excelsae*. Matuszkiewicz in Poland for the Central Europe established this concept. It has been accepted in Germany, Slovakia, Austria and Czech Republic later, as well.

(ii) Revolutionary - based on large phytosociological data set from Austria and adjacent areas of Germany, Italy and the Czech Republic. The alliance *Dicrano-Pinion* was put into calcareous pine forest of class *Erico-Pinetea* by this approach. Moreover, the class *Pulsatillo-Pinetea* (continental thermo- and xerophilous pine woods (syn. *Pyrolo-Pinetea*) was also merged inside this unit!

What is an optimal classification structure – one class with two (or three) orders, or 3 separate classes with internal structure?

Because of acidophilous ericoids of order *Ericales*, mosses (*Dicranum* spec. div., *Polytrichum* spec. div.) and many lichens (*Cladonia* spec. div.) in herb and moss layer the dry acidophilous lichen-pine forests are conspicuously uniform in total physiognomy and their functional and floristic composition. The differences in composition of tree and scrub layers among relevés, ordered from NW towards SE, are minimal, except the level of understorey. Subatlantic elements are mixed with Pannonian, Sarmatic and Continental ones. Greater variability was found also in lichen synusia while diversity of mosses was negligible. The effect of increasing continentality will be lost in uniform sandy substrates.



# OPENING UP THE FOREST CANOPY: THE CHANGE OF UNDERSTOREY VEGETATION AFTER 10 YEARS

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The forest management has changed dramatically over the past decades. The cessation of previous coppicing often resulted in the spread of shady forests and the retreat of heliophilous species. Our aim was to investigate the effects of experimental canopy thinning on understorey vegetation. The field experiment was established in a mixed oak forest in the SE Czech Republic in 1999, originally to assess the impact on increment of oak trees. Ninety circular plots cover a gradient from dry to mesic oak forest communities and include two treatments of different thinning intensity and one control treatment. In 2009 we recorded one relevé 10 m × 10 m in the middle of each plot. Light parameters (hemispheric photography) and soil conditions (pH and main nutrients in topsoil) were also recorded. Ellenberg indicator values have been used to examine ecological characteristics of different plots.

First results of exploratory analysis show that strongly thinned plots are characteristic by much higher cover of shrubs and herbs than the less thinned or the control plots. The species richness and proportion of ruderal species are also higher. Species present in the strongly thinned plots have higher light, moisture and nutrient Ellenberg indicator values. As we have observed marked differences in understorey responses in different vegetation types, our next goal is to find the environmental factors that drive the differences.

# INTER-SEASONAL CHANGES OF CENTRAL EUROPEAN VEGETATION

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It is generally recommended to record phytosociological relevés during the phenological optimum of particular vegetation type. Despite this, it is still common that the vegetation is sampled during the whole vegetation season. There are large phytosociological databases comprised of thousands of relevés that challenge to do synthetic studies on diverse scales. However, many of the relevés were recorded out of vegetation optimum and thus with different cover of herb, shrub and tree layers and some of the species missing. This inter-seasonal variation can lead to a bias in our classification and therefore to a misinterpretation of our results.

The aim of this study was to evaluate variation in vegetation relevés recorded at the same site but in different periods of the vegetation season. Therefore I analysed two datasets of permanent plots sampled in three distinct periods - spring, summer and early autumn. The first dataset includes records of 40 permanent plots of lowland forest vegetation and the second records of 46 permanent plots of steppe vegetation (narrow-leaved dry grasslands). I used various standardizations, distance measures and group linkage methods to classify relevés and tested their plasticity to inter-seasonal changes of vegetation. Final classifications were compared using Goodman-Kruskal's lambda index defined as percentage similarity between classifications. Detrended correspondence analysis (DCA) revealed inter-seasonal changes in main gradients of species composition, which was confirmed also by canonical correspondence analysis (CCA).

Although forest relevés were very similar in summer and autumn, spring relevés were very different. In contrast to forest, steppe vegetation showed different pattern. There was high similarity in spring and autumn relevés of steppe vegetation and summer records were very different.

The differences between classifications of relevés sampled in various seasons and classified with same methods are considerably higher than the differences between classifications of relevés sampled in the same season and classified with different methods. Beta-flexible method applied on the matrix of Sørensen dissimilarity distances proved the highest flexibility to inter-seasonal classifications of forest relevés. By steppe vegetation the best combination was Ward's method with Euclidean dissimilarity distance.



# THE REINTRODUCTION OF THE MICRO-FLORA BIODIVERSITY ON STERILE WASTE DUMPS

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The winning activity and mining procession in Maramures zone, during the last centuries, generated vast areas covered with sterile waste dumps and decantation pond, some of them being included in the urban and rural perimeter. All of these represent at the same time serious environmental problems and challenges for their reconstruction and reinstation in the natural landscape.

This study focuses on identifying and inventory of the micro-organisms species, bacteria and fungi from the sterile substratum and their association with various plant species in the rhizosphere. This is a preliminary study of establishing and identifying some symbiotic connections between micro-flora and cormophytes.

The fungus and plant samples were harvested in July-August 2007-2009: *Laccaria laccata*, *Amanita muscaria*, *Pisolithus tinctorius*, *Telephora terrestris*, *Scleroderma aurantium*, *Betula verrucosa*, *Salix caprea*, *Quercus petraea*, *Rumex acetosella*, *Carex* sp., *Viola tricolor*, etc. We analysed Cu, Fe, Pb, Co, Zn, Cd, Mn by spectrometry with atomic absorption by using the Analyser Perkiner Elmer AA 800.

The different species of plants can be colonized symbiotically by different types of fungi adapted to different types of soil and having different mechanisms of action, according to the particular conditions of the sub-layer. Absorption and concentration of cobalt, iron and chromium in organs differ at the plants depending on the sub-layer it grows on.

The rhizosphere may interfere by increasing the solubility of metals as in the case of Ni, Cu, Zn, whereas in the case of Mn and Pb the microbiota of the soil retains a part of these elements and stocks them.

The plants associated with the fungi in the sterile from the pond and with the micro-organisms in the rhizosphere succeed in surviving in these polluted sites, moreover, manifesting a tendency of hyper-accumulating heavy metals in the sub-layer, which makes possible the comprisal of this native species in the revegetation actions used in repairing tailing ponds.

This research supported by PN II project: "Monitoring the action of the soil's microbiota for considering its use in the ecological rehabilitation of the decantation ponds".

# MENYANTHO-SPHAGNETUM TERETIS WARÉN 1926 — A POST-GLACIAL RELIC OF TUNDRA LANDSCAPE ON A MESOTROPHIC PEATBOG IN POLAND

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Mesotrophic peatbogs are vegetation complexes considered particularly important for the conservation of European biodiversity (cf. Annex 1. to the 'Habitat' Directive 92/43/EEC). Currently, they are quite well represented in natural landscapes of Northern Europe, especially in the Scandinavian Peninsula, whereas in Poland they are indeed rare and threatened ecosystems. The country is situated in a climatically transitional zone characterized by both sub-atlantic, as well as sub-continental influences. Most part of Poland's surface was formed during the last glaciation which left extensive lakelands, moraine plateaus crossed by large proglacial stream valleys, etc. Currently existing peatbogs have been preserved only in specific geomorphologic conditions, i.e. in isolated land depressions without water outflow, which, in predominantly agricultural landscape, are more and more threatened by eutrophication and drainage. Thus, vegetation of peatbogs, and mesotrophic in particular, is represented by many regionally rare and endangered plant communities.

In Northern Wielkopolska, the second largest province of Poland, there is an extensive inland dune area, covered by the Notecka Forest, where a few of the above-mentioned land depressions, supplied by rainfall, have been preserved. They are surrounded by extensive pine forests (including *Leucobryo-Pinetum* and pine plantations). One of such areas, the Rzecin peatbog, has been a subject of our geobotanical investigations since 1998, which focused on the real vegetation diversity (presented on a large scale map), an outline flora of vascular plants and bryophytes, as well as in-depth documentation of the areas' phytocoenological peculiarity, i.e. *Menyantho-Sphagnetum teretis* WARÉN 1926. This plant community was originally described from N Finland at the beginning of the development of phytosociology, but since that times it has been reported from many other sites across N and Central Europe. Our presentation is aimed at: (1) a discussion on the association's local floristic variability compared synthetically with other data taken from published sources, as well as (2) an insight to a large-scale (local) distribution pattern, i.e. the presence of the mentioned phytocoenoses and their diagnostic taxa in a spatial mosaic of various plant communities.



# THE RELATIONSHIP BETWEEN SPECIFIC VEGETATION, SELECTED SPECIES AND CLIMATIC INVERSION IN THE CZECH SANDSTONE LANDSCAPE

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The effect of microclimatic and vegetation inversion in deep sandstone valleys is an interesting phenomenon in ecosystem ecology. Climate inversion was described by several authors (Beer 2007, Sklenář et al. 2007, etc.), but it has not been studied with a sufficient number of quality microclimatic measurements.

The aim of our project is to create a microclimatic-vegetation model of the sandstone landscape based on a set of 400 phytosociological relevés of vascular and non-vascular plants and long-term microclimatic measurements of moisture and temperature with 400 sensors. The basic model will be created for an area of 6 selected valleys. Using the exact digital terrain model from LiDAR surface scanning, this model will be extrapolated to a major part of the Bohemian Switzerland National Park.

The final model will use pretensions of selected species to environmental conditions (found in the area of the 6 valleys) to predict their optimal habitat in different parts of the national park. The environmental pretensions will be studied for the following species: *Empetrum nigrum*, *Huperzia selago*, *Streptopus amplexifolius*, *Ledum palustre* and *Lycopodium annotinum*. The final model will be verified by field research by recording the presence/absence of selected species in optimal habitats predicted by the model.

# FOREST HISTORY OF THE SOPRON HILLS (EASTERN ALPS)

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The Sopron Hills are situated on the border of the Eastern Alps and the Carpathian Basin. Because of its geographical situation the range shows transitional phytogeographical character, and as the consequence of former human impacts its vegetation is strongly transformed. The interpretation of phytogeographical character and actual vegetation of the hills (pine-mixed broadleaved forests, secondary floodplain forests, dry oak fragments, etc.) requires the thorough knowledge of the forest's history.

The first deforestations started at Subboreal, and significant human impacts (with the decrease of forested area) from the 7th century B.C. can be proved at the foothills. A later deforestation wave can be estimated to take place in the 12-13th century and can be located at the foothills. The clearings (meadows) along streams can be dated from the 18th century, however the miner settlements of the hills developed from the beginning of 19th century. Based on historical maps, the forest cover was 59.7 % at the end of 18th century, then this value decreased (56.1 %) by the mid-20th century. Due to spontaneous reforestations of former meadows and vineyards, as well as smaller afforestations from the 1950's on, forest cover increased again, and its value was 61.0 % at the turn of the millennium.

The changes of tree species composition before the 18th century can be concluded partly from vegetation history data, partly from the volume and character of human impacts. In the 1700's coniferous species had only sporadic occurrences, but from the 1850's a strong coniferisation started and its impacts in the forest vegetation can be registered until today. The data sequence available from the period of 1885-2004 on the forest blocks (cca. 4000 ha) formerly owned by Sopron city spectacularly demonstrates the changes of tree species in the last 120 years. The coniferisation process raised the spatial ratio of coniferous species (*Picea abies*, *Pinus sylvestris*, etc.) above 50 % during this period. Parallel to these changes in the forests, degraded in the Middle Ages, the area of pioneer tree species (*Betula pendula*, *Populus tremula*) and *Carpinus betulus* drastically decreased. The area of *Fagus sylvatica* and *Quercus petraea* did not change essentially until the 1970's. The biotic and abiotic damages in coniferous stands started in the 1980's and resulted in the strong decrease of the area of *Picea abies*, a minor increase of *Quercus petraea* and a major increase of *Fagus sylvatica*.



# IS THERE A LOWLAND TAIGA IN THE CZECH REPUBLIC?

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The Doksy area in Northern Bohemia is over 400km<sup>2</sup> large sandstone landscape covered by pine forest with wetlands and isolated temperate beechforests. It emerged that this area represents the most south-western exclave of large-scale occurrence of lowland taiga ecosystems. The closest distribution limit of boreal woodlands lies in Lower Lusatia and Poland (see the Map of the Natural Vegetation of Europe). The study region is remnant of ecosystems which prevailed in Europe in the early Holocene ca 10,000 years ago. Flora of the area contains many exclave boreo-continental elements (e.g. *Ligularia sibirica*, *Carex macroura*) and some endemic species such as *Pinguicula bohémica*. A multi-proxy approach was used to interpret correspondence across various methods from vegetation survey, palaeobotany, archaeology upto the history. For the description of the vegetation, we recorded species lists in 240 plots (100 m<sup>2</sup>) along a 50km-transect through the study area. In the vegetation, species of boreal and boreo-continental biogeographical elements prevailed. The minor part of vegetation was classified as temperate ecosystems (i.e. mesic grasslands, broadleaved forests, pasture pine forests) whereas boreal ecosystems prevailed (i.e. acidophilous and calcicolous pine forests, peatbogs, alluvial wetlands). The taiga-hypothesis was confirmed by paleobotanical research. Palynological profiles showed the development of wetlands since Late Glacial to the present time. A macroremain-analysis showed local stability of waterlogged *Picea abies* forests in the majority of the Holocene. Charcoal profiles dated by radiocarbon confirmed the hypothesis of continual occurrence of *Pinus sylvestris* forests in a broad habitats scale for the whole Holocene. The sandstone pseudokarst, fens, wildfire cyclic succession in coniferous forests and soil conditions unsuitable for agriculture were the main factors stabilizing this landscape both against long-term natural changes and human impact. Therefore, standard colonisation strategies (towns and agriculture villages) mostly failed here whereas alternative and “mild” strategies such as hunting, forestry and fish farming were more successful. So far, correspondence of some datasets has been not fully explained (e.g. local information of charcoal analyses vs. large-scale palynological information). The multi-proxy approach used gives us opportunity to explain the nature of Doksy area by a detailed description of historical events.



# POSTERS

VEGETATION OF EUROPEAN  
RIVERS AND FLOODPLAINS

# INVASION OF ALIEN PLANTS IN FLOODPLAINS COMMUNITIES OF SOUTH URALS

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An active process of alien plants invasion takes place in the South Urals. Among them there are *Ambrosia* species which characterized by naturalization along floodplains. Derivate communities are formed as a result of invasive species introduction into the disturbed floodplains of steppe and forest-steppe zones of the South Urals (Abramova, 2009). So, when *Ambrosia trifida* spreads into shaded floodplain localities of *Galio-Urticetea* PASSARGE 1967 class at margin of floodplain forests of *Salicetea purpurea* MOOR 1958 class and *Alnion incanae* PAWLOWSKI, SOKOLOWSKI & WALLISCH 1928 union of *Quercu-Fagetea* BR.-BL. & VIEGER in VIEGER 1937 class, derivate community *Ambrosia trifida* [*Galio-Urticetea*] is formed. In spreading of species of *Ambrosia* genus into disturbed communities of moist localities of *Bidentetea tripartiti* R.Tx. *et al.* in R.Tx. 1950 class, derivate communities *Ambrosia trifida* [*Bidentetea tripartiti*] and *Ambrosia psyllostachya* [*Bidentetea tripartiti/Plantaginetea majoris*] are developed. So, you can observed naturalization *Ambrosia trifida* into disturbed and weakly-disturbed meadow communities of *Molinio-Arrenatheretea* R. Tx 1937 class, forming derivate communities *Ambrosia trifida-Bromopsis inermis* [*Agropyretea repentis/Molinio-Arrenatheretea*] and *Ambrosia trifida* [*Agropyreteal/Molinio-Arrhenatheretea*]. Activization of *Ambrosia* is connected with human activity and general processes of anthropogenic transformation of ecosystems in the region.

Investigation is supported by the program of Presidium of the Russian Academy of Sciences «Biological diversity».



# HABITAT STUDIES ALONG THE MURA RIVER

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Mura is a tributary of the Drava and subsequently the Danube. Its total length is 465 km, of which 45 km forms the border between Croatia and Hungary, and a short portion between Hungary and Slovenia. The Mura floods and changes its course rather often, moving slowly toward the north on its left. Its versatile flooding area between the embankments serves as a valuable constituent of the Mura Landscape Protection Region.

Our team studied the section from the Kerka inlet to the bridge at Letenye both on Hungarian and Croatian riverside. The aim of the study was to recover and qualify the versatile living world from the point of view of habitat structure, diversity and naturalness regarding the consequences of traditional and modern land use, river control, and regional development.

Field observations were done on the basis of comparative use of the series of the 2nd Hungarian military map, aerial photographs made in 1950, 1983 and 2005. 260 records were done on the spot to determine the main habitat types with corresponding vegetation units, plant communities based on floristic composition. Generalized habitat map has been constructed based upon 2005's aerial photograph on the scale of 1:10000.

Habitat types were enrolled by the General National Habitat Classification System (Á-NÉR).

The habitat structure and species composition proved to be rich because of the post effect of the formerly closed boarder line but influenced by production-oriented forestry, gravel-pits, river-regulation and changes in land-use habit of the local population.

There are 26 habitat types and 22 plant communities which are valuable from the point of view of nature conservation (see-grasses, reeds and marshes, meadows, natural pioneer habitats, riverside bushes and gallery forests); unpreferable (under cultivation), very bad (invasive grasses and woods), and un-ratable (e.g. arable field, mine). We counted 10 species of protected plants, 16 of invasive neophytes, 11 of typical trees, and, in addition, 35 species of mushrooms. There are valuable hayfields, stands of wild grown fruits collected by the inhabitants.

The detailed description of habitats along the studied section of Mura should serve as basis of further conservation and sustainable development in the landscape management.

The study was carried out under the frame of "Man-Mura-Nature" Interreg III joint project of Slovenia, Croatia and Hungary in 2007.

# CORRELATION BETWEEN SPECIES COMPOSITION AND CO<sub>2</sub> FLUXES OF FLOATING AQUATICS

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One main goal of this study was to determine the correlation between CO<sub>2</sub> flux and species composition and biomass at stand level in characteristic aquatic communities of the Carpathian Basin. Another objective was to be familiar with the seasonal and annual dynamics of stand level CO<sub>2</sub> flux and biomass for these communities. The selected plant associations and their dominant hydrophytes are widely distributed in low lying European wetlands. The Net Ecosystem CO<sub>2</sub> Exchange (NEE) measurements were episodically carried out in 3 plant communities (*Salvinio-Spirodeletum*, *Nymphaeetum albo-luteae*, *Trapaetum natantis*) of Füred oxbow (a large dead channel of River Tisza) during the growing season in 2009. For stand level CO<sub>2</sub> flux measurements a self-developed floating „island”, a water-clean perspex-chamber with a diameter of 60 cm, an infrared gas-analyser, and a CR10 data logger were used. Parallel with the stand level chamber measurements operating in open system relevé sampling, biomass measurement as well as measurements of adjunctive micromet (windspeed, photosynthetically active radiation, air and water temperature), hydrological and hydrochemical data were conducted. A significant positive correlation between NEE and green leaf area and percentage cover of the floating species was found in each studied stand. However, Net Ecosystem CO<sub>2</sub> Exchange was not correlated with the number of species and Shannon diversity.



# ASSESSING THE FUNCTIONAL ROLE OF VEGETATION COMMUNITIES IN RELATION WITH THE OTTER POPULATION NATURAL EXPANSION IN ITALY

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In the present work a combination of connectivity analysis and phytosociological investigations is proposed for the assessment of functionality of vegetation communities in the otter expansion. The approach is tested within the northernmost isolated portion (Molise and southern Abruzzo regions) of the Italian range of otter (*Lutra lutra*). The otter is one of the most endangered mammals in Italy and the identification of its suitable riparian habitats and of the corridors through which the species could potentially expand to colonise new areas constitutes a priority for its conservation.

The proposed connectivity analysis is derived from graph theory and summarizes the role of suitable riparian habitat areas (graph nodes) and minimum cost paths through the landscape matrix vegetation (graph links) for maintaining or improving the dispersal movement of otters between river basins.

In order to identify the graph nodes, we used a two-class and fine-scale habitat suitability map. Links were characterized through multiple minimum cost paths between the basins where the species actually occurs and where it is likely to expand in the short-medium term. We used the Probability of Connectivity index (PC) that integrates habitat suitability concept with dispersal probabilities between habitat patches. Furthermore, we evaluated the effectiveness and potential improvement of suitable habitat patches for maintaining or recovering the distribution of otters. To determine the criteria for restoration of nodes and functional links, we appealed to the phytosociological approach. The vegetation analysis in sample areas suggested some potential restoration interventions that would improve both the connectivity for the otter in the study area, and the state of conservation of several EU important habitats.

This combined approach has turned out to be a very effective and powerful tool for both identifying key areas for future expansion of otter and prioritizing the areas where management should concentrate. This approach may be applied to other similar species, areas and conservation problems in Italy and elsewhere.

# CHLOROPHYLL FLUORESCENCE CHANGE OF *SPHAGNUM* SPECIES DURING DRYING AND REHYDRATION

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Many bryophytes such as certain lichens and terrestrial algae, can withstand drying to water contents of 5-10% of their dry weight. Do the *Sphagnum* species on the semi-aquatic peatlands have similar desiccation or dehydration tolerance?

This article investigates the effect of water content changes in different *Sphagnum* mosses (*Sphagnum palustre*, *Sphagnum angustifolium*) as measured in Hungary. We registered the different habitats of mosses on hummock-hollows with coenological samples. We took the samples on two different peatlands. Chlorophyll-fluorescence parameters of peat mosses were measured during drying and following remoistening after a period of dehydration, first in the field and then under controlled conditions. We studied the effect of different dehydration tolerances on the vertical zonation patterns of *Sphagnum* species along hummock-hollow gradients in bogs. We found significant differences in dehydration tolerances between *Sphagnum* species that were related to the preferred height above water table of their habitats, thus giving a physiological explanation of hummock-/hollow-preferences of *Sphagnum* species.



# AQUATIC PLANT COMMUNITIES IN SLOVAKIA: A RECENT STATUS

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In the last decades, the studies of aquatic habitats brought a lot of new information about distribution, floristic composition and ecology of aquatic vegetation in Slovakia. Up to now, there are more than 1300 phytosociological relevés of aquatic vegetation of the *Charetea fragilis*, *Lemnetea* and *Potametea* classes stored in the Slovak National Vegetation Database (SNVD), which were recorded between 1953 and 2009.

In the first step we compiled data in the database and compared our recent knowledge of the aquatic syntaxa to the recently published List of vegetation units of Slovakia (Jarolímek *et al.*, 2008). We selected 1020 relevés from the SNVD for numerical analyses (relevés with plot size <4 m<sup>2</sup> and >30 m<sup>2</sup> were excluded). More than 53% of relevés were published in 53 papers and theses and the rest were unpublished data. The older relevés were recorded mainly in natural habitats of the Slovak lowlands (Podunajská, Východoslovenská and Borská nížina). More than one third of all relevés were recorded in the last 10 years. These newer relevés were obtained mainly from artificial reservoirs in the colline and submontane belts of the Western Carpathians in Slovakia. The published List of vegetation units of Slovakia includes 8 plant communities of *Charetea fragilis*, 15 communities of *Lemnetea* and 25 communities of *Potametea*. Recently, the *Batrachietum rioinii*, *Potametum acutifolii*, *Potametum alpini* and *Potametum zizii* associations were newly recorded in the territory of Slovakia and several other plant communities recently known from Slovakia (e.g. *Callitriche cophocarpa* comm., *Callitriche platycarpa* comm., *Potametum berchtoldii*) were not included in the List. Moreover, some vegetation units presented in the List were not confirmed in Slovakia in long time, e.g. *Wolffietum arrhizae* or *Spirodelo-Aldrovandetum*. In the analysed data set, *Lemnetum minoris*, *Hydrochari-Stratiotetum* or *Nymphaetum albo-luteae* belong to the most frequent communities.

In the following step we numerically analyse the phytosociological relevés and evaluate the effects of selected environmental factors (e.g. altitude, water depth, species occurrence in natural or secondary biotopes) on the diversity of aquatic vegetation and characterise individual syntaxa using the Ellenberg indicator values.

# CHANGES IN THE ACTIVE FLOODPLAIN VEGETATION OF THE SZIGETKÖZ

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The Szigetköz is situated in the northwestern part of Hungary. In the late 19th century, a flood protection dam was built, which divided the original floodplain into an active part and an inundation-free part. In 1992, most of the water in the main Danube channel was diverted into a canal built to supply the hydroelectric power plant at Bős. This large-scale modification led to – among others – the decline of surface water level in the active floodplain as well as the drop of groundwater depth beyond the dikes. The region's wetland vegetation was characteristically rich in species due to a favourable water supply and the wealth of propagules (seeds, fruits, shoots with live buds) dispersed over the area by recurring floods. The area supports only few rare species. Instead, its real value lies in the vast diversity of species: montane and lowland species often grow side by side. The degree of naturalness varies greatly for the different parts of the Szigetköz ranging from intensively managed arable fields under constant human influence to pristine wilderness proposed to be placed under strict legal protection. Plantations of hybrid poplar also cover extensive areas. The most severe water level decline took place on the active floodplain at the section of the Great Danube channel right upstream of the canal supplying the hydroelectric power plant.

Terrestrial plants have very quickly established in the dried-up riverbed of the Old Danube channel. In the first years, the exposed gravel substrate abounded in usual riparian plant species otherwise common on bars. On the new shoreline, a 30 m wide belt of white willow (*Salix alba*) has developed. Above this, a zone of water-demanding tall forb community has established which tolerates temporary inundation. Further away up to the original shoreline, a strip of vegetation composed of box elder (*Acer negundo*) has appeared. Unlike the white willow belt, this zone developed slowly. At first, knee-high box elder saplings vegetated in the dry grassland, but once their roots have reached permanently wet soil layers, their growth greatly accelerated. In the former riverbed, the mass appearance of invasive plants (*Acer negundo*, *Ailanthus altissima*, *Solidago gigantea*, *Aster lanceolatus*, *Fallopia × bohémica*) raises serious concerns for nature protection.



# HYGROPHILOUS VEGETATION ALONG THE IRMINIO RIVER (SOUTHERN ITALY)

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The Irminio river is located on the South-Eastern region of the Sicily island, within the territory of the Ragusa province. It rises in Mt. Lauro (Iblei Mounts) and flows towards the South-Eastern coast of the island. The study area was selected on the upper Irminio, at about 370 m a.s.l., within the S.C.I. area Alto Corso del fiume. Geologically the territory is characterized by limestone and by alluvial sandy-muddy sediments along the river (Carbone et al. 1982). The climate, according to Rivas-Martinez (1981), is sub-humid Thermo-Mediterranean. Average annual temperature is 16.6 °C ; average annual rainfall is about 700 mm. The aim of the study is to point out the plant communities living along the upper Irminio, an area geobotanically not much investigated. The study was carried out following the Braun-Blanquet's method ; many phytosociological relevés had been made on different sites. The data collected were processed by multivariate analysis, applying Syntax 2000 (Podani 2001). The study allowed to identify some plant communities, belonging to different syntaxa. The riparian forest vegetation is mostly represented by the *Platano-Salicetum pedicellatae* BARBAGALLO, BRULLO & FAGOTTO 1979, belonging to the *Platanion orientalis* (*Populetalia albae*, *Quercu-Fagetea*). The presence of *Laurus nobilis* (Inclimona et al. 2008) allowed to distinguish, within this community, the new subassociation: *lauretosum nobilis* INCLIMONA 2010. Near this vegetation, a woody community characterized by *Salix alba* and *Salix pedicellata* is fragmentarily widespread. It belongs to the *Populetalia albae*. Within the helophytic vegetation different communities were identified: *Sparganietum erecti*, belonging to the *Phragmition communis* (*Phragmitetalia*, *Phragmito-Magnocaricetea*); *Helosciadietum nodiflori* and *Nasturtietum officinalis*, belonging to the *Glycerio-Sparganion* (*Nasturtio-Glycerietalia*, *Phragmito-Magnocaricetea*). The study allowed to point out significant aspects of the vegetation along the upper Irminio, where rare species such as *Platanus orientalis* and *Laurus nobilis* play an important ecological role. Since the riparian vegetation belongs to the most endangered habitat types in Sicily, adequate protection actions are urgently needed.

# FLORA, VEGETATION AND LANDSCAPE OF GRASSLANDS IN ZIEMIA LUBUSKA (WESTERN POLAND) – DIVERSITY, THREATS AND LANDUSE CHANGES

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The study shows the results of investigating plant cover of meadows and pastures in Ziemia Lubuska (Western Poland) on three levels: flora, vegetation and landscape. The diversity of plant communities on studied grasslands is high – it comprises 38 associations and 7 communities. 60% of them are vulnerable and endangered in the region, most of all *Molinion* and *Cnidion* meadows and xerothermic swards *Festuco-Brometea*. From among 528 recorded species of vascular plants, 10% were rare or endangered. The comparison of landscape type and structure on historical maps (1938) and on a series of aerial photographs (1963-2006) has shown that the general tendency was the reduction of grasslands surface, in some areas up to 50-60% in the last 70 years. Grasslands have been replaced both with forests and arable fields as result of secondary succession in the first case and of intensification of land use in the second. The analysis of orthophotomaps indicates distinct, directional character of changes in seminatural landscapes. The degree of threat of connected with them species and plant communities will increase.



# PHYTOCOENOLOGICAL INVESTIGATION OF HUNGARIAN HYGRO- AND MESOPHILOUS FORESTS ALONG THE DANUBE AND DRAVA RIVER

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Remnants of the (semi-)natural vegetation of floodplains, in particular, the riparian forests (incl. oak-hornbeam forests as well) are threatened not only in Hungary, but generally in Europe.

Three types of this vegetation, along a theoretical moisture gradient, from the mesophilous oak-hornbeam forest through the intermediate oak-ash-elm forest to the periodically flooded and hygrophilous white poplar forests was studied from a phytosociological point of view in the Danube and Drava valley in Hungary.

A database containing 581 phytosociological relevés of the mentioned forest types were analysed by classification and ordination methods. Results were obtained both from analyzing the three types together and separately.

Four types of oak-hornbeam forests (two in the Danube and two in the Drava valley, respectively) and oak-ash-elm forests (three in the Danube and one in the Drava valley) and three types of white poplar forests (two in the Danube valley and one in the Drava valley) were distinguished as significant clusters by multivariate statistical methods. In general, forests of the Drava valley and the Southern Danube valley were more similar, while the vegetation of the northernmost part of Danube valley (Szigetköz) always formed a distinct cluster. The most important difference between the southern and the northern types of riparian forests are the presence/absence of species with submediterranean and/or subatlantic distribution (e.g. *Carex strigosa*, *Carpesium abrotanoides*, *Cephalaria pilosa*, *Crataegus niger*, *Hedera helix*, *Lonicera caprifolium*, *Quercus cerris*, *Ruscus aculeatus*, *Primula vulgaris*, *Scutellaria altissima*, *Tilia tomentosa*, *Tamus communis*). The difference between the hygrophilous and mesophilous forests within an area is the smallest in the central part of the Hungarian Danube valley, where the effect of continentality and the disturbance are the highest.

# SPRUCE FORESTS OF RIVER VALLEYS OF CENTRAL KAMCHATKA (RUSSIAN FAR EAST)

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Spruce forests formed by *Picea ajanensis* (syn.: *P. jezoensis*) on the Kamchatka peninsula are found only in the Central Kamchatka Valley. They form a fragmentary altitudinal belt at 200-600 m a.s.l. The valley spruce forests grow in the Southern part of Central Kamchatka along the rivers and streams, as well as on the river terraces up to 300-400 m.

The valley spruce forests were studied in the basins of the Levaya Schapina and the Ipuin rivers. The classification of Kamchatka spruce forests was developed according to the Russian phytosociological tradition. The valley spruce forests were placed into the following syntaxa: ass. *Piceetum ajanensis hylocomiosum*, subass. *typicum* and *nanoherbosum* (moss-rich spruce forests); ass. *P. a. polytrichosum* (haircap-moss-rich) and ass. *P. a. nanoherbosum* (small-herb-rich). The tree layer was dominated by spruce with the presence of *Larix cajanderi* and birch (*Betula plathyphylla* or *B. ermanii* depending on the altitudinal position). The tree layer density was 0.5-0.6. The shrub layer was sparse; the characteristic species were: *Pinus pumila*, *Sorbus sambucifolia*, *Lonicera caerulea*, *L. schamisoi*, *Spiraea beauverdiana*. The herb layer coverage varied from 5-15% (in moss-rich communities) to 50%. Boreal species were constant and abundant: *Linnaea borealis*, *Orthilia secunda*, *Trientalis europaea ssp. arctica*, *Moneses uniflora*, *Lycopodium annotinum*, *Equisetum pratense*, *E. sylvaticum* etc. Mesic forbs *Chamerion angustifolium*, *Solidago spiraeifolia*, *Calamagrostis purpurea* and *Rubus arcticus* were constant too. The number of vascular plant species varied from 23 in moss-rich type to 52 in small-herb-rich type. The bryophyte layer was well developed in moist sites and sites with slightly stagnated wetting (the total coverage was 70-80%) and sparse in sites with running wetting (35%). Boreal mesic mosses: *Pleurozium schreberi*, *Polytrichum commune*, *Hylocomium splendens* and *Dicranum majus* were common. The coverage of epigeic lichens was about 1-2%. The number of lichen species varied from 3 to 26. The most frequent species were: *Peltigera aphthosa*, *Cladonia cornuta ssp. cornuta*, *C. gracilis ssp. turbinata*, *C. rangiferina* and *C. cenotea*.

According to Braun-Blanquet approach our ass. *Piceetum ajanensis hylocomiosum* is close to ass. *Moneseto uniflorae-Piceetum jezoensis* KRESTOV & NAKAMURA 2002 var. *typicum*. Our ass. *P. a. nanoherbosum* is close to ass. *Moneseto uniflorae-Piceetum jezoensis* KRESTOV & NAKAMURA 2002 var. *Geranium erianthum*.



# VEGETATION OF VALLEYS OF SALINE RIVERS IN MIDDLE AND LOWER VOLGA REGIONS (RUSSIA)

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The area of the research covers the Volga Basin between the cities of Ulyanovsk and Astrakhan and according to M. A. Fortunatov (1971) is divided into Middle Volga (territory of the Basin to Samara) and the Lower Volga (territory to the south of Samara). Saline soils could be found in valleys of the small rivers.

Applying the method of J. Braun-Blanquet in 1994-2009 570 geobotanical relevés were made in the valleys of saline rivers. All the relevés were collected in the database created with the help of the TURBOVEG (Hennekens, 1996) software package. The groups of the plant communities which are similar in their floristic composition have been allocated. Identification and the name of the new syntaxonomical units were performed in conformity with ICPN (Weber et al., 2000). The syntaxonomic system of plant communities was applied using the list of higher syntaxonomic units of SynBioSys Europe. During the studies 27 syntaxa were determined.

In the Middle Volga Basin in valleys of the small rivers saline soils are widespread and are characterized by low degree of salinization. The vegetation cover is submitted by communities of classes *Molinio-Arrhenatheretea* (alliance *Arrhenatherion elatioris*), *Festuco-Puccinellietea* (alliances *Cirsion esculenti*, *Festuco-Limonion gmelinii*, *Camphorosmo-Suaedion corniculatae*, *Scorzonero-Juncion gerardii*) and *Thero-Salicornietea* (alliance *Salicornion herbaceae*).

In the Lower Volga Basin the small rivers have saline waters and in summer frequently dry up. In their valleys saline soils are widespread. The vegetation is diverse and submitted by communities of classes *Festuco-Puccinellietea* (alliances *Cirsion esculenti*, *Festuco-Limonion gmelinii*, *Camphorosmo-Suaedion corniculatae*, *Scorzonero-Juncion gerardii*, *Artemisio santonicae-Puccinellion fominii*, *Glycyrrhizion glabrae*, *Lepidion latifolii*) and *Thero-Salicornietea* (alliance *Salicornion herbaceae*).

# EXPERIENCES OF THE COMPLEX SURVEY OF A DEGRADED FOREST-STEPPE RELICT IN THE GREAT HUNGARIAN PLAIN

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The natural vegetation of the Great Hungarian Plain has been totally perished or significantly damaged. The vegetation history is poorly known. Hence, it is of great importance to study the vegetation of the verges and the relict habitats. The aim of our project was to investigate the patches of the semi-natural habitats near Kisújszállás town. First, the Öregerdő (Old-Forest) was investigated because it is the most expanded and unfragmented area. It is located on the Trans-Tisza Region in the Great Hungarian Plain, on the periphery of a loess-table and the former Tisza-floodplain.

The recent flora and the land-use history were analysed. The vegetation pattern was monitored by making a GIS database and the vegetation map was edited. Fourteen phytocoenological relevés were taken. Finally, a tree-cadaster was made.

The results show that the Öregerdő is a secondary (man-made) habitat. It was planted in the place of an earlier wooded area in the second half of the 18<sup>th</sup> century. This fact is confirmed after the great botanist Pauli Kitaibel's notes. The maps of the 1<sup>st</sup> and 2<sup>nd</sup> military surveys also support this theory. The recent vegetation presents a degraded loess and alkali forest-steppe mosaics. There was a significant change in the species composition during the last one-hundred and fifty years. There is a high value of the four large-sized grassland patches. One of them is an alkali wooded-steppe meadow (*Peucedano-Asteretum*) relict. The other three are the mosaics of the degraded loess steppes (*Salvio-Festucetum*) and alkalic steppes (*Artemisio-Festucetum*, *Achilleo-Festucetum*). At several places the horizontal vegetation pattern could be recognized according to the mild microrelief. The wooded part is mainly a plantation (*Robinia pseudo-acacia*, *Fraxinus pennsylvanica*, *Populus* spp.), except for some old oak (*Quercus robur*), wild-pear (*Pyrus pyraeaster*) and ash (*Fraxinus excelsior*) trees. Some of them are older than two hundred years. There are some protected and regionally rare species which indicate the earlier state. There is no importance of the invasive transformer species in the area (except for *Robinia*).

The recent status of the Öregerdő is especially important both as a stepping-stone and a landscape value in the surrounding agricultural region.

Furthermore, we also plan monitoring and evaluating the other habitat fragments nearby Öregerdő.



# FOREST MANAGEMENT EFFECTS ON UNDERSTORY A CASE STUDY ALONG RÁBA RIVER.

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We investigated the effect of forestry management on the understory of hornbeam-oak forests along the River Rába at four study sites between 2007 and 2009. We studied isolated woodlands 20–40 km apart from each other along the lower and middle sections of the river situated near Körmend, Egyházashollós, Rum and Sárvár. Most of these woodlands were state owned and were subjected to clear felling according to the management plan without any conservation restrictions. The following understory species were investigated at each study site: *Galanthus nivalis*, *Leucojum venum*, *Scilla vindobonensis*, *Anemone nemorosa*, *Anemone ranunculoides*, *Isopyrum thalictroides*, *Corydalis cava*, *Corydalis solida*. We recorded the position of the plants by GPS and related the resulting distribution to the management history of the forest subcompartments (based on management plans and data from archives). In the analyses we took into account the surrounding and topography of the subcompartment and the regional distribution of plant species. *I. thalictroides* typically inhabits oldgrowth forests and hardly any records were obtained from young or middle-aged stands. The species almost completely disappears after clear felling. *Galanthus nivalis*, *Leucojum venum* and *Scilla vindobonensis* are spreading along wood edges and former river beds. The last species relatively quickly colonises afforested areas. From the two *Corydalis* species, *C. cava* was sensitive to forestry activities, while *C. solida* was common in degraded stands as well. The distribution of *Anemone* species was mainly determined by their regional frequency and the topology of the forest. The negative effect of former forestry management was only revealed on *I. thalictroides*, the rest of the species were able to regenerate during reforestation. The investigated species only slowly colonised the afforested areas, and only *G. nivalis* and *S. vindobonensis* immigrated to 100 years old stands from neighbouring natural stands. Forest edges play an important role in the survival and migration of investigated species, therefore they deserve attention during final felling. In reforested areas that were treated by chemicals we observed the spreading of *Rubus fruticosus* agg. and *Calamagrostis epigeios* and parallelly the decline of the investigated species.

# THE RESEARCH OF THE CONNECTION BETWEEN GEOMORPHOLOGY, SOILS AND VEGETATION IN A SECONDARY SALINE FLOOD- PLAIN (HÓDMEZŐVÁSÁRHELY, NAGYSZIGET)

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Hódmezővásárhely is situated in the Great Hungarian Plain in Southeast Hungary. The sampled area Nagysziget lays in the South Tisza Valley which became a secondary saline grassland after the regulation of the river-ways. During the studies habitat and geomorphology maps were made, soil samples were taken at 16 places and the formerly measured groundwater data were used to evaluate the connections between vegetation, soils, geomorphology and groundwater. The pH(H<sub>2</sub>O), the humus-, soda- and water-soluble salt-content and the percentage distribution of grain-fractions of soil samples were measured. Historical data were used to evaluate the changes in soils since 1980.

The Nagysziget is covered by *Achillea*-type of secondary saline habitat-complex where 3 different vegetation units were separated. The homogeneous salt meadows appear in crescentic flats, paleopotamals at near-to-surface 0-0.5 m deep average yearly groundwater-level, on meadow solonetz, meadow, carbonated alluvial meadow and meadow alluvial soils. The homogeneous *Achillea* alkali steppes are formed on levées, at deeper - 1.3-2.0 m - average yearly groundwater-level on non-sodic – carbonated humous alluvial and carbonated humous alluvial meadow - soils. The mosaics of salt meadows and *Achillea* alkali steppes occur on point bars, at 0.1-1.3 m deep average yearly groundwater-level, on meadow solonetz.

The pH of homogeneous and mosaic salt meadows and the *Achillea* alkali steppes can be slightly acid or slightly alkaline. The *Beckmannia* salt meadows are slightly alkaline, whereas the *Alopecurus* ones are slightly acid. A pH-gradient was found in the salt meadows of the point bars and crescentic flats. The homogeneous *Achillea* alkali steppes have slightly acid pH. The *Beckmannia* salt meadows in homogenous patches are very slightly humous, while the mosaics of salt meadows and *Achillea* alkali steppes are slightly humous. The humus-content of the homogenous *Alopecurus* salt meadows is moderate. The homogeneous *Achillea* alkali steppes are moderately humous. At all the studied vegetation- and soil-types the fine sand is the dominant (30-50%) grain fraction. At Nagysziget the humus-content has increased with 2-4%, while the pH has decreased with 0.2-2.7 values shifting to slightly in the surface layers at most places since the 1980s, which affected the *Achillea* saline grasslands the most. The *Alopecurus* dominated saline meadows preserved their slightly acid features, but their humus-content has doubled.



# DATA TO THE FLORA AND VEGETATION OF JÁSZSÁG MICROREGION (HUNGARY)

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The aim of our work is to give some botanical data the flora and the vegetation of the lesser-known Jászság microregion of Great Hungarian Plain.

Jászság lies on the border of the Crisicum and Praematricum plant geographical regions. Most of it is under cultivation, therefore, natural and close-to-nature habitats are rare. The infection of the flora by invasive neophytes (*Robinia pseudoacacia*, *Ailanthus altissima*, *Prunus serotina*, *Acer negundo*, *Amorpha fruticosa*, *Fraxinus pennsylvanica*, *Asclepias syriaca*, *Aster* spp., *Impatiens parviflora*, *Phytolacca americana*, *Reynoutria* spp. and *Solidago* spp.) is strong. Currently solonetz sodic pastures and meadows, plain marsh meadows, smaller marshes and mostly derivative forests are typical.

The standing- and living waters and channels are belted by band-like marshes (*Caricetum acutiformis*, *C. gracilis*, *C. ripariae*). These marshes are in connection with marsh meadows, where *Iris spuria* and *Clematis integrifolia* are dominant in some places (alongside of the Zagyva- and Tarna-river). On the sodic fields the alkaline bench (*Crypsis aculeatus*, *Camphorosma annua*) appears sporadically, the alkaline pastures (*Achillea-Festucetum pseudovinae*) are more frequent. Loess- and sand meadows are restricted to small patches only. Loess vegetation (*Phlomis tuberosa*, *Peucedanum alsaticum*, *Linaria biebersteini* ssp. *strictissima*, *Agropyron pectinatum*, *Rosa gallica*) and arenicolous vegetation (*Silene conica*, *Anthemis rutenica*, *Artemisia campestris*, *Alyssum desertorum*, *A. tortuosum*, *A. montanum* ssp. *gmelinii*) can be found mostly on boundaries, Cumanian hillocks, dams, abandoned orchards and on the remaining of extensive orchards and on the fringes of forests in a form degraded strongly the many times. Softwood (*Leucojum aestivum*, *Orobanche lupuliformis*) and hardwood gallery forest residues (*Convallaria majalis*, *Polygonatum latifolium*, *P. multiflorum*) can be found mainly along Zagyva-river (Jászfelsőszentgyörgy, Jászberény, Jásztelek, Újszász). The flatland pedunculate oak forests (*Ficaria verna*, *Cephalantera longifolia*, *C. damasonium*, *Epipactis tallosii*, *Colchicum autumnale*, *Melica altissima*, *Sysimbrium strictissimum*) and salt oak forests (*Festuco pseudovinae-Quercetum*) and salt scrubland meadow (*Artemisia pontica*, *Peucedanum officinale*, *Aster sedifolius* ssp. *sedifolius*) are very rare and live in small groves.

# THE FLORA AND VEGETATION OF THE HUNGARIAN BODROGKÖZ

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The list of flora of the Hungarian (lower) Bodrogeköz microregion contains more than 750 vascular plant species. This high number of taxa is of note considering the phytogeographical conditions of the area (Great Plain region).

Bodrogeköz is proved by identification of a large number of rare species and plant associations. In terms of numbers a total of 53 protected and one (*Pulsatilla hungarica*) strictly protected vascular plant under legal jurisdiction live there. The real rarities of the region include *Ludwigia palustris*, *Ranunculus lingua*, and *Thalictrum aquilegiifolium*. As a result of our research numerous species were found that can be considered new to the Bodrogeköz flora e.g. *Dianthus deltoides*, *Iris graminea*, *Epipactis tallosii*.

Alongside the characteristic non-woody associations of the landscape, woody stands in various sizes, structure and species composition are typical. The presented coenological relevés (records) mainly were taken in 27 aquatic and waterside, 4 herbaceous and 10 arboraceous plant associations between 2003 and 2008. Our research was of a stopgap nature due to the lack of previous research into the area. We found several nationally rare (e.g. *Acoretum calami*, *Hottonietum palustris*) and new (*Elatinium alsinastri*, *Oenanthetum aquaticae*, *Butometum umbellatai*, *Veronico anagalloides-Lythretum hyssopifoliae*, *Iridetum pseudacori*) associations. From a coenological perspective, the large number of aquatic and waterside communities of the oxbow lakes and drainage channels are unique e.g. hornbeam-oak population mixed with *Fagus sylvatica* in the forest Long Forest, which is rare in Great Plain conditions found here. Among the woody coenotaxa there we found primarily riverine willow woods next to the waters, and white poplar woods at the banks, or oak-ash-elm woods further from the banks. The Great Plain hornbeam-oak populations are generally typical of on the site of abandoned riverbeds that dried up a while ago. Mixing of the last two coenotaxa can be observed in the area e.g. the oak-ash-elm woods of the Long Forest form a continuous transition with the hornbeam-oak. *Robinia* plantations are typically found near settlements or atop sand hills; their share in comparison to the Great Plain is relatively low. However, the list of plant species and communities known in the Bodrogeköz cannot be considered complete.



# GREEN CORRIDORS OR DEGRADATION ROUTES? EFFECTS OF WATERSIDE HABITATS ON LAND- SCAPE HEALTH

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Watercourses as connectivity corridors may play contradictory roles in maintaining landscape health. In degraded landscapes they often represent last remnants of natural habitats, but into near-natural landscapes anthropogenic land-use and following degradation often intrudes through river and stream valleys. So our hypothesis is that naturalness of waterside areas in degraded landscapes is higher, but in near-natural landscapes is lower than that of areas away from waters.

We tested our hypothesis in vegetational landscape units of South Transdanubia, using data of MÉTA database and biodiversity (naturalness) indicators calculated from them: percent of near-natural areas, number of near-natural habitat types detected, average landscape naturalness, average habitat naturalness and area covered by invasive plants.

We grouped vegetational landscape units of South Transdanubia into two groups: „natural” and „degraded”, according to their average landscape naturalness; selected hexagons of MÉTA GIS database intersecting watercourses and lakes (waterside and non-waterside ones); then calculated and compared indicators for these 2x2 groups.

The biggest difference is found in case of average landscape naturalness: about twofold between degraded and natural landscapes. Values for waterside hexagons are higher in degraded, and lower in natural landscapes. Percent of near-natural areas of waterside hexagons is almost equal in natural and degraded landscapes, but far lower in degraded-non-waterside ones, showing preservation value of waterside areas. There is a big difference between number of near-natural habitat types: waterside areas have significantly higher values in both landscape types. Their average naturalness in natural landscapes is slightly lower, in degraded ones is slightly higher than that of non-waterside ones. Invasive species cover higher areas in waterside areas in both landscape types.

In summary, we found that naturalness of waterside areas in natural landscapes is lower (by three indices), in degraded landscapes is higher (by four indices) than that of non-waterside ones. Contrary to our hypothesis, percent of near-natural areas in natural landscapes is not lower in waterside areas; it can be explained by that anthropogenic secondary habitats (e.g. wet meadows in place of forests) are also regarded as near-natural. Higher cover of invasives shows that watersides are invasion routes in both landscape types.

# LONG-TERM CHANGES OF STRUCTURE OF AQUATIC MACROPHYTE VEGETATION AND LANDSCAPE PATTERNS IN DANUBE FLOODPLAIN LAKE (ČÍČOVSKÉ MŔTVE RAMENO, SLOVAKIA)

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The Číčov Lake is a relic of the remnant Danube anabranch system. It is situated outside the left-flood protection dam of the Danube River in south of Slovakia (1800 river km) being cut off in 1903. Up to 1965, a weak hydrological connection existed between the lake and the inundation area. A large Danube flood in 1965 broke the dam and the rebuilt dam has impaired the hydrological connectivity.

Aquatic macrophytes were sampled in five survey stretches of the lake eleven times, from 1973 to 2007. The species abundance was given by five-degree scale as the PME. On the basis of the PME data of true aquatic macrophytes, Mean Mass Total (MMT) and Relative Plant Mass (RPM) of each species were calculated (Kohler & Janauer 1995). The MMT index was used for calculation of Shannon's index species diversity as well as for PCA using the CANOCO 4.5 for Windows package.

Aerial photographs for the years 1949, 1970, 1990 and 2006 were analyzed in order to differentiate land cover classes and landscape configuration. Landscape changes were evaluated using the program FRAGSTATS\*ARC in the lake ecosystem and in the buffer zone.

The results presented changes in the assemblage of true aquatic macrophytes during the last 34 years and changes in the structural characteristics of aquatic vegetation and the surrounding landscape during the last 50 years. Temporal changes with cyclic course in both structural characteristics at the level of aquatic macrophytes and land cover patterns were found. Altogether 30 true aquatic macrophyte species were recorded in the Číčov lake from 1973. The species composition did not change significantly, but the abundance of true aquatic species fluctuated over a 34-year period. Submerged species *Myriophyllum spicatum* rapidly spread around. The present area of the floating vegetation is slightly smaller (-10.31%) than that documented from 1949. Fragmentation and diversity of landscape-structure in the lake ecosystem were increasing, whereas in the buffer zone they were decreasing.

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# HYGRO- AND MESO-HYGROPHYTE VEGETATION IN ENINSKA RIVER BASIN, CENTRAL STARA PLANINA MOUNTAIN

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Hygro- and meso-hygrophyte vegetation in the basin of Eninska river, Central Stara Planina Mountain is the subject of the present research. These are tall-forb communities and spring vegetation above and below timberline, mainly along the river's and its springs' banks. The described communities occur in the diapason of altitude between 850 and 1450 m. Comments on their flora and syntaxonomy are made. They belong mainly to *Mulgedio-Aconitetea* and *Molinio-Arrhenatheretea*. Eninska river basin contains two protected areas within its outlines – the natural reserve "Kamenshtitsa" and the protected site "Eninsko zhdrelo". It is also a part of a Nature 2000 protected zone. The anthropogenic influence, however, is high in the region. Some conclusions regarding the status of the investigated vegetation are drawn on the basis of the floristic and syntaxonomic analyses.

Key words: meso-hygrophyte vegetation, syntaxonomy, Eninska river basin

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# THE RIPARIAN VEGETATION OF BIFERNO RIVER (MOLISE, SOUTHERN ITALY)

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The riverine vegetation of the Biferno river is showed in this study. The Biferno river is situated in Molise (Southern Italy) along a longitudinal gradient varying between 450 (Matese chain) and 0 meters (river outlet). It has a length of 82.5 km and is oriented from SW to NE towards the Adriatic Sea.

The Biferno catchment plays the most important biogeographic role in the region and it represents the contact zone between the Mediterranean region and the Temperate one (sensu Rivas-Martinez). The floristic and coenotic richness is due to the lithotypes variability and phytoclimatic complexity.

In vegetation analysis we appealed to the phytosociological approach. In the period 1999-2009, 103 phytosociological relevés were realized. We assigned the communities to several syntaxa. To aquatic communities we have recognized were *Fontinaletum antipyreticae* KAISER 1926, *Lemnetum minoris* OBERD. ex T. MÜLLER & GÖRS 1960, *Myriophylletum verticillati* LEMEÈ 1937, *Ceratophylletum demersi* HILD 1956, *Elodeo-Potametum crispum* (PIGNATTI 1953) PASSARGE 1994, *Zannichellietum palustris* LANG 1967. In the riverbank vegetation we have identified *Scirpetum maritimi* (W. CHRISTIANSEN 1934) TX. 1937, *Scirpetum lacustris* SCHMALE 1939, *Sparganietum erecti* (ROLL 1938) PHILIPPI 1973, *Cyperetum longi* SOÓ 1927, *Phragmitetum vulgaris* SOÓ 1927, *Paspalo paspaloidis-Polygonetum viridis* BR.-BL. 1936, *Typhetum latifoliae* LANG 1973, *Polygono-Xanthietum italici* PIROLA & ROSSETTI 1974. The forest and shrubby communities are included in *Saponario-Salicetum purpureae* BR. BL. 1930, *Salicetum eleagni* HAG. 1916 ex JENIK 1955, *Salicetum albae* ISSLER 1926, *Salici albae-Populetum nigrae* (TX. 1931) MEYER-DREES 1936, *Populetum albae* BR. BL. ex TCHOU 1948 *quercetosum roboris* MANZI 1988.



# DIVERSITY OF THE FLOODPLAIN FORESTS IN SOUTHERN MORAVIA (BIOSPHERE RESERVE LOWER MORAVA) WITH REFERENCE TO FOREST MANAGEMENT

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In 2009 almost 500 inventory lists of herb were collected in floodplain forest. We were interested in about 1500 ha of floodplain commercial forests in south-east tip of Czech Republic, in biosphere reserve Lower Morava. We regarded each age part of a stand as an independent inventory unit.

Comparing the diversity of clear-cut and forest stands has been a major focus of our interest. Clear-cuts occupy about tenth of the study area. We examined frequency and fidelity of species in clear-cut areas and interior of forest stands. In the group of 487 taxa only 321 taxa grow in clear-cut area and 461 taxa grow in forest interior. In spite of this fact, Shannon – Wiener diversity index is statistically higher in the clear-cuts than in forest interior. Majority of the most frequented species in clear-cuts belong to non-native species (expansive naturalised or invasive alien species), notably *Amaranthus retroflexus*, *Aster lanceolatus*, *Conyza canadensis*, *Echinochloa crus-galli*, *Lactuca serriola*, *Setaria pumila*, *Sonchus arvensis*, *Tanacetum vulgare*.

Clear-cut areas should become source of expansion of invasive species, but there is concentrated herb diversity of floodplain forests. Technique of forest management affects plant species diversity, we should recognize natural development of floodplain forests and allow to appropriate and sustainable management with reference to commercial forest. We will inform local forest management with a view to protecting the herb diversity, while allowing for their sustainable use. We suggest that clear-cutting in floodplain forests could be replaced with particular management of forest regeneration. The main foundations of the forest management should be based on the state of the environmental conditions of stand, mature forest stand and type of a forest.

# FLOODPLAIN VEGETATION OF SOUTH-WESTERN NECHERNOSEMJE OF RUSSIA

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Western-Southern Nechernozemje is a large territory in the central part of the Russian plain. Floodplain vegetation of this region is an important base of geobotanical and floristic researches.

**Syntaxonomy.** Based on five-years studying of grass vegetation (2000 relevés) 43 associations, 9 subassociations, 10 variants assigned to 16 alliances, 11 orders, 5 classes were described according to the Braun-Blanquet approach. The most syntaxonomically variable class is *Phragmito–Magnocaricetea*. According to results of the cluster analysis all syntaxa of this class are well differentiated. Most established associations are determined by the dominant species, which are the diagnostic species. On this basis, most of the established syntaxa can be transformed into the units of the typological classification used in the meadow management.

**Habitats.** The syntaxa are distributed in a wide range of environmental conditions. The highest syntaxonomical variety is observed in habitats with abundant moisture (7.5–8.5 by H. Ellenberg). Within the compact ecological space the syntaxa form several sequences: 1) at the rate of increase of the soil acidity – in moist soils – alliances *Calthion* 8 *Alopecurion* 8 *Nanocyperion*; 2) on wet and damp soils – alliances *Scirpion marithimi* 8 *Filipendulion* / *Magnocaricion* / *Sparganio–Glycerion*, *Agrostio–Beckmannion*, *Cicution*; 3) on damp soils – alliances *Oenanthion* / *Phragmition* / *Cardamino–Montion*; on the rate of increase of wealth of the soil mineral nitrogen: alliances *Nanocyperion* / *Sparganio–Glycerion*, *Agrostio–Beckmannion*, *Cicution*, *Alopecurion* 8 *Magnocaricion*, *Cardamino–Montion*, *Calthion* 8 *Phragmition*, *Filipendulion* 8 *Oenanthion* 8 *Scirpion marithimi*. The syntaxa of the alliances *Koelerion glaucae* and *Hyperico–Scleranthion* are the indicators of poor and acidic soils. In habitats with a much greater moisture and richness of soil the communities of the *Molinion* formed. For moisture the *Cynosurion* represents the ecological transition from floodplain meadows of the *Molinion* and *Alopecurion* to steppe meadows of the *Scabioso–Poion*. The coenofloras can be used in the phytoindication of the edaphic conditions.

**Protection.** The floristic data (2600 points) are represented in the regional database ‘Rare and protected plant species of Southeast-Desna watershed area’ (Semenishchenkov, 2006). The rarest associations are recommended to protection and described for the regional Green Data Book.



# SYNTAXONOMICAL ANALYSIS OF THE FLOODPLAIN FORESTS OF THE SOUTHERN URAL REGION

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Currently, the structure of the association *Alnetum incanae* LÜDI 1921 is very complicated. In a number of European and Russian regions, these communities have already been described. Several variants and geographical forms have been identified. On the west - east gradient, the floristic structure of associations are changing. Many nemoral species are disappearing from the composition of communities. It is connected with the general tendency of the broad-leaved forest in Europe on the given gradient. At the same time some species of Ural and Siberian forbs are appearing in these communities.

Riparian forest communities are described in a flood-land narrow of the mountain rivers of Southern Ural Mountains. They have essential floristic differences from associations of alliance *Alnion incanae*, described in East Europe and the European part of Russia. Therefore their peculiarity should be reflected in a higher level than association. We consider a rank suballiance to be the most convenient for this purpose. Thus, we suggest the division of union *Alnion incanae* into two suballiances *Alnenion incanae* suball. nov. (floodplain forest of the East Europe and the European part of Russia) and *Cacalio hastatae-Alnenion incanae* suball. nov. (floodplain forest of the mountain territories of Southern Ural Region).

Synopsis of alliance *Alnion incanae* is presented below:

All. *Alnion incanae* PAWŁOWSKI, SOKOŁOWSKI & WALLISCH 1928

Suball. *Alnenion incanae* suball. nov.

Ass. *Alnetum incanae* LÜDI 1921

Suball. *Cacalio hastatae-Alnenion incanae* suball. nov.

Ass. *Aconito lycoctonum-Alnetum incanae* ass. nova

Ass. *Ficario vernae-Alnetum glutinosae* SOLOMESHCH *et al.* 1994

Ass. *Calamagrostio obtusatae-Alnetum incanae* SCHIROKIKH in MARTYNENKO *et al.* 2008

Ass. *Ribeso nigri-Alnetum incanae* (SOLOMESHCH in MARTYNENKO *et al.* 2003) MARTYNENKO & SCHIROKIKH stat. nov.

Ass. *Crepido sibiricae-Alnetum incanae* ass. nova

This investigation is supported by the program of Presidium of Russian Academy of Sciences «Biological diversity» (subprogram «Diversity and monitoring of the forest ecosystems of Russia»).

# VEGETATION OF FALLOWS IN VOLGA RIVER DELTA I.

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In the 60-70s years of the last century tens of thousands hectares of the Volga river delta were diked and transformed into an irrigated arable land. The diking was carried out to prevent a natural flooding arable land during spring-and-summer high waters. In the 90s exploitation of the territory as an irrigated arable land stopped. These sites were abandoned. Absolutely new landscapes appeared on the huge areas of the Volga river delta. They are fallow diked lands devoid of the natural flooding. Due to a close ground water level, under conditions of the exudative water regime, atypical vegetation is developing on these territories.

Successional processes on fallows are preliminarily determined to go in two basic directions. The first one is oleaster woods formation where *Elaeagnus oxycarpa* dominates. The second one is a shrub community formation with the dominance of *Tamarix ramosissima*. In the first direction, succession occurs on ecotopes with less salted soils. In the second direction, succession occurs on ecotopes with more salted soils. It was marked that succession speed depends on pasturable loading. The more pasturable loading is, the slower the succession. These are preliminary conclusions which require additional field research.



# VEGETATION OF FALLOWS IN VOLGA RIVER DELTA II.

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The Volga-Akhtuba floodplain is the part of the Volga river valley located between the dam of Volgograd hydropower station and the Volga river delta. It occupies desert and semidesert areas. The growing azonal plant communities of meadow, marsh and forest species in the Volga-Akhtuba floodplain are caused by regular water release into the [HYPERLINK "http://www.multitrans.ru/c/m.exe?t=726410\\_1\\_2"](http://www.multitrans.ru/c/m.exe?t=726410_1_2) tail-water of the Volgograd reservoir. These reservoir releases imitate natural high waters. The major factors determining the character of the vegetation cover of the Volga-Akhtuba floodplain during the centuries are mowing and meadow pasture. A new factor influencing the vegetation cover in the floodplain has appeared recently. This is recreational use of this territory.

The geobotanical transect 27.7 km long was laid in 1955 in the northern part of the floodplain near Leninsk town in the Volgograd region. Transect was marked on aerial photographs showing the location of key plots. In order to study the vegetation dynamics after 1955 this transect had been observed again in 1971, 1982 and 2008. The results of repeated observations indicate that by 2008 the occurrence of ruderal species has increased: *Conyza canadensis*, *Chenopodium album* + *Ch. acerifolium*, *Lactuca serriola*, *Cannabis sativa* var. *spontanea*, *Sonchus arvensis*, *Cichorium intybus*, taxa of *Polygonum* genus (section *Polygonum*). Both *L. serriola* and *C. intybus* were not recorded in 1955 and the latter species was not even along the transect in the year 1971. The presence of hygrophytes has decreased by 2008 (*Sagittaria sagittifolia*, *Carex acuta*, *Lythrum salicaria*) with a simultaneous increase in occurrence of more mesophytic taxa (*Lythrum virgatum*, *Carex agr.*, *Carex praecox*). The adventive species *Fraxinus pennsylvanica* and *Bidens frondosa* seemed to be widely spread. The fact of the greatest degree of xerophytization and pasture degradation of vegetation in 2008 can be explained by several reasons. 1. General decrease in volumes of spring-summer flooding water under conditions of [HYPERLINK "http://www.multitrans.ru/c/m.exe?t=3137225\\_1\\_2"](http://www.multitrans.ru/c/m.exe?t=3137225_1_2) regulated stream flow. 2. Increased use for recreation. 3. Local deterioration of floodplain inundation in the area of field work caused by the road dam construction.

# DETECTING RIVER HABITAT QUALITY THROUGH ANIMAL AND PLANT BIOINDICATORS

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A variety of natural disturbances create a spatial and temporal environmental mosaic in riverine habitats with few parallels in other systems. Intensive land-use along riparian areas may lead to increased soil erosion and sedimentation in rivers, increased nutrient inputs and alteration of surrounding areas subjected to agricultural and industrial activities affecting biodiversity of the river habitats. Interfaces between terrestrial and freshwater ecosystems are particularly sensitive to environmental changes: for this reason the present study was focused on lateral gradient across the riverbed, using the transect method running from water to shore and back-shore. The transects along the longitudinal gradient (15 sampling sites from the source to the mouth of the river), were surveyed for different components of the ecosystem: vegetation, aquatic macroinvertebrates and edaphic microarthropods. Four different kinds of indices were applied to the matrix of the relevés: hemeroby for evaluating anthropical disturbance, Ellenberg indicator for soil nutrients, both based on vegetation, soil (QBS-ar) and water quality (EBI). Non-parametric Spearman test showed that the indices are highly and significantly correlated. Plant and animal bioindicators applied in this study are able to detect the spatial variations of the lateral as well the longitudinal river gradient.







# POSTERS

USE AND ABUSE  
OF ECOLOGICAL  
INDICATOR VALUES

# LONG-TERM OF SPACE AND TIME VARIATION IN THE POPULATION DYNAMICS OF *LIBANOTIS* *PYRENAICA* IN ABANDONED AND MANAGED CALCAREOUS GRASSLANDS

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Populations of many calcareous grassland species are endangered by habitat deterioration, fragmentation and isolation in the landscape. Understanding how to best estimate their viability is the main conservation problem.

The aim of this study was to compare: (i) LTRE (Life Table Response Experiments) contributions components between the managed and unmanaged plots and (ii) time variation in population growth rate.

**Species:** *Libanotis pyrenaica* (L.) Bourg. (= *Seseli libanotis* (L.) W.D.J. KOCH subsp. *libanotis*, Apiaceae), monocarpic, semi-rosette perennial.

**The study area:** The study was carried out in the Ojców National Park (southern part of the Kraków-Częstochowa Upland, Poland [19°49'79"E; 50°13'61"N]). Calcareous grasslands form small patches on steep slopes of the Prądnik and the Sąsówka valleys, accompanied by shrubs and forest. They belong to the *Festucetum pallentis* (KOZŁ. 1928) KORNAŚ 1950, *Origanum-Brachypodium* MEDW.-KORN. & KORNAŚ 1963 and *Koelerio-Festucetum rupicolae* KORNAŚ 1952 associations.

**Methods:** Demography of two populations had been studied between 1997 and 2006. One of them was managed by clearing the shrubs ("Cleared") while the second was left unused ("Abandoned"). In 100 1m<sup>2</sup> quadrates the very detailed data in terms of percentage cover on each *Libanotis* specimen (rosette) were collected. This enabled to distinguish the individuals from cover data and divide them into four stages: seedlings (S, <=10 cm<sup>2</sup>), juveniles (J, <=250 cm<sup>2</sup>), vegetative adults (V, >250 cm<sup>2</sup>) and generative adults (G, flowering individuals). On the basis of collected data the stage-based transition matrices were constructed (Caswell, 2001). The two way Life Table Response Experiments (LTRE) were used to disentangle the Plot (Abandoned, Cleared) and Year (1997-2006) contributions and deviations in different life stage transitions to variation to overall population growth rate (Horvitz et al. 1997).

**Results:** Both abandoned and managed populations of *Libanotis* seem to decrease, however, the latter one has the best chance for recovery. It is proved that owing to high year to year fluctuations in vital rates, only the long-term experiments are able to explain fully the real trends in population dynamics.



# ECOLOGICAL CLASSIFICATION OF THE VEGETATION MOSAICS IN THE CENTRAL APPENNINES (ITALY) BY THREE BIOINDICATION MODELS: ELLENBERG'S INDICATORS, HEMEROBY INDEX, GRIME STRATEGIES

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The landscape ecology approach was utilized to identify vegetation mosaics in the Greco Mountain (Central Apennines, Abruzzo, Italy). Two different kinds of mosaics were identified: 1) Morphological mosaics, related to risings and depressions (usually a few meters only); depressions are related to longer persistence of snow, and increased inputs of water and nutrients when the snow melts in early summer; 2) Dynamic mosaics related to regrowth of vegetation after the reduction of grazing, very intensive until a few decades ago. The two mosaic types therefore are related to completely different ecological processes: geomorphology and grazing disturbance. A characterization of these two types of mosaics is difficult on floristic grounds, since the vegetation is highly fragmentary; therefore we tried to distinguish the two mosaic types by means of indicators, and in particular the Ellenberg, hemeroby and CSR models.

Ellenberg model distinguished morphological mosaics mainly on the basis of F and N indicators; hemeroby is the same. In the dynamic mosaics CS and S species are predominant, whereas in the morphological one CSR species prevail. In summary, the productivity of the morphological mosaics seems to be higher (CSR predominant, F and N higher).

# SYNPHYTOINDICATION METHOD OF BIOTOPES' ECOLOGICAL FACTORS EVALUATION IN UKRAINE

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Comparison of ecological scales, which had been elaborated by Ramenski (1938), Tsatsenkin (1970), Tsyganov (1983), Ellenberg (1979), Frank & Klotz (1988), Landolt (1877), Zarzycki (1984), Zólyomi *et al.* (1966), enabled to make unified ecological scales and new scale of carbonate content in soils (Didukh, Plyuta, 1994). Information about 3000 of plant species of Ukraine was processed by ECODID software and used in "Ecoflora of Ukraine" edition (there have been published five volumes). Phytosociological descriptions were processed by this software with the goal to obtain factor indices for cenoses. Nine factors were evaluated. They are soil humidity (Hd), variability of damping (fH), acidity (Rc), salt contents (Tr), nitrogen contents (Nt), climate thermic mode (Tm), ombroregime (Om), continentality (Kn), criomode (Cr). The next step is ordination analysis for the evaluation of ecological and coenological range of different biotopes. It permits to find out the correspondence between these biotopes and ecological factors as well as between factors themselves. The ecological maps can be created on the basis of information obtained this way. Synphytoindication method was applied for different biotopes in most regions of Ukraine.



# PRESSURES AND THREATENING ON THE SPECIES AND HABITATS LOCATED IN AREA NATURA 2000 IGNIŞ, MARAMUREŞ COUNTY – REGION 6 NORTH WEST

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The aim of this study is to protect and to allow the administration of the vulnerable species and habitats on their natural territory over all Europe without taking in account the political borders. At the level of Maramures County have been declared 8 sites of community importance (SCI), mentioning the site Ignis, (RO SCI 0089) and 1 SPA – special birds and fauna protection area conditioned – in Rodnei Mountains. The site Ignis located in the Province of Alpine geosynclines – of Carpathian Mountains, Highland of Oriental Carpathian Mountains(1), Land of Volcanic Mountains (c), District Oas–Gutai-Varatec (a), northern group on the northern extension of Mount Ignis, of the Massif Gutai. The site includes 4 natural reservations ( Poiana Brazilor Bog , Dumitru’s Tarn, Iezeru Mare jungle- the wet area and Tatarului Notch), wet valuable conservative areas (active peat bogs and jungles), crag areas, pastures, upland meadows, natural beech forests, pine spruce forests. In the site Ignis could be found 12 community interests habitats: bent vegetation on the mountain river sides, *Molinia* meadows, active peat bogs, peat jungles of transitions and turf moor, *Luzulo-Fagetum* type beech forests, *Asperulo-Fagetum* type beech forests, woody peat bogs, *Alnus glutinosa* and *Fraxinus excelsior* parks, Dacic beech forests (*Symphyto-Fagion*), down-grade Silica crag with chasmophitic vegetation, meadows rich of *Nardus* and at the surface of silica rocks mountain meadows. Plants species of major interest are: *Ligularia sibirica*, *Pinus mugo*, *Molinia coerulea* sp, *Rosalia alpine*. Maintaining these values is possible only if the protected areas are adequately managed, a management what could prevent or even stop the negative aspects of human activities. Pressures and threatening at what is this natural capital exposed are ranged in the following categories: pressures and threatening due to residential and commercial infrastructure development, agricultural and aquaculture activities, transport and serviced corridors, consumption of biological resources, modification of the natural systems, generating disturbances caused by people’s activity and pollution. Natural capital is the main source of ecological services and economical products but also an irreplaceable part of our cultural and historical patrimony. This source must be maintained in a better condition for the benefit of present and future generations.

# EIV IN ZOOLOGICAL RESEARCH: AN EXAMPLE OF MOLLUSC ASSEMBLAGES ALONG A MOISTURE GRADIENT FROM FENS TO GRASSLANDS

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Ellenberg indicator values (EIV) are widely used in vegetation analyses as environmental variables derived from plant species data. We tested whether EIV can be used as a predictor (independent variable) of mollusc species composition and compared the level of prediction with directly measured variables. We analysed vegetation and molluscan data of nine transects stretching from the wet spring fens to the surrounding dry grasslands in the White Carpathian Mountains (Czech Republic and Slovakia). We sampled 60 plots in total, each of size 0.56 m<sup>2</sup>. We directly measured soil moisture, pH, calcium content, organic carbon amount, biomass production, and chemical composition of plant biomass. Our results confirmed that EIV for moisture is a very good predictor of mollusc species composition. Moreover, this variable explained more variation in mollusc species data than the directly measured soil moisture. This result is probably related to the fact that EIV reflects long-term trends in moisture that have influenced vegetation composition, whereas measured factors can shape one-shot influence of weather and other factors. Our study contributes to a growing body of evidence that EIVs are not only useful tool for vegetation science, but can also provide easily available estimates of relevant ecological factors for zoological research.



# NUTRIENT CONCENTRATIONS IN SPHAGNUM CAPITULA AS INDICATORS OF NUTRIENT AVAILABILITY TO BOG PLANTS

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High nitrogen deposition level supplies more nutrients to the ecosystem. It is particularly important in ombrotrophic bogs, whose nutrient balance depends totally on atmospheric deposition. Sampling of biomass from Sphagnum mosses and vegetation plots was carried out in central European bogs in the Sudeten Mts. and in the Orava-Nowy Targ basin in 2006–2007. Our aim was to use Sphagnum nutrient concentrations and ratios as indicators of nutrient availability to plants and relate them to the total vegetation composition of the bogs. Concentrations of major nutrients were determined in the *Sphagnum capitula* where N, P, K are most concentrated. Statistical methods were used to explain differences between regions. Highest N:P and N:K ratios were observed in The Black Triangle (crossborder region between Czech Republic, Poland and Germany) with highest nitrogen deposition level and low phosphorus concentrations resulting in high N:P ratio and thus strong P-limitation. Ellenberg indicator values were used as surrogates of other environmental factors. Direct and indirect gradient analyses were applied to explain the relationship between vegetation composition and nutrient availability. We found that under unchanged water regime, high N-deposition level supports growth of poor fen species in ombrotrophic bogs. On the other hand, fluctuating water regime causes release of all major nutrients from decomposition, even when N-deposition level was lower. In such case, a number of graminoids, mesophilous and more nutrient demanding plant species expand to bog vegetation.

# THE DIFFERENTIATION OF FLORISTIC COMPOSITION OF RUDERAL VEGETATION ALONG MAIN ENVIRONMENTAL GRADIENTS

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The investigations, which were carried out in the area of Silesian Upland (southern Poland), comprised ruderal plant communities, which developed on a variety of urban and post-industrial wastelands. They belong to *Artemisietea vulgaris*, *Stellarietea mediae*, *Polygono-Poetea* and *Molinio-Arrhenatheretea* (*Trifolio-Plantaginetalia* order) classes. The aim of this research was: (i) to find main environmental gradients in the data set, which can be explained by directly measured environmental variables (ii) to check if the differentiation of the ruderal vegetation measured by those variables is reflected in commonly used mean Ellenberg indicator values for relevés.

The soil samples were taken from the depth of 10-20 cm, in patches where phytosociological relevés were made. Chemical properties measured were soil pH, total nitrogen, content of organic carbon and organic matter,  $\text{CaCO}_3$ , C/N ratio, phosphate, potassium, calcium, magnesium. All numerical and statistical analyses were performed in Canoco for Windows 4.5 and Statistica 8.0.

Detrended Correspondence Analysis (DCA), applied in order to find indirectly main environmental gradients which are responsible for differentiation of ruderal vegetation, revealed gradient from nitrophilous plant communities (*Reynoutria japonica* community, *Leonuro-Balotetum*, *Arctietum lappae*), through short-lived ruderal vegetation of the *Sisymbrium* (*Erigeronto-Lactucetum*, *Elymo-Sisymbrietum loeselii*, *Hordeo-Brometum*) to ruderal phytocoenoses confined to dry habitats of the *Onopordion acanthii* alliance. It was confirmed by negative correlations with the water availability F (Kendall's tau =  $-0.296$ ) and nutrient availability in the soil (Kendall's tau =  $-0.628$ ) and I DCA axis. There was no significant correlation with the scores of I, II DCA axes and soil reaction (pH).

Canonical Correspondence Analysis (CCA) confirmed richness pattern among environmental gradient but it let us a more precisely distinction:

- a. group of phytocoenoses which were confined to soils with higher content of magnesium (MgO) and calcium (CaO) and lower of phosphate ( $\text{P}_2\text{O}_5$ ),
- b. group of phytocoenoses which are confined to higher content of phosphate ( $\text{P}_2\text{O}_5$ ),
- c. group of phytocoenoses which are confined to higher content of potassium ( $\text{K}_2\text{O}$ ),

No significant correlation was found with soil reaction (pH), which ranged from 5,620 to 8,690 (pH  $\text{H}_2\text{O}$ ).



# THE PHYTOREMEDIATION POTENTIAL OF NATIVE VERSUS NON-NATIVE WOOD SPECIES IN TAILING PONDS

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The tailing ponds in Maramures county are the focus of our case study. The tailing pond has become host to an incipient vegetation layer made-up of both “fast-growing” non-native species such as *Pinus nigra*, *Robinia pseudacacia*, *Prunus serotina*, *Amorpha fruticosa* etc, perceived as fit in re-vegetation initiatives and planted by purpose in the area, as well as species that belong to the regional flora, such as *Quercus petraea*, *Salix caprea*, *Populus tremula*, *Betula pendula*, spontaneously established. Herbs to the regional flora such as *Hieracium pilosella*, *Carex pillosa*, *Centaurea austriaca*, *Viola arvensis*, *Rumex acetosella*, *Linaria vulgaris*, *Agrostis capillaris* etc, as well as adventive breeds such as *Reinoutria japonica*, *Erigeron canadensis*, *Setaria glauca* add also to a vegetation layer still not properly consolidated (the average coverage ratio of the grass layer does not exceed 5-10%). While taking into account the presence of these two categories of species, our experiment aims to shed light on the phytoremediation capacity of native species as compared to the same ability of non-native species. The introduction of native species in polluted sites could be a reserve of plants able to spread toward, and to invade, the neighbouring eco-systems.

In spite of accumulating significant quantities of heavy metals, the species we have analyzed in terms of their specific behaviour in the tailing ponds established following the flotation of non-ferrous metals cannot be equated to bio-accumulators. Those species have instead the capacity for colonization of, and for contributing to, the development of a well – established vegetation layer, thus supporting the set-up of an eco-system and the decline in erosion generated by winds and rains. The native species that have demonstrated spontaneous germination capacity within the context of the tailing pond, as well as ability to survive and high potential for reproduction either by vegetative means or by means of seeds, are preferable from this perspective. They also establish symbiotic relationships with the mushrooms in soil. They thus reinforce the cohesion between organisms and actively take part in the creation of a network within the eco-system.

# STUDY REGARDING THE HEAVY METALS TRACEABILITY IN SOIL - MELLIFER PLANT CHAIN

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The goal of this paper is to analyse the content of heavy metals in some melliferous plants in order to assess their contaminant potential for bees and honey products. Experiments were developed during July- August 2009 in an area strongly polluted with heavy metals. Starting from a reference point, directions for sampling were defined in order to include all species of melliferous plants present in the area. Soil samples were collected and analyzed considering the pH, total and leachable metals contents. Analysis of metals in melliferous plants was also performed. Experimental data were statistically processed in order to develop the metallic dispersion curves and thus to emphasize the areas with highest potential in metal bioaccumulation in plants. Elements regarding the traceability of metals along of soil-mellifer plants are discussed. We have conducted our research work and subsequent analyses within the framework of the 52144/01.10.2008 PNCDI II Project.



# STUDY REGARDING THE METALS BIOACCUMULATION IN DIFFERENT VEGETAL SPECIES

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Plant species represent an important mineral source for human body. The content of minerals in plants depends on many factors, one of the most important is the chemical composition of soil where they are cultivated.

The study analyses the correlation between metals content in soil (Cu, Pb, Ni, Zn, Co, Cd, Cr, Mn) and three plants species (lettuce, spinach and cabbage) and emphasizes that the highest correlation is obtained considering the metals leachable fraction. Statistical analysis of experimental data obtained by atomic absorption spectrometry allows establishing for each species the preference for metals' bioaccumulation. At the same time, the plants self-protection mechanisms that act by blocking the metals' bioaccumulation at the roots level are emphasized.

We have conducted our research work and subsequent analyses within the framework of the 32124/01.10.2008 PNCDI II Project.

# GROWTH DYNAMICS AND BIOACCUMULATION POTENTIAL OF *QUERCUS PETRAEA* ON POLLUTED LAND ENHANCED WITH IONIC EXCHANGERS

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The recovery of tailing ponds entails significant interdisciplinary work. This includes the physical – chemical particularities of soil, orographic factors, and particularly those describing how micro-climatic characteristics evolve, and other studies on various groups of organisms. Part in the colonization of tailing ponds, *Quercus petraea*, originating in the neighbouring phytocenosis, is a native species with proven potential in phytoremediation. The ecologic context impacts on each component in phytocenosis, including the species to which the oak belongs. In tailing ponds, the high concentration of heavy metals in soil constrains the growth. This cannot be altered in quantitative terms, but we have physics, chemistry and biology – specific options available to decline the bio-disponibility of heavy metals. We have researched the relationships between enabling agents reducing the bio-disponibility of heavy metals: the ions exchangers – micro-organisms – fungi complex and the dynamics of growth of *Quercus petraea* surrounded by tailings. The chemical – biological context can ameliorate its survival and growth potential. To document this correlation, we focused on *Quercus petraea*'s bio-accumulation capacity of heavy metals and the resilience of this native species to extreme conditions. We have roughly evaluated the impact of revegetation of exhausted soil with this species. Sprouts from acorns germinated in laboratory are grown in experimental contexts: in soil with flotation tailings, in soil but ameliorated with bentonite, and in soil mixed with a compound including bentonite, micro-organisms and fungi. Each of these contexts determines a different growth dynamics to seedlings, in terms of the quantity of biomass, as well as in the capacity to accumulate heavy metals. This substantiates the need to simultaneously ameliorate the soil subjected to tailings, and to introduce native plant species. Even from the incipient stages of vegetative growth, biometric parameters can indirectly describe how the microbiota in soil is supportive to the native forestry species and to their adaptive capacity to the context of the tailing ponds. We have conducted our research work and subsequent analyses within the framework of the 32124/01.10.2008 PNCII II Project.



# ECOLOGICAL INDICATORS VS. MANIPULATION AN EX SITU CASE STUDY ON SELECTED WEED TAXA

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The main goal of this research was to investigate the correlations between ecological indicators and stand level CO<sub>2</sub> fluxes in differently manipulated stands of two widely distributed weed species (*Amaranthus retroflexus*, *Chenopodium album*). The experiment was carried out in 18 monodominant plots in the Botanical Garden of Szent István University (Gödöllő, Hungary). The examination covered the whole growing season. Irrigated and partially precipitation-excluded plots were established beside the control stands for both taxa. Manipulation experiments have simulated the predicted climatic extremes on weed species representing different plant functional groups (C3 vs. C4; invasive vs. non invasive; native vs. alien). Characteristics of net ecosystem carbon dioxide exchange (NEE) and soil respiration were measured frequently, while the meteorological parameters were continuously recorded (photosynthetic active radiation, air temperature, soil temperature, soil water content).

Considerable or even significant correlations were found between ecological parameters and CO<sub>2</sub> gas exchange.

The correlation between NEE and PAR showed a quite strong but not significant negative polynomial relationship in the stand for both taxa. There were only poor correlations between soil respiration and soil water content and soil temperature. But we have found a significant correlation ( $P < 0.05$ ) between the three parameters, if they were investigated at the same time. The strongest significant correlation was found with 3D Lorentzian non linear regression curve fitting. The same regression was found for both *Chenopodium album* and *Amaranthus retroflexus* and it was only slightly interfered by the manipulation experiments. ANOVA test showed significant difference between the NEE values of the manipulated and control stands.

# ADAPTIVE MECHANISMS OF PLANTS GROWN IN AGROCENOSSES PRONE TO POLLUTION WITH HEAVY METALS

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The flourishing economic and social activity in Maramures, stimulated by the richness of its underground and soil, is a generator of environmental pollution. Over 100 years have elapsed since the mining field around Baia Mare is prone to pollution, and during the last 50 years the impact of such contamination has particularly intensified. The wastewater, gases, powders in suspension or as tailings, the draining from mining pits, dumps, tailing ponds, flotation or metallurgy plants harm the environment.

Research in the area has revealed a multitude of heavy metals polluting agricultural fields and forests. The impact can be easily traced even 25 – 30 km far from the major polluting sources and translates especially in concentrations of Pb and Cd in the air exceeding the maximum admissible thresholds.

A considerable share of the land within the mining area surrounding Baia Mare is today in agricultural use, planted with *Lactuca sativa*, *Capsicum annum*, *Raphanus sativus*, *Lycopersicon esculentum*, *Phaseolus vulgaris*, *Zea mays* and other species.

Research on the imbibition and germination of *Phaseolus vulgaris* (*Fabaceae*) seeds has revealed a higher absorption capacity of Pb<sup>2+</sup>, Zn<sup>2+</sup> and Cu<sup>2+</sup> if they are planted on clean land, as compared to the seeds grown on polluted soil. Adaptive mechanisms are nascent even during the imbibition and germination stages in the plant's life cycle, as demonstrated during the research work.

We review the outcomes of our examination of plants exposed to polluting factors, starting with the germination stage. We have monitored how adaptive mechanisms have evolved during nurturing, by taking factors showing the dynamics of growth, the biomass and the content of heavy metals accumulated in various parts of the plant as proxies. The emergence of adaptive mechanisms makes the sensitivity of plants against pollutants to decline, by cutting off the absorption of heavy metals in the roots.

Such research could be a source of guidance about how polluted land could be used, either by cultivating species that can easily adapt to polluted environments without accumulating heavy metals, or by the revegetation of plots and their integration within the landscape.

We have conducted our research work and subsequent analyses within the framework of the 52144/01.10.2008 PNCDI II Project.



# ROLE OF THE BENTONITE & MICROBIOTA MIX TO RESTORE VEGETATION ON POLLUTED SITES

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The sites were tailings from mining pits or resulting from the flotation processes of nonferrous minerals are dumped span large areas that are useless for agricultural and industrial purposes. High concentrations of heavy metals impact the organic background, the texture and porosity of soil, becoming constraints in the revegetation of such sites. Very few plants normally tolerate this kind of constraints, and enable the setup of a layer of vegetation and the reinstauration of a complex ecosystem. The colonization and restoration of vegetation occur depending on the amelioration of soil and of the rizosphere. One of the options to support the development of vegetation entails the amelioration of the tailings from mining with a bentonite – microbiota mix. The bentonite acts as ionic exchanger retaining significant amounts of ions of heavy metals. The microbiota has a multitude of roles. On one hand it retains in cells the heavy metals. On the other hand, it generates the organic compound that alters the texture of the tailing and, given the symbiosis with higher plants, supports their growth on polluted land. Our research covers first, the dynamics of the process by which the bentonite blocks heavy metals originating from tailings, and second, the characteristics of the bentonite – microbiota compound, as accelerating driver for the colonization process of polluted land with plants. We summarise the outcomes of our experiments about the decline in bio – disponibility of heavy metals. The growth pattern of species such as *Salix caprea*, *Populus tremula*, *Betula pendula* stands proof of the high correlation between their adaptive capacity and the presence of the microbiota, even during the early stages of vegetative growth. This research shows the capacity of the bentonite – microbiota (micro – organisms plus fungi) mix to act as enabling factor for the installation of the vegetation layer on land polluted with heavy metals, based on the quantitative analysis of heavy metals that this mix absorbs and retains. We have conducted our research work and subsequent analyses within the framework of the 82AS/2008 PNCDI II Project.

# ROLE OF THE ZEOLITE & MICROBIOTA MIX TO RESTORE VEGETATION ON POLLUTED SITES

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The sites were tailings from mining pits or resulting from the flotation processes of non-ferrous minerals are dumped span large areas that are out of agricultural, industrial or ambient usefulness. High concentrations of heavy metals impact the organic background, the texture and porosity of soil, becoming constraints in the revegetation of such sites. Very few plants normally tolerate this kind of constraints, and enable the establishment of any vegetation and the restoration of a complex ecosystem. The colonization and restoration of vegetation occurs depending on ther amelioration of the pedologic support and of the rizosphere.

One of the options to support the development of vegetation entails the amelioration of the tailings from mining with a bentonite – microbiota mix. The bentonite acts as ionic exchanger retaining significant amounts of ions of heavy metals. The microbiota has a multitude of roles. On one hand it retains in cells the heavy metals. On the other hand, it generates the organic compound that alters the texture of the tailing and, given the symbiosis with superior plants, supports their growth on polluted land.

Our research covers first, the dynamics of the process by which the bentonite blocks heavy metals originating from tailings, and second, the characteristics of the bentonite – microbiota compound, as accelerating driver for the colonization process of polluted land with plants. We summarise the outcomes of our experiments about the decline in bio – disponibility of heavy metals.

The growth pattern of such species as *Salix caprea*, *Populus tremula*, *Betula pendula* stands proof of the high correlation between their adaptive capacity and the presence of the microbiota, even during the early stages of vegetative growth.

This research shows the capacity of the bentonite – microbiota (micro – organisms plus fungi) mix to act as enabling factor for the installation of the vegetal layer on land polluted with heavy metals, based on the analysis of quantities of heavy metals that this mix absorbs and retains.

We have conducted our research work and subsequent analyses within the framework of the 82AS/2008 PNCDI II Project.



# EFFECTS OF ENVIRONMENTAL FACTORS ON ARABLE WEED SPECIES COMPOSITION IN WESTERN HUNGARY

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Multivariate analysis of data from 184 cereal and stubble fields from low-input agricultural systems in western Hungary was carried out to assess and rank the environmental factors determining weed species composition. For each variable the gross and net effect on weed species composition were calculated. All variables considered in this study had a significant effect on weed species composition and explained 26.99% of the total variation in species data. Most variation in species composition was explained by the aspect (cereal vs. stubble), followed by soil pH, mean annual precipitation, soil texture, mean annual temperature, and altitude. Separating the cereals and stubbles soil pH became the most important factor. Our results suggest that during the long vegetation period the cereal weed communities dominated by winter annuals are changed by stubble-field weed communities dominated by summer annuals. The changing aspects could have the same important effect on weed species composition as crop types.

# EVALUATION OF ACTUAL STATE AND MANAGEMENT OF SELECTED SMALL-SCALE SPECIALLY PROTECTED AREAS WITHIN THE COMPETENCE OF THE ADMINISTRATION OF PÁLAVA PLA (CZECH REPUBLIC)

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During autumn 2008 and spring 2009 selected small-scale specially protected areas, which fall within the competence of the Administration of Pálava PLA, were evaluated. 19 specially protected areas in total were evaluated, by using the methodology developed in 2005 (Svátek & Buček 2005: Methodology for the evaluation of the state and management of small-scale protected areas. Mendel University in Brno, Czech Republic). This methodology enables to make fast evaluation of actual state and management quality of protected areas. State and management are assessed separately, each of them in terms of eight criteria, which are scored according to the 6-degree (0–5) verbal numeric scale. Each criterion has assigned a multiplicative coefficient (“weight”) in order to distinguish its importance relative to other criteria. The final score for given criterion is obtained by multiplying awarded score by multiplicative coefficient. Final evaluation of state is then calculated as percentage share of obtained total score in maximum total score, which would be possible to gain for evaluated criteria of state. Final evaluation of management is calculated analogously. Retrieved percentage evaluation is expressed also verbally using a 5-degree verbal scale (very poor, poor, average, good, excellent).

The results of evaluation revealed that the state of 11 preserves can be classified as average, and the state of seven preserves as good. Only one area was classified as excellent. Among criteria of actual state evaluation the presence of invasive and expansive species was on average worst assessed. These species were, with only one exception, detected in all preserves. Conversely on average the best assessed criterion was the one assessing impact of other negative influences. Their presence was usually connected with higher attendance of protected areas or eventually with activities of hunters.

With 10 of preserves the quality of management was evaluated as average, with seven of preserves as good and with remaining two as excellent. On average the best assessed criterion was that of documentation of preserves. Conversely criteria of boundary marking and function of buffer zones obtained the lowest average assessment.



# DEVELOPMENT OF REGIONAL INDICATOR VALUES FOR SOUTH BORDER OF BOREAL ECOTONE

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The most popular systems of indicator values in geobotanical studies on European part of Russia are ecological scales developed by Ramensky (1956) and Tcyganov (1983) and Western European systems of Ellenberg (1991) and Landolt (1977). All of them have advantages and disadvantages and many applications. As our area is characterized by ecotone conditions where ecosystem and species diversity include different ecological plant groups, the application of existing systems is problematic. In the present study, several statistical procedures and methods are followed to produce an algorithm for improving Ellenberg's indicator values for environmental conditions of new region by example of the Tatarstan Republic. We applied this algorithm to improve indicator values for moisture factor and assume its applicability for other factors. For the objectives of this study we used 5035 phytosociological plots (relevés). In this study two independent datasets have been used; the first to adjust indicator values whereas the second to compare them with field measurements and to evaluate their applicability for the conditions of selected region. The algorithm includes several steps such as selection of appropriate plots and species from database, computation of probabilities of species occurrence in different environmental classes using bootstrapping, stratified random sampling with proportional allocation and weighted average, calculation of conditional probabilities of certain conditions presence on the assumption of species occurrence and others. Here we made two important assumptions: probability of species occurrence is independent from the presence of other species in the plot; probability of species occurrence only depends from environmental conditions on the plot. Finally we calculated distribution modes and assumed that they can serve as the best approximations of regional indicator values. For 545 species regional indicator values have been determined. Analysis revealed that ecological optima of 305 species have been displaced. Displacements of species optima are related to the factor determining humidity of soil: in Western Europe atmospheric precipitation plays the major role; and in conditions of the Tatarstan Republic with a temperate-continental climate - redistribution of water on the relief. The comparison of regional indicator values with field measurements revealed a linear relationship that shows efficiency of the new algorithm.

# VEGETATION-ENVIRONMENT RELATIONSHIPS IN DECIDUOUS FORESTS: STUDY FROM VOLCANIC PART OF CENTRAL SLOVAKIA

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Forest ecosystems are the most important functional components of the Central European landscape and they are also essential for maintaining biological diversity. The spatial distribution and horizontal structure of forest vegetation are simultaneously influenced by a number of ecological and anthropogenic factors and their interactions. Environmental and geographical gradients are the primary drivers underlying high variation in floristic composition of temperate forests.

For the investigation of internal site conditions (light supply and selected soil properties) and their impact on the ground layer species composition of deciduous forests, the Štiavnické vrchy Mts (48°12'–48°35'N; 18°32'–19°05'S) were chosen. These volcanic mountains represent a homogeneous geomorphologic unit situated in the transition zone between the West Carpathian region and Pannonian region. They occupy an area of about 800 km<sup>2</sup> extending from lowland to the submontane level. The phytosociological data set consisting of 110 relevés were obtained according to the principles of the Zürich-Montpellier approach in the period 2008–2009. Soil samples were taken in each vegetation plot from uppermost mineral horizon, and there were used for analysis of following parameters: total content (%) of sand, silt and clay, soil acidity (pH-H<sub>2</sub>O), exchangeable cations (Ca<sup>2+</sup>, Mg<sup>2+</sup>, K<sup>+</sup>, Al<sup>3+</sup>, H<sup>+</sup>), total carbon, nitrogen content, and also plant-available phosphorus. Light conditions (canopy openness as the percentage of open sky) were estimated with using hemispherical photographs and the Gap Light Analyzer 2.0 software. Vegetation data were classified using the PC-ORD 4 programme, with the relative Euclidean distance as a measure of dissimilarity, Ward's linkage method and logarithmic transformation. The numerical classification resulted in distinguishing nine floristically well-differentiated forest communities within six alliances (*Genisto germanicae-Quercion*, *Alnion incanae*, *Carpinion betuli*, *Tilio-Acerion*, *Fagion sylvaticae* and *Quercion confertae-cerris*). The floristic data together with environmental variables were subjected to canonical correspondence analysis (CCA) from the Canoco 4.5 for Windows package – for explanation of the structure of vegetation-environment data matrix and for ecological interpretation of the main gradients.



# CHARACTERIZATION OF DIFFERENT BRACHYPODIUM DOMINATED STANDS IN NE HUNGARY BASED ON ECOLOGICAL INDICATOR VALUES

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The Carpathian Basin is the westernmost part of the Eurasian forest-steppe belt. Its steppe mosaics are often dominated by *Brachypodium rupestre* stands in Hungary. These stands can host many sensitive and rare species. One main goal of this study was to characterize the different *Brachypodium* dominated stands based on ecological indicator values. The study was carried out in the Tardona Hills, NE Hungary where 64 relevés were analysed. The selected relevés represented *Brachypodium* dominated grassland type in four locations, which were compared for their water regimes, nitrogen and temperature. The floristical elements, social behaviour types and characteristic habitats were also compared among the four types based on the species list of 64 relevés. Statistical analyses showed that the four types are different in some ecological parameters (e.g. water supply).

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